# Summit Utilities - Oklahoma Demand Programs Annual Report 2022 Program Year



May 1, 2023

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## Executive Summary

On October 7, 2010, CenterPoint Energy Resources Corp. d/b/a CenterPoint Energy Oklahoma Gas ("CenterPoint Oklahoma" or the "Company") proposed a comprehensive portfolio of Conservation Improvement Programs ("CIP," and as a whole, the "CIP Portfolio") in response to the Oklahoma Corporation Commission's ("OCC" or the "Commission") Rules for Demand Programs, OAC § 165:45-23-1 et seq. On March 25, 2011, the Commission approved the program portfolio in Order No. 583869 in Cause No. PUD 201000148, and CenterPoint Oklahoma began to implement the program portfolio thereafter in 2011. On February 1, 2012, the Commission approved modifications and additions to the Company's previously approved CIP portfolio in Order No. 593649 in Cause No. PUD 201100149. On August 13, 2013, the Commission approved an updated CIP portfolio for program years ("PY") 2014 - 2016 in Order No. 616573 in Cause No. PUD 201300085. On October 26, 2016, the Commission approved an updated CIP portfolio for PY 2017 - 2019, in Order No. 657250 in Cause No. PUD 201600263. On August 8, 2019, the Company requested approval of an updated comprehensive CIP Portfolio for PY 2020 - 2022. The OCC approved this request on December 10, and CenterPoint Oklahoma began delivery of this CIP Portfolio on January 1, 2020, in Order No. 706092 in Cause No. PUD 201900060. As of January 10, 2022, CenterPoint Energy Oklahoma was acquired by Summit Utilities (Summit) and is now operating as Summit Utilities Oklahoma.

This report is filed in response to the Commission's reporting requirements specified in OAC § 165:45-23-7, which requires the Company to report the performance of its energy efficiency programs for the preceding program year. Consistent with the requirements, this report will outline the activities and results of the Company's CIP Portfolio performance for PY 2022.

Summit Oklahoma implemented and administered the following CIP programs in PY 2022:

- **Summit Utilities Education Program (SUEP)** - Educates residential and commercial customers about their energy usage and provides low-cost to no-cost tips on how to conserve energy.

- **Residential Home Energy Reports Program** - An educational and behavioral change program which provides individualized information and recommendations regarding energy usage through Home Energy Reports, sent to approximately 65,000 Summit Utilities customers. The direct mail Home Energy Reports utilize energy usage data with customer demographic, housing, and GIS data to develop specific, targeted recommendations that educate and motivate customers to reduce their energy consumption.

- **Natural Gas Equipment Program** - Promotes the installation and use of high-efficiency natural gas appliances that include water heaters, space heaters, clothes dryers, and gas

ranges, as well as self-install smart thermostats for residential customers. Commercial customers are encouraged to install high-efficiency natural gas water and space heating. Inducements are offered to customers with an active account with Summit Oklahoma and includes the following components:

- Water Heater – Summit Utilities provides a $500 inducement to customers who upgrade their water heater to a tankless system and provides a $900 inducement to customers who switch from electric resistance water heating to natural gas tankless water heating system. Plumbers that install gas tankless systems for a natural gas water heater upgrade or an electric to natural gas conversion are eligible for a $50 trade ally incentive for every qualifying inducement.

- Natural Gas Furnace - Furnace inducements range from $300 to $500 to residential and commercial customers that purchase and install high-efficiency natural gas furnaces. Customers that switch from electric resistance heating and heat pumps to a more efficient natural gas furnace as their primary heating source receive a $2,000 inducement. Customers who receive a rebate for a qualifying furnace are also eligible for an additional $60 incentive when a qualified Smart Thermostat is installed.

- Clothes Dryer - Provides up to a $450 inducement to qualified residential customers for the purchase and installation of natural gas dryers. A $50 trade ally incentive is also available for each qualifying inducement.

- Cooking Range - Provides up to a $300 inducement to residential customers who replace electric cooking ranges with more efficient natural gas ranges. In addition, a $50 trade ally incentive is offered to encourage trade allies to stock and sell natural gas cooking ranges.

- Multi-Unit Market Transformation - Promotes efficient water heating and space heating solutions to multi-unit developers through inducements ranging from $900 to $2,000. Trade ally rebates are also available at $50 for qualified equipment installations.

- **High Efficiency Homes Program** - Provides a $1,000 inducement to customers or builders who construct new homes equipped with efficient natural gas appliances.

- **Low-Flow Showerhead and Faucet Aerator Program** - Provides residential customers with free low-flow showerhead and faucet aerator kits that, when installed, will conserve water, reduce energy usage, and save customers money.

- **Low-Income Saving Homes Program** – Provides weatherization retrofits that will improve the efficiency and comfort of Summit Utilities Oklahoma's low-income and hard to reach residential customers.

- **Natural Gas Commercial & Industrial ("C&I") Solutions Program** – Administered by CLEAResult, the Natural Gas C&I Solutions Program provides financial incentives and technical consulting assistance designed to help commercial and industrial customers identify, develop and implement cost effective energy efficiency solutions at their facilities. The Natural Gas C&I Solutions Program also provides prescriptive rebates for qualified boiler and foodservice equipment purchases. The program contains the following components:

  - Direct-Install - Measures target small to mid-size commercial customers. It is a turnkey equipment replacement program designed to reduce customer energy usage costs through the installation of low-flow pre-rinse spray valves, faucet aerators, showerheads, weather-stripping, and steam traps.

  - No-Cost Facility Audit - Program representatives will perform a valuable no-cost facility audit, to determine if any natural gas is being used inefficiently and help identify cost-effective solutions to reduce energy waste and save money.

  - Custom Project Measures - target commercial and industrial customers. Projects identified will be eligible for custom incentives based on final program design, after applying documented and defensible calculated energy savings.

  **Prescriptive Programs Include:**

  - Commercial Food Service Program – For the PY 2020 - 2022, the Commercial Food Service Program is now under the C&I Solutions umbrella and administered by CLEAResult. This Program promotes the reduction of natural gas energy usage for commercial food service customers via inducements ranging from $300 to $2,400 for the purchase and installation of qualified new energy efficient food service equipment. Trade ally incentives ranging from $45 to $225 are also available for qualifying equipment.

