EXHIBIT CMS-1

Oklahoma Natural Gas Evaluation of 2022 Energy Efficiency Programs

Prepared for:

Oklahoma Natural Gas®
A Division of ONE Gas

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1 Executive Summary

This report is a summary of the evaluation, measurement, and verification (EM&V) effort of the 2022 program year (PY2022) portfolio of programs for Oklahoma Natural Gas (ONG), a division of ONE Gas. The evaluation was administered by ADM Associates, Inc (herein referred to as the "Evaluator").

The Evaluator collected data for the evaluation through review of program materials, acquisition of program tracking data, surveys of participating customers, residential contractors, and commercial trade allies.

Table 1-1 provides a summary of the EM&V data collection efforts. The table lists data sources used for the evaluation, the data collection method, the research objectives, and the type of analysis performed.

Table 1-1 Summary of ONG EM&V Data Collection Efforts

*Data Source**	*Method*	*Dates*	*Research Objective*	*Analysis Type*
Program documentation (143)	Document review	April 2022–January 2023	Program function; program marketing; quality control	Qualitative
Database analysis (18,838)	Database review	April 2022–February 2023	Number of projects; project type and details; data quality	Quantitative
Program Participants (590)	Telephone and online survey	November 2022 to January 2023	Program experiences; satisfaction with program	Quantitative and qualitative

* Sample sizes in parentheses

Table 1-2 provides a summary of evaluated savings of the ONG programs. The table presents the ex-ante, ex-post gross, and ex-post net therms savings; also included are a comparison between ex-ante and ex-post therms savings, and a comparison between ex-post gross and net therms savings.

During PY2022, the ONG energy efficiency portfolio ex-post gross energy savings totaled 4,889,540 therms, with a 116% gross realization rate.

Net savings are equal to gross savings, minus free ridership. The Evaluator completed a net program impact analysis to determine what portion of gross energy savings achieved by participants in the program are attributable to the effects of the program. The equation used to calculate net savings is the following:

Net Savings = Gross Savings – Free-ridership

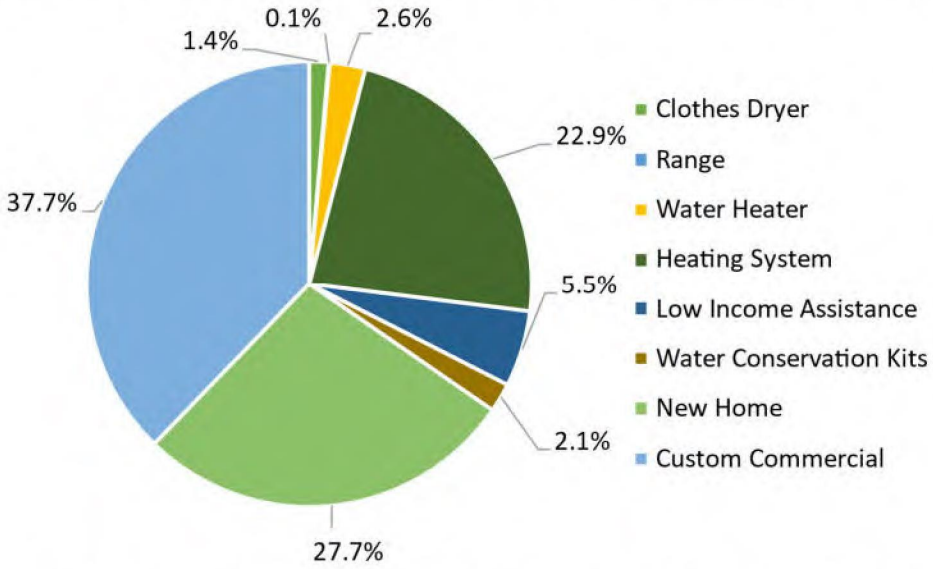
The overall estimated net-to-gross ratio for the ONG energy efficiency portfolio during 2022 is 83% with total net savings of 4,043,440 therms.

Table 1-2 Summary of Therm Energy Savings

Program	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*	*Ex-Post Net Therm Savings*	*Net-to-Gross Ratio*
Clothes Dryer	56,114	68,674	122%	41,012	60%
Range	12,691	3,983	31%	2,284	57%
Water Heater	121,629	126,498	104%	40,351	32%
Heating System	604,191	1,120,268	185%	440,542	39%
Low-income Assistance	241,770	269,714	112%	269,714	100%
Water Conservation Kits	65,001	102,702	158%	97,541	95%
New Home	1,226,294	1,352,473	110%	1,306,769	97%
Custom Commercial	1,889,917	1,845,229	98%	1,845,229	100%
Total	**4,217,607**	**4,889,540**	**116%**	**4,043,440**	**83%**

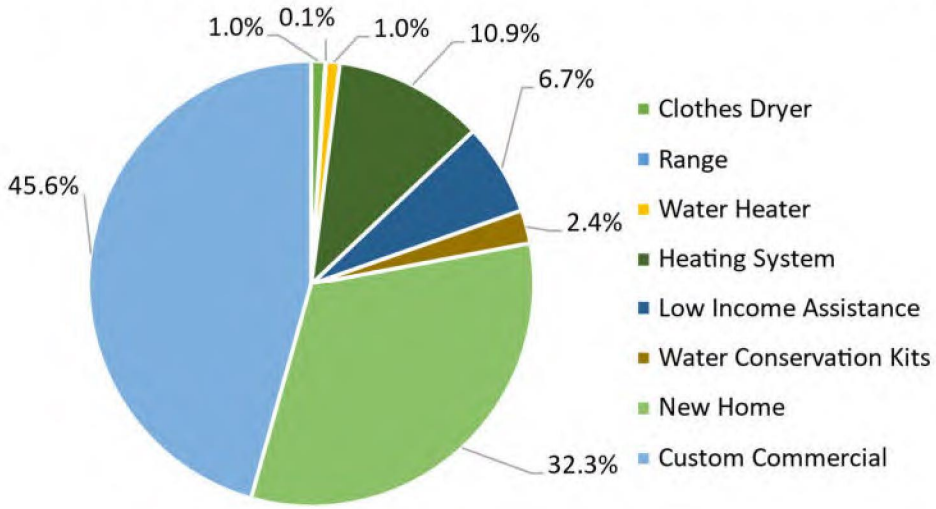
The contribution to portfolio gross ex-post therms savings by program is summarized in Figure 1-1.

Figure 1-1 Contribution to Portfolio Gross Ex-Post Savings by Program



The contribution to portfolio net ex-post therms savings by program is summarized in Figure 1-2.

Figure 1-2 Contribution to Portfolio Net Ex-Post Savings by Program



Cost-benefit analysis of the ONG programs and portfolio was conducted by The Evaluator and Energytools, LLC. The primary cost-benefit test is the Total Resource Cost (TRC) test. Table 1-3 summarizes the TRC results. More detailed results are presented in Appendix A.

Table 1-3 Total Resource Cost Results

Program	*Total Benefits*	*Total Costs*	*TRC (b/c ratio)*
Clothes Dryer	$588,056	$216,971	2.65
Range	$248,199	$16,337	14.74
Water Heater	$737,236	$307,696	2.28
Heating System	$8,190,473	$1,680,816	4.87
Low-income Assistance	$4,260,871	$824,305	5.03
Water Conservation Kits	$1,142,170	$105,809	10.62
New Home	$19,747,870	$9,395,927	2.05
Custom Commercial	$17,244,524	$2,771,911	6.10
Portfolio Non-program Costs	N/A	$2,767,082	N/A
Total	**$52,159,399**	**$18,086,855**	**2.88**

1.1 Conclusions and Recommendations

The Evaluator offers the following conclusions and recommendations for consideration in planning future program cycles.

1.1.1 Clothes Dryer Program

1.1.1.1 Conclusions

- Word-of-mouth was the primary source of program awareness, with 38% of survey participants learning of the rebate program through a friend or relative.
- Customer feedback was generally very positive about a variety of aspects of the program. Participants were most satisfied with equipment performance (89%) and the program overall (84%).

1.1.1.2 Recommendations

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

1.1.2 Range Program

1.1.2.1 Conclusions

- 25% percent of participants found out about the rebate program through ONG's website. Participants this year also relied on word-of-mouth (17.5%) for rebate program information.
- The majority of survey respondents were somewhat or greatly satisfied with ONG as their natural gas service provider.

1.1.2.2 Recommendations

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

1.1.3 Water Heater Program

1.1.3.1 Conclusions

- 25% of program participants who completed the survey learned of the Water Heater program through word-of-mouth.
- Most survey respondents reported being satisfied with ONG as their natural gas service provider.

1.1.3.2 Recommendations

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

1.1.4 Heating System Program

1.1.4.1 Conclusions

- Word-of-mouth was the most common method that program participants learned of the program according to survey responses.
- Participants were most satisfied with the equipment performance (91%), ONG as their service provide (88%), and the program overall (87%).

1.1.4.2 Recommendation

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

1.1.5 Water Conservation Kits

1.1.5.1 Conclusions

- The ONG website was the most common way of learning of the water conservation kits, according to the participant survey.
- 80% of surveyed participants were somewhat or greatly satisfied with the water conservation kits, and 88% were somewhat or greatly satisfied with the process of requesting kits.

1.1.5.2 Recommendations

- Continue to send email blasts promoting the water conservation kits in waves throughout the year to control the number of requests received.
- Track any instances of customers who requested a kit but have not yet received the kit through the program year.

1.1.6 Custom Commercial Program

1.1.6.1 Conclusions

- Most Direct Install component participants surveyed were satisfied with the program overall, the range of equipment that qualifies for the program, and the steps it takes to get through the program.
- Most Custom component participants surveyed were satisfied with the program overall, how thoroughly staff addressed questions/concerns, the facility assessment or services from the program staff, the time it took to receive the rebate, and the time it took for program staff to answer their questions/concerns.

1.1.6.2 Recommendations

- Increase marketing activities and explore new opportunities to increase awareness of the Custom Commercial programs (e.g., social media campaigns that target C&I businesses).

- Increase communication and networking opportunities with contractors to keep them up to date with the activities and progress of the Custom Commercial programs.

2 General Methodology

This chapter details general impact evaluation methodologies by program-type. This chapter will present full descriptions of:

- Glossary of terminology;
- Sampling methodologies; and
- Process evaluation methodologies.

The following sections contain a glossary of terminology used throughout the report.

2.1 Glossary of Terminology

- Ex-ante – Forecasted savings used for program and portfolio planning purposes.
- Ex-post – Savings estimates reported by an evaluator after the energy impact evaluation has been completed.
- Deemed Savings – An estimate of an energy savings outcome (gross savings) for a single unit of an installed energy efficiency measure. This estimate (a) has been developed from data sources and analytical methods that are widely accepted for the measure and purpose and (b) are applicable to the situation being evaluated. (e.g., assuming 17 therms savings for a low-flow showerhead).
- Gross Savings – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, regardless of why they participated.
- Gross Realization Rate – Ratio of Ex-Post Savings / Ex-ante Savings (e.g., If the Evaluator verifies 15 therms per showerhead, Gross Realization Rate = 15/17 = 86%).
- Free-Rider – A program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be total, partial, or deferred.
- Net Savings – The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption. (e.g., if Free-Ridership for low-flow showerheads = 50%, net savings = 15 therms * 50% = 8 therms).
- Net-to-Gross-Ratio (NTGR) = 1 – Free-Ridership %, also defined as Net Savings / Gross Savings
- Ex-ante Net Savings = Ex-ante Gross Savings * (1 – Ex-ante Free-Ridership Rate)
- Ex-post Net Savings = Ex-post Gross Savings * (1 – Ex-post Free-Ridership Rate)
- Net Realization Rate = Ex-post Net Savings / Ex-ante Net Savings

- Effective Useful Life (EUL) – An estimate of the median number of years that the efficiency measures installed under a program are still in place and operable.
- Gross Lifetime Therms = Ex-post Net Savings * EUL

2.2 Sampling Methodology

This section explains the sampling methodology used for evaluating ONG's energy efficiency programs during PY2022.

2.2.1 Clothes Dryer Program

The Evaluator used simple and stratified random sampling strategies to evaluate the programs. The sampling strategies must achieve 10% relative precision at a 90% confidence level (90/10). The required sample size to meet 90/10 requirements is calculated by using the coefficient of variation of savings. The coefficient of variation (CV) is defined as:

$$CV(x) = \frac{Standard\ Deviation\ (x)}{Mean(x)}$$

Where (*x*) represents participant energy savings in each stratum. The required sample size is estimated at:

$$n_0 = \left(\frac{1.645 * CV}{RP}\right)^2$$

Where,

1.645 = Z-score for 90% confidence interval in a normal distribution

CV = Coefficient of variation

RP = Relative precision, 10%

The Evaluator, wherever applicable, used verified clothes dryer model numbers to verify each sample point in the Clothes Dryer Program. Savings calculations for a given dryer use the verified CEF, size, and fuel type. In the residential stratum of the impact evaluation, the Evaluator assumed that all installed gas dryers replaced an electric dyer. The fuel switching status of an installed dryer in the residential stratum was incorporated in the net-to-gross evaluation.

The Clothes Dryer Program's stratified random sample size is shown in Table 2-1.

Table 2-1 Ex-Ante Therm Savings for Clothes Dryer Program Sampled Projects

Stratum	*Sample Size*	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-Ante Savings in Sample*
New Construction	6	202	202	100%
Residential	1,659	55,912	55,912	100%
Total	**1,665**	**56,114**	**56,114**	**100%**

2.2.2 Range Program

The Range Program sampling methodology is like the methodology described in Section 2.2.1.

In the residential and commercial strata of the impact evaluation, the Evaluator assumed all installed gas ranges replaced an electric range. The Evaluator assumed no fuel switching in the new construction stratum because all the ranges in this stratum are newly installed and do not replace a previous range. The fuel switching status of an installed range in the residential and commercial strata was incorporated in the net-to-gross evaluation.

The Range Program random sample is shown in Table 2-2.

Table 2-2 Ex-Ante Therm Savings for Range Program Sampled Projects

Stratum	*Sample Size*	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-Ante Savings in Sample*
Commercial	10	53	53	100%
New Construction	1,642	8,708	8,708	100%
Residential	741	3,930	3,930	100%
Total	**2,393**	**12,691**	**12,691**	**100%**

2.2.3 Water Heater Program

The sampling methodology for the Water Heater Program is the same as the methodology described in Section 2.2.1.

The Evaluator used survey responses and verified water heater model numbers. The Evaluator determined the storage volume, energy factor (EF), and fuel type using the verified modeled numbers. Saving calculations were completed using the verified storage volume, EF, fuel type, survey responses and a participant's zip code.

The Water Heater Program random sample is shown in Table 2-3.

Table 2-3 Ex-Ante Therm Savings for Water Heater Program Sampled Projects

Stratum	*Sample Size*	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-Ante Savings in Sample*
Condensing Water Heater	2	83.74	113	100%
Electric to Gas Water Heater	12	1,997	2,368	14%
Gas to Gas Water Heater	0	0	0	N/A
Tankless Water Heater	1310	58,871	54,623	58%
Electric to Gas Tankless Water Heater	5	832	883	16%
Total	**1329**	**61,785**	**57,987**	**51%**

2.2.4 Heating System Program

The sampling methodology for the Heating System Program is the same as the methodology described in Section 2.2.1.

The Evaluator used survey responses and verified heating equipment model numbers. Heating equipment model numbers were verified using the Air Conditioning, Heating, and Refrigeration Institute (AHRI) database and manufacture specification sheets. The Evaluator found the heating capacity, annual fuel utilization efficiency (AFUE), and fuel type using the AHRI database and manufacturer specification sheets. Saving calculations were completed using the verified capacity, AFUE, fuel type, survey responses and a participant's zip code.

The Heating System Program random sample size is shown in Table 2-4.

Table 2-4 Ex-Ante Therm Savings for Heating System Program Sampled Projects

Stratum	*Sample Size*	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-Ante Savings in Sample*
Commercial	56	4,791	4,725	101%
Evaluated in New Home	0	0	0	N/A
New Construction	3,622	238,980	244,852	98%
Residential	68	14,584	354,614	4%
Total	**3,746**	**258,355**	**604,191**	**43%**

2.2.5 Low-Income Assistance Program

The Evaluator performed a census review for the Low-Income Assistance Program; no sampling strategies were used in this program.

2.2.6 Water Conservation Kit Program

The sampling methodology for the Water Conservation Kit Program is the same as the methodology described in Section 2.2.1.

The Evaluator used participant survey responses to calculate energy savings.

The Water Conservation Kit Program random sample size is shown in Table 2-5.

Table 2-5 Ex-Ante Therm Savings for Water Conservation Kit Program Sampled Projects

Equipment Type	*Sample Size*	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-ante Savings in Sample*
Conservation Kits	**138**	**1,543**	**65,001**	**2.4%**

2.2.7 New Home Program

The sampling methodology for the New Home Program is the same as the methodology described in Section 2.2.1.

The Evaluator used energy simulation models to calculate energy savings for each sample point. The New Home Program random sample is shown in Table 2-6.

Table 2-6 Ex-Ante Therm Savings for New Home Program Sampled Projects

Sample Size	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-ante Savings in Sample*
69	**15,370**	**1,226,294**	**1%**

2.2.8 Custom Commercial Program

The estimation of savings for the program is based on a ratio estimation procedure that allows the measured and verified sample to meet or exceed statistical precisions requirements and to accurately explain the annual ex-post gross savings for all completed projects. The Evaluator selected a sample with a sufficient number of projects to estimate the population ex-post gross therm savings with 10% relative precision at the 90% confidence level. The actual relative precision for the program is 9.92%.

The sample selection is from the population of projects with completion dates during PY2022. Table 2-7 and Table 2-8 show the project population from which the sample was drawn, for the Custom component and the Direct Install component. These samples fell into four or five energy savings strata; strata boundaries were based on ex-ante therm savings. Note that in this table, presentation of population statistics used for sample design, including coefficients of variation, are calculated based on final program data.

Table 2-7 Population Statistics Used for Custom Component Sample Design

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*SEM*	***Totals***
Strata boundaries (Therm)	<1,000	1,000 - 2,999	3,000 - 9,999	10,000 - 49,999	50,000 ≥	Census	
Population Size	17	4	17	18	1	38	**95**
Total Therm savings	9,941	8,470	99,197	283,626	57,453	55,532	**514,219**
Average Therm Savings	585	2,117	5,835	15,757	5,745	1,461	**5,413**
Standard deviation of Therm savings	271	753	1,900	6,428	0	0	**8,351**
Coefficient of variation	0.46	0.36	0.33	0.41	0.00	0.00	**1.54**
Final design sample	3	1	5	3	1	38	**51**

Table 2-8 Population Statistics Used for Direct Install Component Sample Design

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	***Totals***
Strata boundaries (Therm)	<1,000	1,000 - 6,999	7,000 - 21,999	22,000 - 49,000	50,000 ≥	
Population Size	8	26	35	21	2	**92**
Total Therm savings	5,516	112,397	467,779	586,394	203,614	**1,375,701**
Average Therm Savings	690	4,323	13,365	27,924	101,807	**14,953**
Standard deviation of Therm savings	246	1,965	4,653	5,927	64,725	**17,734**
Coefficient of variation	0.36	0.45	0.35	0.21	0.61	**1.19**
Final design sample	3	7	4	7	2	**23**

The Custom component stratified sample shown in Table 2-9 resulted in samples that total 36% of the total ex-ante therm savings.

Table 2-9 Ex-Ante Therm Savings for Custom Component Sampled Projects by Stratum

Stratum	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-ante Savings in Sample*
SEM	55,532	55,532	100%
Custom 5	57,453	57,453	100%
Custom 4	41,489	283,623	15%
Custom 3	30,378	99,197	31%
Custom 2	1,580	8,470	19%
Custom 1	1,161	9,941	12%
Total	**187,593**	**514,216**	**36%**

The Direct Install component stratified sample shown in Table 2-10 resulted in samples that total 38% of the total ex-ante therm savings.

Table 2-10 Ex-Ante Therm Savings for Direct Install Component Sampled Projects by Stratum

Stratum	*Sample Ex-Ante Therm Savings*	*Total Ex-Ante Therm Savings*	*Percentage of Ex-ante Savings in Sample*
DI 5	203,614	203,614	100%
DI 4	212,372	586,394	36%
DI 3	56,709	467,779	12%
DI 2	42,178	112,397	38%
DI 1	1,286	5,516	23%
Total	**516,160**	**1,375,701**	**38%**

2.3 Process Evaluation Approach and Data Collection

This section describes the process evaluation approach and data collection for each of the programs.

2.3.1 Residential Programs

The process evaluation focused on survey responses by program participants. The survey sample size for the residential programs is summarized by program in Table 2-11.

Table 2-11 Number of Participant Surveys Completed for Residential Programs

Program	*Number of Participant Surveys Completed*
Clothes Dryer	88
Range	57
Water Heater	67
Heating System	78
Water Conservation Kit	259
New Home	9
Total	**558**

In addition to the participant survey responses, the Evaluator completed 13 surveys with residential contractors that were involved with the installation of water heaters and heating systems.

2.3.2 Low-Income Assistance Program

No process evaluation was performed in PY2022 for the Low-Income Assistance Program. As part of program implementation, ONG partners with electric utility service providers that share ONG's service territory. ONG provides the necessary funding for dual-fuel measure installation; however, it is assumed that low-income program participants do not have a great deal of perspective or experience with the program with ONG as program administrator.

2.3.3 Custom Commercial Program

The process evaluation focused on survey responses by program participants. The survey sample size for the Custom Commercial Program is summarized in Table 2-12.

Table 2-12 Number of Participant Surveys Completed for Custom Commercial Program

Program Component	*Number of Participant Surveys Completed*
Custom	7
Direct Install	25
Total	**32**

In addition to the participant survey, the Evaluator completed two surveys with trade allies that were involved with the installation of energy efficient equipment for the Custom component of the Program.

2.3.4 Program Operations

Two in-depth interviews were conducted with ONG and CLEAResult Staff. The purpose of these interviews was to gain additional insight into program design, implementation and performance for PY2012.

3 Clothes Dryer Program

The Clothes Dryer Program was designed to provide financial incentives to encourage residential customers to install energy efficient natural gas clothes dryers.

3.1 Program Description

The Clothes Dryer Program provides mail-in rebates for energy efficient natural gas clothes dryers. Table 3-1 summarizes the incentives provided through the program.

Table 3-1 Clothes Dryer Program Incentives

Equipment Type	*Rebate Amount*
Clothes Dryer	$400
ENERGY STAR® Clothes Dryer	$450

Table 3-2 shows the number of rebated appliances and ex-ante therm savings for the Clothes Dryer Program.

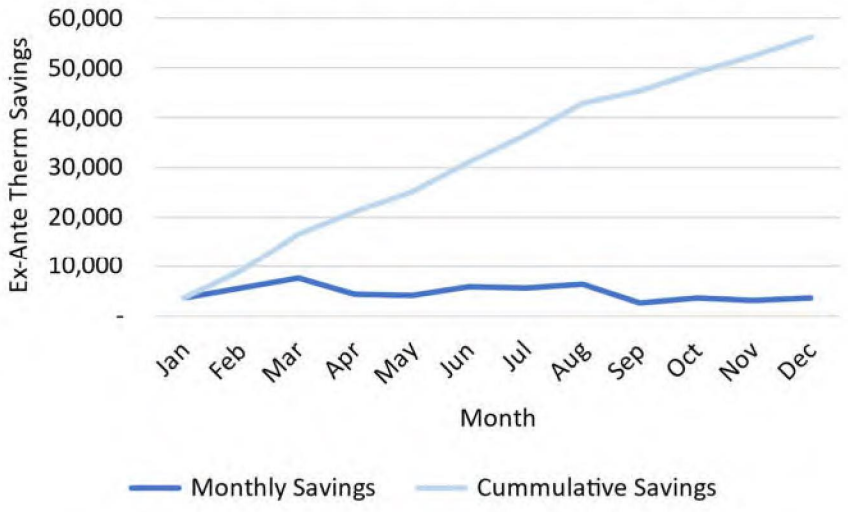
Table 3-2 Ex-Ante Therm Savings of Clothes Dryer Program by Stratum

Stratum	*Number of Clothes Dryers*	*Ex-Ante Therm Savings per unit*	*Ex-Ante Therm Savings*
New Construction	6	33.7	202
Residential	1,659	33.7	55,912
Total	1,665	33.7	56,114

3.2 Program Trends in PY2022

Figure 3-1 plots the Clothes Dryer Program ex-ante therm savings by project completion month.

Figure 3-1 Clothes Dryer Program Ex-Ante Therm Savings by Project Completion



3.3 Impact Evaluation

This section describes the gross impact evaluation of the Clothes Dryer Program.

3.3.1 Gross Impact Evaluation

The estimated gross energy impacts were found using the assumptions provided in the Projected Incentive Calculation workbook provided by ONG. The provided workbook assumed that 4,500 of 5,000 predicted installed dryers had a standard energy rating and 500 installed dryers were ENERGY STAR®-rated. A standard energy rating dryer was estimated to save 33 therms and an ENERGY STAR®-rated was estimated to save 42 therms. The ex-ante unit energy savings was predicted to be:

$$therm_{ex\ ante\ savings} = \left(\left(\frac{4{,}500}{5{,}000}\right) \times 33\ therm + \left(\frac{500}{5{,}000}\right) \times 42\ therms\right)$$

$$therm_{ex\ ante\ savings} = 34\ therms$$

3.3.1.1 Review of Documentation

The combined energy factor (CEF), size, and fuel type were verified wherever possible using clothes dryer model numbers found in the program database. The Evaluator verified clothes dryer model numbers with the US Department of Energy Appliance and Equipment Standard Program Clothes Dryer database, the Energy Star Certified Clothes Dryer database, and manufacturers' websites.

3.3.1.2 Estimating Ex-Post Therm Savings from Measures Installed Through the Program

The Evaluator's approach for the gross energy impact calculation depended on the types of measures installed. Where applicable, deemed values and algorithms from the Pennsylvania TRM (PA TRM) were used to calculate verified gross energy impacts. The Arkansas TRM (AR TRM) does not include clothes dryers saving protocols.

To determine the quantity of measures rebated and installed, the Evaluator reviewed all entries in the tracking system to ensure (a) each measure is program eligible, (b) each measure was purchased and rebated in PY2022, and (c) there were no duplicate or otherwise erroneous entries.

3.3.1.3 Method for Analyzing Savings from Clothes Dryer Measures

The clothes dryer savings calculation in the PA TRM is based on the ENERGY STAR Appliance Calculator.

The savings is calculated for two scenarios: with and without fuel switching.

The savings calculation with fuel switching is shown below:

$$therm_{ex\ post\ savings} = therm_{electric\ savings} - therm_{gas\ increase}$$

$therm_{electric\ savings}$ =$(kWh_{base} - kWh_{gas)} \times (\frac{kWh\ to\ Btu\ conversion\ factor}{Btu\ to\ therm\ conversion\ factor}) \times$

$source\ to\ site\ ratio$, electric to gas

$therm_{gas\ increase}$ = $\Delta MMBtu$, Weighted average gas fuel increase ×

$(therm\ to\ MMBtu\ conversion\ factor) \times source\ to\ site\ ratio$, gas to gas

Where:

$kWh_{base} = 597\ kWh$

$kWh_{gas} = 30\ kWh$

$kWh\ to\ Btu\ conversion\ factor = \frac{1\ kWh}{3{,}214.14\ Btu}$

$Btu\ to\ therm\ conversion\ factor = \frac{100{,}00\ Btu}{1\ Therm}$

Source to site ratio, electric to gas = 3.38

$therm\ to\ MMBtu\ conversion\ factor$ *= 10 therm/MMBtu*

$\Delta MMBtu$, *Weighted average gas fuel increase =2.04*

The savings calculation without fuel switching is shown below:

$therm_{ex\ post\ savings} = therm_{baseline\ gas\ dryer} - therm_{new\ gas\ dryer}$

$therm_{ex\ post\ savings}$ =$Cycles_{wash} \times \%_{dry/wash} \times Load_{avg} \times \left(\frac{1}{CEF_{baseline\ gas\ dryer}} - \frac{1}{CEF_{new\ gas\ dryer}}\right) \times (\frac{kWh\ to\ Btu\ conversion\ factor}{Btu\ to\ therm\ conversion\ factor}) \times source\ to\ site\ ratio$, gas to gas

Where:

$Cycles_{wash} = 250\ cycles/yr$

$\%_{dry/wash} = 95\%$

$Load_{avg} = 8.45\ lbs\ (standard\ dryer), 3\ lbs\ (compact\ dryer)$

$CEF_{baseline\ gas\ dryer}$ *= 3.3 lbs./kWh or verified with model number*

$CEF_{new\ gas\ dryer}$ *= verified with model number*

kWh to Btu conversion factor = 3,412.14 Btu/kWh

Btu to therm conversion factor = 100,000 $Btu/therm$

Source to site ratio, gas to gas = 1.09

3.3.2 Results of Ex-Post Gross Savings Estimation

The ex-ante and ex-post gross therm savings of the Clothes Dryer Program are summarized below by stratum.

Table 3-3 Ex-Ante and Ex-Post Annual Therm Savings for Clothes Dryer Program by Stratum

Stratum	*Percent of Baseline Clothes Dryers which use Electricity*	*Ex-Ante Gross Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
New Construction	0%	202	0	0%
Residential	100%	55,912	68,674	123%
Total	100%	56,114	68,674	122%

There are several factors affecting realized savings. In the residential stratum, the PA TRM was used to calculate ex-post savings instead of using the provided ex-ante savings. Furthermore, it was assumed that all participants in the residential stratum performed fuel-switching when installing the new clothes dryer. The actual impact of fuel switching is accounted for in the net-to-gross evaluation.

Dryers installed in the new construction stratum only save energy when their CEF is greater than the baseline CEF. There are no savings from fuel switching in this stratum because these dryers are all newly installed.

3.3.3 Net Impact Evaluation

The net savings analysis is used to determine what part of the gross energy savings achieved by program participants can be attributed to the effects of the program. Furthermore, the analysis also accounts for the effects of fuel switching on energy savings. The net savings attributable to program participants were the gross savings less a combination of program participant and participating retailer free ridership. The Evaluator estimated free ridership through a survey of program participants and participating retailers.

Program participant survey respondents were asked a series of questions designed to elicit information regarding the following factors:

- Plans and intentions to implement the efficiency measure;
- The program influence on the decision to implement the efficiency measure;
- The program's influence on the timing of the measure installation.

3.3.3.1 Plans and Intentions

An indicator variable was developed based on responses to the survey question on plans and intentions. The variable corresponds to financial ability. Respondents were considered to have not been financially able to install the efficient equipment if they answered "no" to the question below:

- FR1: Would you have been financially able to purchase the [MEASURE] if there was not a rebate available through the [UTILITY_SHORT] program?

A second indicator variable was related to whether the customer had plans to implement the efficiency measure. Respondents were considered to have had plan if they answered "yes" to the following questions:

- FR2: Prior to learning about the [PROGRAM], did you have plans to install a/an [MEASURE]?

3.3.3.2 Program Influence

Participants were asked a question about the direct influence of the program on their decision to implement the energy efficiency measure. Specifically, participants were asked:

- FR3: How likely is it that you would have purchased and installed the same [MEASURE] that you had rebated through the program if the rebate was not viable?

3.3.3.3 Program Influence on Project Timing

To account for deferred free ridership due to the program's effect on the timing of the implementation of the efficiency measure, respondents were asked the following two questions:

- FR4a: Did you install the [MEASURE] sooner than you otherwise would have because of the rebate available through the [UTILTIY_SHORT] program?
- FR4b: When would you have installed the [MEASURE] if rebates through the [UTILITY_SHORT] program were not available?

Based on the responses to those questions, a timing category was determined as shown in Table 3-4.

Table 3-4 Timing Adjustment Category

Timing Category	*Timing Category*
Less than one year	Y
One year or more	N

The three sets of rules just described were used to construct four different indicator variables that addressed free ridership behavior. For each respondent, a free ridership value was assigned based on the combination of variables. With the four indicator variables, there were sixteen applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 3-5 shows these values.

Table 3-5 Appliances Participant Free Ridership Scoring

Indicator Variables				Free Ridership Score
Had Financial ability to install Measure without [Program Name]?	*Had Plans to install Measure without [Program Name]?*	*[Program Name] had influence on Decision to install Measure?*	*[Program Name] had effect on timing of Measure installation?*	
Y	Y	N	Y	100%
Y	N	N	Y	67%
Y	Y	N	N	67%
Y	Y	Y	Y	67%
Y	N	N	N	33%
Y	N	Y	Y	33%
Y	Y	Y	N	33%
Y	N	Y	N	0%
N	N	N	Y	0%
N	N	N	N	0%
N	N	Y	Y	0%
N	N	Y	N	0%
N	Y	N	Y	0%
N	Y	N	N	0%
N	Y	Y	Y	0%
N	Y	Y	N	0%

3.3.3.4 Program Influence on Appliance Sales

Participating retailers were asked a question about the direct influence of the program on their sales of energy efficient appliances. Specifically, participants were asked:

- FR5: Has the presence of the program increased the amount of [MEASURE] that you sell?

3.3.3.5 Rebate Effect on Existing Inventory Levels

Participating retailers were asked a question about the direct influence of the rebate on their existing inventory of energy efficient appliances. Specifically, participants were asked:

- FR6: Would you have stocked the same amount of [MEASURE] without the [PROGRAM] rebate?

3.3.3.6 Rebate Effect on Future Inventory Levels

Participating retailers were asked a question about the direct influence of the rebate on their existing inventory of energy efficient appliances. Specifically, participants were asked:

- FR7: Has the [PROGRAM] rebate influenced what you will stock in the future?

The three sets of rules just described were used to construct three different indicator variables that addressed retailer free ridership behavior. For each respondent, a free ridership value was assigned based on the combination of variables. With the three indicator variables, there were eight applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 3-6 shows these values.

Table 3-6 Appliances Retailer Free Ridership Scoring

Indicator Variables			*Free Ridership Score*
Has program increased the amount of [Appliance Type] sold?	*Would have stocked the same amount of [Appliance Type] without the rebate?*	*Has the rebate influenced [Appliance Type] that will be stocked in the future?*	
Y	N	Y	0%
Y	N	N	0%
Y	Y	Y	25%
Y	Y	N	50%
N	N	Y	50%
N	N	N	50%
N	Y	Y	100%
N	Y	N	100%

Lastly, the free ridership score obtained from Table 3-5 and Table 3-6 were equally averaged to calculate program-level free ridership.

3.3.4 Results of Net Savings Estimation

This section discusses the results of estimating net impacts for the program.

Table 3-7 summarizes the results of the estimation of free ridership. Free ridership was low for the program because there was a low incidence of participant responses indicating a high likelihood of installing energy efficient equipment without a rebate, as well as a near zero incidence of retailer responses indicating a high likelihood of stocking energy efficient equipment without a rebate.

Table 3-7 Clothes Dryer Program Free Ridership Factor

Equipment Type	*FR Factor*
Clothes Dryer	40%

Table 3-8 summarizes the gross and net ex-post therm savings for the Clothes Dryer Program.

Table 3-8 Clothes Dryer Program Summary of Gross and Net Ex-Post Therm Savings

Equipment Type	*Ex-Post Gross Therm Savings*	*Estimated Free Ridership*	*Ex-Post Net Therm Savings*	*Net to Gross Ratio*
Clothes Dryer	**68,674**	**27,662**	**41,012**	**60%**

3.4 Process Evaluation

The following section presents the results of the process evaluation for the Clothes Dryer Program.

3.4.1 Participant Survey

The Evaluator surveyed 88 single-family participants in the Clothes Dryer program. These surveys were performed to collect data on the participants' experience with the program including sources of program awareness, motivations for participating, and satisfaction with the program. Furthermore, the Evaluator collected demographic information about the respondents.

3.4.1.1 Program Awareness

ONG's marketing of the Clothes Dryer program is driven through word-of-mouth and point of sale. Word-of-mouth was the primary source of program awareness, with 37.9% of participants learning about the program through friends or family. This data deviates from prior years in which point-of-sales were the primary source of program awareness. Other common sources of program awareness in PY22 included point of sale (25.3%), ONG's website (6.9%), and bill inserts or mailers (5.7%) (Table 3-9).

Table 3-9 Source of Awareness

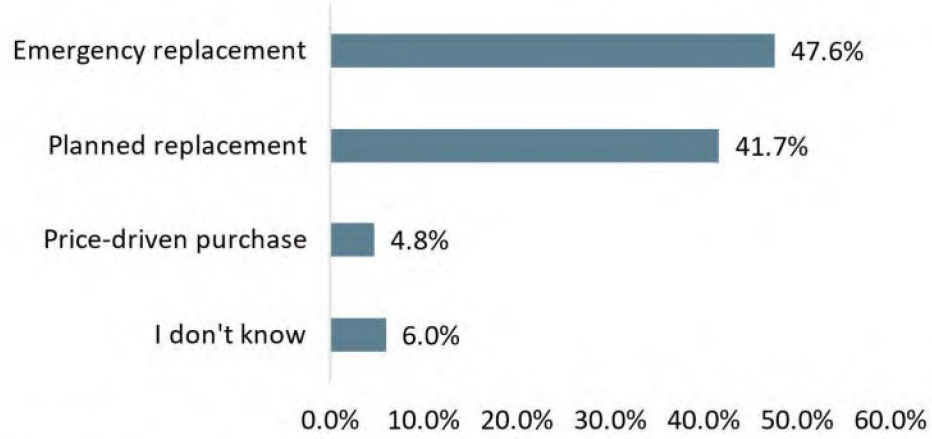
Sources of Awareness	*Share of Respondents (n=76)*
Word-of-mouth	37.9%
Point of sale	25.3%
ONG's website	6.9%
Bill inserts or utility mailer	5.7%
Internet search	4.6%
Radio/TV advertisement	3.4%
Contractor	3.4%
ONG email	2.3%
Internet advertisement	2.3%
ONG newsletter	1.1%
I don't know	5.7%

3.4.1.2 Reasons for Participation

Participants were asked several questions about the type of replacement and the age of the replaced equipment. More than one-third of respondents reported that the old dryer was still functioning at the time they replaced it (38.1%, n=32); 47.6% (n=40) said the old dryer was not functioning, and 14.3% (n=12) reported to not know. Almost half of

respondents reported that this was an emergency replacement (47.6%, n=40); 41.7% (n=35) reported that it was a planned replacement and 4.8% (n=4) reported it was a price-driven replacement (Figure 3-2).

Figure 3-2 Replacement Type (n=84)



Just under three-quarters of respondents knew the age of the previous clothes dryer. Among those respondents (n=60), the average age of the dryer was 11 years old as shown in Table 3-10 below. Forty percent of those surveyed reported that they did not know the age of their dryer.

Table 3-10 Average Baseline Age (n=60)

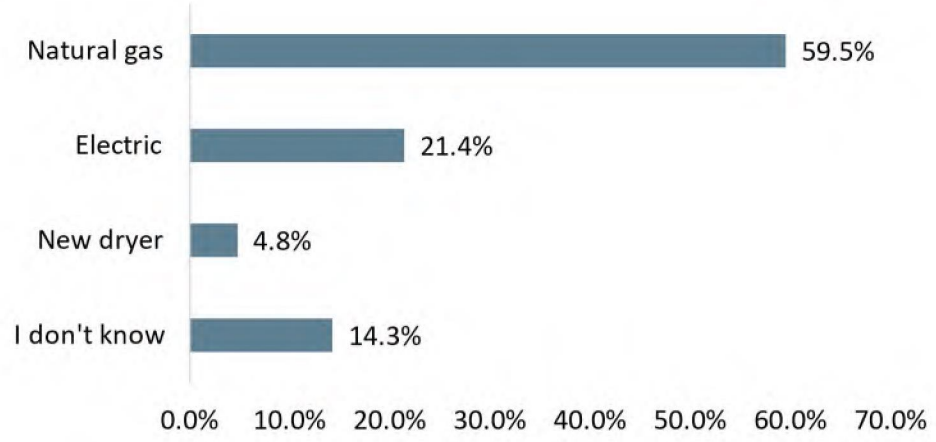
Response	*Average*
Emergency replacement age	11.4 years[1]
Planned Replacement age	10.5 years
Price driven age	9.0 years
All dryers	11 years

3.4.1.3 Fuel Switching

More than half of interviewed participants reported that their prior clothes dryer had been fueled by natural gas (59.5%, n=60). All the new dryers were fueled by natural gas.

[1] The average age is likely underestimated as several respondents did not provide an exact age for the old clothes dryer (i.e. age reported as 25+ years).

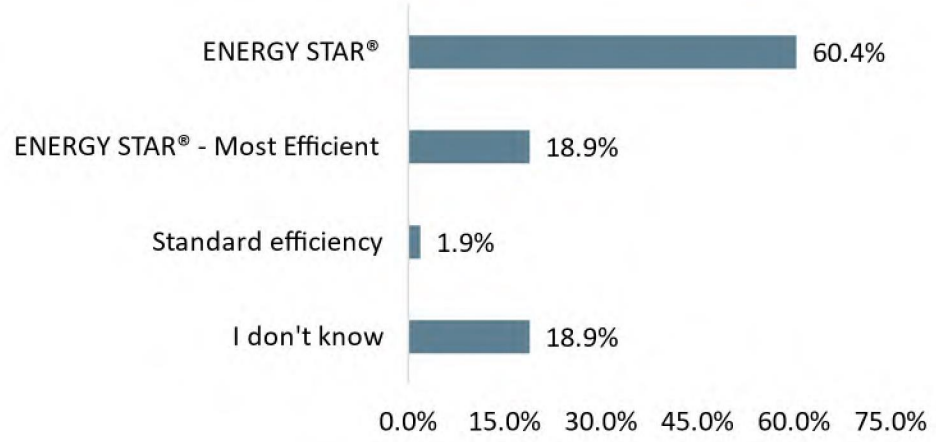
Figure 3-3 Baseline Fuel (n=84)



3.4.1.4 Additional Appliances

Just under two-thirds of respondents replaced their clothes washer along with the clothes dryer (64.3%, n=54), which is slightly down from the percentage found in the previous program year (71%). Almost 80% of respondents of the participants that purchased a new washer purchased an ENERGY STAR® or ENERGY STAR® - Most Efficient model (79.3%, n=42), which is up from the 23% of respondents found in the last program year. Figure 3-4 illustrates the reported efficiency of replaced clothes washers.