- Commercial Boiler Program - For PY 2020 - 2022, the Commercial Boiler Program is now under the C&I Solutions umbrella and administered by CLEAResult. This Program encourages commercial customers to install efficient natural gas comfort heating boilers via inducements ranging from $1,400 to $2,000 per MMBTU of input for the purchase of qualified new energy efficient boilers. Additionally, inducements are available for the purchase and installation of boiler burner replacements.

- In PY 2022, the CIP Portfolio produced net energy savings of 110,763 Mcf and remains cost-effective despite some programs achieving lower energy savings than in previous years. The programs generated a net economic benefit of $1,768,412 and helped participants save money through a combination of prescriptive and custom rebates, direct-install measures, energy usage reports, and facility audits. Key insights from PY 2022 program delivery include:

In PY 2022, the CIP Portfolio produced net energy savings of 110,763 Mcf. The programs generated a net economic benefit of $1,768,412 and helped participants save money through a combination of prescriptive and custom rebates, direct-install measures, energy usage reports, and facility audits. Key insights from PY 2022 program delivery include:

- **Natural Gas Equipment and High Efficiency Homes Program experienced a decrease in participation** – Two factors lead to lower participation and savings in the Natural Gas Equipment Program and High Efficiency Homes Program: higher costs and rising interest rates. Supply chain issues and labor shortages caused higher prices for equipment and labor. Rising interest rates also made financing equipment replacement and purchasing a home more difficult.
- **Natural Gas Commercial Solutions Program** – PY 2022 was another year of strong growth for the Company's Natural Gas Commercial Solutions Program. The direct-installation measures continued to be an effective inducement to drive commercial energy savings at no cost to participants. The custom portion of the program provided participants with technical assistance, recommendations, and financial inducements to implement energy saving measures such as insulation upgrades and equipment controls. The custom program continues to grow as more industrial customers recognize the value of DSM programs. The C&I program delivered the highest amount of energy savings, at 47,552 Mcf, since the inception of DSM programs in Oklahoma. The savings achieved in PY 2022 was 1% higher than the previous year.
- **Home Energy Reports produced higher savings in 2022** – Program savings increased in PY2022 as more participants were added to the program. This program continues to be an

effective channel to educate customers, modify behavior, and drive energy savings through the use of reports and the cross-promoting of other program offerings in the Company's DSM Portfolio. In PY 2022, the program delivered net energy savings of 47,691 Mcf.

**Figure 1: Energy Savings by Program Year**
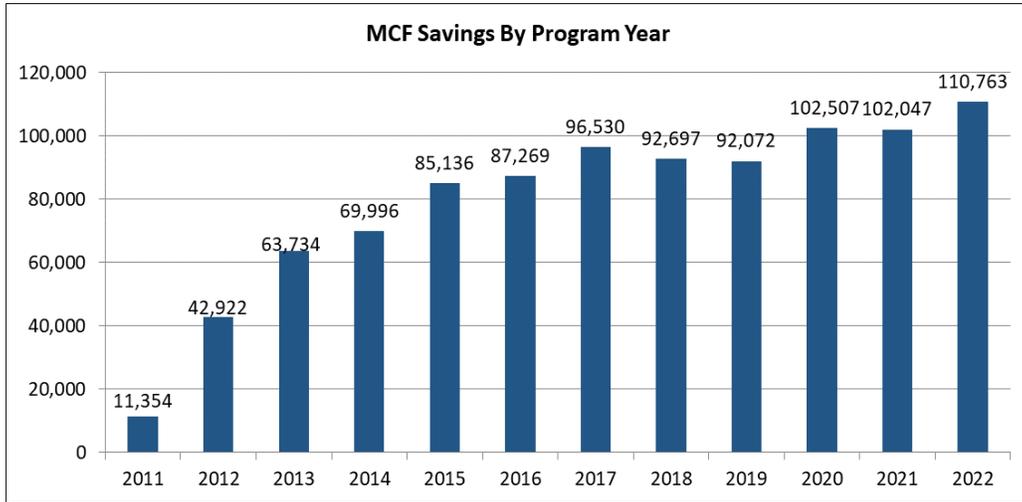


**Figure 2: Net Benefits by Program Year**
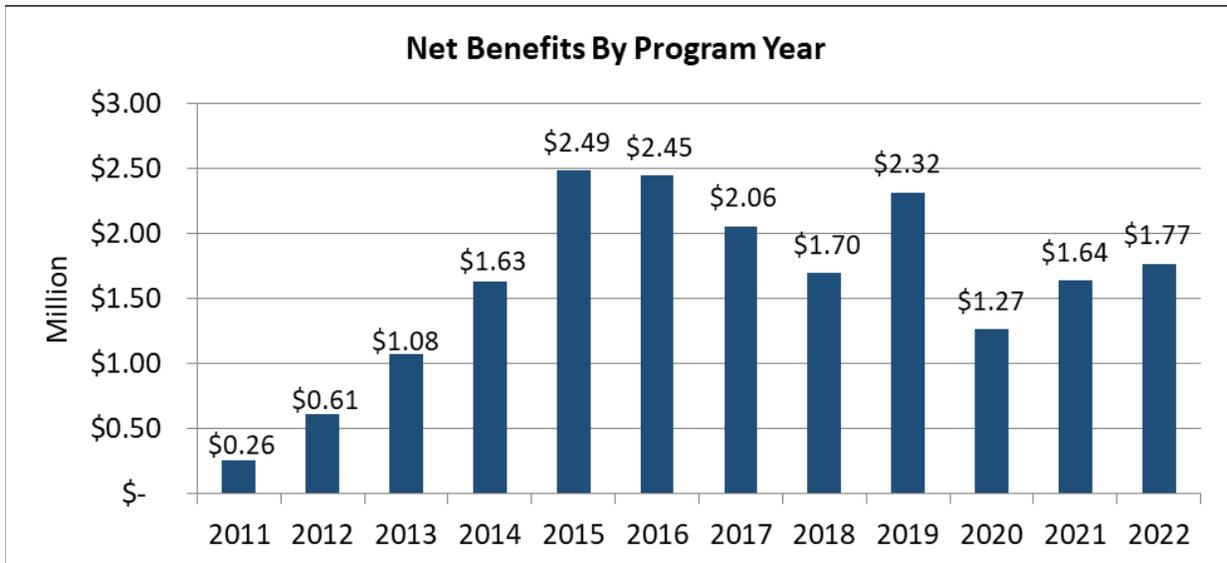


The remainder of this report is organized according to the OCC's reporting requirements specified in OAC § 165:45-23-7(c).

# § 165:45-23-7(c)(1): Demand Programs by Customer Category

**OAC § 165:45-23-7(c)(1): The name of Demand Program listed by Category**

Table 1 lists the customer categories (by class) served by each Conservation Improvement Program delivered by Summit Utilities Oklahoma in PY 2022.

**Table 1: Programs & Customer Categories**

| Program | Customer Category Served | | | |
| --- | --- | --- | --- | --- |
| | Residential | Commercial CS-1 | Commercial CS-2 | Commercial LCS |
| **Natural Gas Equipment Program** | ✓ | ✓ | ✓ | ✓ |
| **Low Flow Showerhead/Aerator** | ✓ | | | |
| **Home Energy Report** | ✓ | | | |
| **High Efficiency Home** | ✓ | | | |
| **Low Income Saving Homes** | ✓ | | | |
| **Natural Gas Commercial Solutions Program** | | ✓ | ✓ | ✓ |
| **CenterPoint Energy Education Program** | ✓ | ✓ | ✓ | ✓ |

# § 165:45-23-7(c)(2): Programs and Date Started

**OAC § 165:45-23-7(c)(2): a list of all programs and the date each program started.**

Upon OCC approval of the first CIP Portfolio on March 25, 2011, Summit Utilities Oklahoma began the delivery of the following energy efficiency programs:

- CenterPoint Energy Education Program (CEEP)
- Residential Home Energy Reports
- Water Heating
- Space Heating Systems
- Low-Flow Showerhead and Faucet Aerator
- Commercial Boiler
- Commercial Food Service

The OCC approved a modified CIP Portfolio on February 1, 2012, and CenterPoint Energy began the delivery of the following programs for 2012:

- Multi-Unit Market Transformation
- Clothes Dryer

On August 13, 2013, the OCC approved a new CIP Portfolio triennial plan for PY 2014 - 2016. In January of 2014, CenterPoint Oklahoma began implementing this triennial plan, which included the previously approved programs along with the following additional programs and program updates:

- Electronic Ignition Hearth
- Cooking Range
- New Home Construction
- Residential Energy Audit
- Furnace Tune Ups (addition to Space Heating Program)

On October 26, 2016, the OCC approved a new CIP Portfolio triennial plan for PY 2017 - 2019. In January of 2017, CenterPoint Oklahoma began implementing this new triennial plan, which includes modifications to previously approved programs and discontinues implementation of the Electronic Ignition Hearth and Residential Energy Audit Programs delivered in 2014-2016.

On December 10, 2019, the OCC approved a new CIP Portfolio triennial plan for PY 2020 - 2022. On January 1st of 2020, CenterPoint Oklahoma began implementation of the new triennial plan, which included the consolidation of the natural gas clothes dryer, natural gas cooking range, and multifamily program into the Natural Gas Equipment program as measures. A residential low-

income program was also added to the portfolio.  Finally, the boiler and foodservice programs were consolidated into the Commercial and Industrial Program as measures.

On January 10th, 2022, Summit Utilities acquired CenterPoint Energy's Oklahoma assets and is now recognized as Summit Utilities Oklahoma.

## § 165:45-23-7(c)(3): Customer Participation

**OAC § 165:45-23-7(c)(3): The number of Participating Customers per Demand Program.**

Listed on Table 2 are Summit Utilities PY 2022 CIP Portfolio participation results which had a total of 72,869 participants and measures installed.

**Table 2: Participation by Program**

| Program | Participants |
|---|---|
| Natural Gas Equipment Program | 475 |
| Low Flow Showerhead/Aerator | 594 |
| Home Energy Report | 65,026 |
| High Efficiency Home | 45 |
| Low Income Saving Homes | 228 |
| Natural Gas Commercial Solutions Program | 6,501 |
| CenterPoint Energy Education Program | NA |
| **Total** | **72,869** |

Listed on Table 3 is Summit Utilities PY 2022 CIP Portfolio with total number of eligible customers and distinct customer totals by program and with percentage analysis of district customers who participated and did not participate in the programs.

**Table 3: Participation vs. Nonparticipation**

| Program | Total Customers | Direct Participants | % Participants | % Nonparticipants |
|---|---|---|---|---|
| Natural Gas Equipment Program[1] | 98,697 | 475 | 0.48% | 99.52% |
| Low Flow Showerhead/Aerator[2] | 89,211 | 594 | 0.67% | 99.33% |
| Home Energy Report[2] | 89,211 | 65,026 | 72.89% | 27.11% |
| High Efficiency Home[2] | 89,211 | 45 | 0.05% | 99.95% |
| Low Income Saving Homes[2] | 89,211 | 228 | 0.26% | 99.74% |
| Natural Gas Commercial Solutions Program[3] | 10,717 | 24 | 0.22% | 99.78% |
| Summit Utilities Education Program[4] | 99,928 | 99,928 | 100% | 0% |

## 165:45-23-7(c)(4-6): Projected & Actual Energy Savings

**OAC § 165:45-23-7(c)(4): By Demand Program, approved projected energy savings (in decatherms) as approved;**

**OAC § 165:45-23-7(c)(5): The gross energy savings (in decatherms) and performance of each Demand program; and**

**OAC § 165:45-23-7(c)(6): The verified energy savings (in decatherms) by Demand Program and methods used to verify.**

Table 4 compares the projected savings to the gross and net savings achieved in 2022 for each program.