Figure 3-4 Reported Clothes Washer Efficiency (n=54)



3.4.1.5 Freeridership

The majority of respondents would have been able to afford the clothes dryer even if the rebate had not been available through the ONG program (86.8%, n=72); however, only about half indicated they would have purchased the same type of dryer on their own if not for the rebate (54.2%, n=45). About one-quarter (27.7%, n=23) of respondents got a new dryer sooner than they would have if not for the rebate; however, most of these respondents noted they still would have gotten a new dryer within one year (73.9%, n=17).

3.4.1.6 Contractor Experience

Just under three-quarters of respondents hired someone to install their new clothes dryer (71.1%, n=59). Respondents found the person who installed their new dryer through a variety of avenues, most notably the store they bought the dryer from or through a recommendation by a residential appliance representative (Figure 3-5). In general, respondents were satisfied with their contractor and their knowledge, timeliness, quality of work, and professionalism (Figure 3-6).

Figure 3-5 Ways of Learning About Contractor (n=59)

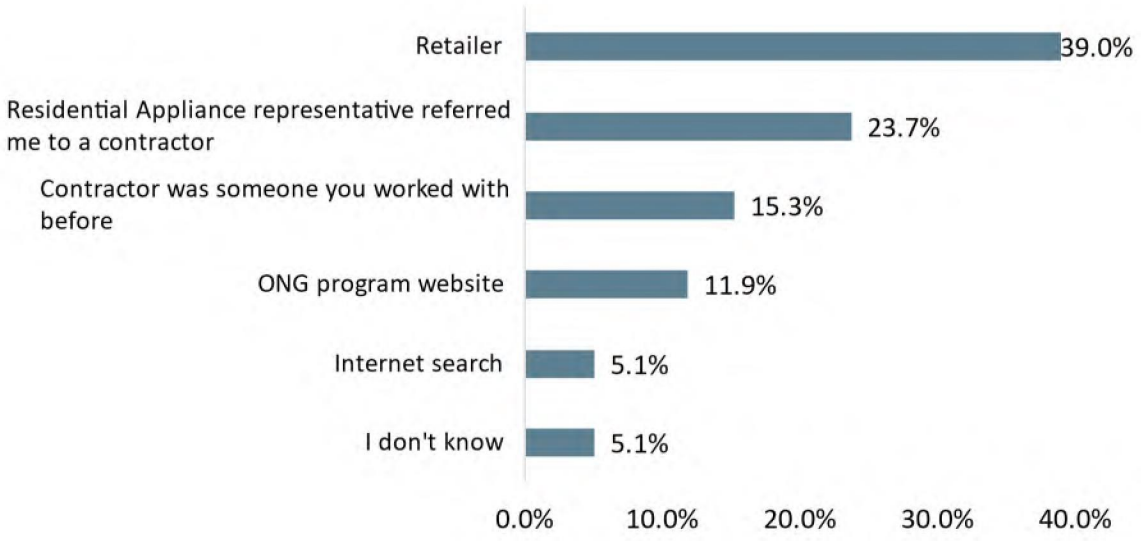
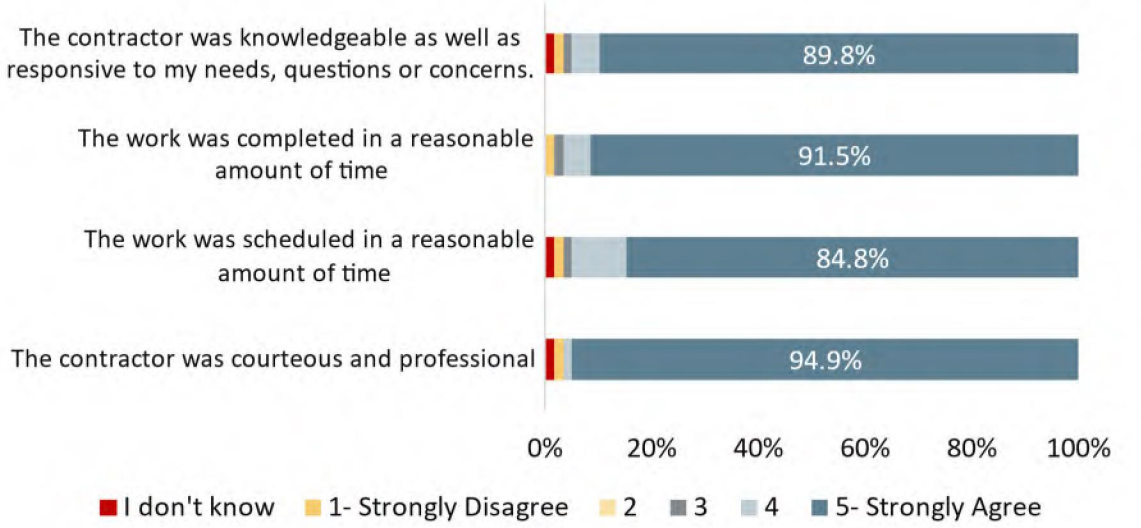


Figure 3-6 Contractor Satisfaction (n=59)



Respondents noted that their contractors recommended the clothes dryer due to its energy efficiency (36.2%, n=21), low price (13.8%, n=8), warranty/reliability (13.8%, n=8), among other things.

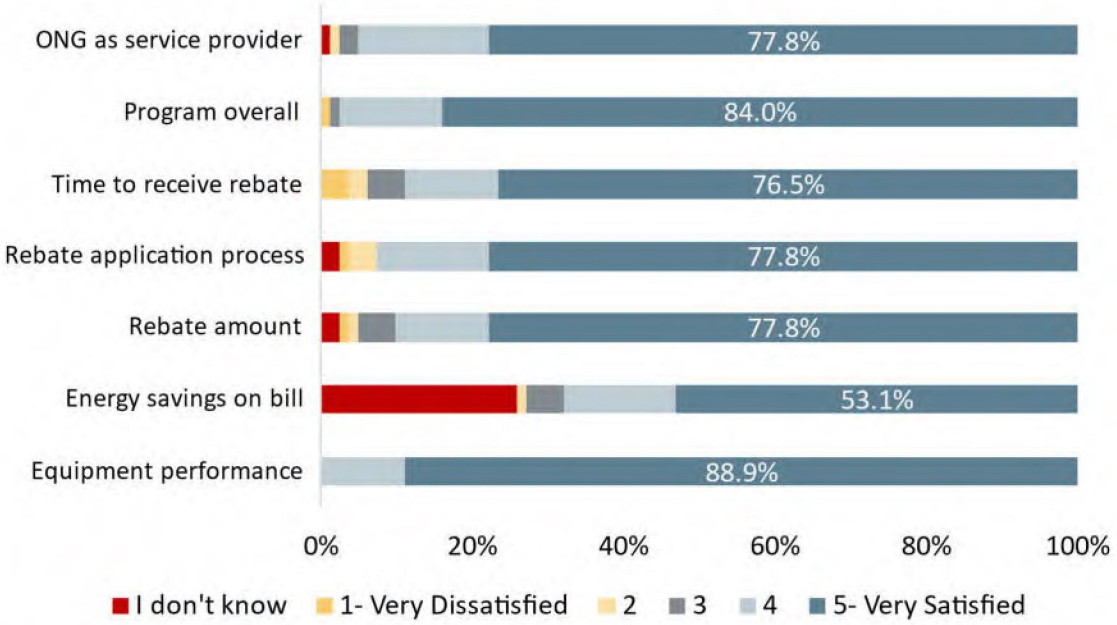
Table 3-11: Preferred Features of the Dryer (n=58)

Response	*Percentage of Respondents*
Energy Efficiency	36.2%
Low price	13.8%
Good warranty/reliability	13.8%
Rebate eligibility	10.3%
Brand/reputation	3.4%
Capacity	3.4%
Permanent press	1.7%
Remote management	1.7%
Steam function	1.7%
Gas	1.7%
Size of the equipment	1.7%
I don't know	10.3%

3.4.1.7 Satisfaction

Customer feedback was generally very positive about a variety of aspects of the program. Participants were asked questions based on a 1-5 Likert Scale, with "1" being very dissatisfied and "5" being very satisfied. Participants were most satisfied with equipment performance (88.9%, n=72) and the program overall (84.0%, n=68). Very few respondents expressed dissatisfaction with any aspects of the program. Figure 3-7 summarizes these responses.

Figure 3-7 Satisfaction with Various Program Aspects (n=81)



The few respondents who expressed dissatisfaction with the program were asked to provide open-ended feedback. Reasons for dissatisfaction included: issues with paperwork (n=4), delays in getting the rebate (n=3), inflated gas rates due to program (n=1), rebate not enough to cover costs (n=1), and ineligible for rebate (n=1).

Respondents were also asked whether participation in the program had any effect on their satisfaction with ONG. As Table 3-12 shows, two-thirds of respondents reported greatly or somewhat increased satisfaction with ONG (65.4%, n=53), while 30.9% (n=25) reported no change in satisfaction or decreased satisfaction (1.2%, n=1). Most respondents had never participated in an ONG program prior to their participation in this program.

Table 3-12 Satisfaction with ONG as Utility (n=81)

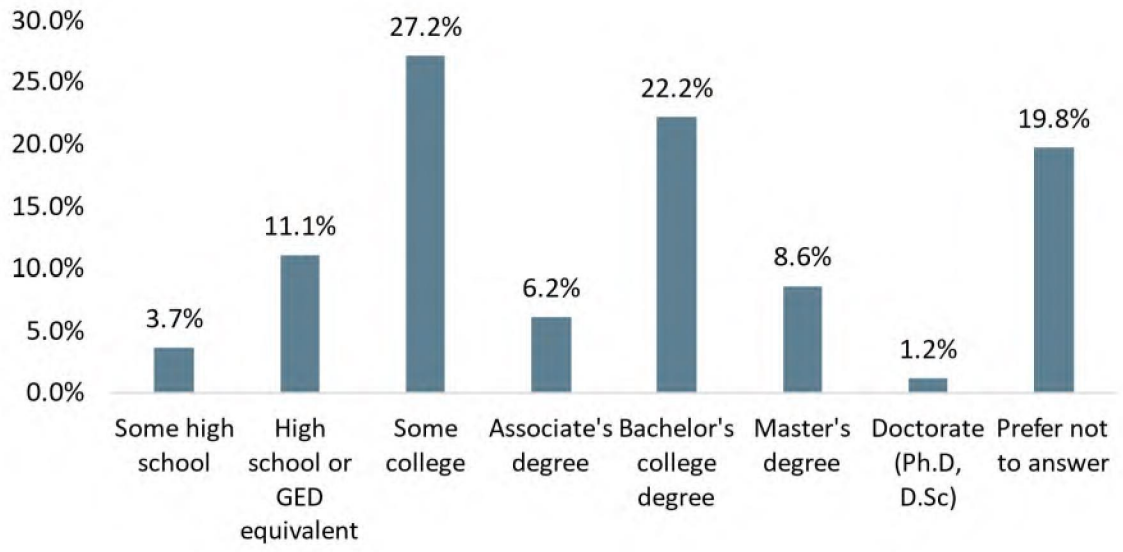
Would you say that your participation in ONG's program has?	*Percentage of Respondents*
Greatly increased your satisfaction with ONG	32.1%
Somewhat increased your satisfaction with ONG	33.3%
Did not affect your satisfaction with ONG	30.9%
Somewhat decreased your satisfaction with ONG	1.2%
Greatly decreased your satisfaction with ONG	0%
Don't know	2.5%

3.4.1.8 Demographics

Additionally, respondents were asked a series of questions related to demographic information. The majority of respondents owned their home (91.4%, n=74) and most live in a single-family home (95.1%, n=77). Half of respondents live with one to two other

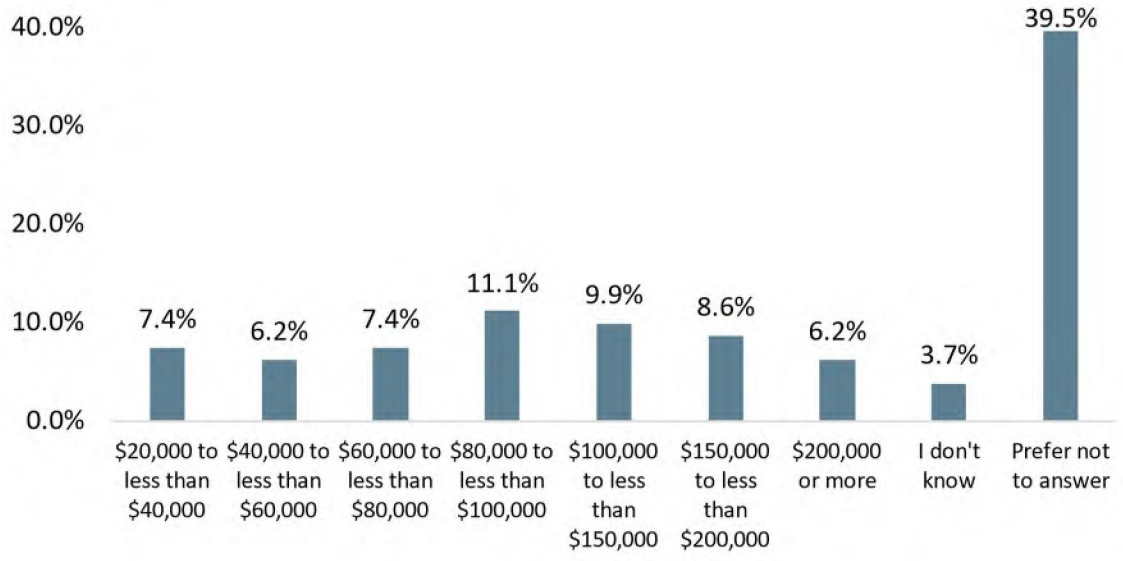
people (49.4%, n=40). Figure 3-8 illustrates the reported education levels of surveyed participants; 14.8% (n=12) of participants have no college experience, while 65.4% (n=53) have at least some college experience.

Figure 3-8 Highest Level of Education (n=81)



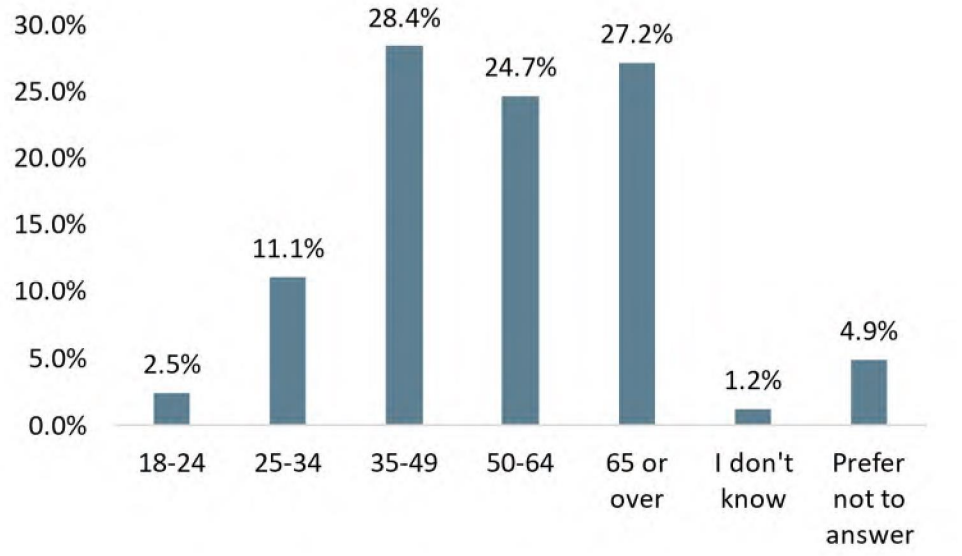
Almost forty percent of survey participants refused to respond to income questions or could not provide an answer (n=35). The remaining 56.8% reported incomes across a large spectrum, with the majority falling within the upper-income ranges, as summarized in Figure 3-9 below.

Figure 3-9 Reported Participant Income (n=81)



Ages varied in reporting with 42.0% (n=34) reporting being aged under 50 and 51.9% (n=42) reporting being aged 50 and over; the results are summarized in Figure 3-10 below.

Figure 3-10 Reported Age Range (n=81)



3.5 Conclusions and Recommendations

This section presents conclusions and recommendations for the Clothes Dryer Program.

3.5.1 Conclusions

- Word-of-mouth was the primary source of program awareness, with 38% of survey participants learning of the rebate program through a friend or relative.
- 42% percent of survey respondents reported that the old dryer was still functioning at the time they replaced it and on average the age of the dryers was 10.5 years.
- 60% of survey respondents reported their prior clothes dryer had been fueled by natural gas.
- Customer feedback was generally very positive about a variety of aspects of the program. Participants were most satisfied with equipment performance (89%) and the program overall (84%).

3.5.2 Recommendations

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

4 Range Program

The Range Program provides financial incentives to encourage residential customers to install energy efficient natural gas ranges.

4.1 Program Description

The Range Program provides mail-in rebates for energy efficient natural gas ranges. Table 4-1 summarizes the incentives provided through the program.

Table 4-1 Range Program Incentives

Equipment Type	*Rebate Amount*
Range	$100

Table 4-2 shows the number of rebated appliances and ex-ante therm savings for the Range Program by stratum.

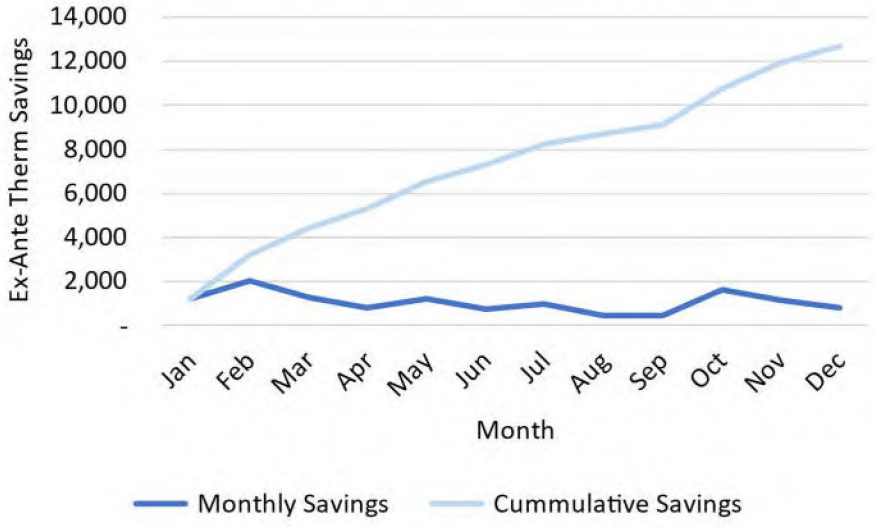
Table 4-2 Ex-Ante Therm Savings of Range Program by Stratum

Stratum	*Number of Ranges*	*Ex-Ante Therm Savings per unit*	*Ex-Ante Therm Savings*
Commercial	10	5.3	53
New Construction	1,642	5.3	8,708
Residential	741	5.3	3,930
Total	**2,393**	**5.3**	**12,691**

4.2 Program Trends in PY2022

Figure 4-1 plots the Range Program ex-ante therm savings by project completion month.

Figure 4-1 Range Program Ex-Ante Therm Savings by Project Completion



4.3 Impact Evaluation

This section describes the gross impact evaluation of the Range Program.

4.3.1 Gross Impact Evaluation

The following section presents the methodology that was used for estimating gross energy impacts resulting from the Range Program.

The estimated gross energy impacts were found using the assumptions provided in Residential Building Stock Assessment: Metering Study[2]. The planned per-unit savings for gas ranges was 5.3 therms.

4.3.1.1 Review of Documentation

The gas range baseline fuel type is assumed to be an electric range in the residential and commercial strata. The baseline range type in the new construction stratum is assumed to be a gas range.

4.3.1.2 Procedures for Estimating Therm Savings from Measures Installed Through the Program

To determine the quantity of measures rebated and installed, the Evaluator reviewed all entries in the tracking system to ensure (a) each measure is program eligible, (b) each measure was purchased and rebated in PY2022, and (c) there were no duplicate or otherwise erroneous entries.

4.3.1.3 Method for Analyzing Savings from Ranges

Ranges are not typically found in TRMs. Ranges also do not have their efficiency rated by ENERGY STAR®. Savings are only calculable in instances of fuel switching. For the gross impact evaluation, it was assumed that all ranges had fuel switching, unless otherwise noted.

The energy savings of a gas range is found by subtracting the energy use of the new range from the energy use of the baseline range.

$$therm_{ex\ post\ savings} = (therm_{basline\ range} - therm_{new\ range})\ X\ \%fuel\ switching$$

$$therm_{basline\ range} = kWh_{site\ requirement} \times \left(\frac{kWh\ to\ Btu\ conversion\ factor}{Btu\ to\ therm\ conversion\ factor}\right) \times (site\ to\ source\ ratio)$$

$$therm_{new\ range} = kWh_{site\ requirement} \times \left(\frac{kWh\ to\ Btu\ conversion\ factor}{Btu\ to\ therm\ conversion\ factor}\right) \times (site\ to\ source\ ratio)$$

[2] Ecotope Inc. (2014). *Residential Building Stock Assessment: Metering Study*. Northwest Energy Efficiency Alliance, pp.76-77

Where:

$kWh_{site\ requirement} = 314\ kWh$[3]

kWh to Btu conversion factor = 3412.14 Btu/kWh

Btu to therm conversion factor = 100,000 $Btu/therm$

Site-to-Source ratio, electricity to gas = 3.38

Site-to-Source ratio, gas to gas = 1.09

$\%fuel\ switching =$ *100% residential stratum from survey responses*

0% new construction stratum,

100% commercial stratum.

4.3.2 Results of Ex-Post Gross Savings Estimation

The ex-ante and ex-post gross therm savings of the Range Program are summarized by stratum in Table 4-3. All participants in the residential and commercial strata were assumed to have performed fuel-switching. All participants in the new construction stratum were assumed not to have performed fuel-switching.

Table 4-3 Ex-Ante and Ex-Post Annual Therm Savings for Range Program by Stratum

Stratum	*Percent of Baseline Ranges which use Electricity*	*Ex-Ante Gross Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
Commercial	100%	53	53	100%
New Construction	0%	8,708	-	0%
Residential	100%	3,930	3,930	100%
Total	**31%**	**12,691**	**3,983**	**31%**

The realization rate for this program was lower than expected savings because fuel switching was found to be less than expected. Savings can only be calculated when fuel switching exists. Fuel switching is not present in the new construction stratum.

4.3.3 Net Impact Evaluation

The net savings approach for the Range Program was the same as the approach described in Section 3.3.3.

4.3.4 Results of Net Savings Estimation

This section discusses the results of estimating net impacts for the program.

Table 4-4 summarizes the results of the estimation of free ridership. Free ridership was low for the program because there was a low incidence of participant responses indicating a high likelihood of installing energy efficient equipment without a rebate, as well as a

[3] Ecotope Inc. (2014). *Residential Building Stock Assessment: Metering Study*. Northwest Energy Efficiency Alliance, pp.76-77

near zero incidence of retailer responses indicating a high likelihood of stocking energy efficient equipment without a rebate.

Table 4-4 Range Program Free Ridership Factor

Equipment Type	*FR Factor*
Range	43%

Table 4-5 summarizes the gross and net ex-post therm savings for the Range Program.

Table 4-5 Range Program Summary of Gross and Net Ex-Post Therm Savings

Equipment Type	*Ex-Post Gross Therm Savings*	*Estimated Free Ridership*	*Ex-Post Net Therm Savings*	*Net to Gross Ratio*
Range	**3,983**	**1,699**	**2,284**	**57%**

4.4 Process Evaluation

The following section presents the results of the process evaluation for the Range Program.

4.4.1 Participant Survey

The Evaluator surveyed 57 participants in the Range program. These surveys were used to collect data on the participants' experience with the program including sources of program awareness, motivations for participating, and satisfaction with the program. Furthermore, the Evaluator collected demographic information about the respondents during the survey.

4.4.1.1 Program Awareness

ONG's marketing of the range program is driven through point of sale, the ONG website, and other outreach methods such as social media, direct mail, and email. ONG's website was the most popular source of program awareness (24.6%, n=14), followed by word-of-mouth (17.5%, n=10), and point of sale (15.8%, n=9). Table 4-6 summarizes the sources of awareness by respondents.

Table 4-6 Source of Awareness (n=57)

Sources of Awareness	*Percentage of Respondents*
ONG's website	24.6%
Word-of-mouth	17.5%
Point of sale	15.8%
Radio/TV ad	10.5%
Bill inserts or utility mailer	7.0%
Prior experience	5.3%
ONG newsletter	3.5%

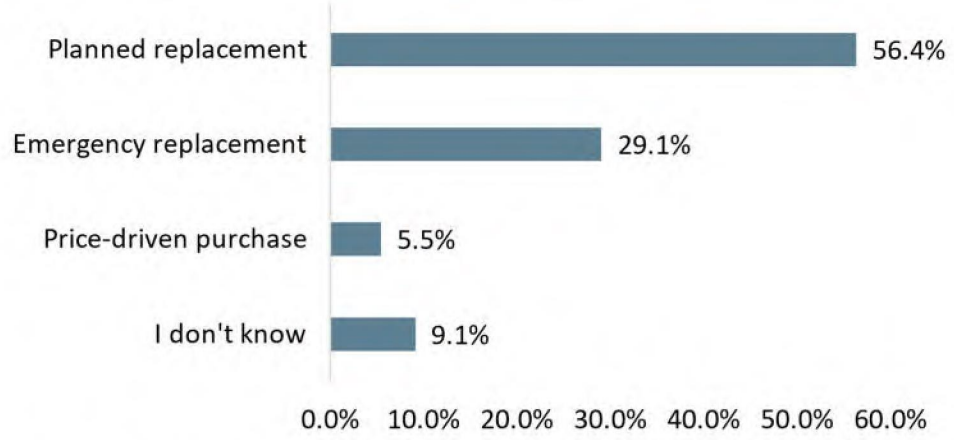
Sources of Awareness	*Percentage of Respondents*
Internet search	3.5%
Print ad	3.5%
Internet advertisement	1.8%
I don't know	7.0%

4.4.1.2 Reasons for Participation

Participants were asked several questions about the type of replacement and the age of the replaced equipment. Sixty percent of respondents (n=33) reported that the old range was still functioning at the time of replacement. Over half of respondents (56.4%, n=31) reported that the new range was a planned replacement, while just under one-third noted it was an emergency replacement (29.1%, n=16) (

Figure *4-2*).

Figure 4-2 Replacement Type



The average age of the previous range is listed in the table below. Thirty percent of those surveyed reported that they did not know the age of their previous range.

Table 4-7 Average Baseline Age (n=54)

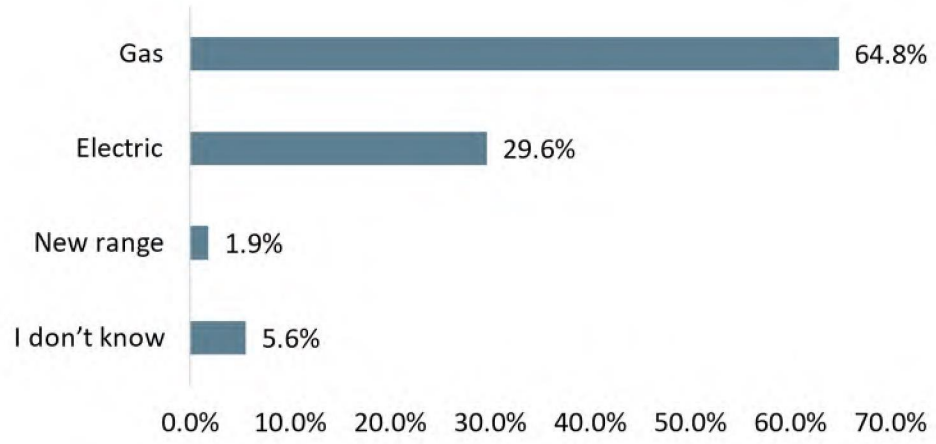
Response	*Average*
Old Range Age	19.0 years[4]
Planned Replacement Age	16.1 years
Emergency Replacement Age	10.1 years
Price-driven Age	8.5 years

[4] The average age of the old range is likely an underestimate as some respondents did not provide an exact age (i.e., reported 25+ years)

4.4.1.3 Fuel Switching

Sixty-five percent (n=35) of respondents reported that their prior range had been fueled by natural gas. This is about the same as the prior program year (63%).

Figure 4-3 Preexisting Range Fuel Type (n=54)

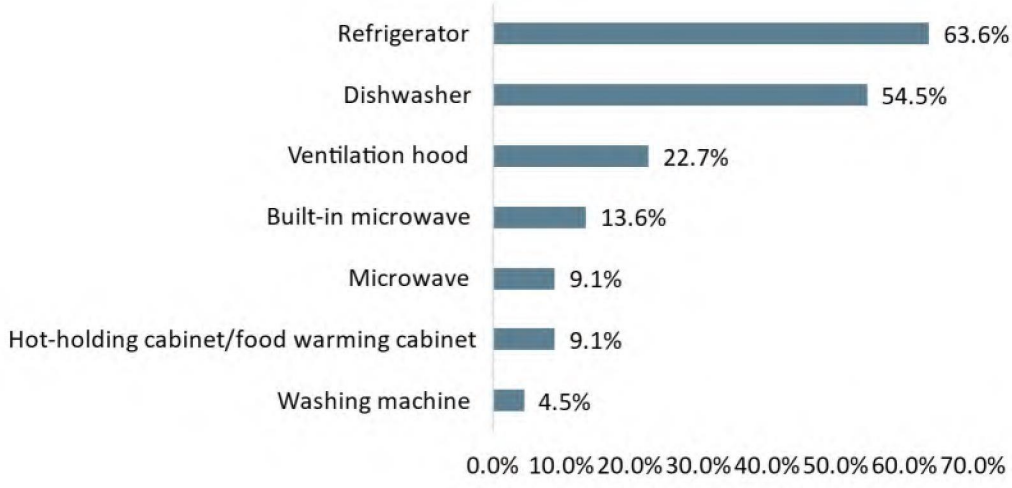


The majority of respondents (83.3%, n=45) planned to install a new range and over two-thirds of respondents indicated they likely would have chosen the same range as that obtained through the program (70.4%, n=38). Almost all respondents (90.7%, n=49) noted they would have been financially able to purchase the new range if the rebate was not available and 70.4% (n=38) of respondents indicated the rebate did not affect the timing of their range purchase.

4.4.1.4 Additional Appliances

Respondents were asked a series of questions about what home improvements they made during the time that they retrofitted their range. Sixty percent (n=33) of those surveyed said this was a standalone replacement. Figure 4-4 illustrates the number of other appliances participants installed during the range replacement.

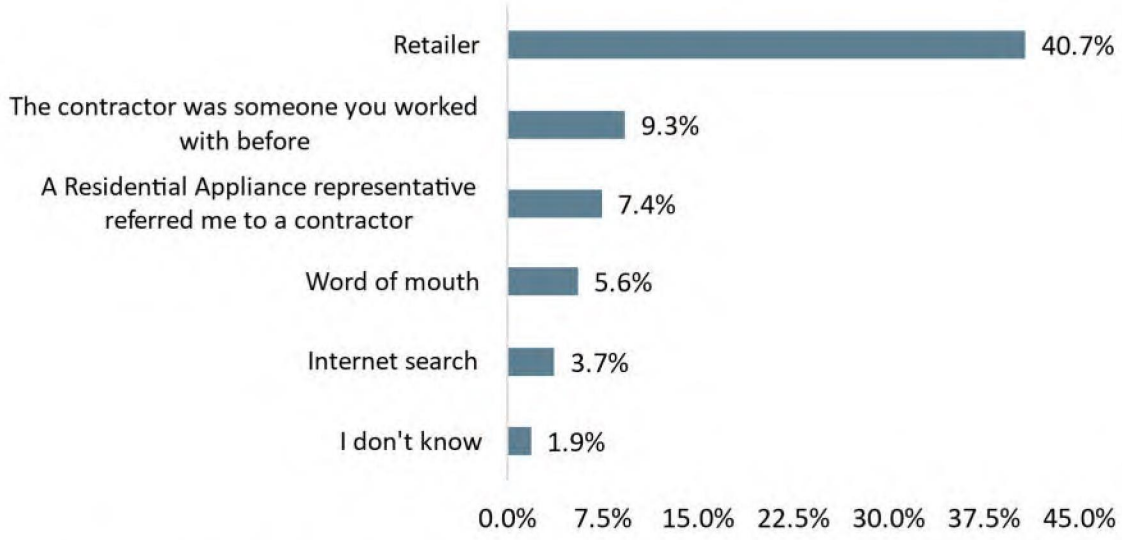
Figure 4-4 Additional Appliances Replaced (n=22)



4.4.1.5 Contractor Experience

Two-thirds of respondents noted that they hired someone to install their range (68.5%, n=37); many of these respondents found their contractor through the retailer from which they bought the range (40.7%, n=22) (Figure 4-5).

Figure 4-5 Contractor Source (n=37)



All but one respondent who worked with a contractor agreed that their contractor was courteous and professional, responsive to their needs, and scheduled and completed the install in a reasonable amount of time. Some respondents indicated that their contractor emphasized benefits of their new range including energy efficiency (16.2%, n=6) and rebate eligibility (8.1%, n=3) (Table 4-8).

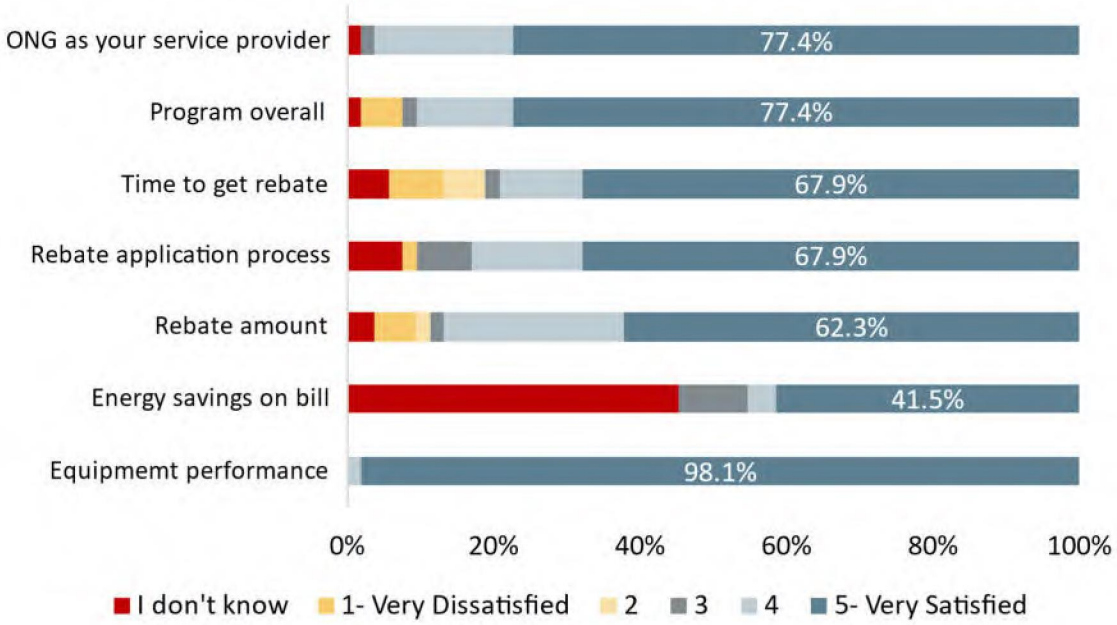
Table 4-8: Features of Range (n=37)

Response	*Average*
Energy Efficiency	16.2%
Rebate eligibility	8.1%
Good warranty/reliability	5.4%
Low price	2.7%
Size of the equipment	2.7%
Smart capabilities	2.7%
Self-cleaning	2.7%
None	13.5%
I don't know	62.2%

4.4.1.6 Satisfaction

Customer feedback was generally positive about a variety of aspects of the program. Participants were most satisfied with the equipment performance (98.1%, n=52), ONG as their service provider (77.4%, n=41), and the program overall (77.4%, n=41) (Figure 4-6).

Figure 4-6 Satisfaction with Various Program Aspects (n=53)



Ten respondents expressed dissatisfaction with any aspects of the program. Among those respondents who did express dissatisfaction, complaints included the time it took to get the rebate (n=6), install quality (n=1), rebate delivery method (n=1), rebate amount (n=1), and concerns that the program artificially inflates gas prices (n=1).

Respondents were also asked whether participation in the program had any effect on their satisfaction with ONG. As Table 4-9 shows, about half of respondents indicated greater satisfaction with ONG (47.2%, n=25). Additionally, the majority of respondents indicated they would likely participate in another ONG program in the future (81.1%, n=43).

Table 4-9 Satisfaction with ONG as Utility (n=53)

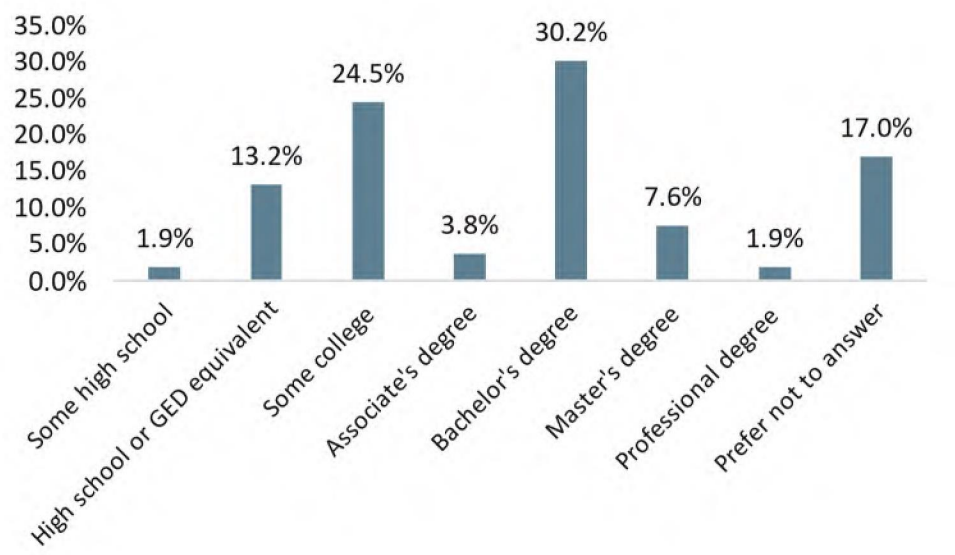
Would you say that your participation in ONG's program has?	*Percentage of Respondents*
Greatly increased your satisfaction with ONG	18.9%
Somewhat increased your satisfaction with ONG	28.3%
Did not affect your satisfaction with ONG	45.3%
Somewhat decreased your satisfaction with ONG	3.8%
Greatly decreased your satisfaction with ONG	0.00%
Don't know	3.8%

4.4.1.7 Demographics

Respondents were asked a series of questions related to demographic information. The majority of respondents own their home (94.3%, n=50) and most live in a single-family home (98.1%, n=52). Half of respondents live with one to two other people (54.7%, n=29). Figure 4-7 illustrates the reported education levels of surveyed participants; 15.1% of

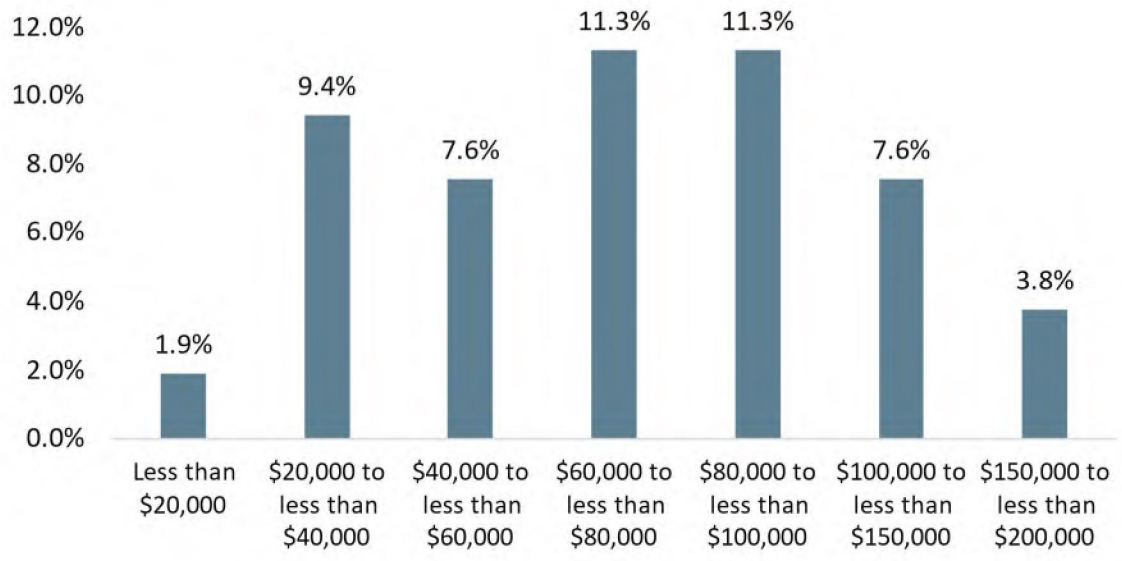
participants have no college experience, while 67.9% have at least some college experience.

Figure 4-7 Highest Level of Education (n=53)



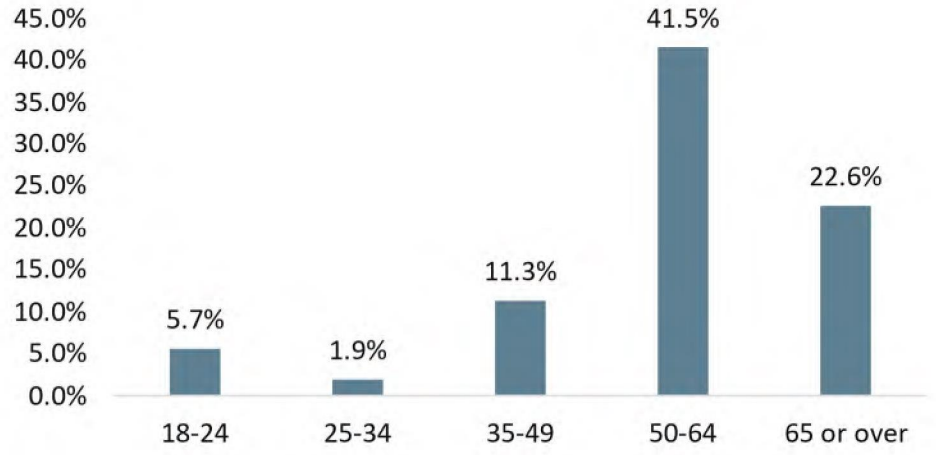
Just under half of respondents refused to respond to income questions or could not provide an answer (47.2%, n=25). The remaining respondents reported incomes across a large spectrum (Figure 4-8).

Figure 4-8 Reported Participant Income (n=53)



Sixty-four percent of respondents (64.2%, n=34) self-reported their age as 50 years or older, while 18.9% reported being younger than 50 years (Figure 4-9). Seventeen percent of respondents refused to provide their age range (n=9).

Figure 4-9 Reported Age Range



4.5 Conclusions and Recommendations

This section presents conclusions and recommendations for the Range Program.

4.5.1 Conclusions

- 25% percent of participants found out about the rebate program through ONG's website. Participants this year also relied on word-of-mouth (17.5%) for rebate program information.
- 56% of survey respondents reported that the old range was still functioning at the time they replaced it and the average age of ranges was 16.1 years.
- 65% of survey respondents indicated their prior range had been fueled by natural gas and 30% had been electric.
- The majority of survey respondents were somewhat or greatly satisfied with ONG as their natural gas service provider.

4.5.2 Recommendations

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

5 Water Heater Program

The Water Heater Program was designed to provide financial incentives to encourage residential customers to install energy efficient natural gas water heaters.

5.1 Program Description

The Water Heater Program provides mail-in rebates for energy efficient natural gas water heaters. Table 5-1 summarizes the incentives provided through the program.

Table 5-1 Water Heater Program Incentives

Equipment Type	*Rebate Amount*
Tankless water heater w/ EF ≥.80	$250
Condensing water heater w/ EF ≥.80	$250
Electric to Natural Gas Water Heater	$850

Table 5-2 shows the number of completed projects and ex-ante therm savings for the Water Heater Program by stratum.

Table 5-2 Ex-Ante Therm Savings of Water Heater Program by Stratum

Equipment Type	*Number of Water Heaters*	*Ex-Ante Therm Savings per unit*	*Ex-Ante Therm Savings*
Condensing Water Heater	2	41.87	84
Electric to Gas Water Heater	36	166.44	5,992
Tankless Water Heater	2,275	44.94	102,239
Electric to Gas Tankless Water Heater	80	166.44	13,315
Total	**2,393**	**50.8**	**121,629**

5.2 Program Trends in PY2022

Figure 5-1 plots the Water Heater Program ex-ante therm savings by project completion month.

Figure 5-1 Water Heater Program Ex-Ante Therm Savings by Project Completion

5.3 Impact Evaluation

This section describes the gross impact evaluation for the Water Heater Program.

5.3.1 Gross Impact Evaluation

The following section presents the methodology that was used for estimating gross energy impacts resulting from the Water Heater Program.

5.3.1.1 Review of Documentation

The water heater uniform energy factor (UEF), storage volume, and fuel type were found for all unique model numbers wherever possible. Water heater model numbers were verified using the AHRI directory database and manufacturer websites. Survey responses were used in the savings calculations as well.

5.3.1.2 Procedures for Estimating Therm Savings from Measures Installed Through the Program

The Evaluator's approach for the calculation of gross energy impacts depended largely on the types of measures installed. Where applicable, deemed values and algorithms from the Arkansas TRM were used to calculate verified gross energy impacts.

To determine the quantity of measures rebated and installed, the Evaluator reviewed all entries in the tracking system to ensure (a) each measure is program eligible, (b) each measure was purchased and rebated in PY2022, and (c) there were no duplicate or otherwise erroneous entries.

The Evaluator verified the baseline fuel type of the removed water heaters through process evaluation surveys and model number verification efforts.

5.3.1.3 Method for Analyzing Savings from Water Heater Measures

The energy savings of a water heater is found by subtracting the energy use of the new water heater from the energy use of the baseline water heater.

$$therm_{ex\ post\ savings} = therm_{basline\ water\ heater} - therm_{new\ water\ heater}$$

First the energy use of the new water heater was calculated using the following equation:

$$therm_{new\ water\ heater} = \rho \times Cp \times V \times (TSetPoint - TSupply) \times \frac{1}{EFpost} \times$$

$$\left(\frac{1}{Btu\ \ to\ therm\ conversion}\right) \times Source\ to\ site\ ratio$$

Where:

ρ = *Water density = 8.33 lb./gal*

Cp = *Specific heat of water = 1 BTU/lb.·°F*

V = *Calculated estimated annual hot water use (gal), based on zip code and tank size*

$T_{SetPoint}$ = *Water heater set point (default value = 120°F)*

T_{Supply} = *average supply water temperature based on climate zone and zip code*

EF_{post} = *verified Energy Factor of new water heater*

Btu to therm conversion factor = 100,000 $Btu/therm$

Source to site ratio, gas to gas = 1.09

$$therm_{electric\ baeline\ water\ heater} = \rho \times C_p \times V \times (T_{SetPoint} - T_{Supply}) \times \frac{1}{EF_{pre}} \times$$

$$\left(\frac{1}{Btu\ to\ therm\ conversion\ factor}\right) \times Source\ to\ site\ ratio, electric\ to\ gas$$

$$therm_{gas\ baeline\ water\ heater} = \rho \times C_p \times V \times (T_{SetPoint} - T_{Supply}) \times \frac{1}{EF_{pre}} \times$$

$$\left(\frac{1}{Btu\ to\ therm\ conversion\ factor}\right) \times Source\ to\ site\ ratio, gas\ \ to\ gas$$

Where:

ρ = *Water density = 8.33 lb./gal*

Cp = *Specific heat of water = 1 BTU/lb.·°F*

V = *Calculated estimated annual hot water use (gal), based on zip code and tank size*

$T_{SetPoint}$ = *Water heater set point (default value = 120°F)*

T_{Supply} = *average supply water temperature based on climate zone and zip code*

EF_{pre} = *verified Energy Factor of new water heater*

kWh to Btu conversion factor = 3,412.14 Btu/kWh

Btu to therm conversion factor = 100,000 $Btu/therm$

Source to site ratio, gas to gas = 1.09, electric to gas = 3.38

5.3.2 Results of Ex-Post Gross Savings Estimation

The ex-ante and ex-post gross therm savings of the Water Heater Program are summarized by stratum in Table 5-3.

Table 5-3 Ex-Ante and Ex-Post Annual Therm Savings for Water Heater Program by Stratum

Equipment Type	*Percent of Baseline Water Heaters which use Electricity*	*Ex-Ante Gross Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
Condensing Water Heater	0%	84	113	135%
Electric to Gas Water Heater	100%	5,992	5,902	98%
Tankless Water Heater	0%	102,239	102,684	100%
Electric to Gas Tankless Water Heater	100%	13,315	17,799	134%
Total		**121,629**	**126,498**	**104%**

The realization rate for this program was high due to several factors. Water usage for commercial projects were determined by building type and by facility square footage, per the AR TRM. Two of the condensing water heater measures were installed in a motel/hotel building. These types of facilities have much higher water usage compared to a single family residence.

Furthermore, the baseline efficiency standard changed starting with AR TRM V8.1. A draw pattern must be determined to calculate the correct energy factor for the baseline unit; the draw pattern is calculated based on the first hour rating of the installed water heater (defined number of gallons of hot water the heater can supply per hour). The shift in equipment baseline resulted in increasing calculated energy savings.

5.3.3 Net Impact Evaluation

The net savings analysis is used to determine what part of the gross energy savings achieved by program participants can be attributed to the effects of the program. The net savings attributable to program participants were the gross savings minus a combination of program participant free ridership. The Evaluator estimated free ridership through a survey of program participants.

Survey respondents were asked a series of questions designed to elicit information regarding the following factors:

- Plans and intentions to implement the efficiency measure;
- The program influence on the decision to implement the efficiency measure;

- The program's influence on the timing of the measure installation.

5.3.3.1 Plans and Intentions

An indicator variable was developed based on responses to the survey question on plans and intentions. The variable corresponds to financial ability. Respondents were considered to have not been financially able to install the efficient equipment if they answered "no" to the question below:

- FR1: Would you have been financially able to purchase the [MEASURE] if there was not a rebate available through the [UTILITY_SHORT] program?

A second indicator variable was related to whether the customer had plans to implement the efficiency measure. Respondents were considered to have had plan if they answered "yes" to the following questions:

- FR2: Prior to learning about the [PROGRAM], did you have plans to install a/an [MEASURE]?

5.3.3.2 Program Influence

Participants were asked a question about the direct influence of the program on their decision to implement the energy efficiency measure. Specifically, participants were asked:

- FR3: How likely is it that you would have purchased and installed the same [MEASURE] that you had rebated through the program if the rebate was not viable?

5.3.3.3 Program Influence on Project Timing

To account for deferred free ridership due to the program's effect on the timing of the implementation of the efficiency measure, respondents were asked the following two questions:

- FR4a: Did you install the [MEASURE] sooner than you otherwise would have because of the rebate available through the [UTILTIY_SHORT] program?
- FR4b: When would you have installed the [MEASURE] if rebates through the [UTILITY_SHORT] program were not available?

Based on the responses to those questions, a timing category was determined as shown in Table 5-4.

Table 5-4 Timing Adjustment Category

Timing Category	*Timing Category*
Less than one year	Y
One year or more	N

The three sets of rules just described were used to construct four different indicator variables that addressed free ridership behavior. For each respondent, a free ridership value was assigned based on the combination of variables. With the four indicator

variables, there were sixteen applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 5-5 shows these values.

Table 5-5 Appliances Participant Free Ridership Scoring

Indicator Variables				*Free Ridership Score*
Had Financial ability to install Measure without [Program Name]?	*Had Plans to install Measure without [Program Name]?*	*[Program Name] had influence on Decision to install Measure?*	*[Program Name] had effect on timing of Measure installation?*	
Y	Y	N	Y	100%
Y	N	N	Y	67%
Y	Y	N	N	67%
Y	Y	Y	Y	67%
Y	N	N	N	33%
Y	N	Y	Y	33%
Y	Y	Y	N	33%
Y	N	Y	N	0%
N	N	N	Y	0%
N	N	N	N	0%
N	N	Y	Y	0%
N	N	Y	N	0%
N	Y	N	Y	0%
N	Y	N	N	0%
N	Y	Y	Y	0%
N	Y	Y	N	0%

5.3.4 Results of Net Savings Estimation

This section discusses the results of estimating net savings impacts for the program.

Table 5-6 summarizes the results of the estimation of free ridership. Free ridership was substantial for the program because there was a high incidences of participant responses indicating a high likelihood of installing energy efficient equipment without a rebate.

Table 5-6 Water Heater Program Free Ridership Factor

Equipment Type	*FR Factor*
Condensing Water Heater	68%
Electric to Gas Water Heater	68%
Tankless Water Heater	68%
Electric to Gas Tankless Water Heater	68%

Table 5-7 summarizes the gross and net ex-post therm savings for the Water Heater Program.

Table 5-7 Water Heater Summary of Gross and Net Ex-Post Therm Savings

Equipment Type	*Ex-Post Gross Therm Savings*	*Estimated Free Ridership*	*Ex-Post Net Therm Savings*	*Net to Gross Ratio*
Condensing Water Heater	113	77	36	32%
Electric to Gas Water Heater	5,902	4,019	1,883	32%
Tankless Water Heater	102,684	69,930	32,754	32%
Electric to Gas Tankless Water Heater	17,799	12,121	5,678	32%
Total	**126,498**	**86,147**	**40,351**	**32%**

5.4 Process Evaluation

The following section presents the results of the process evaluation for the Water Heater Program.

5.4.1 Participant Surveys

The Evaluator surveyed 67 participants in the Water Heater program. Eleven respondents received a water heater, and 57 respondents received a tankless water heater. These surveys were used to collect data on the participants' experience with the program including sources of program awareness, motivations for participating, and satisfaction with the program. Furthermore, the Evaluator collected demographic information aout the respondents during the survey.

5.4.1.1 Program Awareness

ONG's marketing of the Water Heater program is driven through point of sale, the ONG website, and other outreach methods such as direct mail, and email. About half of respondents heard about the program through word-of-mouth (25.0%, n=17) or contractor or retail establishment (23.9%, n=16). Other common sources of program awareness included bill inserts (9.0%, n=6), ONG's website (9.0%, n=6), and internet searches (9.0%, n=6). Table 5-8 summarizes the sources of awareness by respondents.

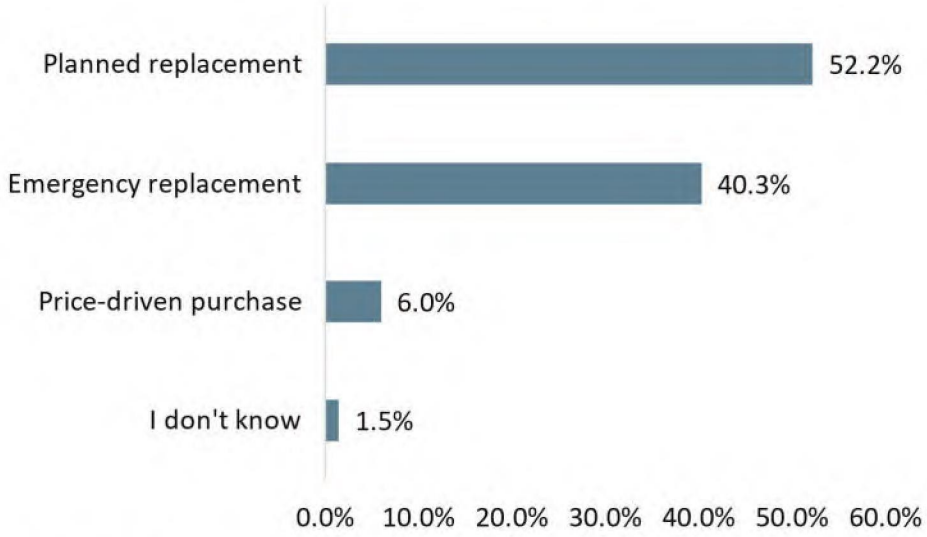
Table 5-8 Source of Awareness (n=67)

Sources of Awareness	*Percentage of Respondents*
Word-of-mouth	25.0%
Contractor or retailer	23.9%
Bill inserts or utility mailer	9.0%
ONG's website	9.0%
Internet search	9.0%
Previous utility employee	4.5%
Internet ad	3.0%
ONG newsletter	1.5%
Radio/TV ad	1.5%
I don't know	14.9%

5.4.1.2 Reasons for Participation

Participants were asked several questions about the type of replacement and the age of the replaced equipment. More than half of respondents reported that the old water heater was still functioning at the time they replaced it (59.7%, n=40). Forty percent of respondents reported that this was an emergency replacement (40.3%, n=27), while 52.2%, n=35) reported that it was a planned replacement (Figure 5-2).

Figure 5-2 Replacement Type (n=57)



The average age of the previous water heater is listed in Table 5-9 below. One-quarter of those surveyed reported that they did not know the age of their water heater (26.9%, n=18). Among those respondents who did know the age of their water heater, the average age of conventional water heaters was 11.2 years, and the age of tankless water heaters was 14 years.

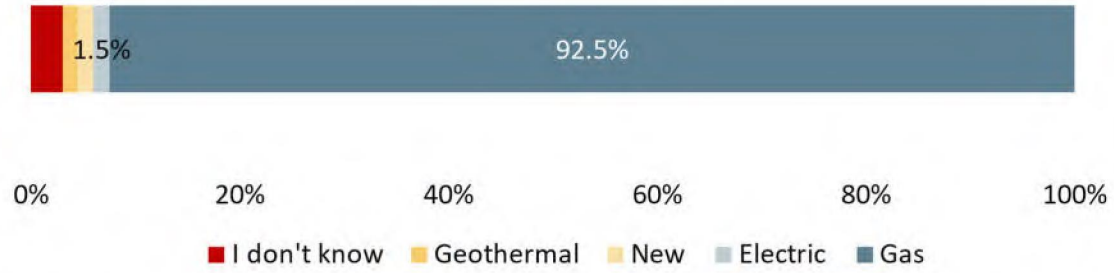
Table 5-9 Average Baseline Age

Response	*Standard Water Heater Average (n=6)*	*Tankless Water Heater Average (n=43)*
Old Water Heater Age	11.2 years	14.0 years
Planned Replacement Age	15.0 years	12.0 years
Emergency Replacement Age	14.0 years	15.0 years
Price-Driven Replacement Age	8.0 years	--

5.4.1.3 Fuel Switching and Water Heater Features

The majority of respondents reported that their prior water heater had been fueled by natural gas (92.5%, n=62); the remaining respondents indicated their previous water heater was electric (1.5%, n=1), or geothermal (1.5%, n=1) (*Figure 5-3*). All respondents indicated their new water heater was fueled by natural gas.

Figure 5-3 Baseline Fuel Type (n=67)



The majority of respondents planned to replace their water heater prior to participation in the program (80.6%, n=54). Most respondents indicated they would have been financially able to buy the water heater without the rebate (88.1%, n=59) and less than one-third of respondents noted they bought the water heater sooner than planned given the presence of the program(30.0%, n=20).

5.4.1.4 Contractor Satisfaction

Most respondents hired someone to install their new water heater (83.6%, n=56). In general, these respondents were pleased with their contractor's professionalism, the time it took to schedule and complete the install, and the contractor's responsiveness to their questions. Respondents indicated their contractor emphasized a variety of unique features of their new water heater including energy efficiency (33.9%, n=19) and never running out of hot water (26.8%, n=15) (Table 5-10).

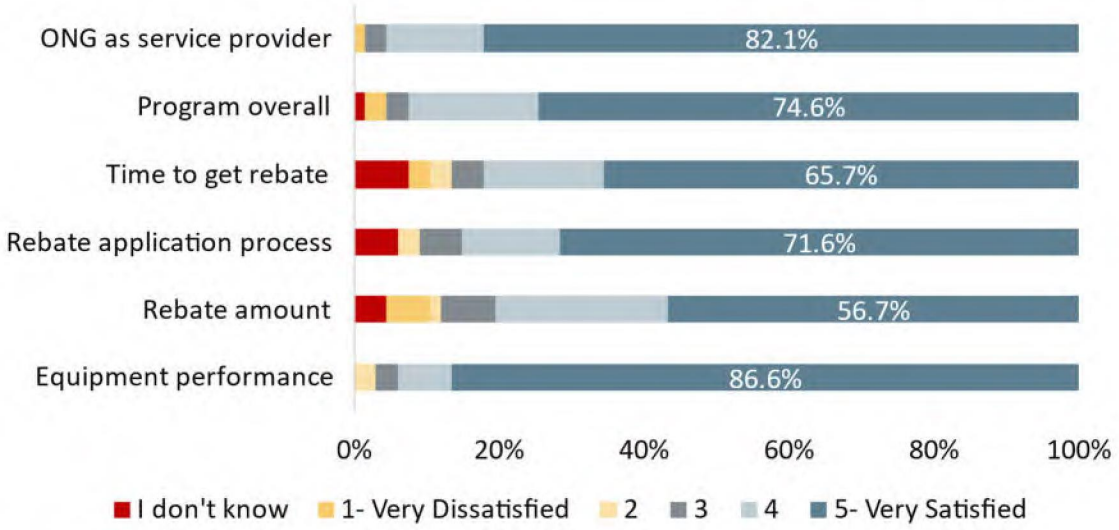
Table 5-10 Water Heater Features (n=56)

Response	*Percentage of Respondents*
Energy Efficiency	33.9%
Never running out of hot water	26.8%
Good warranty/reliability	19.6%
Rebate eligibility	12.5%
Emphasis on the brand and its reputation	8.9%
Size of the equipment	7.1%
Low price	5.4%
Cooking temperature control	1.8%

5.4.1.5 Satisfaction

Customer feedback was generally positive about a variety of aspects of the program. Respondents were asked questions based on a 1-5 scoring system, with "1" being very dissatisfied and "5" being very satisfied. Respondents were most satisfied with the equipment performance (86.6%, n=58) and ONG as their natural gas service provider (82.1%, n=55) (Figure 5-4).

Figure 5-4 Satisfaction with Various Program Aspects (n=67)



Ten respondents expressed dissatisfaction; some stated reasons for dissatisfaction included: delay in getting rebate (n=5), not being eligible for all rebates (n=2), the rebate amount (n=2), and programs perceived as artificially inflating gas prices (n=1).

Respondents were also asked whether participation in the program had any effect on their satisfaction with ONG. As Table 5-11 shows, 55.2% (n=37) of respondents reported greatly or somewhat increased satisfaction with ONG, while 43.3% (n=29) reported no change in satisfaction.

Table 5-11 Satisfaction with ONG as Utility

Would you say that your participation in ONG's program has?	*Percentage Respondents (n =67)*
Greatly increased your satisfaction with ONG	22.4%
Somewhat increased your satisfaction with ONG	32.8%
Did not affect your satisfaction with ONG	43.3%
Somewhat decreased your satisfaction with ONG	0.0%
Greatly decreased your satisfaction with ONG	0.0%
Don't Know	1.5%

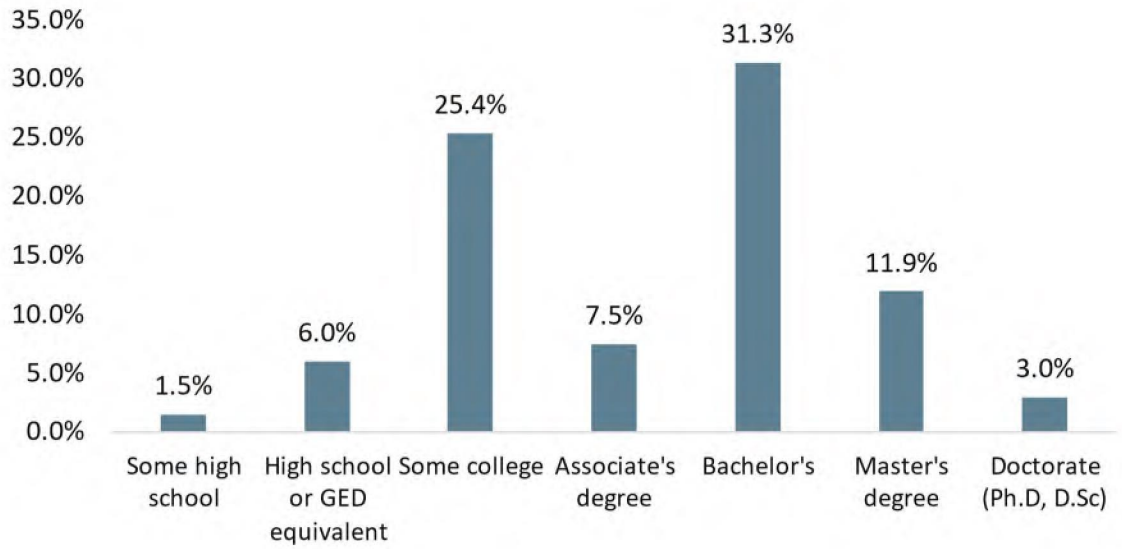
Just over two-thirds of respondents had never participated in an ONG program prior to the residential appliance program (68.7%, n=46) and 80.6% (n=30) of respondents were likely to participate in another ONG program.

5.4.1.6 Demographics

Respondents were asked a series of questions related to demographic information. The majority of respondents owned their home (97.0 %, n=65) and most live in a single-family home (98.5%, n=66). Less than half of respondents live with one to two other people (44.8%, n=30). Figure 5-5 illustrates the reported education levels of surveyed

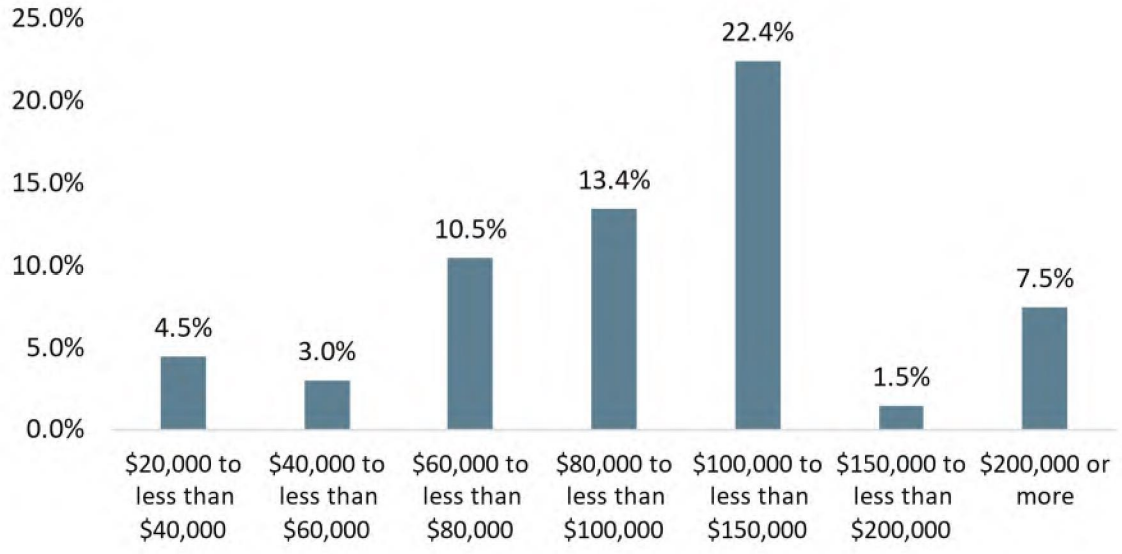
participants; 7.5% (n=5) of respondents have no college experience, while 79.1% (n=53) have at least some college experience.

Figure 5-5 Highest Level of Education (n=67)



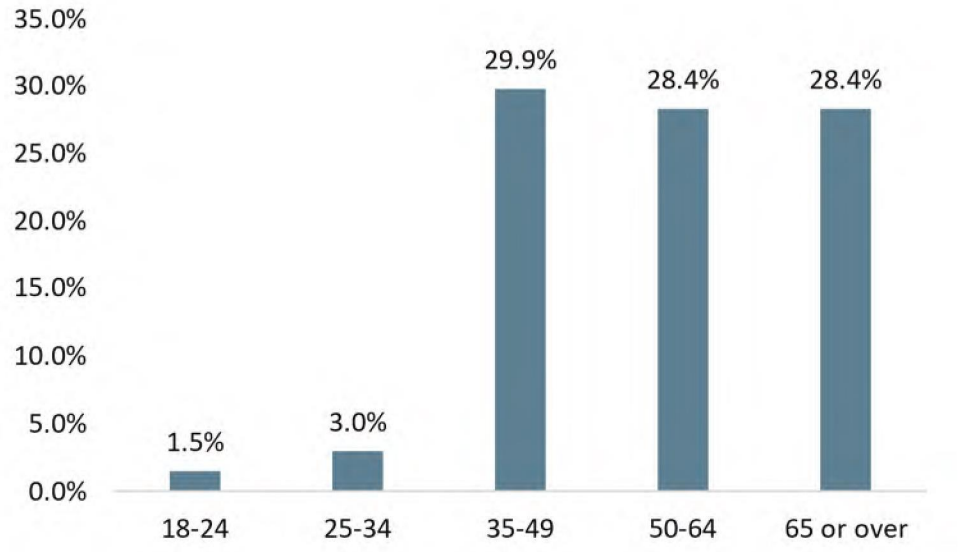
Just over one-third of respondents refused to respond to income questions or could not provide an answer (37.3%, n=25). The remaining respondents reported incomes across a large spectrum (Figure 4-8).

Figure 5-6 Reported Participant Income (n=67)



Over half of respondents (56.7%, n=48) self-reported their age as 50 years or older, while 34.3% (n=23) reported being younger than 50 years (Figure 4-9). Nine percent of respondents refused to provide their age range (n=6).

Figure 5-7 Reported Age Range (n=67)



5.5 Conclusions and Recommendations

This section presents conclusions and recommendations for the Water Heater Program.

5.5.1 Conclusions

- 25% of program participants who completed the survey learned of the Water Heater program through word-of-mouth.
- 52% of survey respondents indicated their old water heater was functioning at the time of replacement and the average age was 15 years for standard water heaters and 12 years for tankless water heaters.
- 92.5% of survey respondents reported their prior water heater was fueled by natural gas.
- Most survey respondents reported being satisfied with ONG as their natural gas service provider.

5.5.2 Recommendations

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

6 Heating System Program

The Heating System Program was designed to provide financial incentives to encourage residential customers to install energy efficient natural gas furnaces.

6.1 Program Description

The Heating System Program provides mail-in rebates for energy efficient natural gas furnaces. Table 6-1 summarizes the incentives provided through the program.

Table 6-1 Heating System Program Incentives

Equipment Type	*Rebate Amount*
Natural Gas Furnace w/ AFUE ≥.95	$550
Electric Furnace to Natural Gas Furnace	$1,950
Heat Pump to Natural Gas Furnace	$1,950
Electric Furnace to Natural Gas Furnace w/ AFUE ≥.95	$2,500
Heat Pump to Natural Gas Furnace w/ AFUE ≥.95	$2,500

Table 6-2 shows the number of completed projects and ex-ante therm savings for the Heating System Program by stratum.

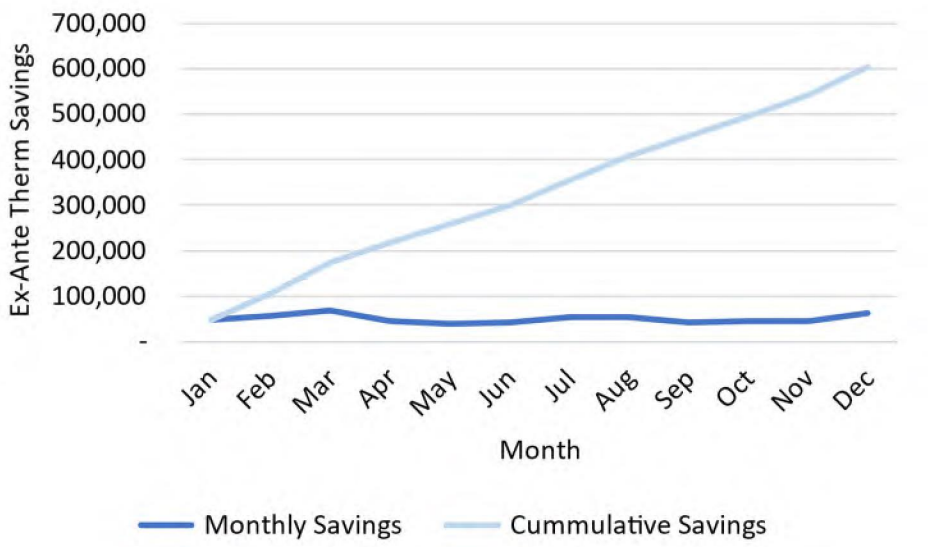
Table 6-2 Ex-Ante Therm Savings of Heating System Program by Stratum

Stratum	*Number of Heating Systems*	*Average Ex-Ante Therm Savings per Unit*	*Ex-Ante Therm Savings*
Commercial	55	85.909	4,725
Evaluated in New Home	0	N/A	0
New Construction	3,711	65.980	244,852
Residential	2,616	135.556	354,614
Total	**6,382**	**94.671**	**604,191**

6.2 Program Trends in PY2022

Figure 6-1 plots the Heating System Program ex-ante therm savings by project completion month.

Figure 6-1 Heating System Program Ex-Ante Therm Savings by Project Completion



6.3 Impact Evaluation

This section describes the gross impact evaluation of the Heating System Program.

6.3.1 Gross Impact Evaluation

The following section presents the methodology that was used for estimating gross energy impacts resulting from the Heating System Program.

6.3.1.1 Review of Documentation

The annual fuel utilization efficiency (AFUE) rated heating capacity, and fuel type for each unique heating systems were verified using the AHRI directory database and manufacturer websites. Also, participant surveys and building research were used to verify a building's age and size.

6.3.1.2 Procedures for Estimating Therm Savings from Measures Installed Through the Program

The Evaluator's approach for the calculation of gross energy impacts depended largely on the types of measures installed. Where applicable, deemed values and algorithms from the Arkansas TRM were used to calculate verified gross energy impacts.

To determine the quantity of measures rebated and installed, the Evaluator reviewed all entries in the tracking system to ensure (a) each measure is program eligible, (b) each measure was purchased and rebated in PY2022, and (c) there were no duplicate or otherwise erroneous entries.

The Evaluator verified the baseline fuel type of the replaced heating systems through process evaluation surveys. The heating system baseline fuel type for each stratum is shown in Table 6-3.

Table 6-3 Baseline Heating System Fuel Type by Stratum and Equipment Type

Stratum	*Equipment Type*	*Percent of Baseline Heating Systems which use Gas*	*Percent of Baseline Heating Systems which use Electricity*
Commercial	Commercial	100%	0%
Evaluated in ONG New Home	Evaluated in ONG New Home	NA	NA
New Construction	New Construction	100%	0%
Residential	95% Eff Heater	100%	0%
	Electric to Gas Heater	90%	10%
	Electric to Gas 95+ Heater	75%	25%

The Evaluator verified the year homes were built using participant surveys and building research. These results are shown in Table 6-4.

Table 6-4 Building Age of Sample Sites by Stratum

Stratum	*Year Home was Built*	*Number of Sample Sites*
Commercial	NA	56
Evaluated in ONG New Home	NA	0
New Construction	2000 - Present	3,622
Residential	Pre-1970 - 1979	28
Residential	1980 - 1989	11
Residential	1990 - 1999	7
Residential	2000 - Present	22

6.3.1.3 Method for Analyzing Savings from Heating System Measures

The energy savings of a gas furnace is found by subtraction the energy use of the new furnace from the energy use of the baseline furnace.

$$therm_{ex\ post\ savings} = therm_{baseline\ heating\ system} - therm_{new\ heating\ system}$$

First the energy use of the new heating system was found.

$$therm_{new\ heating\ system} = \text{Heat load} \times \left(\frac{1}{\text{AFUE}_{\text{new heating system}}}\right) \times 1.09$$

$$\textit{Heat Load} = \left(\frac{\frac{\text{therms}}{\text{site area}}}{\text{yr}}\right) \times \text{site area}$$

Where:

$\frac{therms}{\frac{site\ area}{yr}}$ *=based on age of building and weather zone*

Site area = square footage of building

$\text{AFUE}_{\text{new heating system}}$ = *verified by the Evaluator with AHRI number*

Source to site ratio, gas to gas = 1.09

Below is the energy calculation for early replacement gas baseline heating system.

$$therm_{baseline\ gas\ heating\ system} = \text{Heat load} \times \left(\frac{1}{\text{AFUE}_{\text{baseline heating system}}}\right) \times 1.09$$

Heat Load = $\left(\frac{\frac{\text{therms}}{\text{site area}}}{\text{yr}}\right) \times \text{site area}$

$\text{AFUE}_{\text{baseline heating system}} = \text{AFUE}_{\text{base}} \times (1\text{-}M)^{age}$

Where:

$\frac{\frac{therms}{site\ area}}{yr}$ =*based on age of building and weather zone*

Site area = square footage of building

$\text{AFUE}_{\text{base}}$ = *.8*

$\text{M} = \text{Maintenance Factor} = 0.01$

$\text{Age} = \text{age of replaced furnace}$

Source to site ratio, gas to gas = 1.09

Below is the energy calculation for replace-on-burnout or new construction gas baseline heating system.

$$therm_{baseline\ gas\ heating\ system} = \text{Heat load} \times \left(\frac{1}{\text{AFUE}_{\text{baseline heating system}}}\right) \times 1.09$$

Heat Load = $\left(\frac{\frac{\text{therms}}{\text{site area}}}{\text{yr}}\right) \times \text{site area}$

Where:

$\frac{\frac{therms}{site\ area}}{yr}$ =*based on age of building and weather zone*

Site area = square footage of building

$\text{AFUE}_{\text{baseline heating system}}$ = *0.8*

Source to site ratio, gas to gas = 1.09

Below is the energy calculation for electric baseline heating system.

$$therm_{baseline\ electric\ heating\ system} = \text{CAP}_{\text{heating}} \times \left(\frac{1\ \text{kW}}{1{,}000\ \text{W}}\right) \times \text{EFLH}_{\text{H}} \times \left(\frac{1}{\text{HSPF}_{\text{base}}}\right) \times \left(\frac{kWh\ to\ Btu\ conversion\ factor}{Btu\ to\ therm\ conversion\ factor}\right) \times Source\ to\ site\ ratio, electric\ to\ gas$$

Where:

$\text{CAP}_{\text{H}}\left(\frac{\text{Btu}}{\text{hr}}\right)$ = *rated heating capacity = new furnace heating capacity, see above*

EFLHh = *based on weather using zip code lookup*

HSPFbase = *6.8* $(\frac{\text{Btu}}{\text{W}-\text{hr}})$ *ASHP early replacement (baseline before 2006), 7.7* $(\frac{\text{Btu}}{\text{W}-\text{hr}})$ *ASHP early replacement (baseline after 2006), 8.2* $(\frac{\text{Btu}}{\text{W}-\text{hr}})$ *ASHP replace on burnout, 3.41* $(\frac{\text{Btu}}{\text{W}-\text{hr}})$ *electric furnace early replacement or early replacement*

kWh to Btu conversion factor = 3,412.14 Btu/kWh

Btu to therm conversion factor = 100,000 $Btu/therm$

Source to site ratio, electric to gas = 3.38

6.3.2 Results of Ex-Post Gross Savings Estimation

The ex-ante and ex-post gross therm savings of the Heating System Program are summarized by equipment type in Table 6-5.

Table 6-5 Ex-Ante and Ex-Post Annual Therm Savings for Heating System Program by Stratum

Stratum	*Ex-Ante Therm Savings*	*Ex-Post Therm Savings*	*Gross Therm Savings Realization Rate*
Commercial	4,725	13,972	296%
Evaluated in New Home	0	0	N/A
New Construction	244,852	288,646	118%
Residential	354,614	817,650	231%
Total	**604,191**	**1,120,268**	**185%**

The realization rate for this program was higher than expected; there are several factors affecting realized savings.

Firstly, the ex-ante savings values are not calculated with the same methodology as the Arkansas TRM. For residential projects, the Arkansas TRM employs square feet of home and age to calculate savings. Many homes were built before 1970. Many large homes also participated in the program. A home's heat load increases with age and size.

Furthermore, the Evaluator found that there were a handful of sampled residential projects that were determined to be early retirement retrofits. These types of retrofits have significantly lower base AFUE values (~ 0.64 AFUE) than the verified efficient AFUE values (~ 0.96 AFUE). The combination of large homes, built in the 70's, which replaced their furnaces early, greatly contributed to the overall realized savings.

Finally, for commercial projects, the Arkansas TRM employs the use of equipment input BTUh. Equipment inputs were verified, and the heat loads for sampled commercial projects were calculated. Many large commercial buildings with large heat loads participated in the program.

6.3.3 Net Impact Evaluation

The net savings approach for the Heating System Program was the same as the approach described in Section 5.3.3.

6.3.4 Results of Net Savings Estimation

This section discusses the results of estimating net impacts of the program.

Table 6-6 summarizes the results of the estimation of free ridership. Free ridership was substantial for the program because there was a high incidences of participant responses indicating a high likelihood of installing energy efficient equipment without a rebate.

Table 6-6 Heating System Program Free Ridership Factor

Equipment Type	*FR Factor*
95% Eff Heater	61%
Electric to Gas 95+ Heater	61%
Electric to Gas Heater	61%

Table 6-7 summarizes the gross and net ex-post therm savings for the Heating System Program.

Table 6-7 Heating System Summary of Gross and Net Ex-Post Therm Savings

Equipment Type	*Ex-Post Gross Therm Savings*	*Estimated Free Ridership*	*Ex-Post Net Therm Savings*	*Net to Gross Ratio*
95% Eff Heater	602,165	365,366	236,800	39%
Electric to Gas 95+ Heater	209,702	127,237	82,465	39%
Electric to Gas Heater	308,400	187,123	121,277	39%
Total	**1,120,268**	**679,726**	**440,542**	**39%**

6.4 Process Evaluation

The following section presents the results of the process evaluation for the Heating System Program.

6.4.1 Participant Surveys

The Evaluator surveyed 78 participants in the Heating System Program. These surveys were used to collect data on the participants experience with the program including sources of program awareness, motivations for participating, and satisfaction with the program. Furthermore, the Evaluator collected demographic information about the respondents during the survey.

6.4.1.1 Program Awareness

ONG's marketing of the Furnace program is driven through word-of-mouth, point of sale, and other outreach methods such as direct mail. Word-of-mouth was the primary source

of program awareness – 32.1% of participants found out about the rebate program through friends, family, or colleagues (n=25). The second most reported source of program awareness was hearing about the program from a friend, family member, or colleague (20.5%, n=16). Table 6-8 summarizes the sources of awareness by respondents.