[1]Customer class includes RES and GS-1 (Dec. 2021)
[2]Customer class includes residential only (Dec. 2021)
[3]Custom class include GS-1, CS-1, TSO (Dec. 2021)
[4]All rate classes (Dec. 2021)

**Table 4: Projected, Gross, and Net Energy Savings by Program**

| Program | 2022 Projected Annual Savings (MCF) | 2022 Annual Gross Savings Achieved (MCF) | 2022 Annual Net Savings Achieved (MCF) |
|---|---|---|---|
| Gas Equipment Program | 20,428 | 9,131 | 7,484 |
| Low Flow Showerhead/Aerator | 3,979 | 589 | 550 |
| Home Energy Report | 48,920 | 47,691 | 47,691 |
| High Efficiency Home | 2,340 | 589 | 544 |
| Low Income Saving Homes | 7,500 | 6,942 | 6,942 |
| Natural Gas Commercial Solutions Program | 36,181 | 47,552 | 47,552 |
| CenterPoint Energy Education Program | NA | 0 | NA |
| Total | 119,347 | 112,494 | 110,763 |

**Energy Savings and Methodology**

The energy savings methodologies and inputs outlined in the Arkansas Technical Reference Manual (TRM) were used to calculate energy savings for all programs resulting in energy savings. The TRM can be found on the Arkansas Public Service Commission's website.[2]  All the weather zones in Summit Utilities Oklahoma's service territory are included in the TRM, so any climate differences between the two states have been appropriately considered.

Summit Utilities also modified the data and methodologies provided in the Arkansas TRM to calculate energy savings from fuel switching activities.  The energy savings utilized in electric to gas applications consider the full fuel cycle of energy and account for the source of the fuel in addition to the site emissions.  The Arkansas TRM was used to calculate site and baseline emissions.  For heating systems, the electric baseline was an air source heat pump (HSPF 8.2) with back-up electric resistance heating used for 11% of the heating load.  For water heating systems, the standard electric water heater efficiencies were utilized.

In PY 2022, ADM Associates (ADM) conducted the Evaluation, Measurement, and Verification (EM&V) of Summit Utilities CIP Portfolio.  ADM's review included a process evaluation and an impact evaluation to determine the verified and net savings attributable to the Company's PY 2022

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[2] http://www.apscservices.info/EFilings/Docket_Search_Documents.asp?Docket=10-100-R&DocNumVal=199

program activities.  The 2022 EM&V Report completed by ADM can be found in Appendix A of this report.

# § 165:45-23-7(c)(7): Education Programs

**OAC § 165:45-23-7(c)(7): For Education Programs measurements of outreach efforts, including pre-program and post-program results and copies of evaluations, surveys, focus group results, and other measurement techniques used to gauge the effectiveness of education efforts.**

As part of their PY 2022 EM&V effort, ADM conducted participant surveys to determine how customers became aware of the Company's programs.  These survey results are provided in ADM's EM&V Report, and they provide insights on which outreach efforts were the most effective at creating program awareness.

# § 165:45-23-7(c)(8): Levelized Cost

**OAC § 165:45-23-7(c)(8): The levelized cost per decatherm for the Demand Portfolio, Demand Programs, and by customer sector, including all assumptions used to make the calculation.**

The levelized cost for the Company's PY 2022 CIP Portfolio was $2.90 per Mcf. This is a decrease of $1.54 from PY 2021. Summit Utilities Oklahoma used the following methodology to calculate the levelized cost:

*Levelized TRC Cost =*

$$\text{Capital Recovery Factor} * \frac{\text{(Total Program Administrator Costs + Total Participant Costs (net of incentives)}}{\text{Annual Energy Savings (MCF)}}$$

*Where:*

*Capital Recovery Factor =* $[A*(1+A)^\wedge(B)]/[(1+A)^\wedge(B)-1]$

*A =* *Discount Rate (Societal Rate)*

*B =* *Weighted Average Life of Savings*

Tables 5 and 6 provide details on the levelized cost at the program, customer sector, and portfolio levels.

## Table 5: Levelized Cost by Program

| Total Resource Cost Test and TRC Levelized Cost By Program | | Net Energy Savings | Total Resource Cost Test (TRC) | | |
|---|---|---|---|---|---|
| | | Annual Net Energy Savings | Total Net Benefits | TRC | TRC Levelized Cost |
| Program | Savings Type | MCF | $ | Ratio | ($/MCF) |
| Natural Gas Equipment - Residential | Natural Gas | 4,694 | ($4,564) | 0.92 | $6.57 |
| Natural Gas Equipment - Residential | Electric to Gas Fuel Switch | 1,283 | $35,010 | 1.58 | $3.58 |
| Natural Gas Equipment - GS-1 | Natural Gas | 1,279 | ($30,523) | 0.80 | $7.63 |
| Natural Gas Equipment - GS-1 | Electric to Gas Fuel Switch | 228 | $418 | 1.02 | $5.97 |
| Natural Gas Equipment - CS-1 | Natural Gas | 0 | $0 | 0 | NA |
| Natural Gas Equipment - CS-1 | Electric to Gas Fuel Switch | 0 | $0 | 0 | NA |
| **Natural Gas Equipment - Total** | | **7,484** | **$342** | **1.00** | **$6.28** |
| Natural Gas Commercial Solutions - GS-1 | Natural Gas | 14,627 | $1,135,177 | 14.20 | $0.41 |
| Natural Gas Commercial Solutions - CS-1 | Natural Gas | 32,925 | $906,086 | 1.53 | $3.76 |
| Natural Gas Commercial Solutions - LCS-1 | Natural Gas | 0 | $0 | NA | NA |
| **Natural Gas Commercial Solutions - Total** | | **47,552** | **$2,041,263** | **2.14** | **$2.70** |
| **Low Flow Showerhead/Aerator** | **Natural Gas** | **550** | **($10,315)** | **0.70** | **$7.09** |
| **Residential Home Energy Reports** | **Natural Gas** | **47,691** | **($12,756)** | **0.94** | **$4.36** |
| **High Efficiency Homes** | **Natural Gas** | **544** | **($38,901)** | **0.57** | **$10.70** |
| **Low Income Savings Homes** | **Natural Gas** | **6,942** | **$410,989** | **10.17** | **$0.54** |
| CenterPoint Energy Education Program - Res | Educational Program | 0 | ($75) | 0 | NA |
| CenterPoint Energy Education Program - GS-1 | Educational Program | 0 | ($23) | 0 | NA |
| CenterPoint Energy Education Program - CS-1 | Educational Program | 0 | ($36) | 0 | NA |
| CenterPoint Energy Education Program - LCS | Educational Program | 0 | $0 | NA | NA |
| **CenterPoint Energy Education Program Total** | **Educational Program** | **0** | **($134)** | **0** | **NA** |
| **Total Portfolio** | | **110,763** | **$2,390,488** | **1.83** | **$2.90** |