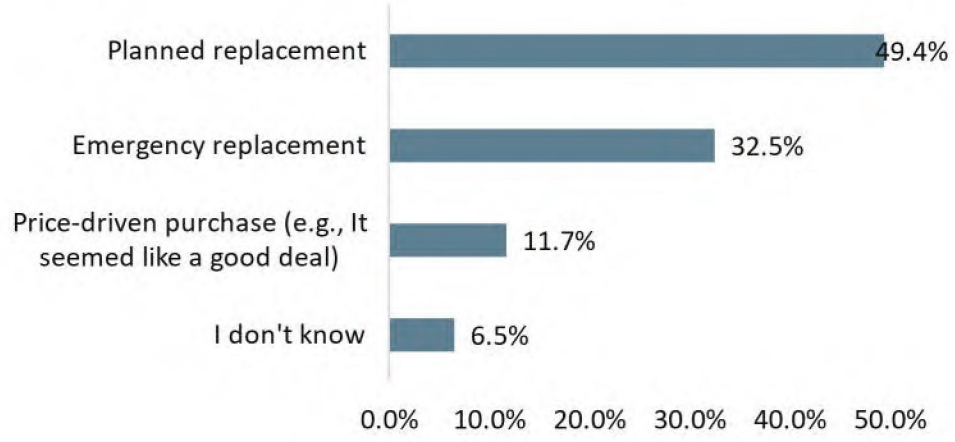
Table 6-8 Source of Awareness (n=78)

Sources of Awareness	*Percentage of Respondents*
Word-of-mouth	32.1%
Retailer	20.5%
Contractor	14.1%
ONG website	9.0%
Bill inserts or utility mailer	6.4%
ONG newsletter	2.6%
Internet ad	2.6%
ONG employee	2.6%
Previous participant	2.6%
ONG email	1.3%
Internet search	1.3%
Insurance Inspector	1.3%
I don't know	6.4%

6.4.1.2 Reasons for Participation

Participants were asked several questions about the type of replacement and the age of the replaced equipment. Sixty-one percent of respondents (n=47) reported that the old heating system was still functioning at the time they replaced it, while 29.9% (n=23) said the old heating system was not functioning. One-third of respondents (32.5%, n=25) reported that this was an emergency replacement and half indicated it was a planned replacement (49.4%, n=38) (Figure 6-2).

Figure 6-2 Replacement Type (n=77)



The average age of the previously installed furnace is listed in Table 6-9 below. Seven percent of those surveyed reported that they did not know the age of their furnace. Furthermore, the average age of the old functioning heating systems was 21.7 years; the average age of planned and emergency replacements is also shown.

Table 6-9 Average Baseline Age

Response	*Average (n=57)*
Planned Replacement Age	20.0 years[5]
Emergency Replacement Age	16.4 years
Price Driven Age	16.0 years

About three-quarters of respondents planned to install a furnace before that learned about the residential appliance program (76.6%, n=59), and 70.1% (n=54) of respondents indicated they would have been financially able to buy the furnace even if the rebate was not available. About half of respondents noted they were likely to purchase the same type of furnace they obtained through the program (53.3%, n=41) and about two-thirds of respondents indicated they did not purchase the furnace sooner than planned (62.3%, n=48).

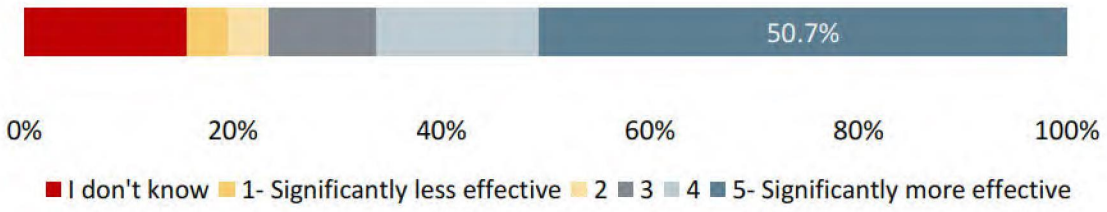
6.4.1.3 Fuel Switching

Eighty-five percent of respondents reported that their prior heating system had been fueled by natural gas (85.7%, n=66), 1.3% (n=1) said it was geothermal, and 1.3% (n=1) said there was no previous furnace; 9.1% respondents were not sure how the previous furnaced was fueled.

6.4.1.4 Heating System Features

All but three respondents indicated that their new furnace was fueled by natural gas (96.1%, n=74). The remaining respondents indicated their furnace was geothermal (n=1) or they did not know the fuel source (n=2). After obtaining these survey responses, ONG reviewed records for these three participants and was able to confirm that the new furnaces were in fact fueled by natural gas. About two thirds of respondents thought their new furnace was more effective at heating their home than their previous furnace (66.3%, n=51) (Figure 6-3).

Figure 6-3 Efficacy of New Furnace (n=77)



[5] This average is likely an underestimate, as some respondents did not provide the exact age of their old furnace (i.e., reporting 25+ years).

Respondents use a variety of different thermostat types with their new furnace including a programmable thermostat (39.0%, n=30), a Wi-Fi compatible thermostat (36.4%, n=28), and a manual thermostat (19.5%, n-15). Among respondents with special thermostats, one-third of programmable thermostat owners have a set schedule (33.3%, n=10) and 78.6% of Wi-Fi compatible thermostat owners us the Wi-Fi connectivity (n=22). The majority of respondents set their thermostat at or below the recommended 78 degrees during cooling season (87.0%, n=67). Forty-one percent of respondents set their thermostat at or above the recommended 68 degrees during heating season (41.6%, n=32).

6.4.1.5 Contractor Experience

All but four respondents (94.8%, n=73) hired someone to install their furnace. Almost half of these respondents had previously worked with the contractor who installed their furnace (45.2%, n=33) (Figure 6-4). All but one respondent agreed their contractor was courteous and professional, the work was scheduled and completed in a reasonable amount of time, and the contractor was knowledgeable and responsive. Respondents also indicated that the contractor emphasized a variety of features in their new furnace, with energy efficiency being the most notable feature (Table 6-10).

Figure 6-4 Contractor Source (n=73)

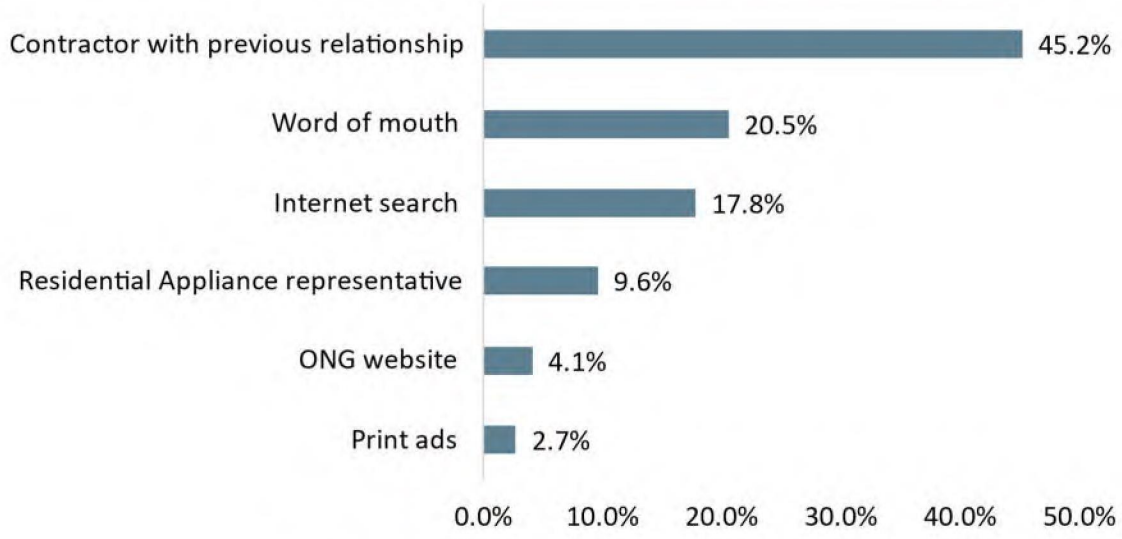


Table 6-10 Emphasized Features (n=73)

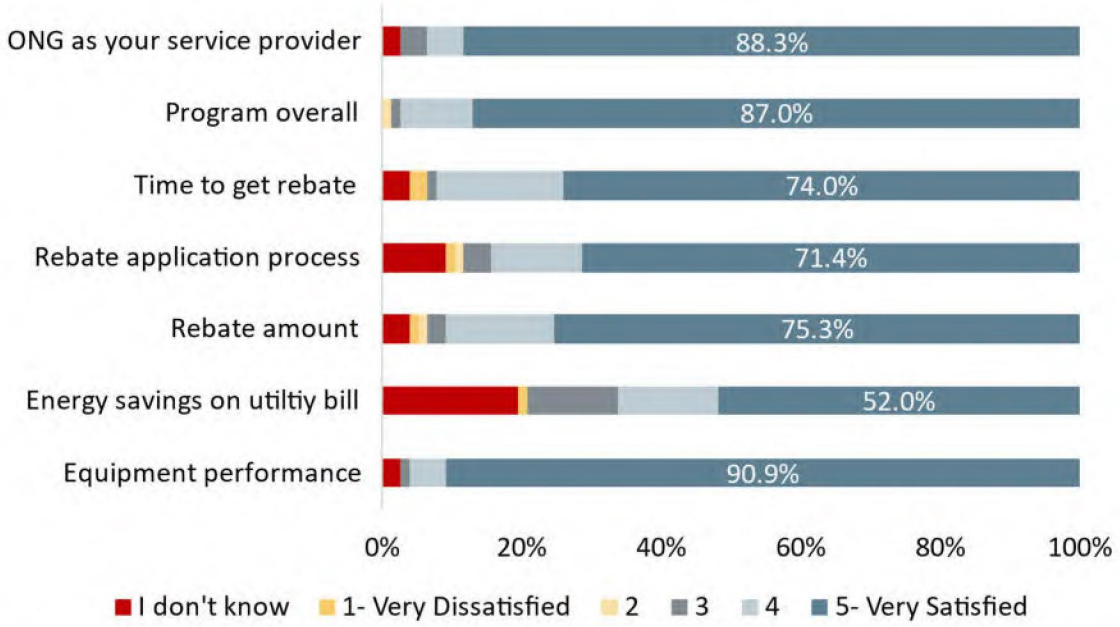
Response	*Percentage of Respondents*
Energy Efficiency	68.5%
Low price	12.3%
Rebate eligibility	11.0%
Good warranty/reliability	8.2%
Emphasis on the brand and its reputation	8.2%
Never running out of hot water	5.5%

Response	*Percentage of Respondents*
Quiet operation	4.1%
Size of the equipment	2.7%
Comfort	2.7%
Cooking temperature control	1.4%
Wi-Fi capability	1.4%
Filter replacement	1.4%

6.4.1.6 Satisfaction

Customer feedback was overwhelmingly positive about a variety of aspects of the program. Participants were asked questions based on a 1-5 scoring system, with "1" being very dissatisfied and "5" being very satisfied. Participants were most satisfied with the equipment performance (90.9%, n=70), ONG as their service provide (88.3%, n=68), and the program overall (87.0%, n=67) (Figure 6-5).

Figure 6-5 Satisfaction with Various Program Aspects (n=77)



Respondents were also asked whether participation in the program had any effect on their satisfaction with ONG. As Table 6-11 shows, 66.3% (n=51) of respondents reported greatly or somewhat increased satisfaction with ONG, while 28.6% (n=22) reported no change in satisfaction. Additionally, the majority of respondents indicated they were likely to participate in another ONG program in the future (80.5%, n=62).

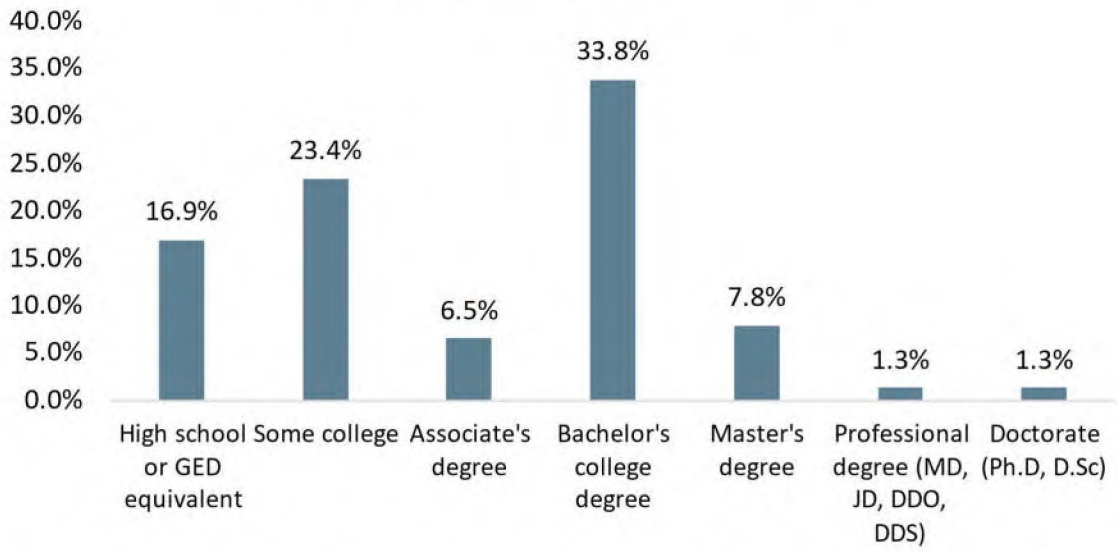
Table 6-11 Satisfaction with ONG as Utility (n=77)

Would you say that your participation in ONG's program has…?	*Percentage of Respondents*
Greatly decreased your satisfaction with ONG	0.0%
Somewhat decreased your satisfaction with ONG	3.9%
Did not affect your satisfaction with ONG	28.6%
Somewhat increased your satisfaction with ONG	35.1%
Greatly inccreased your satisfaction with ONG	31.2%
Don't Know	1.3%

6.4.1.7 Demographics

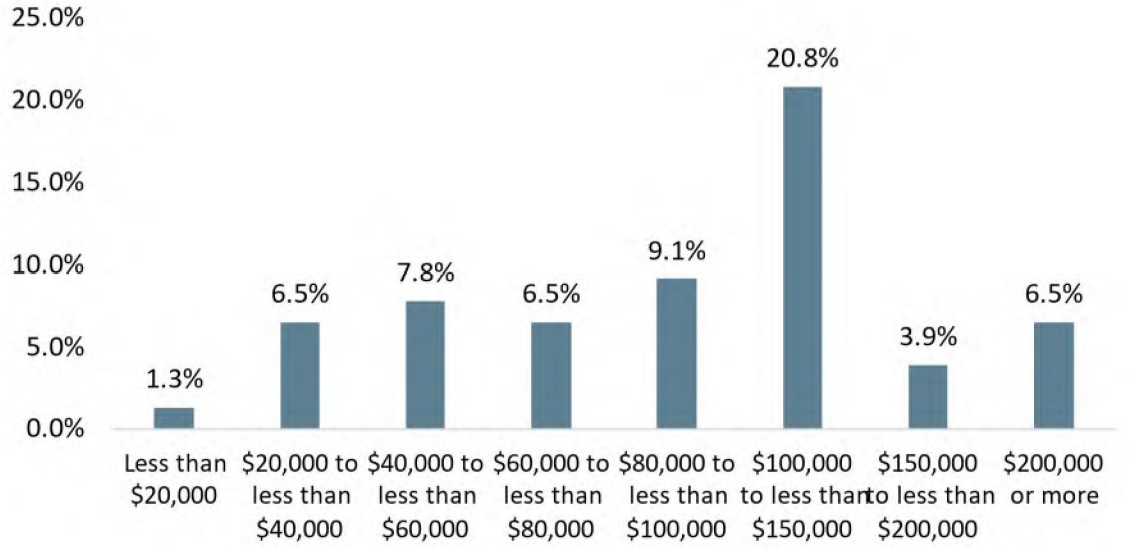
Respondents were asked a series of questions related to demographic information. The majority of respondents owned their home (97.4%, n=70) and most live in a single-family home (94.8%, n=73). About two-thirds of respondents live with one to two other people (62.3%, n=48). Figure 6-6 illustrates the reported education levels of surveyed participants; 16.9% (n=13) of respondents have no college experience, while 74.0% (n=57) have at least some college experience.

Figure 6-6 Highest Level of Education (n=53)



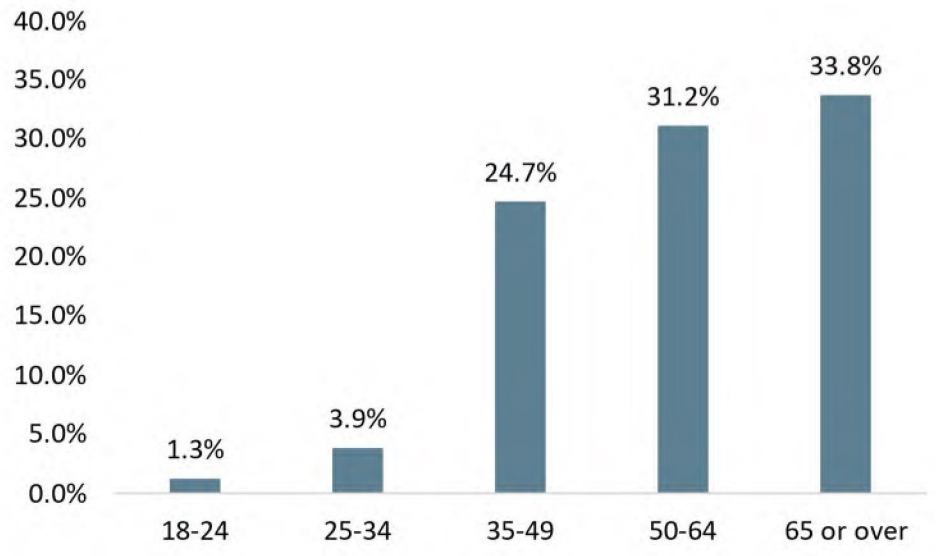
Just over one-third of respondents refused to respond to income questions or could not provide an answer (37.7%, n=29). The remaining respondents reported incomes across a large spectrum (Figure 4-8).

Figure 6-7 Reported Participant Income (n=77)



Sixty-five percent of respondents (64.9%, n=50) self-reported their age as 50 years or older, while 29.9% (n=23) reported being younger than 50 years (Figure 4-9). Five percent of respondents refused to provide their age range (5.2%, n=9).

Figure 6-8 Reported Age Range (n=77)



6.5 Conclusions and Recommendations

This section presents conclusions and recommendations for the Heating System Program.

6.5.1 Conclusions

- Word-of-mouth was the most common method that program participants learned of the program according to survey responses.

- 49% of surveyed program participants reported that the old heating system was still functioning at the time they replaced it and the average age was 20 years.
- 85% of surveyed program participants indicated they replaced a heating system that was fueled by natural gas.
- Participants were most satisfied with the equipment performance (91%), ONG as their service provide (88%), and the program overall (87%).

6.5.2 Recommendations

- Consider offering a midstream program for residential appliances, where participating retailers offer already-discounted energy efficient appliances in an effort to further develop working relationships with local retailers.

7 Low-Income Assistance Program

The Low-Income Assistance Program was designed to provide residential energy efficiency improvements to customers that live on a low or fixed income. The program operates in partnership with Oklahoma Gas & Electric (OG&E) and Public Service Company of Oklahoma (PSO).

7.1 Program Description

The Low-Income Assistance Program provides residential energy efficiency improvements free of charge to low-income or fixed income customers. The program is available to all residential customers who own or lease a single-family, duplex, or mobile home and have an income of less than $60,000 per year for OG&E and $55,000 per year for PSO. Weatherization services are also available to tenants of rental properties if the eligible tenant has approval from a property owner. Home improvements include the following:

- Attic Insulation;
- Air Sealing; and
- Duct Sealing.

Table 7-1 shows the number of homes where projects were completed as well as Ex-Ante Therm savings by cross-participating electric utility.

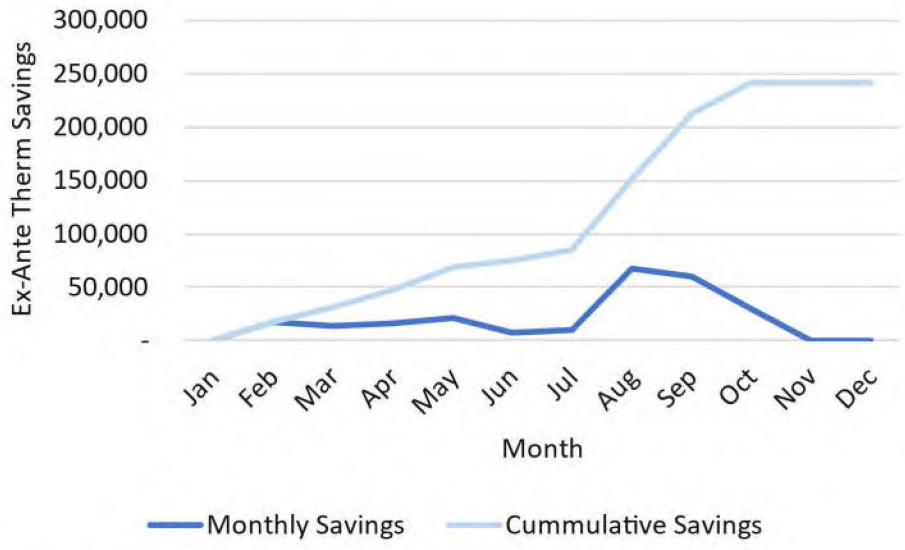
Table 7-1 Ex-Ante Therm Savings of Low-Income Assistance Program by Equipment Type

Cross-Participating Electric Utility	*Number of Homes*	*Ex-Ante Therm Savings*
OG&E	344	135,147
PSO	311	106,622
Total	**655**	**241,770**

7.2 Program Trends in PY2022

Figure 7-1 plots the Low-Income Assistance Program ex-ante therm savings by project completion month.

Figure 7-1 Low-Income Assistance Program Ex-Ante Therm Savings by Project Completion



7.3 Impact Evaluation

7.3.1 Gross Impact Evaluation

The following section presents the methodology that was used for estimating gross energy impacts resulting from the Low-Income Assistance Program.

The estimated gross energy impacts were found using the databases provided by PSO and OG&E The planned savings for the low-income program is shown below.

Table 7-2 Ex-Ante Therm Savings by Partner Electric Utility

Cross-Participating Electric Utility	*Number of Homes*	*Therm Savings per Home*	*Ex-Ante Therm Savings*
OG&E	344	392.9	135,147
PSO	311	342.8	106,622
Total	**655**	**735.7**	**241,770**

7.3.2 Review of Documentation

The Evaluator performed a census review of tracking data. No other documentation was utilized for the evaluation.

7.3.2.1 Procedures for Estimating Therm Savings from Measures Installed Through the Program

The Evaluator's approach for the calculation of gross energy impacts depended largely on the types of measures installed. Where applicable, deemed values and algorithms

from the Arkansas TRM and Frontier Associates' 2018 Updated Oklahoma Deemed Savings were used to calculate verified gross energy impacts.

To determine the quantity of measures rebated and installed, The Evaluator reviewed all entries in the tracking system to ensure (a) each measure is program eligible, (b) each measure was purchased and rebated in PY2022, and (c) there were no duplicate or otherwise erroneous entries.

The Evaluator assumed all participating homes used gas for heating.

7.3.2.2 Method for Analyzing Savings from Low-income Measures

This section describes the various savings methodologies used to evaluate measures in the program.

7.3.2.2.1 Air Sealing

First, participant's homes were traced to a climate zone using the participant's zip code. Once the climate weather zone was determined, the infiltration reduction deemed savings value was found using the table below.

Table 7-3 Infiltration Reduction Deemed Savings by Zone

Zone	*Annual Gas Savings (Therms/ΔCFM50)*
	Gas Heat
Zone 9	0.08
Zone 8A	0.09
Zone 8B	0.09
Zone 7	0.07
Zone 6	0.04

Next, the energy savings were calculated using the equation below.

$$therm_{air\ sealing} = \Delta CFM_{50} \times V$$

Where:

$\Delta CFM_{50} = CFM_{pre50} - CFM_{post50}$

V (Therms/ΔCFM50) = value found in Table 7-3

7.3.2.2.2 Attic Insulation

First, a participant's home was traced to an appropriate climate zone using the participant's zip code. Once the climate weather zone was determined, the infiltration reduction deemed savings value could be found using Table 7-4. It was assumed that all retrofit ceiling insulation R-value was R 38.

Table 7-4 Ceiling Insulation Deemed Savings by Climate Zone and Pre-existing Ceiling Insulation

Climate Zone	*Pre-existing Ceiling Insulation R-Value*	*Annual Gas Savings (Therms/sq. ft.)*
9	R0	0.23
9	R-1 to R-4	0.19
9	R-5 to R-8	0.1
9	R-9 to R-14	0.06
9	R-15 to R-22	0.03
8a	R0	0.22
8a	R-1 to R-4	0.18
8a	R-5 to R-8	0.09
8a	R-9 to R-14	0.05
8a	R-15 to R-22	0.03
8b	R0	0.21
8b	R-1 to R-4	0.18
8b	R-5 to R-8	0.09
8b	R-9 to R-14	0.05
8b	R-15 to R-22	0.02
7	R0	0.18
7	R-1 to R-4	0.15
7	R-5 to R-8	0.08
7	R-9 to R-14	0.04
7	R-15 to R-22	0.02
6	R0	0.15
6	R-1 to R-4	0.13
6	R-5 to R-8	0.06
6	R-9 to R-14	0.04
6	R-15 to R-22	0.02

Next the energy savings were calculated using the equation below.

$$therm_{air\ sealing} = \Delta CFM_{50} \times V$$

7.3.2.2.3 Duct Sealing

First, a participant's home was traced to a climate zone using the participant's zip code. Once the climate weather zone was determined, the HDD could be found. Next, the following equation was used:

$$Therms_{savings,H} = \frac{(DL_{pre} - DL_{post}) \times 60\, x\, HDD \times 24 \times 0.018}{100{,}000 \times AFUE}$$

Where:

DLpre = Pre-improvement duct leakage at 25 Pa (ft3/min) reported in database

DLpost = Post-improvement duct leakage at 25 Pa (ft3/min) reported in database

60 = Constant to convert from minutes to hours

HDD = Heating degree days found via zip code lookup

24 = Constant to convert from days to hours

0.018 = Volumetric heat capacity of air (Btu/ft3°F)

100,000 = Constant to convert from Btu to therms

AFUE = Annual Fuel Utilization Efficiency of existing system = 0.78 (default)

7.3.3 Results of Ex-Post Gross Savings Estimation

The ex-ante and ex-post gross therm savings of the Low-Income Assistance Program are summarized by measure type and with OG&E as the cross-participating electric utility in Table 7-5.

Table 7-5 ONG & OG&E Ex-ante and Ex-Post Annual Therm Savings for Low-Income Assistance Program by Equipment Type

Measure Type	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
Air Sealing	43,604	47,726	109%
Attic Insulation	11,898	13,025	109%
Duct Sealing	79,645	86,654	109%
Total	**135,147**	**147,405**	**109%**

The ex-ante and ex-post gross therm savings of the Low-Income Assistance Program are summarized by measure type with PSO as the cross-participating electric utility in Table 7-6.

Table 7-6 ONG & PSO Ex-Ante and Ex-Post Annual Therm Savings for Low-Income Assistance Program by Equipment Type

Measure Type	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
Air Sealing	28,476	33,177	117%
Attic Insulation	18,908	18,368	97%
Duct Sealing	59,238	70,764	119%
Total	**106,622**	**122,309**	**115%**

The Program realization rate was slightly greater than expected. The Evaluator included a source-to-site ratio of 1.09 in the savings ex-post calculations and therefore increased the realized savings from the installed measures. Ex-ante calculations did not include source to site ratios in savings estimates.

Additionally, there were a handful of line items for which the weather zone may have been incorrectly assumed for ex-ante calculations. This usually occurred for projects that may have been assumed to be in weather zone 7, but were then determined to be in 8a, 8b weather zones.

7.3.4 Net Impact Evaluation

Because the Low-Income Assistance Program targeted energy efficiency improvements in low-income residential housing, free ridership is assumed to be zero; therefore, net ex-post savings are equal to gross ex-post savings.

7.3.5 Results of Net Savings Estimation

For the Low-Income Assistance Program, The Evaluator assumed a net-to-gross ratio of 1. This is a normal assumption for low-income programs as participants cannot afford the improvements without program assistance.

Table 7-7 summarizes the gross and net ex-post therm savings for the Low-Income Assistance Program.

Table 7-7 Heating System Summary of Gross and Net Ex-Post Therm Savings

Cross-Participating Electric Utility	*Ex-Post Gross Therm Savings*	*Estimated Free Ridership*	*Ex-Post Net Therm Savings*	*Net to Gross Ratio*
OG&E	147,405	0	147,405	100%
PSO	122,309	0	122,309	100%
Total	**269,714**	**0**	**269,714**	**100%**

7.4 Process Evaluation

No process evaluation was performed in PY2022 for the Low-Income Assistance Program. As part of program implementation, ONG partners with electric utility service providers that share ONG's service territory. ONG provides the necessary funding for dual-fuel measure installation; however, it is assumed that low-income program participants do not have a great deal of perspective or experience with the program with ONG as program administrator.

8 Water Conservation Kit Program

The Water Conservation Kit Program was designed to provide water-efficient direct install equipment, free of charge, to residential customers who have natural gas water heating.

8.1 Program Description

Residential customers can complete an online application to receive a water conservation kit. The kit includes one showerhead, one kitchen faucet aerator, and two bathroom faucet aerators. Program implementation is performed by Energy Federation, Inc (EFI), which is the firm responsible for shipping the kits to participants who have completed an online application.

Table 8-1 shows the number of completed projects and ex-ante therm savings for the Water Conservation Kit Program by equipment type.

Table 8-1 Ex-Ante Therm Savings of Water Conservation Kits Program by Equipment Type

Equipment Type	*Number of Components*	*Ex-Ante Therm Savings per unit*	*Ex-Ante Therm Savings*
Bathroom Aerator	11,630	1.4	16,357
Kitchen Aerator	5,815	0.8	4,907
Low-Flow Showerhead	5,815	7.5	43,737
Total	**23,260**	**2.8**	**65,001**

8.2 Impact Evaluation

8.2.1 Gross Impact Evaluation

The following section presents the methodology that was used for estimating gross energy impacts resulting from the Water Conservation Kit Program.

8.2.1.1 Review of Documentation

The Evaluator performed a census review of tracking data. Communications between ONG and EFI, the program implementation contractor, were also reviewed to determine kit contents and specifications. No other documentation was utilized for the evaluation.

8.2.1.2 Procedures for Estimating Therm Savings from Measures Installed Through the Program

The Evaluator's approach for the calculation of gross energy impacts depended largely on the types of measures installed. Where applicable, deemed values and algorithms from the Arkansas TRM were used to calculate verified gross energy impacts.

To determine the quantity of measures rebated and installed, The Evaluator reviewed all entries in the tracking system to ensure (a) each measure is program eligible, (b) each measure was purchased and rebated in PY2022, and (c) there were no duplicate or otherwise erroneous entries.

8.2.1.3 Method for Analyzing Savings from Measures in the Conservation kits

The conservation kit consists of one showerhead, one kitchen faucet aerator and two bathroom faucet aerators. In-service rates (ISRs) were developed for each measure using the program participant survey; ISRs are shown below.

Table 8-2 Measure ISRs

Equipment Type	*ISR*
Bathroom Aerator	59%
Kitchen Aerator	57%
Low-Flow Showerhead	70%

Per-unit energy savings calculations are shown below:

Showerhead:

$$Annual\ Energy\ Savings = \frac{\rho \times C_P \times V \times (T_{Mixed} - T_{Supply}) \times (1/RE)}{\text{Conversion Factor}} \times \text{ISR} \times \%\text{Water Heater fuel type x source to site ratio}$$

ρ = Water density = 8.33 lb./gallon

C_P = Specific heat of water = 1 BTU/lb.·°F

V = ($Gallons/Shower$_base × $Showers\ per\ Person/Day$ _base - $Gallons/Shower$_post × $Showers\ per\ Person/Day$_post) × (365 $Days/Year$) × ($Occupants\ per\ Home/\ Showerheads\ per\ Home$)

Occupants per home = 2.82 persons, survey results

Shower per home = 1.75 showers, survey results

V = (20.7 × 0.69 – 12.4 × 0.72) × (365) × (2.82) / (1.75) = 3,143.38gal

$Tmixed$ = from AR TRM, based on climate zone

$TSupply$ = from AR TRM, based on climate zone

RE = 0.79 gas water heater, 0.98 electric water heater

$Conversion\ Factor$ = 100,000 Btu/therm

ISR = see above table

%Water heater fuel type = 92.86% gas water heater, 7.14% electric water heater

Source to site ratio = 1.09 gas, 3.38 electric to gas

Faucet Aerator:

$$Annual\ Energy\ Savings = \frac{\rho \times CP \times V \times (TMixed - TSupply) \times (1/RE)}{\text{Conversion Factor}} \times \text{ISR} \times \%\text{Gas Water Heater x source to site ratio}$$

ρ = Water density = 8.33 lb./gallon

CP = Specific heat of water = 1 BTU/lb.·°F

V = ($Faucet\ Use\ per\ Person/Day$_base - $Faucet\ Use\ per\ Person/Day$_post) × ($Occupants\ per\ Home$) × (365 $Days/Year$) × / (Faucets $per\ Home$)

Occupants per home = 2.82 persons, survey results

Number of faucets per home = number of bath faucet + 1= 2.29 + 1= 3.29, survey results

$Faucet\ Use\ per\ Person/Day$_post = 8.2 kitchen aerator, 7.2 bathroom aerator

V = (9-7 –8.2 or 7.2) × (2.7) x (365) × / (3.41) = 674.29 gal. kitchen aerator, 1,123.81 gal. bathroom aerator

Tmixed= from AR TRM, based on climate zone

$TSupply$ = from AR TRM, based on climate zone

RE= 0.79 gas water heater, 0.98 electric water heater

$Conversion\ Factor$ =100,000 Btu/therm

ISR = see above table

Source to site ratio = 1.09 gas, 3.38 electric to gas

8.2.2 Results of Ex-Post Gross Savings Estimation

The ex-ante and ex-post gross therm savings of the Water Conservation Kit Program are summarized by equipment type in Table 8-3.

Table 8-3 Ex-Ante and Ex-Post Annual Therm Savings for Water Conservation Kit Program by Equipment Type

Equipment Type	*Ex-ante Gross Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
Bathroom Aerator	16,357	35,403	216%
Kitchen Aerator	4,907	10,237	209%
Low-Flow Showerhead	43,737	57,062	130%
Total	**65,001**	**102,701**	**158%**

The savings realization rate for the Water Conservation Kits Program is higher than expected because ex-ante calculations did not account for source to site ratios. Also, the kit contents were installed less frequently than expected, leading to lower ISRs and fewer realized savings. Measure ISR has improved overall since last year with bathroom aerator ISR up almost 30% and kitchen aerators and showerheads up 16% and 19% respectively.

8.2.3 Net Impact Evaluation

All survey response data was systematically reviewed by a researcher who was familiar with the program, the individual project, and the social science theory underlying the decision maker survey instrument. As part of this review, the researcher determined whether the available information justified modifying the free ridership score calculated in accordance with the algorithm outlined below.

Several factors were considered in the determination of the presence of free ridership. These included:

- Financial ability to afford the installed measure without a program rebate;
- Plans and intentions of the participant to install a measure even without support from the program;
- A participant's previous purchase of a measure that is also offered through the program.

To assess these factors, program participants were asked a series of questions about the decision to implement the measure. Based on their responses, respondents were assigned a free ridership score used to estimate the extent of project free ridership.

Several criteria were used to determine what portion of a customer's savings for a project should be attributed to free ridership. The first criterion was based on the response to the following question:

Using a scale where 0 means "not at all likely" and 10 means "very likely", if you had not requested the Water Conservation Kit, how likely would you have been to purchase any of the following items on your own within 12 months of when you received them?

If a customer answered "5" or lower to the first question, a free ridership score of 0 was assigned to the project. That is, if a customer required financial assistance from the program to undertake a project, then that customer was not deemed a free rider.

For decision makers that indicated that they were able to undertake energy efficiency projects without financial assistance from the program, two additional factors were analyzed to determine what percentage of savings may be attributable to free ridership. The two factors were:

- Plans and intentions of participant to install a measure even without support from the program;
- A participant's previous purchase of a measure that is also available through the program.

For each of these factors, rules were applied to develop binary variables indicating whether a participant's behavior showed free ridership. These rules made use of answers to questions on the decision maker survey questionnaire.

The first factor required determining if a participant's intention was to install an energy efficiency measure even without the program. The answers to a combination of several questions were used with a set of rules to determine whether a participant's behavior indicated likely free ridership. Two binary variables accounted for customer plans and intentions: one, based on a more restrictive set of criteria that may describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that may describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria indicating customer plans and intentions that likely signified free ridership were as follows:

The respondent answered "9" or higher to the following question: "Using a scale where 0 means "not at all likely" and 10 means "very likely", if you had not requested the Water Conservation Kit, how likely would you have been to purchase any of the following items on your own within 12 months of when you received them?"

The second, less restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

The respondent answered "6" or higher to the following question: "Using a scale where 0 means "not at all likely" and 10 means "very likely", if you had not requested the Water Conservation Kit, how likely would you have been to purchase any of the following items on your own within 12 months of when you received them?"

The second factor required determining if a customer had purchased a measure that is also offered through the program.

The criterion indicating that a previous purchase may have signified a lower likelihood of free ridership is that the following condition was true:

The respondent answered "yes" to the following question: "Thinking back to before you completed the Online Energy Check-up, had you purchased any of the following items in the last three years?"

The three sets of rules just described were used to construct three different indicator variables that addressed free ridership behavior. For each respondent, a free ridership value was assigned based on the combination of variables. With the three indicator variables, there were seven applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 8-4 shows these values.

Table 8-4 Water Conservation Kits Free Ridership Scoring

Indicator Variables				*Free Ridership Score*
Had Plans and Intentions to Install Measure without [Program Name]? (Definition 1)	*Had Plans and Intentions to Install Measure without [Program Name]? (Definition 2)*	*[Program Name] had Influence on Decision to Install Measure?*	*Made Previous Purchase of Like Measure?*	
Y	Y	N	N	100%
Y	Y	N	Y	100%
N	Y	N	Y	67%
N	N	N	Y	33%
N	Y	N	N	33%
N	N	N	N	0%
N	N	Y	N	0%

8.2.4 Results of Net Savings Estimation

This section discusses the results of estimating net impacts.

Table 8-5 summarizes the results of the estimation of free ridership. Overall, free ridership was low for the program.

Table 8-5 Water Conservation Kits Program Free Ridership Factor

Equipment Type	*FR Factor*
Bathroom Aerator	4%
Kitchen Aerator	3%
Low-Flow Showerhead	6%

Table 8-6 summarizes the gross and net ex-post therm savings for the Water Conservation Kit Program.

Table 8-6 Water Conservation Kit Program Summary of Gross and Net Ex-Post Therm Savings

Equipment Type	*Ex-Post Gross Therm Savings*	*Estimated Free Ridership*	*Ex-Post Net Therm Savings*	*Net to Gross Ratio*
Bathroom Aerator	35,403	1,548	33,855	96%
Kitchen Aerator	10,237	315	9,922	97%
Low-Flow Showerhead	57,062	3,298	53,764	94%
Total	**102,701**	**5,161**	**97,540**	**95%**

Table 8-7 summarizes the gross and net ex-post water savings for the Water Conservation Kit Program.

Table 8-7 Water Conservation Kit Program Summary of Gross and Net Water Savings

Equipment Type	*Gross Water Savings (gal)*	*Estimated Free Ridership*	*Net Water Savings (gal)*	*Net to Gross Ratio*
Bathroom Aerator	3,299,029	105,849	3,193,180	97%
Kitchen Aerator	1,907,843	58,709	1,849,134	97%
Low-Flow Showerhead	10,634,757	614,681	10,020,076	94%
Total	**15,841,629**	**779,238**	**15,062,391**	**95%**

8.3 Process Evaluation

The following section presents the results of the process evaluation for the Water Conservation Kits Program.

8.3.1 Participant Survey

ONG provided the Evaluator contact information for any customers who received water conservation kits. The Evaluator reached out to all participants at least three times to

request survey responses. Among all program participants, 259 provided their feedback. Of those 259 respondents, 139 remembered receiving the kit; the remaining 120 either requested a kit but never received one (n=116), did not remember receiving a kit (n=2), did not request nor receive a kit (n=2).

The following summary outlines responses from the 139 respondents who indicated they remember receiving a kit.

8.3.1.1 Program Participation

Respondents learned about the kits through a variety of sources including ONG's website and bill inserts (Figure 8-1). Just over half of respondents wanted a kit to learn about ways to save money on energy bills (Figure 8-2).

Figure 8-1 Program Awareness Source (n=139)

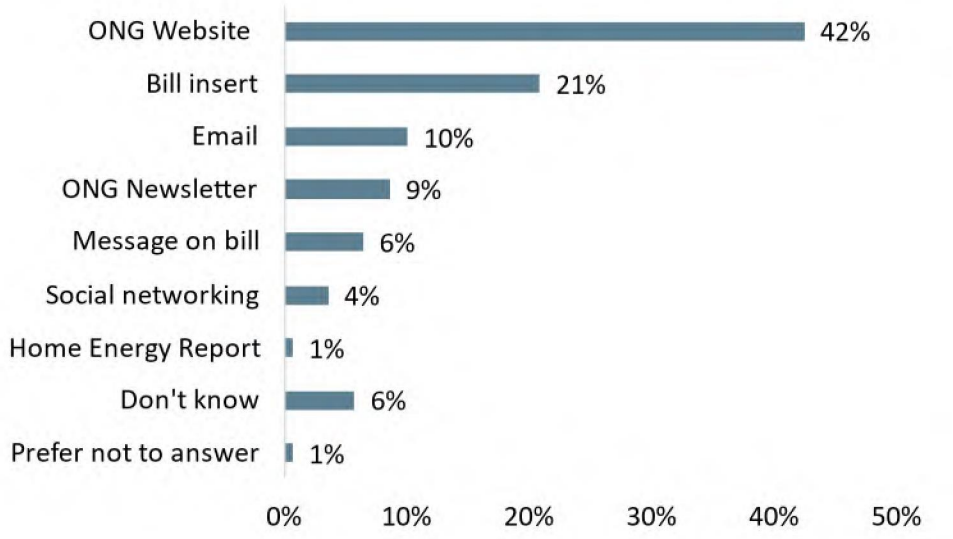
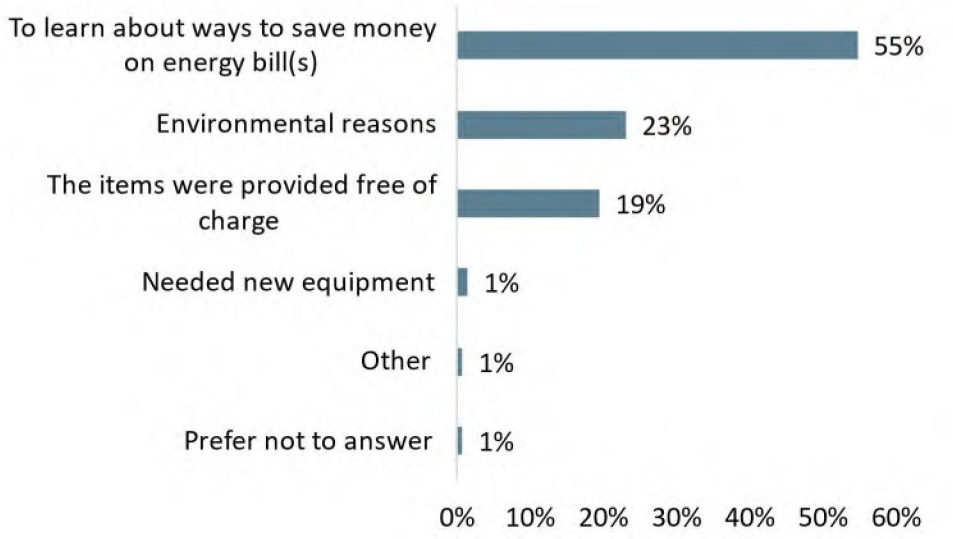


Figure 8-2 Motivation for Requesting a Kit (n=139)



When asked whether or not they had installed the components of the kit, about two-thirds of respondents indicated they installed at least one of the bathroom faucet aerators, two-thirds installed the showerhead, and just over half had installed the kitchen swivel faucet aerator. Reasons for not installing the equipment included not having enough time yet or low priority, as well as fit and flow issues; some respondents also reported not receiving specific equipment in their kit (Figure 8-3).