**Table 6: Levelized Cost by Customer Sector**

| Total Resource Cost Test and TRC Levelized Cost By Customer Sector | Net Energy Savings | Total Resource Cost Test (TRC) | | |
|---|---|---|---|---|
| | Energy Savings | Total Net Benefits | TRC | Levelized Cost |
| Customer Sector | MCF | $ | Ratio | ($/MCF) |
| Residential | 61,703 | $379,389 | 1.42 | $3.48 |
| Commercial GS-1 | 16,135 | $1,105,049 | 5.27 | $1.11 |
| Commercial CS-1 | 32,925 | $906,050 | 1.53 | $3.76 |
| Commercial LCS | 0 | $0 | NA | NA |
| **Total Portfolio** | **110,763** | **$2,390,488** | **1.83** | **$2.90** |

# § 165:45-23-7(c)(9): Reduced Emissions and Water Consumption

**OAC § 165:45-23-7(c)(9): The amount of reduced emissions and water consumption experienced by the utility, including all assumptions and calculation details, during the Demand Program period for the current program year.**

**Reduced Emissions**

Summit Utilities used the United States Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator[3] to estimate the impact of reduced emissions attributable to the 110,763 in Mcf savings delivered through the PY 2022 CIP Portfolio. Overall, the Company's programs reduced carbon dioxide ($CO_2$) emissions by 6,089 metric tons. This is equivalent to:

Greenhouse gas emissions from:

- 1,355 passenger vehicles driven for one year; or
- 15,610,093 miles driven by an average passenger vehicle.

Carbon dioxide emissions from:

- Annual energy use of 767 homes;

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[3] epa.gov/energy/greenhouse-gas-equivalencies-calculator?unit=MCF&amount=102,507

- 6,820,896 pounds of coal burned; or
- 685,186 gallons of gasoline consumed.

**Reduced Water Consumption**

Table 7 Summit Utilities Oklahoma calculated the reduction in water consumption delivered through the Low-Flow Showerhead and Faucet Aerator Program. Based on the count, by weather zone, of each low-flow equipment type, an estimated annual reduction in gallons of water use was calculated.

**Table 7: Reduced Water Consumption**

| Annual Water Savings Low Flow Showerhead And Faucet Aerator Program | | | |
|---|---|---|---|
| Measure | Equipment Count | Gross Water Savings (Gallons) | Net Water Savings (Gallons) |
| Bathroom Aerator | 164 | 83,992 | 80,884 |
| Kitchen Aerator | 99 | 28,433 | 27,381 |
| Showerhead | 288 | 751,771 | 723,955 |
| Total | 551 | 864,195 | 832,220 |

# § 165:45-23-7(c)(10): Portfolio Budget & Total Annual Gas Revenue

**OAC § 165:45-23-7(c)(10): The Demand Portfolio funding as a percent of total annual gas revenue**

Table 8 displays the PY 2022 CIP Portfolio budget as a percentage of Summit Utilities 2022 revenue.

**Table 8: Demand Portfolio Funding as a Percent of Total Annual Gas Revenue**

| 2022 Portfolio Budget | 2022 Revenue | Demand Portfolio Funding % Total Revenue |
|---|---|---|
| $2,504,347.32 | $101,303,494.88 | 2.47% |

## § 165:45-23-7(c)(11): Portfolio Energy Savings & Annual Gas Usage

**OAC § 165:45-23-7(c)(11): The Demand Portfolio Net source energy savings as a percent of total gas annual usage**

Table 9 displays the PY 2022 CIP Portfolio net energy savings as a percentage of Summit Utilities 2022 natural gas throughput.

**Table 9: Demand Portfolio Savings as a Percent of Total Natural Gas Usage**

| 2021 Net Energy Savings (MCF) | 2021 Natural Gas Usage (MCF) | Energy Savings %Annual Gas Usage |
|---|---|---|
| 110,763 | 10,119,485 | 1.09% |

## § 165:45-23-7(c)(12): Projected Program Costs

**OAC § 165:45-23-7(c)(12): The projected program costs;**

**These costs should be separated into the following categories to allow review of spending:**

(i) Administrative costs;
(ii) Inducements: direct payments and other inducements
(iii) Educations and marketing costs;
(iv) Program delivery costs; and
(v) EM&V costs

Table 10 provides the PY 2022 budgets for each program by cost category.

**Table 10: Program Budgets by Category**

| Program | Admin | Inducements | Education/ Advertising | Delivery | Evaluation | Total Program |
|---|---|---|---|---|---|---|
| Gas Equipment Program | $21,218 | $922,150 | $63,654 | $137,917 | $35,000 | $1,179,939 |
| Low Flow Showerhead and Faucet Aerator | $6,365 | $20,713 | $26,523 | $58,087 | $4,065 | $115,752 |
| Residential Home Energy Reports | $4,244 | $0 | $0 | $192,989 | $1,273 | $198,506 |
| High Efficiency Homes Program | $6,365 | $105,000 | $5,305 | $19,618 | $2,500 | $138,787 |
| Low Income Savings Homes | $10,609 | $150,000 | $15,914 | $42,436 | $10,609 | $229,568 |
| Natural Gas Commercial Solutions | $15,914 | $318,976 | $42,436 | $159,135 | $25,767 | $562,228 |
| CenterPoint Energy Education Program | $0 | $0 | $79,568 | $0 | $0 | $79,568 |
| **Total Program Costs** | **$64,715** | **$1,516,839** | **$233,398** | **$610,181** | **$79,214** | **$2,504,347** |

# § 165:45-23-7(c)(13): Actual Program Costs

**OAC § 165:45-23-7(c)(13): The projected program costs;**

**These costs should be separated into the following categories to allow review of spending:**

(i) Administrative costs;
(ii) Inducements: direct payments and other inducements
(iii) Educations and marketing costs;
(iv) Program delivery costs; and
(v) EM&V costs

Table 11 provides the actual PY 2022 expenditures for each program by cost category.