Figure 8-3 Kit Components Installed (n=139)

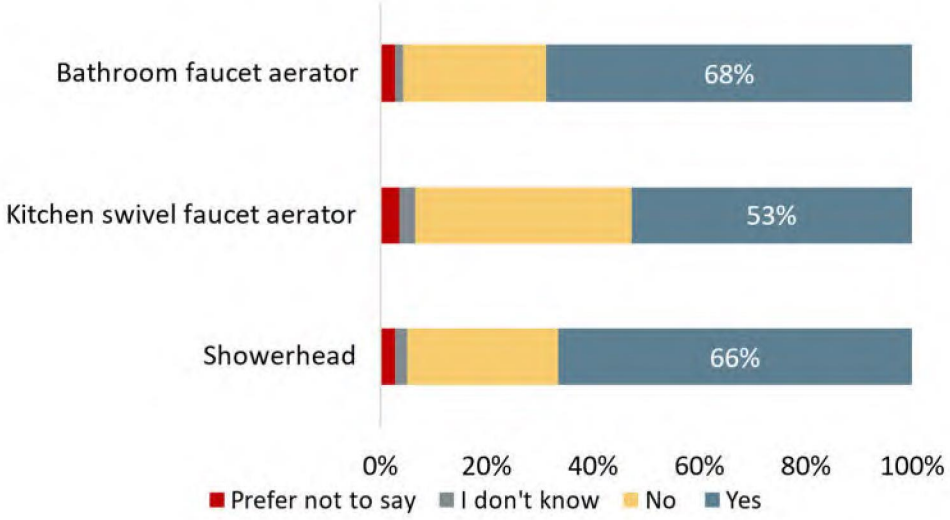


Table 8-8 Reasons for Not Installing

	Showerhead	Kitchen faucet aerator	Bathroom faucet aerator
Need help installing	7	7	5
Fit/Flow issues	8	19	14
Haven't had a chance	22	20	20
Already have/only need one	1	2	15
Did not get one	0	6	16

In general, most respondents had never installed similar equipment to those provided in the kit, however more respondents had installed efficient showerheads compared to bathroom or kitchen faucet aerators (Figure 8-4). Moreover, two-thirds (66%, n= 93) of respondents did not have plans to install any of the equipment types prior to receiving them in the kits and only 11-22% of respondents indicated they were likely to buy the equipment in the next 12 months (Figure 8-5).

Figure 8-4 Previously Installed Energy Efficient Equipment (n=138)

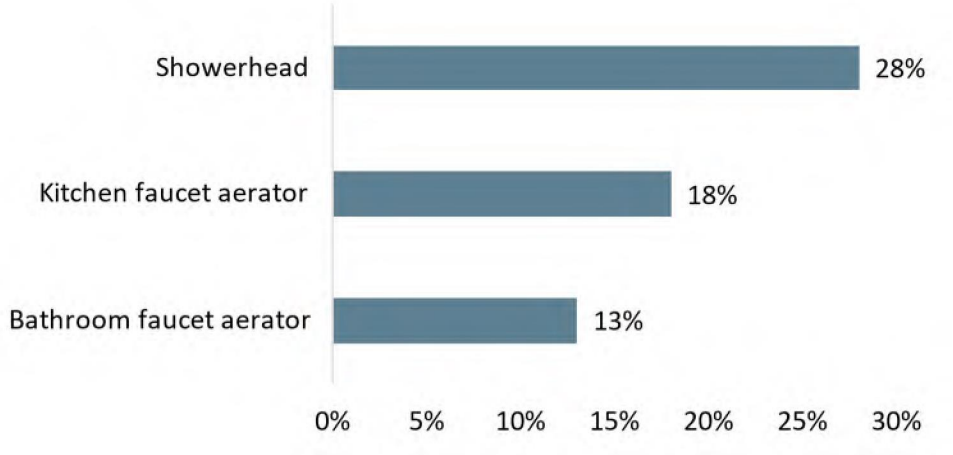
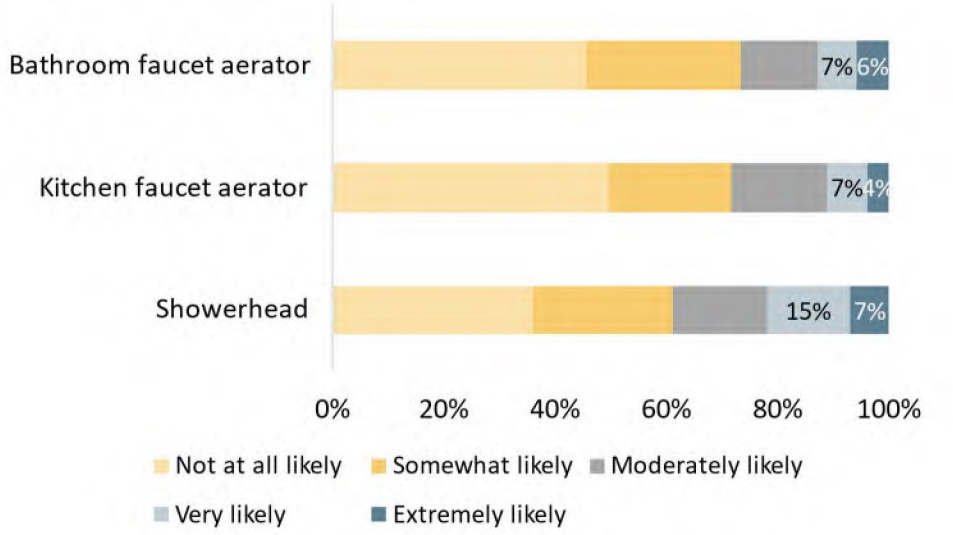


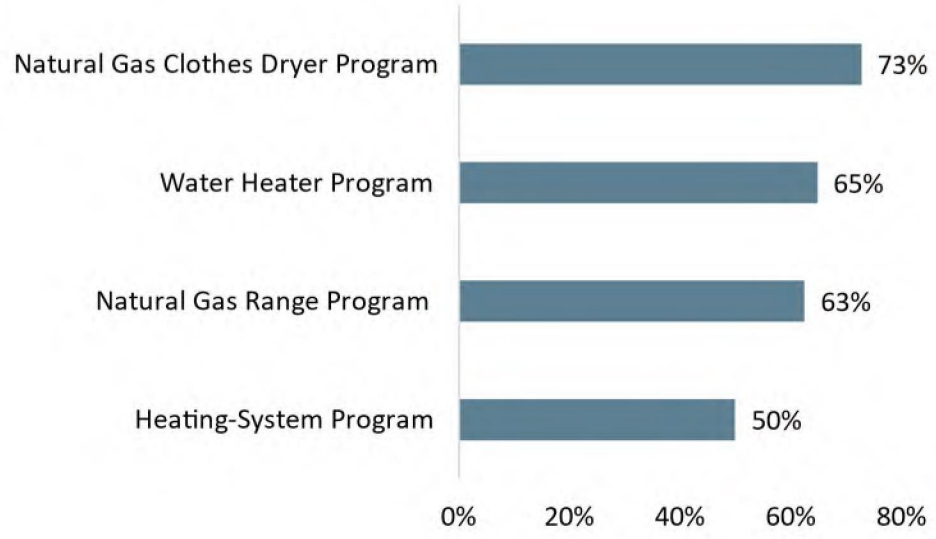
Figure 8-5 Likelihood of Buying Equipment in Next Year (n=138)



8.3.1.2 Program Awareness

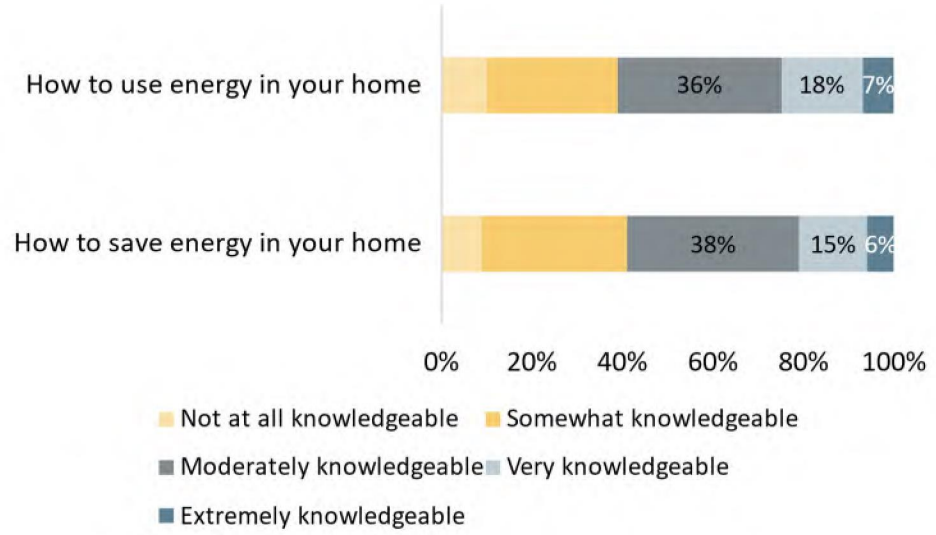
Just under two-thirds of respondents (63%, n=88) were aware that ONG offers rebates and discounts for energy efficient natural gas appliances. Among those respondents, people were most familiar with the natural gas clothes dryer program (73%, n=64) (Figure 8-6).

Figure 8-6 Other Program Awareness (n=88)



Most respondents noted that they were not extremely or moderately knowledgeable about energy use or saving techniques in their home (Figure 8-7).

Figure 8-7 Knowledge about topics (n=136)



8.3.1.3 Program Impact

Some respondents noted that since receiving their water conservation kit they have purchased and installed more energy efficient equipment (Table 8-9).

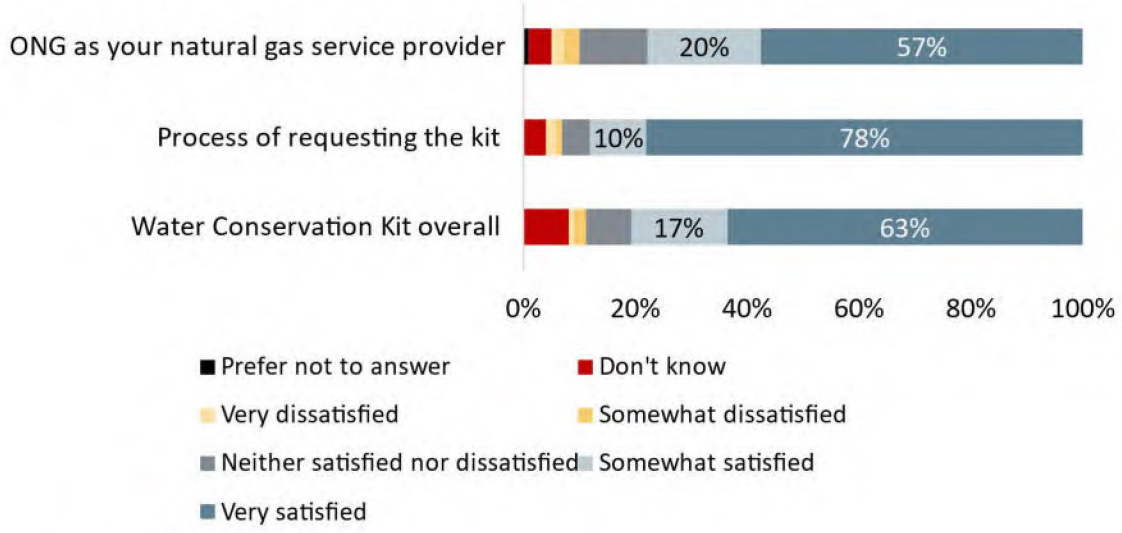
Table 8-9 Bought more Equipment

Equipment	n	Percentage of Respondents
Showerheads	8	6%
Bathroom faucet aerators	4	3%
Bathroom faucet aerators AND low flow showerheads	8	6%

8.3.1.4 Program Satisfaction

In general, respondents were satisfied with the water conservation kit, the process for requesting the kit, and ONG as their natural gas service provider (Figure 8-8). Respondents who expressed dissatisfaction indicated that high utility bill costs (n=5), the flow on the equipment was too low (n=1), and not noticing a difference on their bill after equipment installation (n=1)

Figure 8-8 Program Satisfaction (n=138)



8.3.1.5 Household Characteristics

The majority of respondents own their home (74%, n=103) and most respondents live in a single family home (83%, n=115). The age of homes varied with over half being built before 1980 (58%, n=81) and 31% (n=43) being built between 1990 and present day; the remaining respondents did not know when their homes were built. The square footage of respondents' homes ranged from 777sqft to 22,000 sq. ft. with the median size being 1,700sqft.

Three quarters of respondents live with at least one other person (74%, n=102). Annual household income varied considerably with about a quarter of respondents falling into the $40,000-100,000 range (24%, n=33). About one-third of respondents earned at least a bachelor's degree (33%, n=45).

Most respondents heat their home (82%, n=113) and water (82%, n=113) with natural gas. Most respondents have 1-3 bathroom faucets in their home (85%, n=117) and just over half have two shower heads installed (56%, n=77).

8.4 Conclusions and Recommendations

8.4.1 Conclusions

- The ONG website was the most common way of learning of the water conservation kits, according to the participant survey.
- 23% of surveyed program participants indicated they requested the kits for environmental reasons and 55% were interested in learning ways to save on their utility bill.
- 80% of surveyed participants were somewhat or greatly satisfied with the water conservation kits, and 88% were somewhat or greatly satisfied with the process of requesting kits.

8.4.2 Recommendations

- Continue to send email blasts promoting the water conservation kits in waves throughout the year to control the number of requests received.
- Track any instances of customers who requested a kit but have not yet received the kit through the program year.

9 New Home Program

The New Home Program was designed to provide financial incentives to encourage home builders to build energy efficient homes.

9.1 Program Description

The objective of the New Home Program is to elicit homebuilders to include energy efficient measures in the construction of new homes built within ONG's service area. The program also educates participants about the benefits of energy efficient homes and tries to influence home buying decisions.

ONG utilized a third-party Home Energy Rater (HERS rater) to create an energy model and generate a HERS score for each home in the program. A User Defined Reference Home (UDRH) is incorporated with the energy model. The UDRH represents Oklahoma's code minimum home. The HERS raters perform inspections during and after a home's construction to support the HERS score and the energy models.

Table 9-1 summarizes the incentives provided through the program.

Table 9-1 New Home Program Incentive

Home Type	*Rebate Amount*
Home w/ minimum four natural gas outlets, including natural gas space and water heating, and one other natural gas appliance.	$750

Table 9-2 Shows the number of completed projects and ex-ante therm savings for the New Home Program by strata.

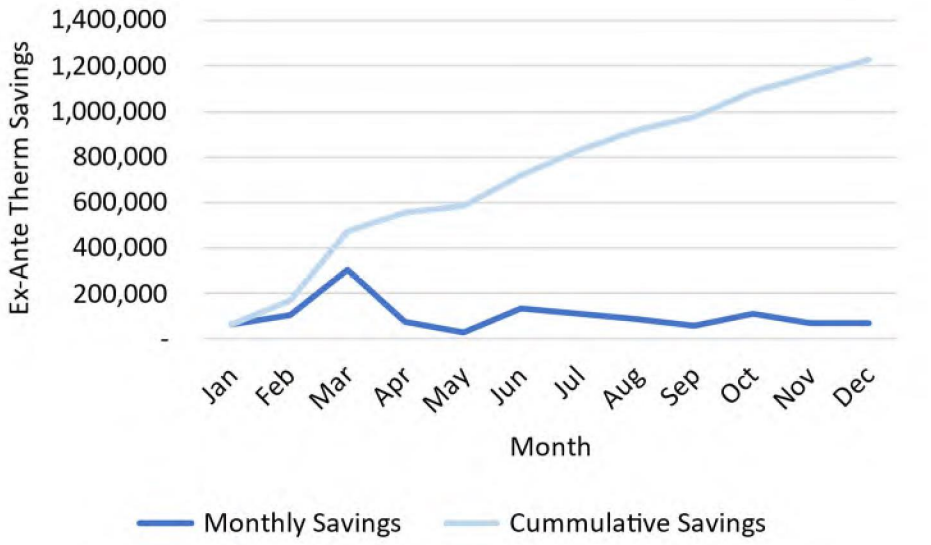
Table 9-2 Ex-Ante Therm Savings of New Home Program

Number of Homes	*Ex-Ante Therm Savings per unit*	*Ex-Ante Therm Savings*
5,505	222.76	1,226,294

9.2 Program Trends in PY2022

Figure 9-1 plots the New Home Program ex-ante therm savings by project completion month.

Figure 9-1 New Home Program Ex-Ante Therm Savings by Project Completion



9.3 Impact Evaluation

9.3.1 Gross Impact Evaluation

The following section presents the methodology that was used for estimating gross energy impacts resulting from the New Home Program.

9.3.1.1 Review of Documentation

The Evaluator received a sample of energy models from program HERS raters as well as application materials via ONG. All data was reviewed for consistency and accuracy.

9.3.1.2 Procedures for Estimating Therm Savings from Measures Installed Through the Program

The Evaluator's approach for the calculation of gross energy impacts depended largely on the types of measures installed. This program incentivizes builders to improve the energy efficiency of participating homes. Energy models were created for participating homes and then were compared to Oklahoma's baseline code minimum home to calculate energy savings.

9.3.1.3 Method for Analyzing Savings from New Home

HERS raters created energy models of the as-built house to model the energy use of the actual house. This model was compared to the UDRH. The UDRH reflects Oklahoma's energy code minimum house. The UDRH was developed by inspecting building codes, HVAC equipment codes, and appliance codes. The as-built home saves energy because its building envelope and ducts are sealed tighter, walls and attic have more insulation, and HVAC and appliances are more efficient than the code minimum house.

9.3.1.4 UDRH Baseline Homes

There is one UDRH house used in the program. The UDRH represents Oklahoma's code minimum house. Some of the key UDRH assumption are shown in Table 9-3.

Table 9-3 UDRH Key Assumptions

Input	*UDRH Assumption*	*Source*
Attic Insulation	R-30	2009 IRC Table N1102.1 values.
Wall Insulation	R-13	2009 IRC Table N1102.1 values.
Door R	R-2	2009 IRC Table N1102.1 fenestration requirements.
Window U	0.5	2009 IRC Table N1102.1 values.
Window SHGC	0.35	2009 IRC Table N1102.1 values.
Infiltration	0.00036 F-L-A	2009 IECC Reference home, Table 405.5.2(1).
Slab Edge Insulation	None	2009 IRC Table N1102.1 values.
Gas Instant Water Heater (%)	82	2009 IRC Table N1102.1 values.
Conventional Gas Water Heater (%)	58	2009 IRC Table N1102.1 values.

9.3.1.5 Desk Review Verification Procedure

The primary goal of the desk review verification effort is to verify as much data as possible using supporting documentation. The Evaluator can verify the following metrics through a desk review:

- Efficiency of HVAC equipment, water heaters, and appliances;
- Thermal properties of windows, walls, floor, and ceilings; and
- Area of walls, ceilings, floor, windows, and doors.

The Evaluator received several energy models from program HERS raters via ONG.

9.3.1.6 Sampling Plan

The Evaluator developed a sampling plan to achieve the required relative precision at the required confidence level. Table 9-4 shows the evaluation sampling strategy.

Table 9-4 New Home Sampling Plan

Gross Ex-Post Therm Savings	*Coefficient of Variation*	*Number of Sampled Homes*	*Number of Homes*	*Relative Precision (90% Confidence Interval)*
1,352,473	**0.5**	**69**	**5,505**	**9.84%**

9.3.2 Results of Ex-Post Gross Savings Estimation

The ex-ante and ex-post gross therm savings of the New Home Program are summarized in Table 9-5. The method by which ex-post gross savings were estimated is described in section 9.3.1.3.

Table 9-5 Ex-ante and Ex-Post Annual Therm Savings for New Home Program

Number of Sampled Homes	*Gross Ex-Ante Therm Savings*	*Gross Ex-Post Therm Savings*	*Gross Therm Savings Realization Rate*
69	**1,226,294**	**1,352,473**	**110%**

The Evaluator incorporated a User Defined Reference Home (UDRH) into the energy models provided by the HERS raters. The UDRH reflects Oklahoma's code minimum house. The homes in the program are more efficient than the code minimum. Participating homes have increased air sealing and duct sealing, more insulation in the walls and in the attic, and have more efficient furnaces and appliances.

The ex-ante and ex-post gross therm savings of the New Home Program are summarized in Table 9-6. About 89% of gross program savings are represented in the table below.

Table 9-6 Ex-Ante and Ex-Post Annual Therm Savings for New Home Program by Top 10 Builders

Builder	*Number of Homes*	*Gross Ex-Ante Therm Savings per Builder*	*Gross Ex-Post Therm Savings per Builder*	*Gross Therm Savings Realization Rate*
Builder 1	1,061	236,348	260,667	110%
Builder 2	665	148,135	163,378	110%
Builder 3	569	126,750	139,792	110%
Builder 4	499	111,157	122,595	110%
Builder 5	491	109,375	120,629	110%
Builder 6	441	98,237	108,345	110%
Builder 7	333	74,179	81,812	110%
Builder 8	216	48,116	53,067	110%
Builder 9	177	39,429	43,486	110%
Builder 10	132	29,404	32,430	110%
Program Total	**5,505**	**1,226,294**	**1,352,473**	**110%**
Percent of Program	83.27%	83.27%	83.27%	0%

9.3.3 Net Impact Evaluation

The Evaluator did not conduct a builder survey. Free ridership ratios from the previous program year were used to calculate net savings in PY2022. For reference, the methods used to calculate free ridership last year are described below.

Survey responses of participating builders were collected to estimate a net-to-gross ratio for the program. Free ridership scores were developed for each interviewed builder by analyzing responses to two lines of questioning: program influence and building practices in the absence of the program. The scoring for each line of questioning is detailed below, followed by the algorithm for calculating the overall net-to-gross ratio.

9.3.3.1 Program Influence

The Program Influence indicator variable was calculated using the response to the following:

- FR1: We would like to identify which, if any, aspects of the program were important in your decision to build homes to a higher efficiency standard than is required by code. Please rate each of the following factors on a scale of 0 to 10, where 0 means that the factor was "not at all important" in your decision to build energy efficient homes, and 10 means that the factor was "extremely important" in your decision to build energy efficient homes.
- FR 2: How, if at all, have any of the resources offered by the program affected your success in selling energy efficient homes?
- FR 3: Could you please tell me, in your own words, the influence the ONG New Home Program had on your building practices?

Question FR1 provided respondents with a list of factors that were associated with the ONG program; respondents were to rate the importance of each of them in their decision-making process. These factors included:

- Information from ONG staff;
- Technical assistance from HERS raters;
- The incentive provided by the program; and
- Program marketing and program informational literature.

The unadjusted Program Influence score was defined as the maximum rating provided by respondents for the above factors in FR1, converted to a percentage by dividing the score by 10. FR2 and FR3 served as free ridership mitigation variables, where respondents provided open-ended commentary indicating that the program had positively influenced their sales of efficient homes, or had affected their building practices, receive a 50% reduction in free ridership for this variable. For example, a respondent providing a rating of 6 for Information from ONG staff, and a rating of 8 for the incentive provided by the program, would receive a Program Influence score of (8/10) = 80%. This represents a free ridership level of 20%. If this respondent also stated that the program had positively affected their sales of efficient homes or their building practices, their free ridership rate would be adjusted to (0.2/2.0) = 0.1, or 10%, resulting in a final Program Influence Score of 90%.

9.3.3.2 Behavior Absent Program

The Behavior Absent Program indicator variable was calculated using the response to the following:

- FR5: On a scale of 0 to 10, where 0 represents "not at all likely" and 10 represents "extremely likely," how likely would you be to build your homes to the same

efficiency standard if the ONG New Home Program and incentive were not available?"; and

- FR6: If the ONG program and incentive were not available, how likely would your company be to build fewer homes to the same efficiency standard? Please answer on the same 0 to 10 scale where 0 means "not at all likely" and 10 means "extremely likely".
- FR7: What factors influence decisions to include energy efficient equipment/materials/construction practices which exceed IECC 2009 building code requirements?

Responses to FR5 were divided by 10 to calculate the level of unadjusted free ridership for the behavior absent program variable. FR6 and FR7 served as free ridership mitigation factors, where respondents providing a score of 5 or greater received a 50% reduction in free ridership for the behavior in the absence of the program indicator, and respondents providing an open-ended response to FR7 indicating that their decision to build efficient homes was affected by financial factors received another 50% reduction in free ridership for this variable. Thus, a respondent meeting both mitigation criteria would receive a 100% reduction in free ridership for this variable.

After the adjustment was applied, the behavior in the absence of the program score was be calculated by subtracting the adjusted behavior absent program free ridership from 1. For example, a respondent providing a response of 4 to FR5 would receive an unadjusted behavior absent program of the program free ridership value of (4/10) = 0.4, or 40%. If this respondent provided an answer of 6 to FR6, their adjusted behavior in the absence of the program free ridership value would be (0.4/2.0) = 0.2, or 20%. Finally, their behavior absent program score was calculated as (1.0 – 0.2) = 0.8, or 80%.

Builder net-to-gross ratios were based on the Program Influence Score and the Behavior Absent Program Score, as follows, where Program Influence accounts for 60% of the net-to-gross score and Behavior Absent Program accounts for 40% of the net-to-gross score:

*Net-to-Gross Score = (0.6 * Program Influence Score) + (0.4 * Behavior Absent Program Score)*

The net-to-gross scores were then weighted by the number of participating homes that each responding builder had in the program.

9.3.4 Results of Net Savings Estimation

This section discusses the results of estimating net impacts.

Table 9-7 summarizes the results of the estimation of free ridership. Free ridership was low for the program because there was a low incidences of participant responses indicating a high likelihood of building energy efficient homes in the absence of the program.

Table 9-7 New Home Program Free Ridership Factor

Program	FR Factor
New Home	3%

Table 9-8 summarizes the gross and net ex-post therm savings for the New Home Program by Stratum.

Table 9-8 New Home Summary of Gross and Net Ex-Post Therm Savings

Ex-Post Gross Therm Savings	Estimated Free Ridership	Ex-Post Net Therm Savings	Net to Gross Ratio
1,352,473	**45,704**	**1,306,769**	**97%**

9.4 Process Evaluation

The following section presents the results of the process evaluation for the New Home Program

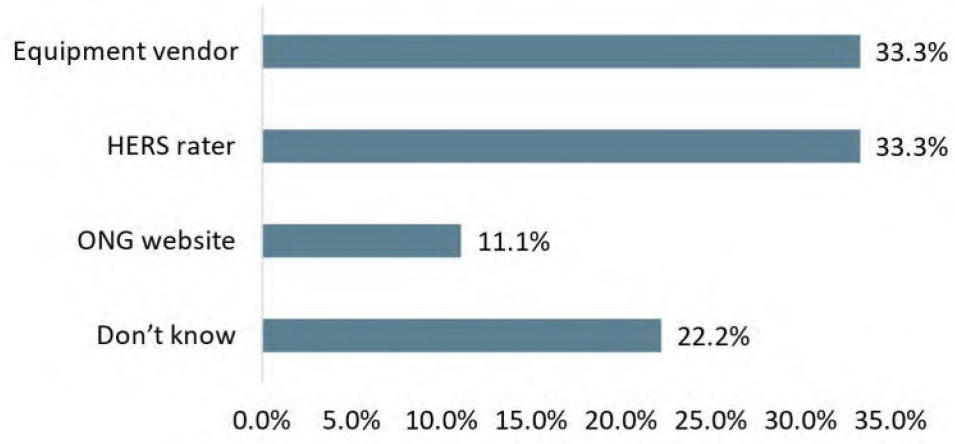
9.4.1 Participant Survey

ONG provided the Evaluator contact information for New Home program builders who received rebates for constructing energy efficient new homes. The Evaluator reached out to a random sample of builders to request an interview or survey. Among the sampled builders, 9 provided their feedback. The following summary outlines those participants' responses to survey questions.

9.4.1.1 Program Awareness and Motivation for Participation

Across the nine responding builders, seven had previously participated in the program, while two were new to the program. Respondents learned about the program through a variety of sources including equipment vendors, HERS raters, and the ONG website (Figure 9-2).

Figure 9-2 Program Awareness (n=9)

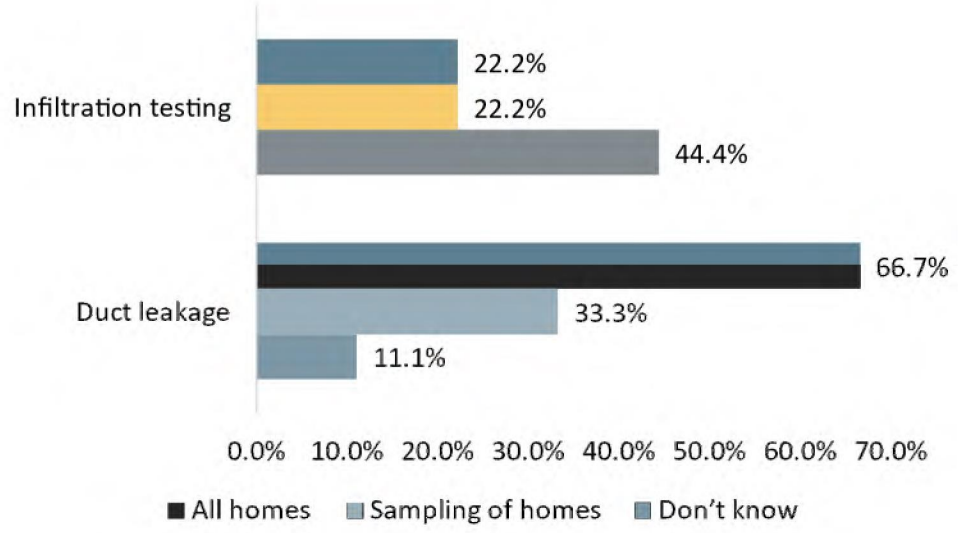


Most respondents indicated the decision to build a home that meets qualification is made prior to the time homes are available to buyers (66.7%, n=6); two builders indicated the decision is made by the home buyers themselves. Just over half of respondents indicated the primary benefit for home buyers to purchase energy efficient homes is to reduce energy costs (55.6%, n=5). Responding builders noted that their companies build efficient homes because of city codes and keeping up with other builders (n=2), it is part of their branding (n=1), and it is something they do because it is good for the customers (n=1).

9.4.1.2 Building Practices

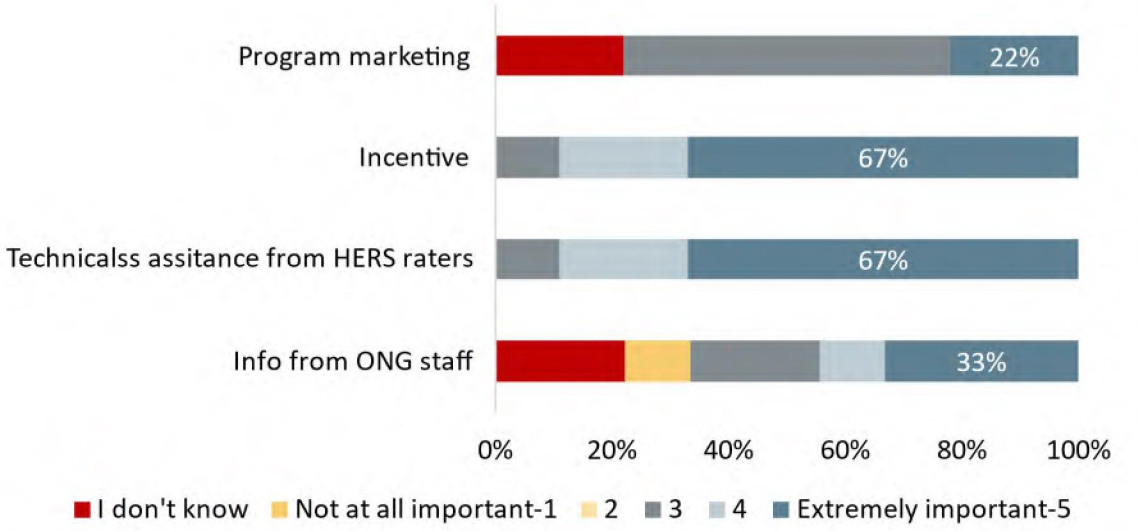
Respondents testing procedures vary by test type (Figure 9-3). Additionally, four of the nine respondents utilize a HERS rater for homes in ONG's territory.

Figure 9-3 Testing Procedures (n=9)



When asked what aspects of ONG's New Home Program were important in their decision to build higher efficient homes than code, builders ranked technical information and incentives the highest (Figure 9-4). About half of respondents noted they were still likely to build efficient homes even if the incentive was not available (55.6%, n=5). That being said, responding builders did indicated that the ONG standards have helped them to build homes that meet city standards as efficient equipment is made more affordable and more widely accepted. Only two respondents indicated they participated in another above-code program; they participated in the EPA's "Energy Star New Homes" program and other utilities incentive programs.

Figure 9-4 Importance of Program Factors (n=9)



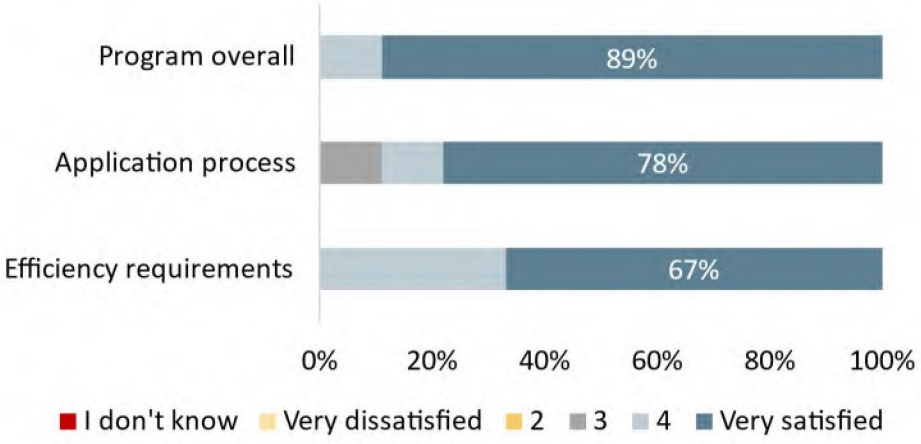
Most builders do not remember receiving technical training or assistance from ONG in 2022. Additionally, most builders did not believe the ONG program affected their success in selling energy efficient homes; two respondents did note that buyers will get discounts from insurance companies if there is a HERs certificate for the home.

9.4.1.3 Program Satisfaction

Builders could not identify any potential barriers or disadvantages to ONG's program that might discourage other builders from participating. All but one respondent indicated they planned to participate in ONG's New Home Program in 2023.

Respondents were satisfied with the program (Figure 9-5) and had no additional feedback to provide.

Figure 9-5 Program Satisfaction (n=9)



9.5 Recommendations

- Continue attending meetings/events to increase awareness and to promote the program, as well as to develop networking opportunities.

10 Custom Commercial Program

The Custom Commercial Program was designed to provide financial incentives and technical services to encourage non-residential customers to implement energy saving measures.

10.1 Program Description

The implementation contractor for the Custom Commercial Program is CLEAResult.

The design of the Custom Commercial Program is twofold. First, the Direct Install component is designed to provide energy saving measures free of charge to ONG's commercial sector customers. The available direct install measures are:

- Low Flow Spray Valves;
- Faucet Aerators;
- Showerheads;
- Commercial Door Weather Stripping;
- Drysmart Units; and
- Steam Traps.

Second, the Custom component offers rebates to ONG's commercial sector customers toward high-efficiency equipment and energy-saving processes. Eligible energy efficient equipment is dependent on facility type, and operating characteristics. Financial incentives are based on expected savings for the measure implemented and vary by end–use.

Table 10-1 shows the number of completed projects and ex-ante therm savings for the Custom and Direct Install component of the Commercial Program.

Table 10-1 Ex-Ante Therm Savings of Custom Commercial Program

Program Component	*Number of Projects*	*Ex-Ante Therm Savings*
Custom	95	514,216
Direct Install	92	1,375,701
Total	**187**	**1,889,917**

10.2 Program Trends in PY2022

Figure 10-1 plots the Custom component ex-ante therm savings by project completion month.

Figure 10-1 Custom Component Ex-Ante Therm Savings by Project Completion

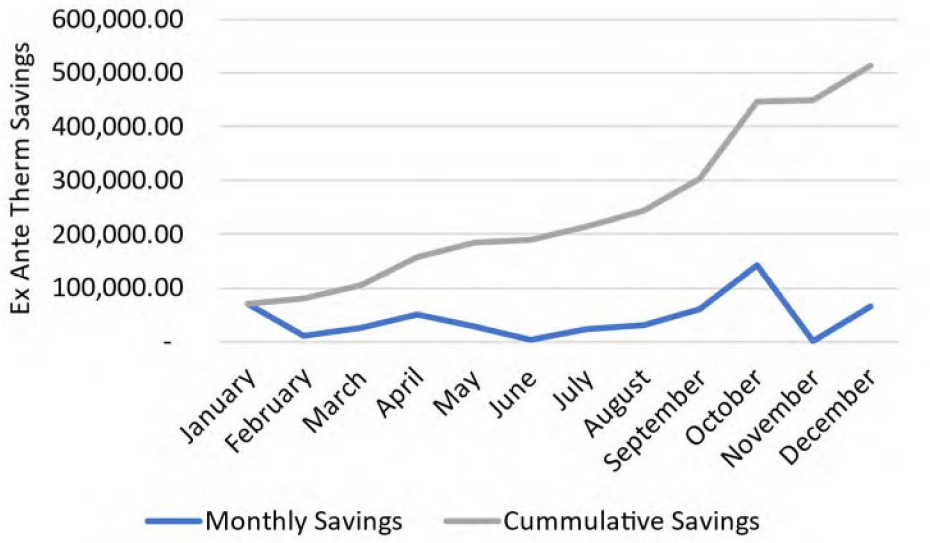
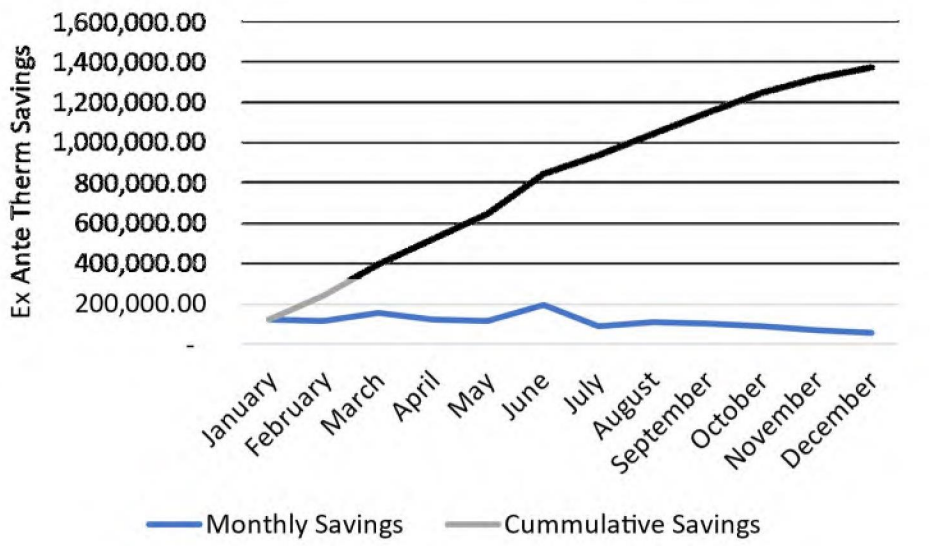


Figure 10-2 plots the Direct Install component ex-ante therm savings by project completion month.

Figure 10-2 Direct Install Component Ex-Ante Therm Savings by Project Completion Month



10.3 Impact Evaluation

10.3.1 Gross Impact Evaluation

The following section presents the methodology that was used for estimating gross energy impacts resulting from the Custom Commercial Program.

10.3.1.1 Sampling Methodology

The estimation of savings for the program is based on a ratio estimation procedure that allows the measured and verified sample to meet or exceed statistical precisions requirements and to accurately explain the annual ex-post gross savings for all completed projects. The Evaluator selected a sample with a sufficient number of projects to estimate the population ex-post gross therm savings with 10% relative precision at the 90% confidence level. The actual relative precision for the program is 9.31%.