**Table 11: Program Spending by Category**

| Program | Admin. | Inducements | Education/ Advertising | Delivery | Evaluation | Total Program |
|---|---|---|---|---|---|---|
| Gas Equipment Program | $15,431 | $296,980 | $0 | $100,302 | $39,825 | $452,539 |
| Low Flow Showerhead and Faucet Aerator | $4,629 | $4,597 | $0 | $21,273 | $8,145 | $38,643 |
| Residential Home Energy Reports | $3,087 | $0 | $0 | $188,882 | $10,809 | $202,778 |
| High Efficiency Homes Program | $4,629 | $45,000 | $0 | $14,267 | $6,647 | $70,543 |
| Low Income Savings Homes | $7,716 | $258,883 | $0 | $30,862 | $6,229 | $303,689 |
| Natural Gas Commercial Solutions | $11,574 | $353,989 | -$875 | $267,508 | $36,991 | $669,187 |
| CenterPoint Energy Education Program | $0 | $0 | $134 | $0 | $0 | $134 |
| Total Program Costs | $47,065 | $959,449 | -$741 | $623,095 | $108,645 | $1,737,513 |

# § 165:45-23-7(c)(14-15): Incentives

**OAC § 165:45-23-7(c)(14): Projected incentives – including projected cost effectiveness tests;**

**OAC § 165:45-23-7(c)(15): Actual calculated incentives – including workpapers and working spreadsheets (formulas, calculations, linkages, and assumptions) or for updated cost effectiveness tests, in sufficient detail to allow review of cost effectiveness calculations.**

Summit Utilities calculated incentive is $246,183 based on the results of its PY 2022 CIP Portfolio. Pursuant to OAC § 165:45-23-8, eligibility to receive an incentive requires that the Company's Demand Portfolio reach a goal ratio (Verified savings divided by Projected Savings) of at least 80% and achieve a total resource cost test benefit/cost ratio of greater than one. For PY 2022, the Company is eligible for an incentive because Summit Utilities CIP portfolio goal ratio was 93% and it achieved a cost/benefit ratio of 1.83.

Table 12 provides the calculation for the requested 2022 CIP Portfolio incentive.

**Table 12: Incentive Calculation**

| Line No. | Incentive Calculation Input | |
|---|---|---|
| 1 | Projected Energy Savings (MCF) | 119,347.28 |
| 2 | Actual Portfolio Energy Savings (MCF) | 110,763.07 |
| 3 | Program Expenditure | $1,737,513 |
| 4 | TRC Ratio | 1.83 |
| 5 | Portfolio Net Benefits | $1,768,412 |
| 6 | Maximum Incentive, Percentage Net Benefits | 15% |
| 7 | Goal Ratio (Line 2/Line 1) | 92.81% |
| 8 | Maximum Eligible Incentive $ (Line 5 X Line 6 X Line 7) | $246,183 |
| 9 | Incentive Cap Percentage Portfolio Expenditure | 8% |
| 10 | Incentive Cap (Line 3 X Line 9) | $260,627 |
| 11 | 2021 Incentive | $246,183 |

## § 165:45-23-7(c)(16): Utility growth or reduction

**OAC § 165:45-23-7(c)(16): The utility's annual growth or reduction in metered natural gas for the previous three years, with a calculation of the average growth or reduction rate over that entire period.**

Summit Utilities metered sales volumes are provided by customer class in Table 13.

**Table 13: Metered Sales Volumes (CCF) per Customer Class**

| Customer Class | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Average Rate of Change Per Year |
|---|---|---|---|---|---|---|---|
| Residential | 41,224,824 | 53,639,082 | 54,106,960 | 47,029,340 | 48,894,439 | 48,469,243 | 1.52% |
| Commercial GS-1 | 12,892,967 | 13,715,340 | 11,860,902 | 9,443,865 | 10,992,565 | 10,796,796 | 6.92% |
| Commercial CS-1 | 19,799,411 | 17,254,304 | 19,685,831 | 21,830,008 | 17,016,011 | 18,152,499 | -8.81% |
| TSO | 19,799,411 | 50,120,091 | 51,583,016 | 47,980,262 | 51,502,349 | 52,806,312 | 4.91% |

## § 165:45-23-7(c)(17): Market Conditions

**§ 165:45-23-7(c)(17): The most current information available comparing the base line and milestones to be achieved under market transformation programs with actual conditions in the market.**

PY 2022 marked the final year of Summit Utilities updated CIP Portfolio for PY 2020-2022.   It remains important for the Company to evaluate market conditions to improve program performance in PY 2021 - 2022, as well as plan for the PY 2023 - 2025 CIP Portfolio.

The Natural Gas Equipment Program faced significant headwinds in PY2022 primarily due to higher equipment and labor costs resulting from supply chain issues and a tight labor market. Rising interest rates also made financing equipment replacement projects more costly causing customers to repair their equipment rather than replace their equipment.

The Low-Flow Program continued to see declines in participation due to the maturity of the program. The primary factor in savings reduction was due to lower installation rates. To improve participation, self-install thermostats were added as a means to offer a new measure that could drive traffic to the website. The addition proved to be beneficial and produced a good amount of savings. Additional measures will be introduced to refresh program offerings for PY2023 as marketing efforts alone to drive traffic to the website produced mixed results. Additional efforts will also be made to ensure installation rates improve.

The Low-Income Saving Homes Program ("LISHP") is a program implemented by a third-party vendor in partnership with Public Service Company of Oklahoma ("PSO"). The LISHP is well received by Summit Utilities customers, and the Company will be looking to build on its success. As such we increase the budget for the program to serve more eligible natural gas customers.