The sample selection is from the population of projects with completion dates during PY2022. Table 10-2 and Table 10-3 show the project population from which the sample was drawn, for the Custom component and the Direct Install component. These samples fell into three or five energy savings strata; strata boundaries were based on ex-ante therm savings. Note that in this table, presentation of population statistics used for sample design, including coefficients of variation, are calculated based on final program data.

Table 10-2 Population Statistics Used for Custom Component Sample Design

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*SEM*	***Totals***
Strata boundaries (Therm)	<1,000	1,000 - 2,999	3,000 - 9,999	10,000 - 49,999	50,000 ≥	Census	
Population Size	17	4	17	18	1	38	**95**
Total Therm savings	9,941	8,470	99,197	283,626	57,453	55,532	**514,219**
Average Therm Savings	585	2,117	5,835	15,757	5,745	1,461	**5,413**
Standard deviation of Therm savings	271	753	1,900	6,428	0	0	**8,351**
Coefficient of variation	0.46	0.36	0.33	0.41	0.00	0.00	**1.54**
Final design sample	3	1	5	3	1	38	**51**

Table 10-3 Population Statistics Used for Direct Install Component Sample Design

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	***Totals***
Strata boundaries (Therm)	<1,000	1,000 - 6,999	7,000 - 21,999	22,000 - 49,000	50,000 ≥	
Population Size	8	26	35	21	2	**92**
Total Therm savings	5,516	112,397	467,779	586,394	203,614	**1,375,701**
Average Therm Savings	690	4,323	13,365	27,924	101,807	**14,953**
Standard deviation of Therm savings	246	1,965	4,653	5,927	64,725	**17,734**
Coefficient of variation	0.36	0.45	0.35	0.21	0.61	**1.19**
Final design sample	3	7	4	7	2	**23**

The Custom component stratified sample shown in Table 10-4 resulted in samples encompassing 36% of the total ex-ante therm savings.

Table 10-4 Ex-Ante Therm Savings for Custom Component Sampled Projects by Stratum

Stratum	Sample Ex-Ante Therm Savings	Total Ex-Ante Therm Savings	Percentage of Ex-ante Savings in Sample
SEM	55,532	55,532	100%
Custom 5	57,453	57,453	100%
Custom 4	41,489	283,623	15%
Custom 3	30,378	99,197	31%
Custom 2	1,580	8,470	19%
Custom 1	1,161	9,941	12%
Total	**187,593**	**514,216**	**36%**

The Direct Install component stratified sample shown in Table 10-5 resulted in samples totaling 38% of the total Ex-Ante Therm savings.

Table 10-5 Ex-Ante Therm Savings for Direct Install Component Sampled Projects by Stratum

Stratum	Sample Ex-Ante Therm Savings	Total Ex-Ante Therm Savings	Percentage of Ex-ante Savings in Sample
DI 5	203,614	203,614	100%
DI 4	212,372	586,394	36%
DI 3	56,709	467,779	12%
DI 2	42,178	112,397	38%
DI 1	1,286	5,516	23%
Total	**516,160**	**1,375,701**	**38%**

10.3.1.2 Review of Documentation

ONG's program implementation contractor, CLEAResult, provided documentation for the projects completed during the program year. The first step in the evaluation effort was to review this documentation and other relevant program materials.

For each sampled project, the available documentation (audit reports, savings calculation workbooks, invoices, etc.) for each rebated measure was reviewed. Documentation reviewed for all sampled projects included program forms, databases, reports, weather data, and any other potentially useful data.

10.3.1.3 Procedures for Estimating Therm Savings from Measures Installed Through the Program

The Evaluator reviewed the natural gas energy savings algorithms to verify that the assumptions were reasonable, the algorithms were correct for assigning gross ex-ante therm savings per measure, and the procedures used aligned with the methodologies outlined in the Arkansas TRM Version 8.1. In cases where project documentation was incomplete or unclear, the Evaluator contacted CLEAResult to seek further information.

The Evaluator calculated annual energy savings for each sampled measure per the formula given in the Arkansas TRM. Engineering calculation using industry standards were used to calculate energy savings for measures where savings could be more accurately estimated using methodology not described in the TRM.

10.3.1.3.1 Method for Analyzing Savings from Program Measures

Appendix B of this report presents the specific, applied methodologies used to estimate ex-post gross natural gas savings and the savings estimation results for each sampled measure.

10.3.2 Results of Ex-Post Gross Savings Estimation

Energy savings were estimated using proven techniques, including engineering calculations using industry standards to determine energy savings.

Sampling for evaluation of the Custom Commercial Program was developed using the Stratified Random Sampling procedure. This procedure provides 90% confidence and ±10% precision with a significantly reduced sample than random sampling would require, by selecting the highest saving facilities with certainty, thereby minimizing the variance that non-sampled sites can contribute to the overall results.

Sites chosen within each stratum are reviewed to confirm installation of rebated measures and to process data needed for calculation of ex-post verified savings. The realization rates for sites within each stratum are then applied to the non-sampled sites within their respective stratum.

The ex-ante and ex-post gross therm savings of the Custom and Direct Install components are summarized by sampling stratum in Table 10-6 and Table 10-7.

Table 10-6 Ex-Ante and Ex-Post Annual Therm Savings for Custom Component by Sample Stratum

Stratum	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
SEM	55,532	55,532	100%
Custom 5	57,453	60,325	105%
Custom 4	283,623	292,587	103%
Custom 3	99,197	99,085	100%
Custom 2	8,470	8,470	100%
Custom 1	9,941	9,938	100%
Total	**514,216**	**525,938**	**102%**

Table 10-7 Ex-Ante and Ex-Post Annual Therm Savings for Direct Install Component by Sample

Stratum	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
DI 5	203,614	202,003	99%
DI 4	586,394	596,724	102%
DI 3	467,779	416,709	89%
DI 2	112,397	99,401	88%
DI 1	5,516	4,454	81%
Total	**1,375,701**	**1,319,291**	**96%**

Table 10-8 and Table 10-9 show the expected and realized energy savings by project for the Custom and Direct Install components.

Table 10-8 Ex-Ante and Ex-Post Annual Therm Savings for Custom Component by Project

Project ID	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
PRJ-3060729	510	510	100%
PRJ-3084462	235	235	100%
PRJ-3061610	416	416	100%
PRJ-3091499	1,580	1,580	100%
PRJ-3031121	9,590	9,590	100%
PRJ-3046995	5,715	5,715	100%
PRJ-3081674	6,061	6,061	100%
PRJ-3097183	4,223	4,223	100%
PRJ-2979887	10,664	10,664	100%
PRJ-3094672	15,377	15,377	100%
PRJ-2996007	57,453	60,325	105%
PRJ-3118673	15,447	16,759	108%
PRJ-3110061	4,789	4,755	99%
Non-Sampled Projects	382,155	389,727	102%
Total	514,216	525,938	102%

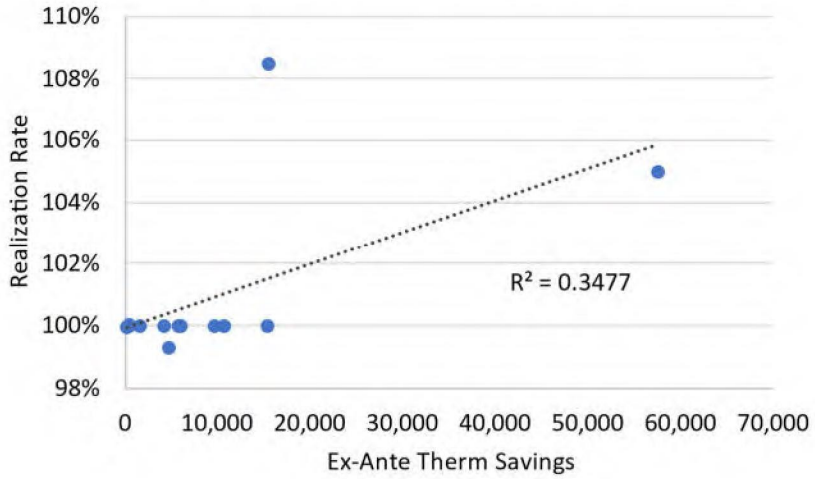
Table 10-9 Ex-Ante and Ex-Post Annual Therm Savings for Direct Install Component by Project

Project ID	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
PRJ-3062098	485	485	100%
PRJ-3074157	519	384	74%
PRJ-3060576	282	169	60%

Project ID	*Ex-Ante Therm Savings*	*Ex-Post Gross Therm Savings*	*Gross Therm Savings Realization Rate*
PRJ-3094503	5,024	4,573	91%
PRJ-3063393	6,456	4,503	70%
PRJ-3094492	5,539	5,043	91%
PRJ-3078767	6,056	5,380	89%
PRJ-3074224	5,917	6,680	113%
PRJ-3098053	6,907	4,841	70%
PRJ-3062140	10,311	10,580	103%
PRJ-3102849	14,818	14,928	101%
PRJ-3079911	14,711	8,625	59%
PRJ-3061833	24,333	26,014	107%
PRJ-3059961	29,509	29,924	101%
PRJ-3074251	23,580	24,596	104%
PRJ-3094533	16,870	16,385	97%
PRJ-3094562	22,100	22,728	103%
PRJ-3094546	30,998	30,999	100%
PRJ-3086456	42,624	42,624	100%
PRJ-3114605	145,453	143,841	99%
PRJ-3123330	6,279	6,281	100%
PRJ-3125750	39,228	39,228	100%
PRJ-3185382	58,161	58,162	100%
Non-Sampled Projects	859,541	812,317	95%
Total	**1,375,701**	**1,319,291**	**96%**

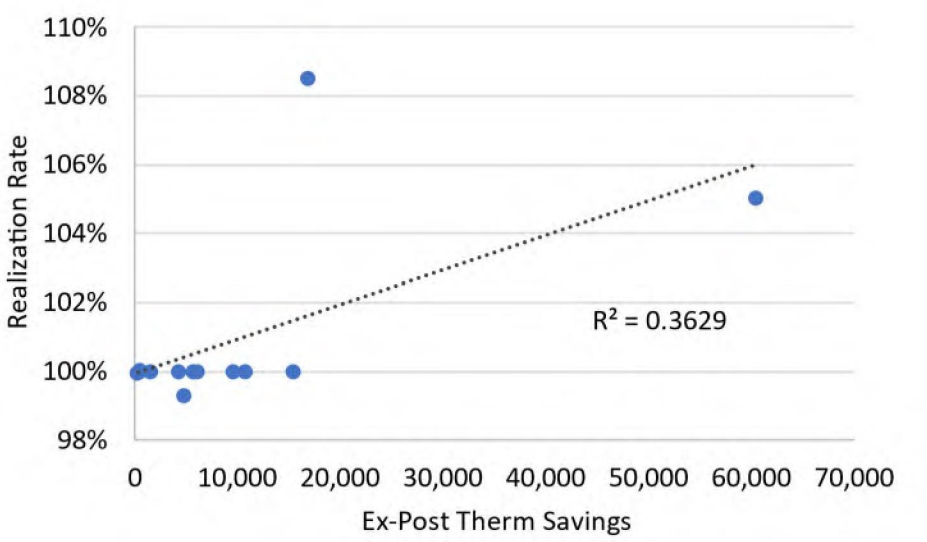
Custom component gross therm savings realization rate and ex-ante therm savings are plotted in Figure 10-3 for sample projects.

Figure 10-3 Custom Component Sample Project Gross Therm Savings Realization Rate Versus Ex-Ante Therm Savings



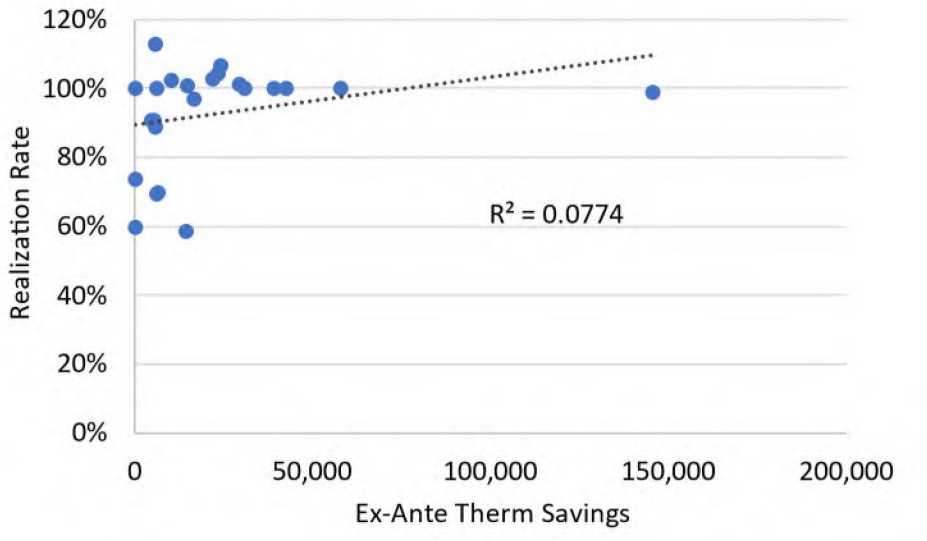
Custom component ex-ante energy savings and ex-post energy savings are plotted in Figure 10-4 for each sample project.

Figure 10-4 Custom Component Sample Project Gross Ex-Post Therm Savings versus Ex-Ante Therm Savings



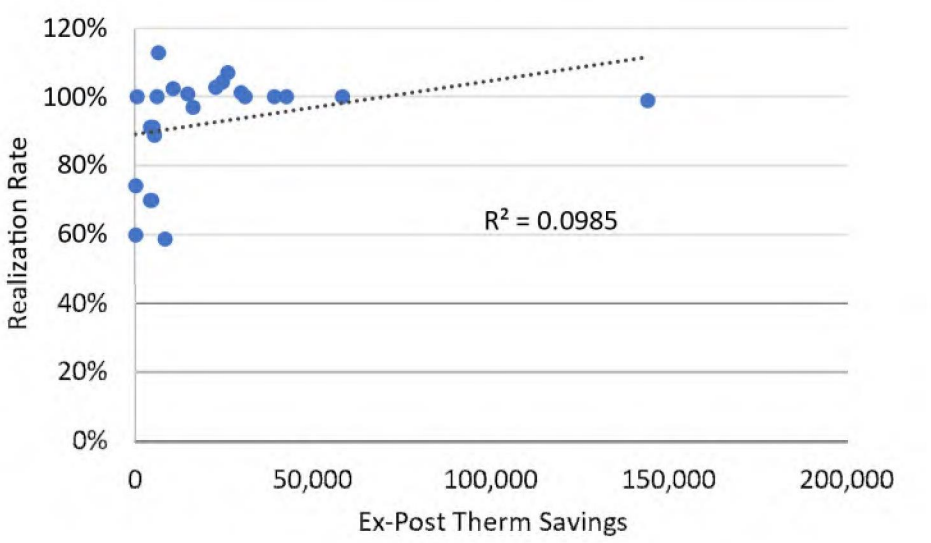
Direct Install component gross therm savings realization rate and ex-ante therm savings are plotted in Figure 10-5 for sample projects.

Figure 10-5 Direct Install Component Sample Project Gross Therm Savings Realization Rate Versus Ex-Ante Therm Savings



Custom component ex-ante energy savings and ex-post energy savings are plotted in Figure 10-6 for each sample project.

Figure 10-6 Direct Install Component Sample Project Gross Ex-Post Therm Savings versus Ex-Ante Therm Savings



As the figures above show, there was no strong relationship between project size and energy savings for the Direct Install and Custom components.

10.3.3 Net Impact Evaluation

Information collected through a survey of a sample of program participants was used for the net-to-gross analysis.

10.3.3.1 Custom Component

All survey response data was systematically reviewed by a researcher who is familiar with the program, the individual project, and the social science theory underlying the decision maker survey instrument. As part of this review, the researcher determined whether the available information justified modifying the free ridership score calculated in accordance with the algorithm outlined below.

Several factors were considered in the determination of the presence of free ridership. These included:

- Financial ability to afford the installed measure without a program rebate;
- Plans and intentions of the firm to install a measure even without support from the program;
- Influence that the program had on the decision to install a measure; and
- A firm's previous experience with a measure installed under the program.

To assess these factors, program participants were asked a series of questions about the decision to implement the program project. Based on their responses, respondents were assigned a free ridership score used to estimate the extent of project free ridership.

Several criteria were used to determine what portion of a customer's savings for a project should be attributed to free ridership. The first criterion was based on the response to the following two questions:

- If it were not provided free-of-charge by the program, would your organization have been financially able to install…
- If the financial incentive from the [PROGRAM] program had not been available, how likely is it that you would have install the same equipment anyway? Would you say…

If a customer answered "No" to the first question and "Yes, that is correct" to the second, a free ridership score of 0 was assigned to the project. That is, if a customer required financial assistance from the program to undertake a project, then that customer was not deemed a free rider.

For decision makers that indicated that they were able to undertake energy efficiency projects without financial assistance from the program, three factors were analyzed to determine what percentage of savings may be attributable to free ridership. The three factors were:

- Plans and intentions of firm to install a measure even without support from the program;
- Influence that the program had on the decision to install a measure; and
- A firm's previous experience with a measure installed under the program.

For each of these factors, rules were applied to develop binary variables indicating whether a participant's behavior shows free ridership. These rules made use of answers to questions on the decision maker survey questionnaire.

The first factor required determining if a participant's intention was to install an energy efficiency measure even without the program. The answers to a combination of several questions were used with a set of rules to determine whether a participant's behavior indicated likely free ridership. Two binary variables accounted for customer plans and intentions: one, based on a more restrictive set of criteria that may describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that may describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria indicating customer plans and intentions that likely signified free ridership were as follows:

- The respondent answered "yes" to the following two questions: "Before participating in the program, did you have plans to install…?" and "Would you have gone ahead with this planned project even if you had not participated in the program?"
- The respondent answered, "definitely would have installed" to the following question: "If the financial incentive from the [PROGRAM] program had not been available, how likely is it that you would have install the same equipment anyway?"

The second, less restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

- The respondent answered “yes” to the following two questions: “Before participating in the program, did you have plans to install…?” and “Would you have gone ahead with this planned project even if you had not participated in the program?”
- The respondent answered, “definitely would have installed” or “probably would have installed” to the following question: “If the financial incentive from the [PROGRAM] program had not been available, how likely is it that you would have install the same equipment anyway?”

The second factor required determining if a customer reported that a recommendation from a Program representative or past experience with the program was influential in the decision to install a piece of equipment or measure.

The criterion indicating that program influence may signify a lower likelihood of free ridership is that either of the following conditions were true:

- The respondent answered “yes” to the following question: “Did a [PROGRAM] or other [UTILITY] representative recommend that you install the [PROJECT_DESCRIPTION] at this location?”
- The respondent answered, “very important” to the following question: “If the [PROGRAM] program representative had not recommended installing the [PROJECT_DESCRIPTION], how likely is it that you would have installed it anyway?”

The third factor required determining if a participant in the program indicated that he or she had previously installed an energy efficiency measure similar to one that they installed under the program without an energy efficiency program incentive during the last three years. A participant indicating that he or she had installed a similar measure is considered to have a likelihood of free ridership.

The criteria indicating that previous experience may signify a higher likelihood of free ridership are as follows:

- The respondent answered “yes” to the following question: “Thinking about all of the projects you completed in the last three years, did you implement any energy efficient equipment or projects similar to the [MEASURE1] that you [IMPLEMENTED1] at your facility…?”
- The respondent answered “yes” to the following question: “Not including the project that your organization received an incentive for in [YEAR], has your organization completed any significant energy efficiency projects in the last three years?”

The four sets of rules just described were used to construct four different indicator variables that addressed free ridership behavior. For each respondent, a free ridership value was assigned based on the combination of variables. With the four indicator variables, there were eleven applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 10-10 shows these values.

Table 10-10 Custom Commercial Free Ridership Scoring

Indicator Variables				Free Ridership Score
Had Plans and Intentions to Install Measure without [Program Name]? (Definition 1)	*Had Plans and Intentions to Install Measure without [Program Name]? (Definition 2)*	*[Program Name] had influence on Decision to Install Measure?*	*Had Previous Experience with Program?*	
Y	Y	Y	Y	100%
Y	Y	N	N	100%
Y	Y	N	Y	100%
Y	Y	Y	N	67%
N	Y	N	Y	67%
N	N	N	Y	33%
N	Y	N	N	33%
N	Y	Y	N	0%
N	N	N	N	0%
N	N	Y	N	0%
N	N	Y	Y	0%

10.3.3.2 Direct Install Component

All survey response data was systematically reviewed by a researcher who was familiar with the program, the individual project, and the social science theory underlying the decision maker survey instrument. As part of this review, the researcher determined whether the available information justified modifying the free ridership score calculated in accordance with the algorithm outlined below.

Several factors were considered in the determination of the presence of free ridership. These included:

- Financial ability to afford the installed measure without a program rebate;
- Plans and intentions of the firm to install a measure even without support from the program;
- Influence that the program had on the decision to install a measure; and
- A firm's previous experience with a measure installed under the program.

To assess these factors, program participants were asked a series of questions about the decision to implement the program project. Based on their responses, respondents were assigned a free ridership score used to estimate the extent of project free ridership.

Several criteria were used to determine what portion of a customer's savings for a particular project should be attributed to free ridership. The first criterion was based on the response to the following two questions:

- If it were not provided free-of-charge by the program, would your organization have been financially able to install…

- If the financial incentive from the [PROGRAM] program had not been available, how likely is it that you would have install the same equipment anyway? Would you say…

If a customer answered "No" to the first question and "Yes, that is correct" to the second, a free ridership score of 0 was assigned to the project. That is, if a customer required financial assistance from the program to undertake a project, then that customer was not deemed a free rider.

For decision makers that indicated that they were able to undertake energy efficiency projects without financial assistance from the program, three factors were analyzed to determine what percentage of savings may be attributable to free ridership. The three factors were:

- Plans and intentions of firm to install a measure even without support from the program;
- Influence that the program had on the decision to install a measure; and
- A firm's previous experience with a measure installed under the program.

For each of these factors, rules were applied to develop binary variables indicating whether a participant's behavior shows free ridership. These rules made use of answers to questions on the decision maker survey questionnaire.

The first factor required determining if a participant's intention was to install an energy efficiency measure even without the program. The answers to a combination of several questions were used with a set of rules to determine whether a participant's behavior indicated likely free ridership. Two binary variables accounted for customer plans and intentions: one, based on a more restrictive set of criteria that may describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that may describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria indicating customer plans and intentions that likely signified free ridership were as follows:

- The respondent answered "yes" to the following two questions: "Before participating in the program, did you have plans to install…?" and "Would you have gone ahead with this planned project even if you had not participated in the program?"
- The respondent answered, "definitely would have installed" to the following question: "If the financial incentive from the [PROGRAM] program had not been available, how likely is it that you would have install the same equipment anyway?"

The second, less restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

- The respondent answered "yes" to the following two questions: "Before participating in the program, did you have plans to install…?" and "Would you have

gone ahead with this planned project even if you had not participated in the program?"

- The respondent answered, "definitely would have installed" or "probably would have installed" to the following question: "If the financial incentive from the [PROGRAM] program had not been available, how likely is it that you would have installed the same equipment anyway?"

The second factor required determining if a customer reported that a recommendation from a Program representative with the program was influential in the decision to install a particular piece of equipment or measure.

The criterion indicating that program influence may have signified a lower likelihood of free ridership is that either of the following conditions were true:

- The respondent answered "yes" to the following question: "Did a [PROGRAM] or other [UTILITY] representative recommend that you install the [PROJECT_DESCRIPTION] at this location?"
- The respondent answered, "Definitely would have installed" to the following question: "If the [PROGRAM] program representative had not recommended installing the [PROJECT_DESCRIPTION], how likely is it that you would have installed it anyway?"

The third factor required determining if a customer reported that past experience with the program was influential in the decision to install a particular piece of equipment or measure.

The criterion indicating that program influence may have signified a lower likelihood of free ridership is that either of the following conditions were true:

- The respondent answered "yes" to the following question: "Prior to this project, did your organization participate in any [UTILITY] energy efficiency programs?"
- The respondent answered, "very important" to the following question: "How important was previous experience with [UTILITY] programs in making your decision to install the [PROJECT_DESCRIPTION]?"

The four sets of rules just described were used to construct four different indicator variables that addressed free ridership behavior. For each respondent, a free ridership value was assigned based on the combination of variables. With the four indicator variables, there were eleven applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables.

10.3.4 Results of Net Savings Estimation

This section discusses the results of estimating net impacts.

Table 10-11 summarizes the results of the estimation of free ridership. Free ridership was low for both components of the program.

Table 10-11 Custom Commercial Program Free Ridership as a Percent of Gross Ex-Post Therm Savings

Program Component	FR Factor
Custom	0%
Direct Install	0%

Table 10-12 summarizes the gross and net ex-post therm savings for the Custom Commercial Program.

Table 10-12 Custom Commercial Program Summary of Gross and Net Ex-Post Therm Savings

Program Component	Ex-Post Gross Therm Savings	Estimated Free Ridership	Net Ex-Post Therm Savings	Estimated Net-to-Gross Ratio
Custom	525,996	0	525,996	100%
DI	1,319,291	0	1,319,291	100%
Total	**1,845,286**	**0**	**1,845,286**	**100%**

Table 10-13 summarizes the gross and net water savings for the Custom Commercial Program.

Table 10-13 Custom Commercial Program Summary of Gross and Net Water Savings

Program Component	Gross Water Savings	Estimated Free Ridership	Net Water Savings	Estimated Net-to-Gross Ratio
Custom	260,892	0	260,892	100%
DI	0	0	0	N/A
Total	**260,892**	**0**	**260,892**	**100%**

Table 10-14 summarizes the gross and net kWh savings for the Custom Commercial Program.

Table 10-14 Custom Commercial Program Summary of Gross and Net kWh Savings

Program Component	Gross kWh Savings	Estimated Free Ridership	Net kWh Savings	Estimated Net-to-Gross Ratio
Custom	0	0	0	0
DI	560,589	0	560,589	100%
Total	**560,589**	**0**	**560,589**	**100%**

Table 10-15 summarizes the gross and net kW savings for the Custom Commercial Program.

Table 10-15 Custom Commercial Program Summary of Gross and Net kW Savings

Program Component	*Gross kW Savings*	*Estimated Free Ridership*	*Net kW Savings*	*Estimated Net-to-Gross Ratio*
Custom	0	0	0	0
DI	406	0	406	100%
Total	**406**	**0**	**406**	**100%**

10.4 Process Evaluation

The following section presents the results of the process evaluation for the Custom Commercial Program.

10.4.1 Staff Interviews and Program Operations

ONG contracts CLEAResult to implement its Commercial Program. The Commercial Program includes two pathways: Direct Install and Custom. There were no major changes to program design or implementation in the 2022 program year; the SEM program was added in 2022 as part of the custom pathway. Staff explained that the SEM program has a small therms goal and primarily focuses on helping schools save money.

10.4.1.1 Supply Chain Concerns

Staff did not express major disruptions to the Commercial Program due to supply chain issues. During the beginning of the pandemic staff indicated it was difficult to replace and upgrade air ducts, as apartment managers did not want contractors entering tenants' apartments, but those concerns have subsided. Staff also noted that more businesses seem interested in investing money in their businesses again, so the Commercial Program has rebounded – "people aren't holding on to their money as much." Staff did note the supply chain issues have delayed gas related equipment.

10.4.1.2 Trade Allies

CLEAResult staff indicated that there is no trade ally network for the commercial custom track, but rather it is a mixture of businesses self-installing their equipment and businesses using an outside contractor or installer. Staff noted that some customers have struggled to find contractors qualified to install air ducts, as this skills in in high demand and there are not as many people equipped with the necessary skill set. When possible, program staff try to schedule several air duct projects from known contractors in specific areas and have them bounce around in an attempt to make the install more lucrative for them. All SEM and direct install work is implemented in-house by CLEAResult staff.

10.4.1.3 Marketing

CLEAResult staff explained that they often use case studies to demonstrate what is possible through the Custom, SEM, and Direct Install pathways. CLEAResult works with

ONG to gather data, create flyers, and market the Commercial Program. That being said, staff indicated they do not need to spend too much time marketing or promoting the program.

10.4.1.4 Tracking

CLEAResult tracks all of the commercial projects and keeps records in their offices. They use approved calculators to determine therms savings and those savings calculations are used to determine the incentive provided. CLEAResult communicates with ONG staff regularly to update them on program progress – providing "full transparency as far as what's being done every month."

10.4.1.5 Conclusion

CLEAResult staff noted an increase in word-of-mouth marketing of their direct install offerings, which was a welcome surprise compared to years past. Business owners are now coming to CLEAResult and ONG asking about the program and what they can do to get involved. CLEAResult staff has also improved communication with business owners, which they believe has helped to promote the program. The primary challenge brought up by staff was building a robust enough Custom pipeline to get contractors interested in getting involved. Participating in the program is most lucrative for contractors when they can get an ample amount of jobs in small geographic area and then move on to another area, rather than go back and forth throughout the year.

10.4.2 Direct Install Participant Survey Responses

CLEAResult provided the Evaluator contact information for Commercial Direct Install program participants who received rebates for energy efficient equipment upgrades. The Evaluator reached out to all participants at least three times to request an interview or survey. Among those participants who were contacted, 25 provided their feedback. The following summary outlines those participants' responses to survey questions.

Respondents included company owners (n=10), managers (n=9), presidents (n=2), and proprietors (n=2).

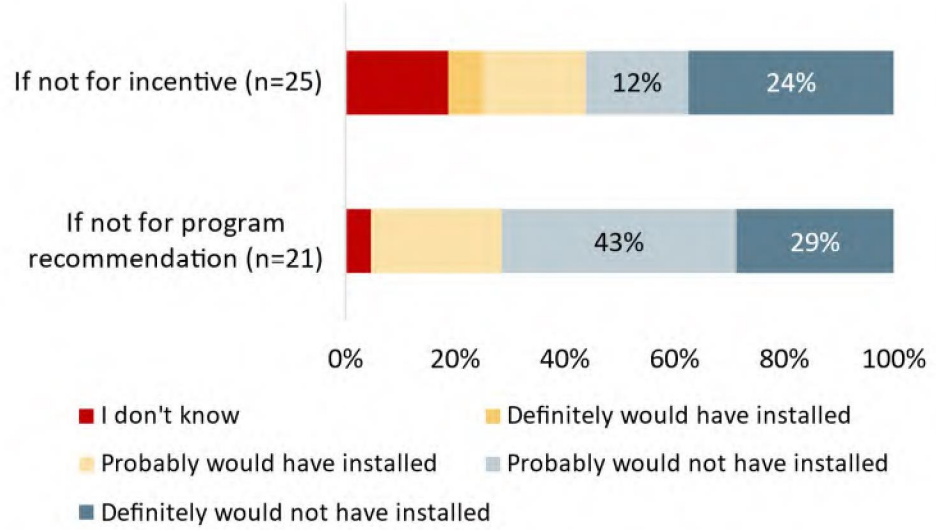
10.4.2.1 Program Awareness and Participation

All but one of the respondents (96%, n=1) learned about the Direct Install program through an ONG program representative. Only one respondent had previously participated in an ONG energy efficiency program. Just over three-quarters of respondents (76%, n=19) communicated with program staff while participating in the program.

None of the respondents indicated they had ever installed weatherstripping or overhead door weatherstripping prior to participating in the Direct Install program. One of the 17 respondents who had received weatherstripping and two of the 24 respondents who had received overhead door weatherstripping indicated they had plans to install similar materials prior to their participation in the program. None of the respondents indicated they removed any of the weatherstripping or door weatherstripping they had received through the program.

The majority of respondents (84%, n=21) noted that a program representative recommended they install the energy efficient equipment they received through the program. Just under three quarters of those respondents indicated they likely would not have installed the upgrades without the recommendation by the program representative. Just under one-third of respondents indicated they would not have installed the equipment without a financial incentive (Figure 10-7).

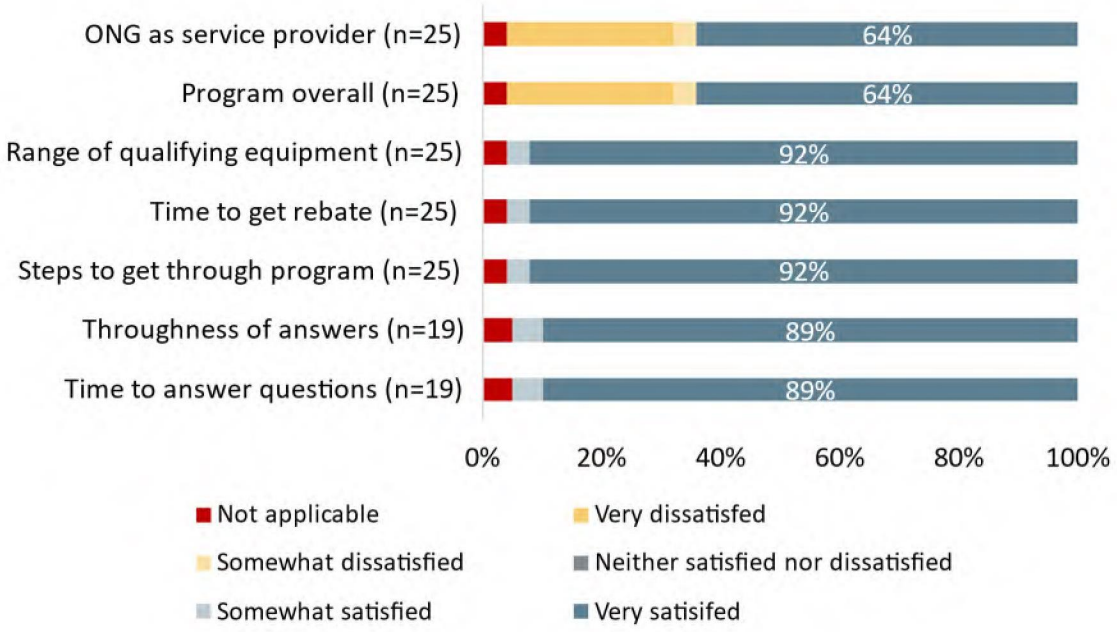
Figure 10-7 Likelihood of Installing



10.4.2.2 Program Satisfaction

In general, respondents were satisfied with various aspects of the program (Figure 10-8).

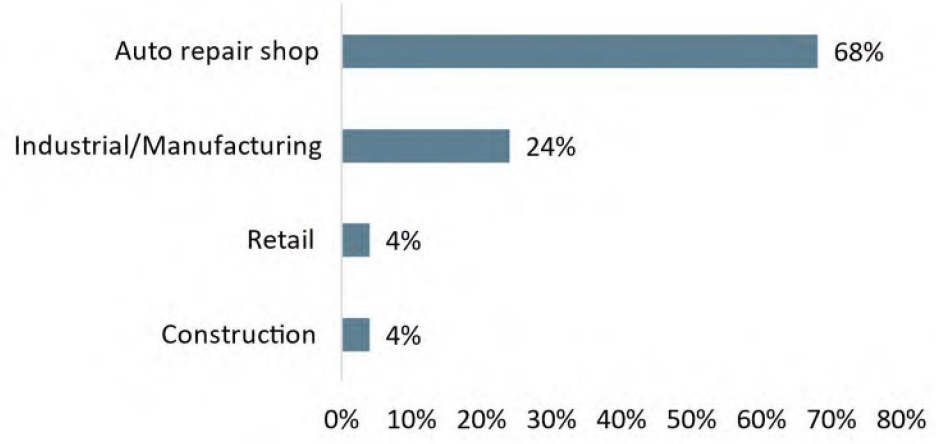
Figure 10-8 Program Satisfaction (n=25)



10.4.2.3 Firmographics

The majority of respondents own and occupy the building that received the upgrades (88%, n=22) and pay for the gas bills at the facility (92%, n=23). More than two-thirds of respondents (68%, n=17) worked for auto repair shops; the other respondents represented industrial/manufacturing, retail, and construction facilities(Figure 10-9).

Figure 10-9 Businesses Represented (n=25)



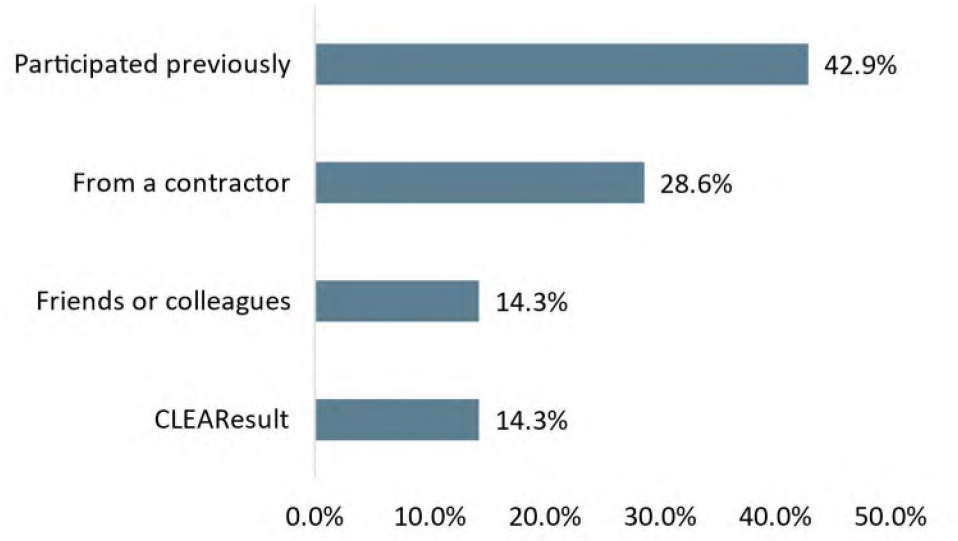
10.4.3 Custom Participant Survey Responses

CLEAResult provided the Evaluator contact information for Custom commercial program participants who received rebates. The Evaluator reached out to all participants at least three times to request an interview or survey. Among those participants contacted, 7 provided their feedback. The following summary outlines those participants' responses to survey questions.

10.4.3.1 Program Awareness and Motivation for Participation

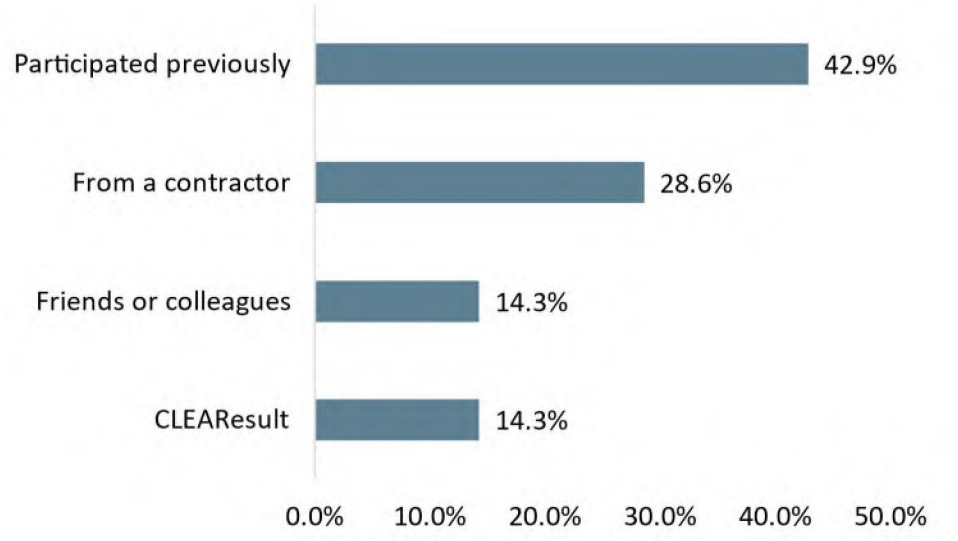
The respondents learned about the Custom commercial program because they were a previous participant, through a contractor, through friends/colleagues, or through CLEAResult (Figure 10-10). Only one respondent indicated they had any hesitations about the program before they participated; the one respondent who was hesitant noted that they trusted their contacts who vouched for the program. About half of the respondents saw marketing materials when they were first learning about the program (42.9%, n=3); these materials were somewhat influential in their decision to participate in the program.

Figure 10-10 Program Awareness (n=7)



Only one respondent indicated that their organization has completed any significant energy efficiency upgrade projects in the past three years. Respondents noted they use a variety of financial methods to evaluate energy efficiency improvements for their company (Figure 10-11). Two respondents noted that their companies expect a 3–5-year return on investment when deciding whether or not to upgrade to efficient equipment.

Figure 10-11 Financial Methods used to Evaluate Energy Efficiency Improvements (n=7)



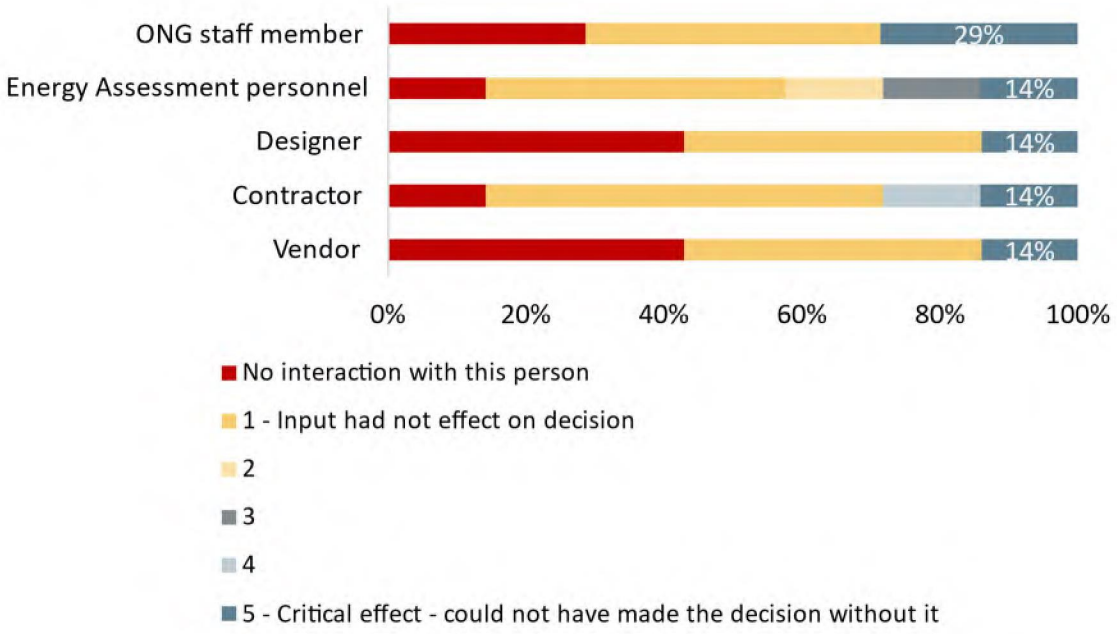
10.4.3.2 Program Participation

Four of the seven respondents (57.1%) remembered receiving technical services, like an assessment, when deciding which equipment to upgrade. Almost all respondents indicated the equipment incentives offered through the program met their expectations.