The Home Energy Reports Program was able to increase participation, which resulted in increased savings this year. The program helps customers create habits that reduce energy consumption. Cross-platform marketing also helps promote energy savings in other programs. The promotion of other programs typically comes in the form of direct mail and digital interactions.

The Natural Gas Commercial Solutions Program again proved to be a high-performing program delivering 43% of the CIP Portfolio's energy savings. Projects by C&I Program participants yielded 47,552 Mcf in energy savings for PY 2022.

## § 165:45-23-7(c)(18): Summary of Spending by Demand Program

**OAC § 165:45-23-7(c)(18): By Demand Program, provide a summary of spending, including the following:**

    (A) Administrative Costs;
    (B) Inducements, including direct payments and other inducements;
    (C) Education and marketing costs;
    (D) Program Delivery Costs; and
    (E) EM&V Costs.

Table 14 provides the actual 2022 program expenditures by Demand Program and cost category.

**Table 14: 2022 Program Spending by Category**

| Program | Admin. | Inducements | Education/ Advertising | Delivery | Evaluation | Total Program |
|---|---|---|---|---|---|---|
| Gas Equipment Program | $15,431 | $296,980 | $0 | $100,302 | $39,825 | $452,539 |
| Low Flow Showerhead and Faucet Aerator | $4,629 | $4,597 | $0 | $21,273 | $8,145 | $38,643 |
| Residential Home Energy Reports | $3,087 | $0 | $0 | $188,882 | $10,809 | $202,778 |
| High Efficiency Homes Program | $4,629 | $45,000 | $0 | $14,267 | $6,647 | $70,543 |
| Low Income Savings Homes | $7,716 | $258,883 | $0 | $30,862 | $6,229 | $303,689 |
| Natural Gas Commercial Solutions | $11,574 | $353,989 | -$875 | $267,508 | $36,991 | $669,187 |
| CenterPoint Energy Education Program | $0 | $0 | $134 | $0 | $0 | $134 |
| **Total Program Costs** | **$47,065** | **$959,449** | **-$741** | **$623,095** | **$108,645** | **$1,737,513** |

## § 165:45-23-7(c)(19): Funds Planned versus Funds Expended

**§ 165:45-23-7(c)(19): A statement of any funds that were committed but not spent during the year, by program, with an explanation for non-spending.**

Summit Utilities PY 2022 CIP Portfolio expenses were $1,737,513, which is 69% of the approved budget of $2,504,347.

| Program | Comment |
|---|---|
| Natural Gas Equipment Program | The program reached 38% of the planned budget with final expenses reaching $452,539, which is a slight decrease over last year's program spend. Program overhead and management costs from CenterPoint Energy was suspended and Summit's overhead and management cost had not resumed in 2022. |
| Low Flow Shower Aerator Program | The program expenses reached 33% of the planned budget. The program was heavily marketed, however, the program continues to see declining participation mainly due to market saturation. The program will get an update with new measures being introduced to improve participation. |
| Summit Utilities Education Program | Program spend by CenterPoint Energy was not allocated to the SUEP for 2022. |

**Table 15: Budgeted Funding and Actual Expenditures by Program**

| Program | Program Funds Budgeted | Program Funds Expended | % Budget Spent |
|---|---|---|---|
| Gas Equipment Program | $1,179,939.00 | $452,538.77 | 38% |
| Low Flow Showerhead and Faucet Aerator | $115,752.42 | $38,643.25 | 33% |
| Residential Home Energy Reports | $198,505.83 | $202,777.83 | 102% |
| High Efficiency Homes Program | $138,787.07 | $70,542.78 | 51% |
| Low Income Savings Homes | $229,567.50 | $303,689.41 | 132% |
| Natural Gas Commercial Solutions | $562,228.00 | $669,187.20 | 119% |
| CenterPoint Energy Education Program | $79,567.50 | $133.88 | 0% |
| **Total Program Costs** | **$2,504,347** | **$1,737,513** | **69%** |

# § 165:45-23-7(c)(20): Description of Each Demand Program

**§ 165:45-23-7(c)(20): A detailed description of each Demand Program reflecting the scale of the program as part of the Demand Portfolio that includes the following:**

(A) Number of customers served by each Demand Program or program category;

(B) Program or program category expenditures;

(C) Verified energy and peak demand savings achieved by the Demand Program or program category, when available; and

(D) A description of proposed changes in the Demand Program plans.

Detailed information related to 2022 expenditures, participation, energy savings, overall program scale, as well as recent or proposed changes is provided below for each program:



**Natural Gas Equipment Program**

The Natural Gas Equipment program is designed to promote efficient water heating and space heating solutions to residential and commercial consumers.  Rebates are offered to consumers for high-efficiency furnaces, water heaters, clothes dryers, cooking ranges, and smart thermostats.

Summit Utilities does not propose any major changes to the program currently.

## Participation & Energy Savings

| Customer Class | Participation | Gross Energy Savings (MCF) | % Portfolio Gross Savings | Net Energy Savings (MCF) | % Portfolio Net Savings |
|---|---|---|---|---|---|
| **Residential** | 378 | 7042 | 6.26% | 5,977 | 5.40% |
| **GS-1** | 97 | 2,089 | 1.86% | 1,508 | 1.36% |
| **CS-1** | 0 | 0 | 0.00% | 0 | 0.00% |
| **Total** | 475 | 9,131 | 8.12% | 7,484 | 6.76% |

## Program Expenditures

| Customer Class | Admin | Inducement | Marketing | Delivery | EM&V | Total Program | % Total Portfolio |
|---|---|---|---|---|---|---|---|
| **Residential** | $11,717 | $225,503 | $0 | $76,162 | $30,240 | $343,622 | 19.78% |
| **GS-1** | $3,714 | $71,477 | $0 | $24,141 | $9,585 | $108,917 | 6.27% |
| **CS-1** | $0 | $0 | $0 | $0 | $0 | $0 | 0.0% |
| **Total** | $15,431 | $296,980 | $0 | $100,302 | $39,825 | $452,539 | 26.05% |

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# Low-Flow Program

The Low-Flow Showerhead and Faucet Aerator Program provides customers with no-cost showerheads and faucet aerators that conserve water and reduce energy usage. Customers can order equipment through an online shopping cart, and the requested number of low-flow units are mailed, along with comprehensive installation directions.