Five of the respondents completed the incentive paperwork themselves (71.4%); two noted a contractor completed the paperwork for them. All five respondents who completed the paperwork themselves indicated the paperwork was completely clear and they had a clear sense of who to go to for assistance with the application process. Four respondents noted they talked to an ONG or CLEAResult representative during their participation in the program.

All but one respondent indicated that the incentive was about what they expected (85.7%, n=6); the remaining respondent noted the incentive was much less than they expected. Twenty-nine percent of respondents indicated that the ONG staff member had a critical effect on their decision to install energy efficiency equipment; that being said 43% of respondents indicated that ONG staff member had no impact on their decision (Figure 10-12).

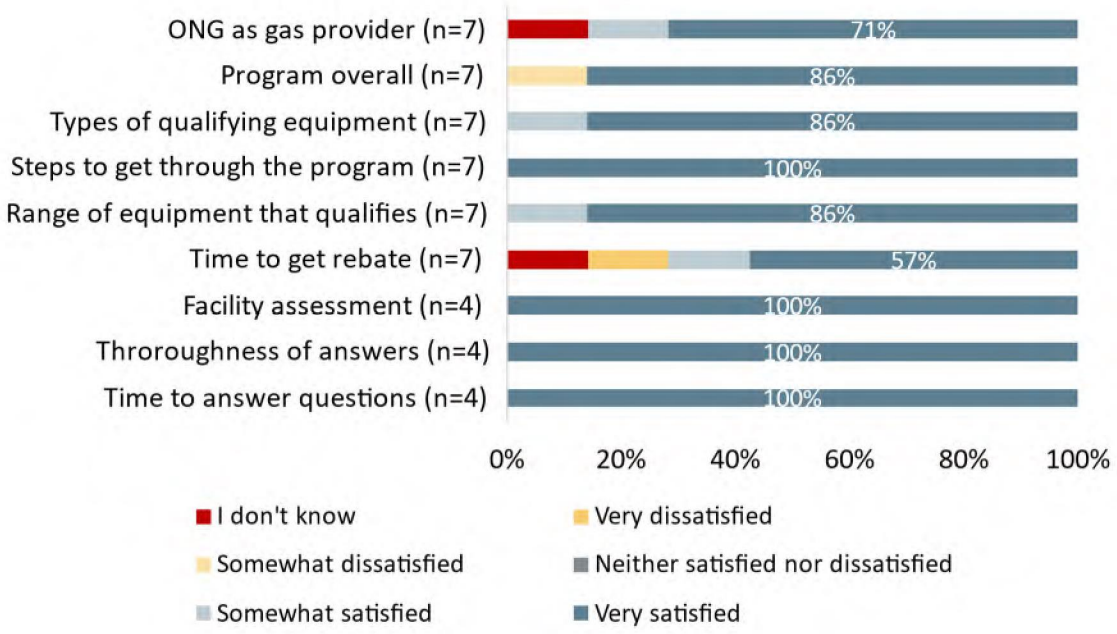
Figure 10-12 Impact of Personnel on Participation (n=7)



10.4.3.3 Program Satisfaction

In general, Custom commercial respondents were satisfied with the Custom Commercial Program (Figure 10-13). Respondents were least satisfied with the time it took to get the rebate, with one respondent noting they never received their rebate.

Figure 10-13 Program Satisfaction



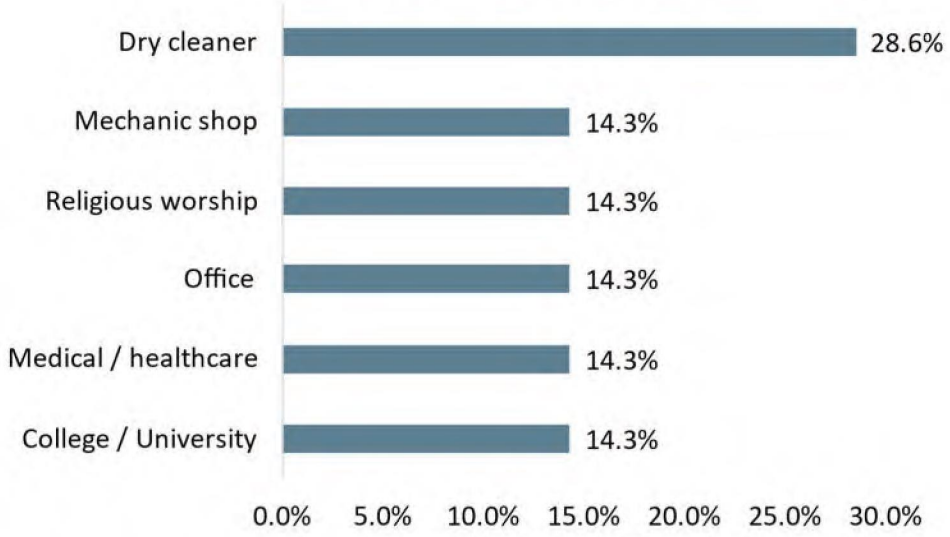
Most respondents indicated that participation in the Custom Commercial Program did not impact their satisfaction with ONG (71.4%, n=5), but two respondents indicated that program participation increased their satisfaction (28.6%). Most respondents did not have any additional feedback to provide to ONG; one respondent noted that there should be a better system to ensure participants receiver their rebate and another respondent recommended better outreach to potential participants.

10.4.3.4 Firmographics

All respondents indicated their company owns and occupies the building where the equipment upgrades occurred. Three of those locations were one of several locations operated by the company, while four were the company's only location. All respondents also indicated their company pays for the gas services provided by ONG.

Respondents' company type varied, as seen in (Figure 10-14).

Figure 10-14 Company Type (n=7)



10.4.4 Custom Commercial Trade Ally Interviews

The Evaluator reached out to nine trade allies who participated in ONG's Commercial Program in 2022. Trade allies were initially contacted via email, followed by three phone call attempts; recruitment efforts are outlined in Table 10-16. The following sections summarizes the conversations with two participating trade allies.

Table 10-16 Trade Ally Recruitment Efforts

Summary	Number of Attempts
Number of Contacts	9
Not interested	1
Scheduled	3
Completed	2

Of the two trade allies who were interviewed, one is the owner of their respective company, which focuses on mechanical insulation work. The other trade ally is a principal engineer and works on servicing, installing, and repairing boilers.

10.4.4.1 Motivation for Participation

2022 was the first year the mechanical insulation focused trade ally participated in the program. They learned about the program through one of their suppliers and started taking on some smaller jobs where they could come in and quickly install insulation. The boiler focused trade ally has been involved with the rebate program for several years; they first learned about the program through a CLEAResult representative. This trade ally was already engaged in a CLEAResult program in Arkansas and was interested in saving money on their Oklahoma based projects as well.

10.4.4.2 Customer Engagement

Both trade allies noted that neither ONG nor CLEAResult provide any program brochures or marketing materials. Although the more experienced trade ally was not interested

marketing materials, the newer trade ally expressed interested in marketing materials, noting that materials would help them pitch the program to potential customers. When marketing the program, trade allies focus on the programs' financial savings, improved safety opportunities, and comfort. In general, lowering energy bills is the primary driver for customer engagement.

10.4.4.3 Barriers to Participation and Program Incentives

One trade ally identified costs as being the biggest barrier to program participation and energy efficient equipment upgrades. However, they did note that ONG's rebate program enables many of their customers to make upgrades they may have not otherwise been able to afford. Regarding the program's incentives, one trade ally noted that incentives vary by project size, as they are based on linear feet of insulation installed. The other trade ally could not speak to the incentives, as they are handled by the customer.

10.4.4.4 Impact of Inflation and Supply Chain Issues

Both trade allies noted supply chain issues. One trade ally mitigated these issues by stocking up early in the pandemic and now most supplies are in stock. The other trade ally however continues to experience lengthy delays in materials which in turn has impacted their ability to schedule and scope out projects for customers. This trade ally has also experience labor shortages, noting that "you can't find anybody that wants to work hard."

10.4.4.5 Program Satisfaction

Only one trade felt as though they could adequately speak to program satisfaction, as the other trade ally indicated they have not completed many projects for the program lately. The responding trade ally expressed satisfaction in the program, noting that the program is really needed because "so many people don't realize the cost savings of insulation." This trade ally is pleased with the flow of projects coming in from CLEAResult, as well as communication with program staff, the application process and the range of measures that qualify.

10.4.4.6 Suggestions for Improvement

Despite general satisfaction with the program, suggestions for improvement remain. One trade ally requested increased program awareness and marketing materials. They suggested program brochures or marketing materials that easily explain the program and its benefits to clients. These materials could not only help increase program awareness, but also would provide clarity on which measures are rebate-eligible to avoid confusion.

10.5 Conclusions and Recommendations

10.5.1 Conclusions

- Most Direct Install component participants surveyed were satisfied with the program overall, the range of equipment that qualifies for the program, and the steps it takes to get through the program.
- Most Custom component participants surveyed were satisfied with the program overall, how thoroughly staff addressed questions/concerns, the facility

assessment or services from the program staff, the time it took to receive the rebate, and the time it took for program staff to answer their questions/concerns.

10.5.2 Recommendations

- Increase marketing activities and explore new opportunities to increase awareness of the Custom Commercial programs (e.g., social media campaigns that target C&I businesses).
- Increase communication and networking opportunities with contractors to keep them up to date with the activities and progress of the Custom Commercial programs.

11 Residential Cross-Program Research

This chapter describes the process evaluation research that was performed for the residential programs.

11.1 ONG Staff and Implementer Interviews

The Evaluator interviewed staff from ONG and CLEAResult about the programs' design and implementation. Interview with ONG staff included the portfolio supervisor, two program managers, and a consultant who has been involved with the portfolio since its inception. Interview with CLEAResult staff included two program managers and two engineers involved with the ONG portfolio.

ONG self-implements its residential appliance program. The program includes customer rebates for clothes dryers, ranges, water heaters, heaters, and new homes. There were no major changes to program design or implementation in the 2022 program year. 2022 marked the last year of the triennial, so staff noted they expect budget adjustments next year as the new triennial period begins. ONG staff indicated that the programs have been doing well. They do their best to not over exceed the budget, while still aiding as many customers as possible, by moving funds around across the various program paths. The staff explained that although there is one large budget for all the residential pathways, each path has its own separate budget. ONG staff indicated that they are on track to meet their 2022 goals. They emphasized the success of the New Home pathway, indicating that the program "has really taken off" in the past two years.

11.1.1 Supply Chain Concerns

Although the program is tracking to spend down its budget and meet goals, staff noted that supply chain disruptions have disrupted their programming. They explained that contractors have struggled to procure 95% furnaces and high efficiency dryers; sometimes these contractors will resort to less efficient models if the customer needs a new furnace immediately. Staff indicated that supply-chain issues are particularly difficult for smaller contractors, as they do not have as much market power as larger contracting businesses, and distributors are more inclined to provide equipment to the larger companies first.

11.1.2 Trade Allies

ONG does not have an established trade ally network. Customers receiving a furnace rebate must use a licensed contractor, but none of the other measures have trade ally requirements; some measures can even be self-installed. Although there is no formal network, ONG staff maintain close relationships with local contractors, updating them about the program and acting as a liaison between customers and contractors. Staff prioritize communication with high-volume contractors to make sure they have everything they need to be successful, as well as some of the newer participating contractors to ensure they are doing everything correctly.

11.1.3 Marketing

Much of ONG's marketing of the residential program is done through communication with local contractors with some leaving promotional materials behind. In addition to the aforementioned communication with contractors, staff visit the big box stores that sell the program eligible equipment and to provide push cards and flyers for stores to use as promotional material. Getting the word out to big box stores can be difficult as ONG staff are only able to talk to a few employees at a time and these stores often see staff turnover. Additionally, many contractors already know about the program, so they do a lot of marketing of the program on their own.

11.1.4 Tracking

Customers submit applications to ONG online or via mail. Customer relations processes the applications and creates a case; reviewers then review the applications to make sure it has all the requisite information and sends it along to the processor for payment. ONG staff perform random audits of rebated equipment for quality assurance purposes.

11.1.5 Conclusion

When asked what the biggest success of the year has been, staff pointed to the number of customers who have participated in the program and received a rebate. They emphasized the strong team they have on staff and how well everyone woks together to manage the program. They did indicate some concerns and challenges regarding the New Home's pathway moving forward. They explained that although they plan to increase the path's budget in the next triennial, they worry about being able to meet demand despite the increased budget. In the past they have had to close the New Home Program early and then wait until the next year to pay it off, which creates confusion and administrative burden.

11.2 Residential Contractor Survey

ONG provided the Evaluator contact information for 158 residential contractors who assisted customers with energy efficient equipment upgrades through the residential rebate programs. The Evaluator reached out to all contractors at least three times to request an interview or survey. Among those 158 contractors, 13 provided their feedback. The following summary outlines those contractors' responses to survey questions.

11.2.1 Respondent Characteristics

Of responding contractors, 10 indicated they were HVAC contractors, 5 were water heater contractors, and 2 were plumbers. Respondents' companies ranged in size from 1-4 employees (7.7%, n=1) to 10-19 employees (30.8%, n=4).

11.2.2 Program Awareness and Motivation for Participation

All but one respondent indicated they learned about ONG's residential rebate program through previous year's participation; the remaining respondent indicated they learned about the program through word-of-mouth. The percentage of customers that were aware of ONG's incentives prior to contractors mentioning it in their sales process varied widely from 20% to 100%; some respondents were not sure how many of their customers previously knew about the incentives. About half of the respondents (46.2%, n=15)

believed ONG could improve its marketing strategy; suggestions included bill inserts/mailers, tv advertisements, larger rebates, and automated rebate forms.

More than half of respondents indicated they actively market ONG's rebates to their customers (61.5%, n=8). These respondents noted they used word-of-mouth, television and website marketing, and mailers to market the program to customers. More than two-third of respondents noted they marketed some equipment more than others (69.2%, n=9) (Table 11-1). They also noted they considered a variety of factors when deciding to promote equipment including warranties, performance/quality, cost, longevity, specifications, and brand.

Table 11-1 Equipment Promoted (n=9)

Equipment	n
95% furnace	5
Tankless water heaters	5
Specific brands	4

All but two respondents were aware that ONG provides additional rebates for fuel switching; nine actively promoted fuel switching in their sales process. Respondents mentioned a variety of selling points they used to promote fuel switching to customers. Three respondents (23.1%) indicated some of their customers applied for the fuel switching rebates. Among the nine respondents who indicated they actively pushed for fuel switching, seven (77.8%) thought the incentive provided was sufficient to encourage fuel switching.

Table 11-2 Fuel Switching Selling Points (n=9)

Selling Point	n
Equipment cost	3
Efficiency	6
Utility bill cost	2
Warmer	1

Only one respondent recommended ONG provide additional incentives for equipment not currently covered; they noted ONG used to provide an incentive for gas furnace tune ups. Three respondents (23.1%) thought ONG should increase the amount of incentives offered for certain equipment, specifically gas furnaces (n=2) and tankless water heaters (n=1).

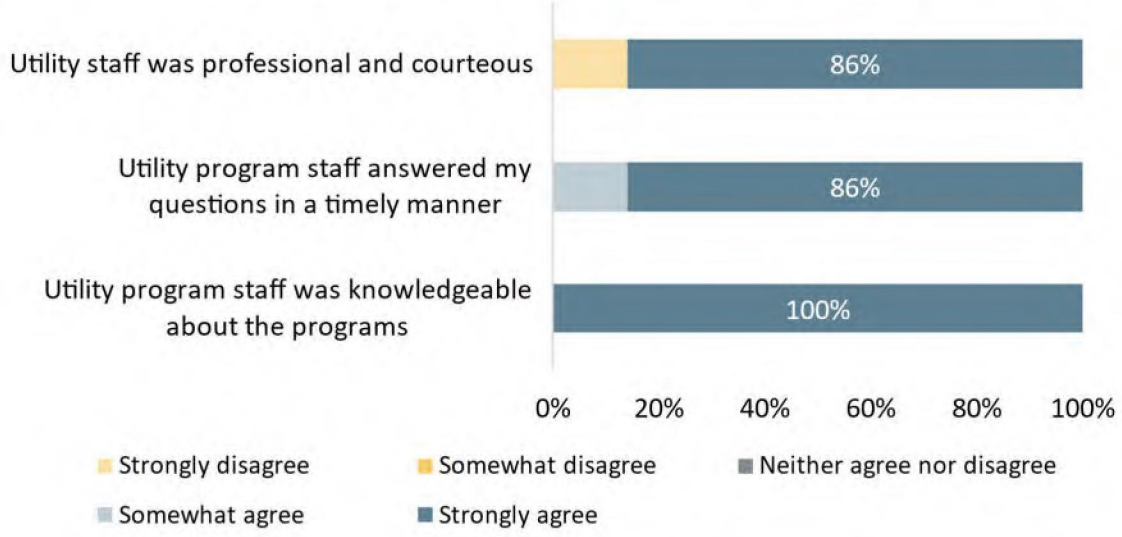
11.2.3 Program Satisfaction

Almost all of the respondents noted they assisted customers in the completion of incentive applications (84.6%, n=11); six of those respondents completely filled out the application for customers, while the remaining respondents provided the equipment and installation services and then the customer submited the application.

About half of respondents have communicated with ONG staff over the past year (53.8%, n=7). Among those respondents, satisfaction was generally high (Figure 11-1). Suggestions for application improvement included having online updates regarding

rebate status as well as allowing installing contractor to submit rebate instead of the customer.

Figure 11-1 Satisfaction with Program Staff (n=7)



When asked how effective various form of communication are for announcing program updates, respondents indicated that email was most effective followed by phone; presentations at conferences, and website updates; in-person visits demonstrated some value, but not as much as email and phone.

About half of respondents indicated that involvement in the ONG program has impacted the types of equipment they provide (46.2%, n=6), noting that participating in the programs has resulted in more sales and promotion of efficient equipment. Respondents have noticed an increased in interest from their customers for efficient equipment, specifically tankless water heaters; some respondents noted some of their customers still gravitate towards the cheapest and most readily available equipment.

More than half of respondent (61.5%, n=8) noted that all of their qualifying customers applied for incentives in 2022. Respondents listed a variety of reasons customers were not interested in energy efficient equipment (Table 11-3 Resistance to Energy Efficient Equipment (n=13).

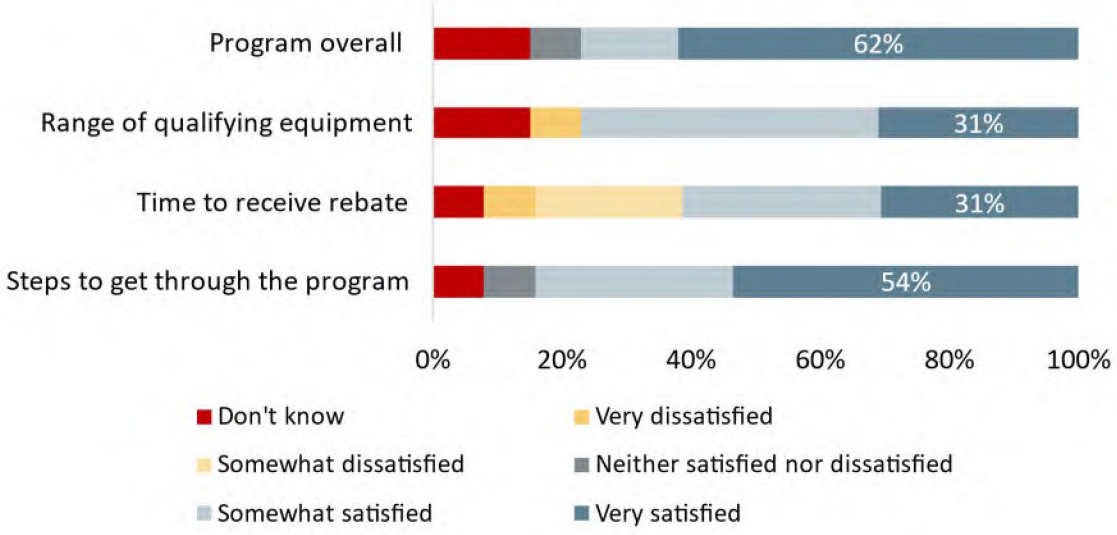
Table 11-3 Resistance to Energy Efficient Equipment (n=13)

Factor	n
Upfront cost	8
Availability	2
Resistance to change	1
Paperwork	1
Lack of knowledge	1

In general, program satisfaction was high (Figure 11-2). Respondents who expressed some dissatisfaction noted that the rebate takes too long to process (n=2) and that rebate

amounts have not increased for a long time, despite rapidly increasing equipment costs. One respondent mentioned appreciation for the contractor specific incentive.

Figure 11-2 Program Satisfaction (n=13)



12 Appendix A: Cost-Benefit Analysis

This appendix provides an overview of each program's participation, verified therm savings, annual administrative costs, total program costs, as well as a summary of the cost effectiveness analysis. Costs include program costs incurred in the implementation of ONG's PY2022 energy efficiency portfolio from January 1, 2022, through December 31, 2022.

12.1 Cost Effectiveness Summary

The cost-effectiveness of ONG's PY2022 programs was calculated based on reported total spending and verified net energy savings for each of the energy efficiency programs. ONG provided all spending estimates. The Evaluator used incentive amounts from program tracking data. The methods used to calculate cost-effectiveness are informed by the California Standard Practice Manual.[6]

To calculate the cost-effectiveness of each program, measure lives were assigned on a measure-by-measure basis. When available, measure life values came from the Arkansas Technical Reference Manual 8.0 (TRM).[7] Additionally, assumptions regarding incremental/full measure costs were necessary.

Avoided energy, capacity, and transmission/distribution costs used to calculate cost-effectiveness were provided by ONG. Residential and commercial rates used to estimate certain cost-effectiveness tests were also provided by ONG.

Table 12-1 lists each program included in this analysis, along with the final verified net savings estimates, total expenditures, and Total Resource Cost (TRC) test results.

In addition to TRC results, results from the Program Administrator Cost Test (PACT), the Rate-payer Impact Measure (RIM) test, and Participant Cost Test (PCT) are included in the body of this appendix.

Table 12-1 Cost Effectiveness by Program

Program	*Total Benefits*	*Total Program Expenditures*	*TRC (b/c ratio)*
Clothes Dryer	$588,056	$754,990	2.71
Range	$248,199	$255,637	15.19
Water Heater	$737,236	$752,051	2.40
Heating System	$8,190,473	$4,347,277	4.87
Low-Income Assistance	$4,260,871	$824,305	5.17
Water Conservation Kits	$1,142,170	$105,809	10.79
New Home	$19,747,870	$4,325,312	2.10

[6] California Standard Practice Manuel: Economic Analysis of Demand Side Management Programs, October 2001. Available at: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_-_Electricity_and_Natural_Gas/CPUC_STANDARD_PRACTICE_MANUAL.pdf

[7] http://www.apscservices.info/EEInfo/TRM.pdf

Program	*Total Benefits*	*Total Program Expenditures*	*TRC (b/c ratio)*
Custom Commercial	$17,244,524	$2,334,350	6.22
Portfolio Non-incentive Costs	N/A	$2,767,082	N/A
Total	**$52,159,399**	**$16,466,812**	**2.88**

12.2 Energy Efficiency Program Results

ONG's energy efficiency portfolio in PY2022 consisted of eight programs with verified net therm savings of 4,043,440 therms. Total spending in PY2022 equaled $16,466,812. Table 12-2 provides a summary of program costs.

Table 12-2 Reported Costs by Program

Program	*Incentives*	*Program Overhead Costs*
Clothes Dryer	$738,873	$16,117
Range	$239,300	$16,337
Water Heater	$4,049,200	$298,077
Heating System	$666,850	$85,201
Low-income Assistance	$796,061	$28,244
Water Conservation Kits	$78,700	$27,110
New Home	$4,277,650	$47,662
Custom Commercial	$1,408,118	$926,232
Portfolio Non-incentive Costs	N/A	$2,767,082
Total	**$12,254,751**	**$4,212,061**

In the tables that follow, total costs and benefits, and cost-effectiveness test results are provided for each energy efficiency program in the PY2022 portfolio.

Table 12-3 Clothes Dryer Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$588,056	$588,056	$588,056	$995,652
Total Costs	$754,990	$216,971	$1,070,705	$200,854
Benefit/Cost Ratio	**0.78**	**2.71**	**0.55**	**4.96**

Table 12-4 Range Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$34,513	$248,199	$34,513	$411,512
Total Costs	$255,637	$16,337	$274,181	$-
Benefit/Cost Ratio	**0.14**	**15.19**	**0.13**	**#DIV/0!**

Table 12-5 Water Heater Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$737,236	$737,236	$737,236	$966,342
Total Costs	$752,051	$307,696	$1,148,714	$222,496
Benefit/Cost Ratio	**0.98**	**2.40**	**0.64**	**4.34**

Table 12-6 Heating System Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$8,190,473	$8,190,473	$8,190,473	$7,363,924
Total Costs	$4,347,277	$1,680,816	$8,755,011	$1,382,739
Benefit/Cost Ratio	**1.88**	**4.87**	**0.94**	**5.33**

Table 12-7 Low-income Assistance Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$4,260,871	$4,260,871	$4,260,871	$2,595,220
Total Costs	$824,305	$824,305	$3,113,213	$796,061
Benefit/Cost Ratio	**5.17**	**5.17**	**1.37**	**3.26**

Table 12-8 Water Conservation Kits Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$1,068,117	$1,142,170	$1,068,117	$1,033,700
Total Costs	$105,809	$105,809	$675,437	$78,700
Benefit/Cost Ratio	**10.09**	**10.79**	**1.58**	**13.13**

Table 12-9 New Home Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$19,747,870	$19,747,870	$19,747,870	$12,788,058
Total Costs	$4,325,312	$9,395,927	$14,935,630	$9,348,266
Benefit/Cost Ratio	**4.57**	**2.10**	**1.32**	**1.37**

Table 12-10 Custom Commercial Benefit/Cost Tests

Program	*Program Administrator Cost Test*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Total Benefits	$15,295,345	$17,244,524	$15,295,345	$11,707,488
Total Costs	$2,334,350	$2,771,911	$14,159,694	$1,845,679
Benefit/Cost Ratio	**6.55**	**6.22**	**1.08**	**6.34**

13 Appendix B: Site-Level Estimation of Ex-Post Gross Savings

The following sections present site-level reports for the Custom and Direct Install components of the Custom Commercial Program.

13.1 Custom Component Site-Level Reports

Project Number PRJ-2996007

Program Oklahoma Natural Gas Commercial & Industrial

Project Background

The participant is a manufacturing facility that received incentives from Oklahoma Natural Gas for recovering and utilizing waste heat from an air compressor to provide supplemental space heating to decrease the load on the facility's gas furnace.

M&V Methodology

Savings for the heat recovery measure was calculated using the sensible heat equation and deemed values from the AR TRM v7.0. The remaining values used in the calculations were measured on-site in the ex-ante review or are from a customer testimony.

Savings Calculations

Using deemed values from the table above, the Evaluator calculated heat recovery savings as follows:

$$Annual\ Therm\ Savings = \frac{1.08 \times CFM \times \frac{Hours}{Year} \times (T_{exhaust} - T_{heat})}{E_C \times 100{,}000\ BTU/therm}$$

Where:

1.08 = Sensible heat equation factor

$\frac{Hours}{Year}$ = annual heating hours that coincide with compressor operation

CFM = Flow rate of the exhaust air containing compressor waste heat

$T_{exhaust}$ = Temperature of the exhaust air from the air compressor (°F)

T_{heat} = Temperature of the indoor heat setpoint (°F)

$E_{C_{Base}}$ = Heating efficiency of gas-fired heating equipment (assumed to be 80% AFUE for baseline gas-fired heating equipment)

Compressor Heat Recovery Therm Savings Calculations

Measure	*Expected Therms Savings*	*Realized Therms Savings*	*Realization Rate*
Compressor Heat Recovery	57,453	60,384	105%
Total	**57,453**	**60,384**	**105%**

Results

The therm realization rate for PRJ-2996007 is 105%. To calculate heating energy savings, ADM used a different indoor heat setpoint than the ex-ante. ADM used the heating setpoint of 70°F which is what the indoor heating setpoint is. The ex-ante used 75°F which deflated their savings estimate. The combination of these changes resulted in a high savings realization rate.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Compressor Heat Recovery	57,453	60,384	105%
Total	**57,453**	**60,384**	**105%**

Program Custom Commercial Program

Project ID PRJ-3031121

Project Background

The participant is a dry-cleaning facility that received incentives from Oklahoma Natural Gas for:

- ECM #1 – Pipe Insulation

The Pipe insulation measure saved energy by reducing the heat loss from tanks, the piping, and joints/values, thus reducing the gas consumption.

M&V Methodology

The M&V effort for this project follows the guidelines of the 2012 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement. ADM evaluated the savings associated with this site during a desk review.

Measurement and verification activities are based on the following assumptions:

- Annual operating hours for the site are 2,750 hours
- Combustion efficiency is 80% (for both pre-retrofit and post-retrofit condition)

Pipe Insulation

Through this method, energy savings are calculated using key data and through the North American Insulation Manufacturers Association's 3E Plus software:

(http://www.pipeinsulation.org/).

Measurement and verification activities are based on the following assumptions:

- Insulation thickness: 1 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-1
- Process temperature is 344°F
- The average annual ambient air temperature is 75°F

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 1 in insulation (post-retrofit). The software required these inputs: process temperature, ambient temperature, pipe size, base metal, insulation, and jacket material. Annual therms savings was calculated using the following equation:

Equation 1. Pipe Insulation Installation Annual Energy Savings

$$Annual\ Therms\ Savings = \frac{Heat\ Loss\ \left(\frac{Btu}{hr}\right)\ x\ Annual\ Operating\ Hours\ \left(\frac{hrs}{yr}\right)}{Boiler\ Efficiency\ x\ 100{,}000\ \left(\frac{BTU}{CCF}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Table 11. Pipe/Vale/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	.5 Pipe	Pipe	[redacted]	450	0.5
2	1.5 Pipe	Pipe		350	2
3	1 Pipe	Pipe		30	1
4	.5 soft roll copper	Pipe		50	0.5
5	1.5 tees	Valve or fitting	25	2.54	1.5
6	1.5 90' elbow	Valve or fitting	10	2.54	1.5
7	.5 90' elbow	Valve or fitting	112	1.82	0.5

Measure Life

Table 12. Estimated Useful Life for Respective Measures

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Table 13. Pipe Insulation Annual Energy Savings

Entry #	*Description*	*Pipe or Valve*	*Temperature (°F)*	*Pre Heat Loss*	*Post Heat Loss*	*Therms Savings*
1	.5 Pipe	Pipe	344	344	56	2,509
2	1.5 Pipe	Pipe	344	344	51	4,301
3	1 Pipe	Pipe	344	344	105	260
4	.5 soft roll copper	Pipe	344	344	129	236
5	1.5 tees	Valve or fitting	344	344	49	789
6	1.5 90' elbow	Valve or fitting	344	344	49	316
7	.5 90' elbow	Valve or fitting	344	344	54	1,181
					Total:	**9,590**

Overall, project savings are as follows:

Table 14. Overall Project Savings

Measure	*Expected Annual therms Savings*	*Realized Annual therms Savings*	*Realization Rate*	*Lifetime therms Savings*
Pipe and Tank Insulation	9,590	9,590	100%	191,806
TOTAL	**9,590**	**9,590**	**100%**	**191,806**

Program Custom Commercial Program

Project ID PRJ-3046995

Project Background

The participant is a dry-cleaning facility that received incentives from Oklahoma Natural Gas for:

- ECM #1 - Steam trap replacement

The steam system serves the hospital's typical systems, including space heat, sanitization, and laundry.

M&V Methodology

The M&V effort for this project follows the guidelines of the 2012 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement.

Measurement and verification activities are based on the following assumptions:

- Supply water temperature is 65°F based on the AR TRM 8.1
- Annual operating hours for the site are 2,625 hours
- Combustion efficiency is 80% (for both pre-retrofit and post-retrofit condition)

Steam Trap Repairs

The following table shows relevant failed steam traps parameters required for annual energy savings.

Table 15. Steam Trap Parameters

Steam Trap #	Orifice Size (in.)	Inlet Pressure (psig)	Outlet Pressure (psig)	Service (Drip/Process)	Feedwater Temperature (°F)	Boiler Efficiency	Operating Hours
1	7/64	100	5	Drip	65	80%	2625
2	7/64	100	5	Drip	65	80%	2625
3	7/64	100	5	Drip	65	80%	2625
4	7/64	100	5	Drip	65	80%	2625
5	7/64	100	5	Drip	65	80%	2625
6	7/64	100	5	Drip	65	80%	2625
7	7/64	100	5	Drip	65	80%	2625
8	7/64	100	5	Drip	65	80%	2625
9	1/8	100	5	Drip	65	80%	2625
10	7/64	100	5	Drip	65	80%	2625
11	7/64	100	5	Drip	65	80%	2625
12	7/64	100	5	Drip	65	80%	2625

Calculations for the annual therms savings use the following equation:

Equation 2. Steam Trap Replacement Annual Energy Savings

$$Annual\ \ therms\ Savings = \frac{Steam\ Trap\ Discharge\ Rate \times OpHrs \times h_{fg}}{EC_{Base} \times Therm\ Conversion\ Factor}$$

Where:

Steam Trap Discharge Rate = steam loss from the system (lb/hr)

OpHrs = annual hours the system is pressurized (hrs/yr) = 2,625 annual hours

H_{fg} = latent heat of evaporation (BTU/lb) found in Table 17

EC_{Base} = combustion efficiency of boiler (%), 80%

Therm Conversion Factor = 12,961 (BTU/therm)

The discharge rate (lb/hr) was calculated using Armstrong's "Steam Loss Through Failed Trap Calculator" (found here: https://www.armstronginternational.com/knowledge/resources-library/calculators/steam-loss)

Measure Life

Table 117. Estimated Useful Life for Respective Measures

Measure	EUL
Steam Trap Repairs	5 years

Calculated Savings:

Steam Trap Repairs

Table 17. Steam Trap Repairs Savings

Steam Trap #	Discharge Rate (lbs/hr)	Steam Enthalpy (BTU/lb)	Feedwater Enthalpy (BTU/lb)	Therms Savings
1	37	1,191	33	1,054
2	37	1,191	33	1,054
3	37	1,191	33	1,054
4	37	1,191	33	1,054
5	37	1,191	33	1,054
6	37	1,191	33	1,054
7	37	1,191	33	1,054
8	37	1,191	33	1,054
9	48	1,191	33	1,367
10	37	1,191	33	1,054
11	37	1,191	33	1,054
12	37	1,191	33	1,054
			Total:	12,961

Overall, project savings are as follows:

Table 119. Overall Project Savings

Measure	*Expected Annual therms Savings*	*Realized Annual therms Savings*	*Realization Rate*	*Lifetime therms Savings*	*Annual Water Gallons Savings*	*Lifetime Water Gallons Savings*
Steam Trap Repair	12,961	12,961	100%	64,804	N/A	N/A
TOTAL	**12,961**	**12,961**	**100%**	**64,804**	**N/A**	**N/A**

Project Number RBT-3061610

Program Custom Commercial Program

Project Background

The participant is a retailer that received incentives from Oklahoma Natural Gas for installing (2) new gas fired furnaces.

M&V Methodology

Savings for the commercial furnace replacement measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies from the Oklahoma C&I Natural Gas Guidebook V1.

Savings Calculations

The annual energy savings from commercial furnace is calculated with the following equation:

Equation 3: Annual Therm Savings

$$Annual\ Therms\ Savings\ (therms) = \frac{Capacity\left(\frac{Btu}{hr}\right) x\ EFLH_H(hr)\ x\ \left(\frac{1}{\eta pre} - \frac{1}{\eta post}\right)}{100{,}000\ \frac{Btu}{therm}}$$

Where:

Capacity: Rated equipment heating capacity Btu/hr

$EFLH_H$: Equivalent full-load hours for heating from AR TRM Table 475

η_{pre} : 78% Energy Efficiency of the baseline furnace

η_{post}: Nameplate Efficiency of the new furnace

100,000 Btu/therm: thermal conversion factor (BTU/yr to therm/yr)

Table 120: Commercial Furnace Replacement Summary

Unit	Heating Capacity (Btu/hr)	η_{pre}	η_{post}	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
2	80,000	78%	95%	416	416	8,318	100%
Total				**235**	**235**	**4,702**	**100%**

Table 121: Measure EUL

Measure	*EUL*
Furnace Replacement	20 years

Results

The ex-ante and ex-post calculations used the same TRM based savings equation and input values resulting in 100% Therm savings realization rate.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Furnace Replacement	416	416	100%
Total		416	**100%**

Project Number PRJ-3081674

Program Oklahoma Natural Gas Commercial & Industrial

Project Background

The participant is a laundromat that received incentives from Oklahoma Natural Gas for implementing energy efficient steam traps. On-site, the Evaluator verified the participant had installed:

- (14) Failed Open Steam Traps Replacement
- (7) Steam Leaks Repaired

M&V Methodology

Savings for the steam trap measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies from the Oklahoma C&I Natural Gas Guidebook V1.

Savings for the steam leak repairs measure was calculated using steam plume calculations derived by G.G. Rajan ("Energy Savings in Steam Systems," Cochin, Indea) and methodology from the Steam Trap measure of the Arkansas TRM v7.0.

Savings Calculations

The Evaluator calculated steam trap savings as follows:

$$Annual\ Therm\ Savings = \frac{\dot{m} \times\ h_g - h_f \times \frac{Hours}{Year}}{E_C\ \times 100{,}000\ BTU/therm}$$

Where:

$\dot{m}$ = Steam loss in lb/hr

$\frac{Hours}{Year}$ = annual hours the steam system is pressurized

h_g = Total enthalpy of steam (obtained from steam tables) BTU/lb

h_f = Enthalpy of liquid – i.e., boiler feedwater enthalpy if condensate is returned to steam system; otherwise, makeup water enthalpy if condensate is not returned (determined using steam tables and inlet pressure and, if necessary, AR TRM V7.0 Table 143) BTU/lb

$E_{C_{Base}}$ = Combustion efficiency for boiler. If unknown, 80%

ADM Steam Trap Replacement Summary

Trap Type	Trap Make and Model	Discharge Rate (lb/hr)	Estimated System Hours	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	United 849	66	1,825	1,279.99	1,743.25	8,716.25	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong PS-900	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong 880	40	1,825	775.75	1,056.52	5,282.58	136.19%
IB	Armstrong 800	34	1,825	659.39	898.04	4,490.19	136.19%
IB	Armstrong 800	34	1,825	659.39	898.04	4,490.19	136.19%
Total				9,968.41	13,576.22	67,881.09	136.19%

Steam Trap Replacement Therms Savings Calculations

Measure	***Expected Therms Savings***	***Realized Therms Savings***	***Realization Rate***
Steam Trap Replacement	9,968.41	13,576.22	136.19%
Total	**9,968.41**	**13,576.22**	**136.19%**

The Evaluator calculated steam leak repair savings as follows:

$$Annual\ Therm\ Savings = \frac{\dot{m} \times h_g - h_f \times \frac{Hours}{Year}}{E_C \times 100{,}000\ BTU/therm}$$

$$\dot{m} = 5.661 \times e^{(0.562 \times Plume\ Lenght\ (ft))}$$

Where:

$\dot{m}$ = Steam loss in lb/hr (Equation above derived by G.G. Rajan ("Energy Savings in Steam Systems," Cochin, India)

Plume Length (ft) = measured length of steam out of a steam leak in linear feet

$\frac{Hours}{Year}$ = annual hours the steam system is pressurized

h_g = Total enthalpy of steam (obtained from steam tables) BTU/lb

h_f = Enthalpy of liquid – i.e., boiler feedwater enthalpy if condensate is returned to steam system; otherwise, makeup water enthalpy if condensate is not returned (determined using steam tables and inlet pressure and, if necessary, AR TRM V7.0 Table 143) BTU/lb

$E_{C_{Base}}$ = Combustion efficiency for boiler. If unknown, 80%

ADM Steam Leak Repair Summary

Description		Steam Leak Rate (lb/hr)	Estimated System Hours	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
IB	Armstrong PS-900	5.93	1,825	153.38	156.69	81,268.60	102%
IB	United 849	5.93	1,825	153.38	156.69	40,634.30	102%
IB	Armstrong PS-900	5.93	1,825	153.38	156.69	60,951.45	102%
IB	Armstrong PS-900	6.22	1,825	160.70	164.21	81,268.60	102%
IB	Armstrong PS-900	6.22	1,825	160.70	164.21	60,951.45	102%
IB	Armstrong PS-900	5.93	1,825	153.38	156.69	81,268.60	102%
IB	Armstrong PS-900	6.22	1,825	160.70	164.21	60,951.45	102%
Total				1,095.62	1,119.39	812,686	102%

Steam Leak Repair Therms Savings Calculations

Measure	*Expected Therms Savings*	*Realized Therms Savings*	*Realization Rate*
Steam Leak Repair	9,951.26	162,537.20	1633.33%
Total	**9,951.26**	**162,537.20**	**1633.33%**

Results

The therms realization rate for RBT-1418094 is 2,542.86%. To calculate steam trap discharge rate, ADM used the given orifice diameter of 7/16", while the ex-ante used an orifice diameter of 7/64", leading to underestimated savings.

Verified Gross Savings & Realization Rates

Measure	*Expected Therms Savings*	*Verified*	
		Therms Savings	*Therms Realization Rate*
Steam Trap Replacement		162,537.20	1633.33%
Steam Leak Repairs			
Total		**162,537.20**	**1633.33%**

Project Number PRJ-3084462

Program Custom Commercial Program

Project Background

The participant is a religious facility that received incentives from Oklahoma Natural Gas for installing a new furnace. During a desk review of project documentation, the Evaluator verified the participant had installed:

- (1) Commercial furnace Replacement

M&V Methodology

Savings for the commercial furnace replacement measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies from the Oklahoma C&I Natural Gas Guidebook V1.

Savings Calculations

The annual energy savings from commercial furnace is calculated with the following equation:

Equation 4: Annual Therm Savings

$$Annual\ Therms\ Savings\ (therms) = \frac{Capacity\left(\frac{Btu}{hr}\right) x\ EFLH_H(hr)\ x\ \left(\frac{1}{\eta_{pre}} - \frac{1}{\eta_{post}}\right)}{100{,}000\ \frac{Btu}{therm}}$$

Where:

Capacity: Rated equipment heating capacity Btu/hr

$EFLH_H$: Equivalent full-load hours for heating from AR TRM Table 475

η_{pre} : 78% Energy Efficiency of the baseline furnace

η_{post}: Nameplate Efficiency of the new furnace

100,000 Btu/therm: thermal conversion factor (BTU/yr to therm/yr)

Table 122: Commercial Furnace Replacement Summary

Unit	Heating Capacity (Btu/hr)	η_{pre}	η_{post}	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
1	120,000	78%	95%	235	235	4,702	100%
Total				**235**	**235**	**4,702**	**100%**

Table 123: Measure EUL

Measure	*EUL*
Furnace Replacement	20 years

Results

The therms realization rate for the installed measures is 100%.

Table 124: Verified Gross Savings & Realization Rates

Measure	*Expected Annual therms Savings*	*Realized Annual therms Savings*	*Realization Rate*	*Lifetime therms Savings*
Furnace Replacement	235	235	100%	4,702
Total	**235**	**235**	**100%**	**4,702**

Project Number PRJ-3091499

Program Custom Commercial Program

Project Background

The participant is a restaurant that received incentives from Oklahoma Natural Gas for implementing pipe insulation. On-site, the Evaluator verified the participant had installed:

- (3) Commercial Fryers HD #50G

M&V Methodology

Savings for the Commercial Fryer measure were calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies from section 3.8.6 Commercial Fryers found in the Arkansas TRM 8.1.

Savings Calculations

The following equations were used to calculate the savings from installing more efficient commercial fryers:

$$BTU_{cooking} = \frac{(LB) * \left(E_{food}\right) * (\#Days)}{\eta}$$

$$BTU_{idle} = (Idle\ Energy) * \left(Daily\ Hours - \frac{LB}{Capacity} - \frac{Preheat\ Time}{60}\right) * (\#Days)$$

$$BTU_{preheat} = (Preheat\ Energy) * (\#Days) * (\#Preheats)$$

$$BTU_{baseline,\ efficient} = BTU_{cooking} + BTU_{idle} + BTU_{preheat}$$

$$Annual\ Therms\ Savings = \frac{BTU_{baseline} - BTU_{efficient}}{100{,}000}$$

Where:

Annual Therms Savings = Therms saved by equipment per year. (therms/year).

$BTU_{baseline}$ *= Baseline Fryer Energy (BTU)*

$BTU_{efficient}$ *= Efficient Fryer Energy (BTU)*

$BTU_{cooking}$ *= Cooking Energy (BTU)*

BTU_{idle} *= Idle Energy (BTU)*

$BTU_{preheat}$ *= Preheat Energy (BTU)*

LB = Pounds of food per day (lbs/day)

Capacity = Fryer capacity per hour (lbs/hour)

η = *Fryer efficiency (%)*

E_{food} = *Cooking Efficiency (btu/lb)*

Preheat Time = Minutes it takes to preheat the fryers (min)

Therms conversion factor = (1 therm)/(100,000 BTU)

Hours to Minutes conversion factor = (60 minutes)/(1 hr)

Daily Hours = Number of hours fryers are on per day (hrs/day)

#Days = Number of days the business runs the fryers per year (days/year)

Preheat Energy = Energy required to preheat the fryers (BTU/preheat)

 # Preheats = Number of preheats per day (assumed 1)

The inputs for this measure's baseline and efficient models are described in the table below.

Table 125: Gas Fryer Specifications

Parameter	Standard Vat Gas Fryers	
	Baseline Model	Efficient Model
Preheat Energy (BTU/day)	16,00	15,500
Idle Rate (BTU/hr)	14,000	**7,124**
Cooking Efficiency (%)	35%	**51%**
Production Capacity (lb/hr)	60	**50**
Lbs of food Cooked/Day	150	150
E_food (BTU/lb)	570	570

Measure Life

Table 126: Measure Life

Measure	EUL
Commercial Fryers	12 years

Table 127: Project Summary

Item #	Model #	Idle Rate (BTU/hr)	Cooking Efficiency	Production Capacity (lbs)	# of units	Lifetime Therms Savings
1	HD #50G	7,124	51%	50	3	18,962
					Total:	**18,962**

Results

Table 128: Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Commercial Fryers	1,580	1,580	100%
Total	**1,580**	**1,580**	**100%**

Project Number PRJ-3094672

Program Custom Commercial Program

Project Background

The participant is an apartment complex which performed a duct sealing measure in 32 apartment units. The participant received incentives from Oklahoma Natural Gas for implementing energy efficient measures.

During a desk review, the Evaluator verified that the participant had implemented:

- Duct Sealing

M&V Methodology

Savings for the air sealing are outlined in Arkansas TRM V8.1 section 2.2.9, along with the measurement techniques. Similarly, duct sealing measures were evaluated using guidelines outlined under section 2.3.4 of the ONG Commercial Deemed Savings Guidebook PY2021. Pre-installation and post-installation testing should be performance using identical measurement procedures. ADM used IPMVP option A, Key Parameter Measurement and provided leakage testing rates to estimate the savings using deemed savings formulas.

Savings Calculations

Using deemed values and measured leakage rates, the Evaluator calculated duct sealing savings and air sealing savings as follows:

$$Therms_{savings,duct} = \frac{\left(DL_{pre} - DL_{post}\right)\frac{ft^3}{min} * 60\frac{min}{hour} * HDD * 24\frac{hours}{day} * \frac{0.018Btu}{ft^3 - F}}{\frac{100{,}000Btu}{Therm} * AFUE}$$

Table 129: Parameters for Therms Savings Calculation of Duct Sealing and Air Sealing

Parameter	Description
DL_{pre}	Minimum value of Pre-improvement duct leakage at 25 Pa or air leakage at 50 Pa.
DL_{post}	Post-improvement duct leakage at 25 Pa or air leakage at 50 Pa.
HDD	Heating degree days
$\frac{0.018Btu}{ft^3 - F}$	Volumetric heat capacity of air
$AFUE$	Annual fuel utilization efficiency of existing system (default = 0.8)

The EUL for duct sealing is 18 years.

Results

The participant performed the duct sealing measure in 32 units. The total therms saved realization rate for this site was100%.

Table 130: Duct Sealing Therms Savings Calculations

Measure	*Expected therms Savings*	*Realized therms Savings*	*Realize lifetime Savings*	*% of Total Savings*
Duct Sealing	15,377	15,377	276,790	100%
Total	**15,377**	**15,377**	**276,790**	**100%**

Project Number PRJ-3097183

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient steam traps. On-site, the Evaluator verified the participant had installed:

- (6) Failed Open Steam Traps Replacement
- (2) Steam Leak Repairs

M&V Methodology

Savings for the steam trap measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies from the Oklahoma C&I Natural Gas Guidebook V1.

The M&V effort for steam leak repair follows the guidelines of the 2012 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement.

Savings Calculations

Using deemed values from the table below, the Evaluator calculated steam trap savings as follows:

$$Annual\ Therm\ Savings = \frac{\dot{m} \times\ h_g - h_f \times \frac{Hours}{Year}}{E_C\ \times 100{,}000\ BTU/therm}$$

Where:

$\dot{m}$ = Steam loss in lb/hr

$\frac{Hours}{Year}$ = annual hours the steam system is pressurized

h_g = Total enthalpy of steam (obtained from steam tables) BTU/lb

h_f = Enthalpy of liquid – i.e., boiler feedwater enthalpy if condensate is returned to steam system; otherwise, makeup water enthalpy if condensate is not returned (determined using steam tables and inlet pressure and, if necessary, AR TRM V7.0 Table 143) BTU/lb

$E_{C_{Base}}$ = Combustion efficiency for boiler. If unknown, 80%

ADM Steam Trap Replacement Summary

Trap Type	Trap Model	Discharge Rate (lb/hr)	Estimated System Hours	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
IB	B1H-125	78	2,295	1,943	1943	9,713	100%
IB	890	37	2,295	921	921	4,607	100%
IB	890	37	2,295	921	921	4,607	100%
IB	890	37	2,295	921	921	4,607	100%
IB	890	37	2,295	921	921	4,607	100%
IB	C-850-B	75	2,295	1,868	1,868	9,339	100%
Total				3,810	3,810	19,048	100%

Steam Trap Replacement Therms Savings Calculations

Measure	*Expected Therms Savings*	*Realized Therms Savings*	*Realization Rate*
Steam Trap Replacement	3,810	3,810	100%
Total	**3810**	**3,810**	**100%**

The annual energy savings from repairing a steam leak is calculated with the following equation:

Equation 5. Steam Leak Repair Annual Energy Savings

$$Annual\ Energy\ Savings\ (therms) = \frac{Heat\ Loss\ \left(\frac{Btu}{hr}\right)\ x\ Annual\ Operating\ Hours\ \left(\frac{hrs}{yr}\right)}{Boiler\ Efficiency(\%)\ x\ 100{,}000\ \frac{Btu}{therm}}$$

Where:

Annual Operating Hours = number of hours facility operates annually = 2,295 hours

Boiler Efficiency = 80%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

The following table shows relevant steam leak parameters required for annual energy savings calculations.

ADM Steam Trap Replacement Summary

Steam Leak #	Plume Length (ft)	Leak Rate (lbs/hr)	Steam Pressure (psig)	Steam Enthalpy (Btu/lb)	Feedwater Enthalpy (Btu/lb)	Estimated System (Hrs)	Heat Loss (Btu/hr)	Boiler Efficiency
1	0.25	6.51	100	0.25	100	2295	7541	80%
2	0.08	5.93	100	0.08	100	2295	6867	80%

Steam Trap Replacement Therms Savings Calculations

Plume Length (ft)	Discharge Rate (lb/hr)	Estimated System (Hrs)	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
1/4	6.51	2295	216.337963	216	2163.3796	100%
1/12	5.93	2295	196.9943724	197	1969.94	100%
Total			413	413	2163.3796	100%

Results

The therms realization rate for PRJ-3097183 is 100%. However, the total therms savings of steam trap replacement is limited to 30% of the annual usage (30% of 12,699 therms = 3,810).

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Steam Trap Replacement	3,180	3,810	100%
Steam Leak Repair	413	413	100%
Total	**4,223**	**4,223**	**100%**

Project Number PRJ-3097183

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient steam traps. During a desk review, the Evaluator verified the participant had installed:

- (8) Failed Open Steam Traps Replacement
- (3) Steam Leak Repairs

M&V Methodology

Savings for the steam trap measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies from the Oklahoma C&I Natural Gas Guidebook V1.

The M&V effort for steam leak repair follows the guidelines of the 2012 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement.

Savings Calculations

Using deemed values from the table below, the Evaluator calculated steam trap savings as follows:

$$Annual\ Therm\ Savings = \frac{\dot{m} \times\ h_g - h_f \times \frac{Hours}{Year}}{E_C\ \times 100{,}000\ BTU/therm}$$

Where:

$\dot{m}$ = Steam loss in lb/hr

$\frac{Hours}{Year}$ = annual hours the steam system is pressurized

h_g = Total enthalpy of steam (obtained from steam tables) BTU/lb

h_f = Enthalpy of liquid – i.e., boiler feedwater enthalpy if condensate is returned to steam system; otherwise, makeup water enthalpy if condensate is not returned (determined using steam tables and inlet pressure and, if necessary, AR TRM V7.0 Table 143) BTU/lb

$E_{C_{Base}}$ = Combustion efficiency for boiler. If unknown, 80%

ADM Steam Trap Replacement Summary

Trap Type	Trap Model	Discharge Rate (lb/hr)	Estimated System Hours	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
IB	890	37	3,250	1,299	1,299	6,496	100%
IB	890	37	3,250	1,299	1,299	6,496	100%
IB	890	37	3,250	1,299	1,299	6,496	100%
IB	890	37	3,250	1,299	1,299	6,496	100%
IB	890	37	3,250	1,299	1,299	6,496	100%
IB	890	37	3,250	1,299	1,299	6,496	100%
IB	890	37	3,250	1,299	1,299	6,496	100%
TS	BPT13S	75	3,250	2,634	2,634	13,168	100%
Total				**3,798**	**3,798**	**18,990**	**100%**

Steam Trap Replacement Therms Savings Calculations

Measure	*Expected Therms Savings*	*Realized Therms Savings*	*Realization Rate*
Steam Trap Replacement	3,798	3,798	100%
Total	**3,798**	**3,798**	**100%**

The annual energy savings from repairing a steam leak is calculated with the following equation:

Equation 6. Steam Leak Repair Annual Energy Savings

$$Annual\ Energy\ Savings\ (therms) = \frac{Heat\ Loss\ \left(\frac{Btu}{hr}\right)\ x\ Annual\ Operating\ Hours\ \left(\frac{hrs}{yr}\right)}{Boiler\ Efficiency(\%)\ x\ 100{,}000\ \frac{Btu}{therm}}$$

Where:

Annual Operating Hours = number of hours facility operates annually = 2,295 hours

Boiler Efficiency = 80%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

The following table shows relevant steam leak parameters required for annual energy savings calculations.

ADM Steam Leak Repair Summary

Steam Leak #	Plume Length (ft)	Leak Rate (lbs/hr)	Steam Pressure (psig)	Steam Enthalpy (Btu/lb)	Feedwater Enthalpy (Btu/lb)	Estimated System (Hrs)	Heat Loss (Btu/hr)	Boiler Efficiency
1	0.5	7.50	100	1,150	38	3,250	8,343	80%
2	0.25	6.51	100	1,150	38	3,250	7,249	80%
3	0.42	7.15	100	1,150	38	3,250	7,961	80%

Steam Leak Repair Therms Savings Calculations

Plume Length (ft)	Discharge Rate (lb/hr)	Estimated System (Hrs)	Expected Annual Therm Savings	Calculated Annual Therm Savings	Lifetime Savings	Realization Rate
1/2	7.50	3,250	351	339	3,389	97%
1/4	6.51	3,250	305	2945	2,945	97%
5/12	7.15	3,250	335	323	3,234	97%
Total			**413**	**957**	**9,569**	**97%**

Results

The therms realization rate for PRJ-3110061 is 99%. However, the total therms savings of steam trap replacement is limited to 30% of the annual usage (30% of 12,660 therms = 3,798).

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Steam Trap Replacement	3,798	3,798	100%
Steam Leak Repair	991	957	97%
Total	4,789	4,755	99%

13.2 Direct Install Component Site-Level Reports

Project Number PRJ-3059961

Program Oklahoma Natural Gas Commercial & Industrial

Project Background

The participant is an agricultural equipment (ditch digging) rental and repair facility that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. Through photo documentation, the Evaluator verified the participant had installed:

- 448 Linear Feet Weather Stripping, 3/4" Gap
- 56 Linear Feet Weather Stripping, 7/8" Gap
- 262 Linear Feet Weather Stripping, 1" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values include savings for weather stripping in 3/4" gaps and 1" gaps but not 7/8" gaps. For this analysis, the average of 3/4" and 1" savings values were used for 7/8" door gaps. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)				
	1/8	1/4	1/2	3/4	7/8
Altus	4.58	9.25	18.36	27.56	32.16
Clinton/Sherman	6.76	13.62	27.06	40.62	47.37
Gage	6.35	12.8	25.43	38.18	44.53
McAlester	3.34	6.77	13.43	20.16	25.14
Oklahoma City	5.77	11.63	23.11	34.7	40.47
Ponca City	4.92	9.94	19.73	29.62	34.52
Tulsa	5.59	11.28	22.4	33.62	39.23

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
OHD 1 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 2 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 3 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 4 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 5 Weather Stripping	56	1	8a	-	2,589	-
OHD 6 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 7 Weather Stripping	56	1	8a	-	2,589	-
OHD 8 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 9 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 10 Weather Stripping	56	3/4	8a	-	1,943	-
OHD 11 Weather Stripping	56	1	8a	-	2,589	-
OHD 12 Weather Stripping	56	7/8	8a	-	2,266	-
OHD 13 Weather Stripping	38	1	8a	-	1,757	-
OHD 14 Weather Stripping	56	1	8a	-	2,589	-
Total				**29,507**	29,924	**101%**

Results

The total therms saved realization rate for this project is 101%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	29,509	29,924	101%
Total		**29,924**	**101%**

Project Number PRJ-3060576

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. On-site, the Evaluator verified the participant had installed:

- 18 Linear Feet Weather Stripping, 1/4" Gap
- 7 linear feet of door sweeps, 1/4" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Realized therms Savings
	Feet	Inches	
Weather Stripping	18	1/4	122
Door Sweeps	7	¼	47
Total			**169**

Results

The total therms saved realization rate for this project is 60%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed. Using implementer provided data, the ex-ante therm values were not reproducible using actual project information.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	282	169	60%
Total		**169**	**60%**

Project Number PRJ-3061833

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 7/8" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 7/8" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 7/8" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 7/8" Gap
- 48 Linear Feet Weather Stripping, 1" Gap
- 48 Linear Feet Weather Stripping, 1/2" Gap
- 48 Linear Feet Weather Stripping, 7/8" Gap
- 48 Linear Feet Weather Stripping, 7/8" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/2	3/4	7/8	1
Altus	18.36	27.56	32.15	36.75
Clinton/Sherman	27.06	40.62	47.36	54.12
Gage	25.43	38.18	44.51	50.87
McAlester	13.43	20.16	26.35	30.12
Oklahoma City	23.11	34.7	40.45	46.23
Ponca City	19.73	29.62	34.49	39.41
Tulsa	22.4	33.62	39.22	44.83

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	48	3/4	8a	-	1,666	-
Weather Stripping	48	7/8	8a	-	1,942	-
Weather Stripping	48	3/4	8a	-	1,666	-
Weather Stripping	48	7/8	8a	-	1,942	-
Weather Stripping	48	3/4	8a	-	1,666	-
Weather Stripping	48	7/8	8a	-	1,942	-
Weather Stripping	62	3/4	8a	-	2,151	-
Weather Stripping	48	3/4	8a	-	1,666	-
Weather Stripping	56	7/8	8a	-	2,265	-
Weather Stripping	48	1	8a	-	2,219	-
Weather Stripping	44	1/2	8a	-	1,017	-
Weather Stripping	44	7/8	8a	-	1,780	-
Weather Stripping	48	7/8	8a	-	1,942	-
Weather Stripping	62	3/4	8a	-	2,151	-
Total				**24,333**	**26,014**	**107%**

Results

The total therms saved realization rate for this project is 107%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	24,333	26,014	107%
Total		**26,014**	**107%**

Project Number PRJ-3062098

Program Prescriptive DI

Project Background

The participant is a vehicle mechanic shop that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. On-site, the Evaluator verified the participant had installed:

- 43 Linear Feet Weather Stripping, 1/4" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	43	1/4	8b	485	485	100%
Total				**485**	**485**	**100%**

Results

The total therms saved realization rate for this project is 100%.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	485	485	100%
Total		**485**	**100%**

Project Number PRJ-3062140

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. On-site, the Evaluator verified the participant had installed:

- 48 Linear Feet Weather Stripping, 1" Gap
- 48 Linear Feet Weather Stripping, 1" Gap
- 48 Linear Feet Weather Stripping, 7/8" Gap
- 56 Linear Feet Weather Stripping, 3/4" Gap
- 56 Linear Feet Weather Stripping, 1" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/2	3/4	7/8	1
Altus	18.36	27.56	32.15	36.75
Clinton/Sherman	27.06	40.62	47.36	54.12
Gage	25.43	38.18	44.51	50.87
McAlester	13.43	20.16	26.35	30.12
Oklahoma City	23.11	34.7	40.45	46.23
Ponca City	19.73	29.62	34.49	39.41
Tulsa	22.4	33.62	39.22	44.83

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	48	1	OHD 1	-	2,152	-
Weather Stripping	48	1	OHD 2	-	2,152	-
Weather Stripping	48	7/8	OHD 3	-	1,883	-
Weather Stripping	56	3/4	OHD 4	-	1,883	-
Weather Stripping	56	1	OHD 5	-	2,510	-
Total				**10,311**	**10,580**	**103%**

Results

The total therms saved realization rate for this project is 103%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	10,311	10,580	103%
Total		**10,580**	**103%**

Project Number PRJ-3063393

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 48 Linear Feet Weather Stripping, 1" Gap
- 52 Linear Feet Weather Stripping, 1" Gap
- 44 Linear Feet Weather Stripping, 1 1/8" Gap

M&V Methodology

Savings for the weather-stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	3/4"	1"	1 1/8"	1-1/4"
Altus	27.56	36.75	41.34	45.93
Clinton/Sherman	40.62	54.12	60.89	67.66
Gage	38.18	50.87	57.23	63.59
McAlester	20.16	30.12	33.88	37.65
Oklahoma City	34.7	46.23	52.01	57.79
Ponca City	29.62	39.41	44.34	49.27
Tulsa	33.62	44.83	50.43	56.03

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Realized therms Savings
	Feet	Inches		
Weather Stripping	48	1	West OHD	1,446
Weather Stripping	52	1	South OHD	1,566
Weather Stripping	44	1 1/8	East OHD	1,491
Total				**4,503**

Results

The total therms saved realization rate for this project is 70%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	6,456	4,503	70%
Total		**4503**	**70%**

Project Number PRJ-3074157

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 17 Linear Feet Weather Stripping, 1/4" Gap
- 17 Linear Feet Weather Stripping, 1/4" Gap
- 3 Linear Feet Weather Stripping Sweeps, 1/4" Gap
- 3 Linear Feet Weather Stripping Sweeps, 1/4" Gap
- 3 Linear Feet Weather Stripping Sweeps, 1/4" Gap
- 3 Linear Feet Weather Stripping Sweeps, 1/4" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	17	1/4	8b	192	192	100%
Weather Stripping	17	1/4	8b	192	192	100%
Weather Stripping	3	1/4	8b	34	34	100%
Weather Stripping	3	1/4	8b	34	34	100%
Weather Stripping	3	1/4	8b	34	34	100%
Weather Stripping	3	1/4	8b	34	34	100%
Total				**519**	**519**	**100%**

Results

The total therms saved realization rate for this project is 100%.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	519	519	100%
Total		**519**	**100%**

Project Number PRJ-3074224

Program Oklahoma Natural Gas Commercial & Industrial

Project Background

The participant is an Auto Repair facility that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. Through photo documentation, the Evaluator verified the participant had installed:

- 136 Linear Feet Weather Stripping, 7/8" Gap
- 40 Linear Feet Weather Stripping, 3/4" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values include savings for weather stripping in 3/4" gaps and 1" gaps but not 7/8" gaps. For this analysis, the average of 3/4" and 1" savings values were used for 7/8" door gaps. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)				
	1/8	1/4	1/2	3/4	7/8
Altus	4.58	9.25	18.36	27.56	32.16
Clinton/Sherman	6.76	13.62	27.06	40.62	47.37
Gage	6.35	12.8	25.43	38.18	44.53
McAlester	3.34	6.77	13.43	20.16	25.14
Oklahoma City	5.77	11.63	23.11	34.7	40.47
Ponca City	4.92	9.94	19.73	29.62	34.52
Tulsa	5.59	11.28	22.4	33.62	39.23

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
OHD 1 Weather Stripping	48	7/8	OHD 1	-	1,883	-
OHD 2 Weather Stripping	48	7/8	OHD 2	-	1,883	-
OHD 3 Weather Stripping	40	3/4	OHD 3	-	1,345	-
OHD 4 Weather Stripping	40	7/8	OHD 4	-	1,569	-
Total				**5,917**	**6,680**	**113%**

Results

The total therms saved realization rate for this project is 113%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	5,917.12	6,680	113%
Total		**6,680**	**113%**

Project Number PRJ-3074251

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 48 Linear Feet Weather Stripping, 1" Gap
- 48 Linear Feet Weather Stripping, 1" Gap
- 48 Linear Feet Weather Stripping, 1 3/8" Gap
- 48 Linear Feet Weather Stripping, 1 1/4" Gap
- 48 Linear Feet Weather Stripping, 1 1/4" Gap
- 48 Linear Feet Weather Stripping, 1 1/8" Gap
- 56 Linear Feet Weather Stripping, 7/8" Gap
- 48 Linear Feet Weather Stripping, 1 1/4" Gap
- 56 Linear Feet Weather Stripping, 1 1/2" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	48	1"	OHD 1	-	2,219	-
Weather Stripping	48	1"	OHD 2	-	2,219	-
Weather Stripping	48	1 3/8"	OHD 3	-	3,051	-
Weather Stripping	48	1-1/4"	OHD 4	-	2,774	-
Weather Stripping	48	1-1/4"	OHD 5	-	2,774	-
Weather Stripping	48	1 1/8"	OHD 6	-	2,497	-
Weather Stripping	48	7/8"	OHD 7	-	1,942	-
Weather Stripping	56	1-1/4"	OHD 8	-	3,236	-
Weather Stripping	56	1-1/2"	OHD 9	-	3,884	-
Total				**23,580**	**24,596**	**104%**

Results

The total therms saved realization rate for this project is 104%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	23,580	24,596	104%
Total		**24,596**	**104%**

Project Number PRJ-3078767

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review.00, the Evaluator verified the participant had installed:

- 40 Linear Feet Weather Stripping, 1" Gap
- 40 Linear Feet Weather Stripping, 1" Gap
- 40 Linear Feet Weather Stripping, 1" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/4	1/2	3/4	1
Altus	9.25	18.36	27.56	36.75
Clinton/Sherman	13.62	27.06	40.62	54.12
Gage	12.8	25.43	38.18	50.87
McAlester	6.77	13.43	20.16	30.12
Oklahoma City	11.63	23.11	34.7	46.23
Ponca City	9.94	19.73	29.62	39.41
Tulsa	11.28	22.4	33.62	44.83

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	40	1	8b	-	1,793	-
Weather Stripping	40	1	8b	-	1,793	-
Weather Stripping	40	1	8b	-	1,793	-
Total				**6,056**	**5,380**	**89%**

Results

The total therms saved realization rate for this project is 89%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	6,056	5,380	89%
Total		**5380**	**89%**

Project Number PRJ-3079911

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 1" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap
- 52 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 1 1/8" Gap
- 48 Linear Feet Weather Stripping, 1 1/8" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	48	3/4	W1 OHD	-	968	-
Weather Stripping	48	3/4	W2 OHD	-	968	-
Weather Stripping	48	1	W3 OHD	-	1,446	-
Weather Stripping	48	3/4	E1 OHD	-	968	-
Weather Stripping	52	3/4	E2 OHD	-	1,048	-
Weather Stripping	48	1 1/8	E3 OHD	-	1,614	-
Weather Stripping	48	1 1/8	E4 OHD	-	1,614	-
Total				**14,711**	**8,625**	**60%**

Results

The total therms saved realization rate for this project is 60%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	14,711	8,625	60%
Total		**8,625**	**60%**

Project Number RBT-1426355

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 922 Linear Feet Weather Stripping, 1" Gap

M&V Methodology

Savings for the weather-stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/4	**1/2**	**3/4**	**1**
Altus	9.25	18.36	27.56	36.75
Clinton/Sherman	13.62	27.06	40.62	54.12
Gage	12.8	25.43	38.18	50.87
McAlester	6.77	13.43	20.16	30.12
Oklahoma City	11.63	23.11	34.7	46.23
Ponca City	9.94	19.73	29.62	39.41
Tulsa	11.28	22.4	33.62	44.83

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	46	1	8a	-	2,127	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	52	1	8a	-	2,404	-
Weather Stripping	64	1	8a	-	2,959	-
Weather Stripping	32	1	8a	-	1,479	-
Total				**42,624**	**42,624**	**100%**

Results

The total therms saved realization rate for this project is 100%.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	42,624	42,624	100%
Total		**42,624**	**100%**

Project Number PRJ-3094492

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 52 Linear Feet Weather Stripping, 1 1/8" Gap
- 48 Linear Feet Weather Stripping, 1 1/8" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Realized therms Savings
	Feet	Inches		
Weather Stripping	52	1 1/8	S2 OHD	2,622
Weather Stripping	48	1 1/8	S1 OHD	2,421
Total				**5,043**

Results

The total therms saved realization rate for this project is 91.04%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	5,539	5,043	91%
Total		**5,043**	**91%**

Project Number PRJ-3094503

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. Through photo documentation, the Evaluator verified the participant had installed weather stripping on two doors:

- Door #1: 50 Linear Feet Weather Stripping, 1" Gap
- Door #2: 52 Linear Feet Weather Stripping, 1" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)				
	1/8	1/4	1/2	3/4	1
Altus	4.58	9.25	18.36	27.56	36.75
Clinton/Sherman	6.76	13.62	27.06	40.62	54.12
Gage	6.35	12.8	25.43	38.18	50.87
McAlester	3.34	6.77	13.43	20.16	30.12
Oklahoma City	5.77	11.63	23.11	34.7	46.23
Ponca City	4.92	9.94	19.73	29.62	39.41
Tulsa	5.59	11.28	22.4	33.62	44.83

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Realized therms Savings
	Feet	Inches		
Weather Stripping	50	1	East OHD	2,242
Weather Stripping	52	1	West OHD	2,331
Total				**4,573**

Results

The total therms saved realization rate for this project is 91%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	5,024	4,573	91%
Total		**4,573**	**91%**

Project Number PRJ-3094533

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 44 Linear Feet Weather Stripping, 1 1/8" Gap
- 40 Linear Feet Weather Stripping, 1 1/8" Gap
- 40 Linear Feet Weather Stripping, 1" Gap
- 40 Linear Feet Weather Stripping, 1" Gap
- 44 Linear Feet Weather Stripping, 1 1/8" Gap
- 40 Linear Feet Weather Stripping, 1 1/8" Gap
- 48 Linear Feet Weather Stripping, 1 1/8" Gap
- 48 Linear Feet Weather Stripping, 1" Gap

M&V Methodology

Savings for the weather-stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/2	3/4	1	1 1/8
Altus	18.36	27.56	36.75	41.34
Clinton/Sherman	27.06	40.62	54.12	60.89
Gage	25.43	38.18	50.87	57.23
McAlester	13.43	20.16	30.12	33.88
Oklahoma City	23.11	34.7	46.23	52.01
Ponca City	19.73	29.62	39.41	44.34
Tulsa	22.4	33.62	44.83	50.43

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	44	1 1/8	8b	-	2,219	-
Weather Stripping	40	1 1/8	8b	-	2,017	-
Weather Stripping	40	1	8b	-	1,793	-
Weather Stripping	40	1	8b	-	1,793	-
Weather Stripping	44	1	8b	-	1,973	-
Weather Stripping	40	1 1/8	8b	-	2,017	-
Weather Stripping	48	1 1/8	8b	-	2,421	-
Weather Stripping	48	1	8b	-	2,152	-
Total				**16870**	**16,385**	**97%**

Results

The total therms saved realization rate for this project is 97%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	16,870	16,385	97%
Total		**16,385**	**97%**

Project Number PRJ-3094546

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 180 Linear Feet Weather Stripping, 1 1/4" Gap
- 220 Linear Feet Weather Stripping, 1 1/8" Gap
- 132 Linear Feet Weather Stripping, 1" Gap
- 44 Linear Feet Weather Stripping, 1 1/2" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches			
Weather Stripping	180	1 1/4	-	10,402	-
Weather Stripping	220	1 1/8	-	11,443	-
Weather Stripping	132	1	-	6,102	-
Weather Stripping	44	1 1/2	-	3,051	-
Total			**30,998**	**30,999**	**100%**

Results

The total therms saved realization rate for this project is 100%.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	30,998	30,999	100%
Total		**30,999**	**100%**

Project Number PRJ-3094562

Program Oklahoma Natural Gas Commercial & Industrial

Project Background

The participant is a manufacturing facility that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. Through photo documentation, the Evaluator verified the participant had installed:

- 72 Linear Feet Weather Stripping, 3/4" Gap
- 96 Linear Feet Weather Stripping, 7/8" Gap
- 292 Linear Feet Weather Stripping, 1" Gap
- 56 Linear Feet Weather Stripping, 1-3/8" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values include savings for weather stripping in 1-1/4" gaps and 1-1/2" gaps but not 1-3/8" gaps. For this analysis, the average of 1-1/4" and 1-1/2" savings values were used for 1-3/8" door gaps. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)				
	3/4"	7/8"	1"	1-1/4"	1-3/8"
Altus	27.56	32.155	36.75	45.93	50.525
Clinton/Sherman	40.62	47.37	54.12	67.66	74.425
Gage	38.18	44.525	50.87	63.59	69.95
McAlester	20.16	25.14	30.12	37.65	41.41
Oklahoma City	34.7	40.465	46.23	57.79	63.57
Ponca City	29.62	34.515	39.41	49.27	54.195
Tulsa	33.62	39.225	44.83	56.03	61.635

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Doc OHD 1 Weather Stripping	36	3/4"	8b	-	1,210	-
Doc OHD 2 Weather Stripping	36	3/4"	8b	-	1,210	-
N OHD Weather Stripping	48	1"	8b	-	2,152	-
SE OHD 1 Weather Stripping	48	1"	8b	-	2,152	-
SE OHD 2 Weather Stripping	48	7/8"	8b	-	1,883	
SE OHD 3 Weather Stripping	48	7/8"	8b	-	1,883	
SW OHD 1	52	1"	8b	-	2,331	
SW OHD 2	68	1"	8b	-	3,048	
W OHD	76	1"	8b	-	3,407	
NW OHD	56	1-3/8"	8b	-	3,452	
Total				**22,100**	**22,728**	**103%**

Results

The total therms saved realization rate for this project is 103%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	22,100	22,728	103%
Total		**22,728**	**103%**

Project Number PRJ-3098053

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap
- 48 Linear Feet Weather Stripping, 3/4" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
Weather Stripping	48	3/4	W OHD 1	-	1,614	-
Weather Stripping	48	3/4	W OHD 2	-	1,614	-
Weather Stripping	48	3/4	E OHD	-	1,614	-
Total				**6,907**	**4,841**	**70%**

Results

The total therms saved realization rate for this project is 70%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	6,907	4,841	70%
Total		**4,841**	**70%**

Project Number PRJ-3102849

Program Oklahoma Natural Gas Commercial & Industrial

Project Background

The participant is an Auto Repair facility that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. Through photo documentation, the Evaluator verified the participant had installed:

- 112 Linear Feet Weather Stripping, 3/4" Gap
- 172 Linear Feet Weather Stripping, 1" Gap
- 56 Linear Feet Weather Stripping, 1-3/8" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values include savings for weather stripping in 1-1/4" gaps and 1-1/2" gaps but not 1-3/8" gaps. For this analysis, the average of 1-1/4" and 1-1/2" savings values were used for 1-3/8" door gaps. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)				
	3/4"	7/8"	1"	1-1/4"	1-3/8"
Altus	27.56	32.155	36.75	45.93	50.525
Clinton/Sherman	40.62	47.37	54.12	67.66	74.425
Gage	38.18	44.525	50.87	63.59	69.95
McAlester	20.16	25.14	30.12	37.65	41.41
Oklahoma City	34.7	40.465	46.23	57.79	63.57
Ponca City	29.62	34.515	39.41	49.27	54.195
Tulsa	33.62	39.225	44.83	56.03	61.635

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Area	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches				
N OHD 1 Weather Stripping	56	3/4	North OHD 1	-	1,883	-
N OHD 2 Weather Stripping	56	3/4	North OHD 2	-	1,883	-
N OHD 3 Weather Stripping	56	1	North OHD 3	-	2,510	-
N OHD 4 Weather Stripping	56	1	North OHD 4	-	2,510	-
S OHD Weather Stripping	56	1-3/8	South OHD	-	3,452	-
SW OHD Weather Stripping	60	1	Southwest OHD	-	2,690	-
Total				**14,818**	**14,928**	**101%**

Results

The total therms saved realization rate for this project is 101%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	14,818	14,928	101%
Total		**14,928**	**101%**

Project Number PRJ-3114605

Program Custom Commercial Program

Project Background

The participant is a manufacturing facility that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. On-site, the Evaluator verified the participant had installed:

- 290 Linear Feet Weather Stripping, 1 3/8" Gap
- 356 Linear Feet Weather Stripping, 1-1/2" Gap
- 578 Linear Feet Weather Stripping, 1-1/4" Gap
- 140 Linear Feet Weather Stripping, 1 5/8" Gap
- 610 Linear Feet Weather Stripping, 1" Gap
- 316 Linear Feet Weather Stripping, 1 1/8" Gap
- 40 Linear Feet Weather Stripping, 3/4" Gap
- 136 Linear Feet Weather Stripping, 7/8" Gap
- 154 Linear Feet Weather Stripping, 5/8" Gap
- 210 Linear Feet Weather Stripping, 1/2" Gap
- 126 Linear Feet Weather Stripping, 3/8" Gap
- 206 Linear Feet Weather Stripping, 1/8" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches			
Weather Stripping	290	1 3/8"	-	18,436	-
Weather Stripping	356	1-1/2"	-	21,625	-
Weather Stripping	578	1-1/4"	-	30,814	-
Weather Stripping	140	1 5/8"	-	8,172	-
Weather Stripping	610	1"	-	36,073	-
Weather Stripping	316	1 1/8"	-	18,054	-
Weather Stripping	40	3/4"	-	2,774	-
Weather Stripping	136	7/8"	-	9,108	-
Weather Stripping	154	5/8"	-	6,391	-
Weather Stripping	210	1/2"	-	9,790	-
Weather Stripping	126	3/8"	-	5,097	-
Weather Stripping	206	1/8"	-	6,507	-
Total			**145,453**	**143,841**	**100%**

Results

The total therms saved realization rate for this project is 100%. The difference in therms savings can be attributed to the difference in deemed savings values per linear foot of weather stripping installed.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	145,453	143,841	100%
Total		**143,841**	**100%**

Project Number PRJ-3123330

Program Custom Commercial Program

Project Background

The participant is a warehouse facility that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. On-site, the Evaluator verified the participant had installed:

- 568 Linear Feet Weather Stripping, 1" Gap
- 224 Linear Feet Weather Stripping, 1 1/8" Gap
- 68 Linear Feet Weather Stripping, 3/8" Gap
- 12 Linear Feet Weather Stripping Sweeps, 1/4" Gap

M&V Methodology

Savings for the weather stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches			
Weather Stripping	568	1"	-	26,259	-
Weather Stripping	224	1 1/8"	-	11,651	-
Weather Stripping	68	3/8"	-	1,179	-
Weather Stripping	12	1/4"	-	140	-
Total			**39,228**	**39,228**	**100%**

Results

The total therms saved realization rate for this project is 100%.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	39,228	39,228	**100%**
Total		39,228	**100%**

Project Number RBT-1426355

Program Custom Commercial Program

Project Background

The participant is a motel that received incentives from Oklahoma Natural Gas for implementing energy efficient door weather stripping. During a desk review, the Evaluator verified the participant had installed:

- 44 Linear Feet Weather Stripping, 1 1/8" Gap
- 44 Linear Feet Weather Stripping, 1 1/8" Gap
- 44 Linear Feet Weather Stripping, 1 1/8" Gap
- 17 Linear Feet Weather Stripping, 1/4" Gap
- 17 Linear Feet Weather Stripping, 1/4" Gap
- 3 Linear Feet Weather Stripping Sweeps, 1/4" Gap
- 3 Linear Feet Weather Stripping Sweeps, 1/4" Gap
- 3 Linear Feet Weather Stripping Sweeps, 1/4" Gap

M&V Methodology

Savings for the weather-stripping measure was calculated using Oklahoma stipulated deemed values. The deemed values were formulated using methodologies in the Oklahoma C&I Natural Gas Guidebook V1. The deemed values used in calculating savings are presented in the table below.

Deemed Savings Parameters

Area	Gap Width (inches)			
	1/8	1/4	1/2	3/4
Altus	4.58	9.25	18.36	27.56
Clinton/Sherman	6.76	13.62	27.06	40.62
Gage	6.35	12.8	25.43	38.18
McAlester	3.34	6.77	13.43	20.16
Oklahoma City	5.77	11.63	23.11	34.7
Ponca City	4.92	9.94	19.73	29.62
Tulsa	5.59	11.28	22.4	33.62

Savings Calculations

Using deemed values from the table above, the Evaluator calculated weather stripping savings as follows:

$$Annual\ Therms\ Savings = Length * Heating\ Savings$$

Parameters for Therms Savings Calculation of Weather Stripping Retrofit

Length	Total length of installed door weather stripping
Heating Savings	Deemed heating savings per foot of installed weather stripping

Weather Stripping Retrofit Therms Savings Calculations

Measure	Length	Gap	Expected therms Savings	Realized therms Savings	Realization Rate
	Feet	Inches			
Weather Stripping	44	1 1/8"	-	1,951	-
Weather Stripping	44	1 1/8"	-	1,951	-
Weather Stripping	44	1 1/8"	-	1,951	-
Weather Stripping	17	1/4"	-	169	-
Weather Stripping	17	1/4"	-	169	-
Weather Stripping	3	1/4"	-	30	-
Weather Stripping	3	1/4"	-	30	-
Weather Stripping	3	1/4"	-	30	-
Total			**6,279**	**6,281**	**100%**

Results

The total therms saved realization rate for this project is 100%.

Verified Gross Savings & Realization Rates

Measure	Expected Therms Savings	Verified	
		Therms Savings	Therms Realization Rate
Weather Stripping	6,279	6,281	100%
Total		**6,281**	**100%**