Summit Utilities does not propose any major changes to the program at this time.

## Participation & Energy Savings

| Customer Class | Participation | Gross Energy Savings (MCF) | % Portfolio Gross Savings | Net Energy Savings (MCF) | % Portfolio Net Savings |
|---|---|---|---|---|---|
| **Residential** | 594 | 589 | 0.52% | 550 | 0.50% |

## Program Expenditures

| Customer Class | Admin | Inducement | Marketing | Delivery | EM&V | Total Program | % Total Portfolio |
|---|---|---|---|---|---|---|---|
| **Residential** | $4,629 | $4,597 | $0 | $21,273 | $8,145 | $38,643 | 2.22% |

# Home Energy Report

The Home Energy Reporting Program is a behavioral program that combines energy usage data with customer demographic, housing and GIS data to develop specific, targeted recommendations that educate and motivate consumers to reduce their energy consumption.  Program participants receive this information through direct-mail and email reports.

Summit Utilities continues to implement the Residential Home Energy Reports Program in its 2022 CIP Portfolio, and no major changes to the program are proposed at this time.

## Participation & Energy Savings

| Customer Class | Participation | Gross Energy Savings (MCF) | % Portfolio Gross Savings | Net Energy Savings (MCF) | % Portfolio Net Savings |
|---|---|---|---|---|---|
| **Residential** | 65,026 | 47,691 | 42.39% | 47,691 | 43.06% |

## Program Expenditures

| Customer Class | Admin | Inducement | Marketing | Delivery | EM&V | Total Program | % Total Portfolio |
|---|---|---|---|---|---|---|---|
| **Residential** | $3,087 | $0 | $0 | $188,882 | $10,809 | $202,778 | 11.67% |

# High Efficiency Homes Program

The High Efficiency Home Program provides inducements to encourage builders to construct new homes that are equipped with efficient natural gas appliances.  Builders or homeowners are eligible to receive a $1,000 rebate for new homes equipped with a primary heat source of 95% AFUE natural gas furnace, natural gas water heating, and at least one additional natural gas appliance.

The Company does not propose any program changes at this time.

## Participation & Energy Savings

| Customer Class | Participation | Gross Energy Savings (MCF) | % Portfolio Gross Savings | Net Energy Savings (MCF) | % Portfolio Net Savings |
|---|---|---|---|---|---|
| **Residential** | 45 | 589 | 0.52% | 544 | 0.49% |

## Program Expenditures

| Customer Class | Admin | Inducement | Marketing | Delivery | EM&V | Total Program | % Total Portfolio |
|---|---|---|---|---|---|---|---|
| **Residential** | $4,629 | $45,000 | $0 | $14,267 | $6,647 | $70,543 | 4.06% |

# Low-Income Saving Homes Program

Provides weatherization retrofits that will improve the efficiency and comfort of Summit Utilities low-income and hard to reach residential customers.

The Company does not propose any major changes to the program at this time.

## Participation & Energy Savings

| Customer Class | Participation | Gross Energy Savings (MCF) | % Portfolio Gross Savings | Net Energy Savings (MCF) | % Portfolio Net Savings |
|---|---|---|---|---|---|
| **Residential** | 228 | 6,942 | 61.71% | 6,942 | 6.27% |

## Program Expenditures

| Customer Class | Admin | Inducement | Marketing | Delivery | EM&V | Total Program | % Total Portfolio |
|---|---|---|---|---|---|---|---|
| **Residential** | $7,716 | $258,883 | $0 | $30,862 | $6,229 | $303,689 | 17.48% |

# Natural Gas Commercial Solutions Program

The Natural Gas Commercial Solutions Program encourages Commercial and Industrial (C&I) customers to use natural gas efficiently by installing cost-effective energy efficient equipment, adopting energy-efficient designs, and using energy-efficient operations at their facilities.  The program provides financial incentives to C&I customers installing or implementing cost-effective energy efficiency measures through the Direct-Install, Custom, or Prescriptive measure components of the program.

The Company does not propose any major changes to the program at this time.

## Participation & Energy Savings

| Customer Class | Participation | Gross Energy Savings (MCF) | % Portfolio Gross Savings | Net Energy Savings (MCF) | % Portfolio Net Savings |
|---|---|---|---|---|---|
| GS-1 | 3,309 | 14,627 | 13.00% | 14,627 | 13.21% |
| CS-1 | 3,192 | 32,925 | 29.27% | 32,925 | 29.73% |
| LCS - TSO | 0 | 0 | 0.00% | 0 | 0.00% |
| Total | 6,501 | 47,552 | 42.27% | 47,552 | 42.93% |

## Program Expenditures

| Customer Class | Admin | Inducement | Marketing | Delivery | EM&V | Total Program | % Total Portfolio |
|---|---|---|---|---|---|---|---|
| GS-1 | $3,157 | $96,564 | ($239) | $72,973 | $10,091 | $182,546 | 10.51% |
| CS-1 | $8,417 | $257,425 | ($636) | $194,535 | $26,900 | $486,641 | 28.01% |
| LCS - TSO | $0 | $0 | $0 | $0 | $0 | $0 | 0.00% |
| Total | $11,574 | $353,989 | ($875) | $267,508 | $36,991 | $669,187 | 38.51% |

# Summit Utilities Education Program (SUEP)

CEEP is an education and awareness program that has no directly attributable energy savings associated with program implementation.

Summit Utilities continues to implement the SUEP in its 2022 CIP Portfolio and does not propose any major changes to the program at this time.

## Program Expenditures

| Customer Class | Admin | Inducement | Marketing | Delivery | EM&V | Total Program | % Total Portfolio |
|---|---|---|---|---|---|---|---|
| **Residential** | $0 | $0 | $75 | $0 | $0 | $75 | 0.00% |
| **GS-1** | $0 | $0 | $23 | $0 | $0 | $23 | 0.00% |
| **CS-1** | $0 | $0 | $36 | $0 | $0 | $36 | 0.00% |
| **LCS** | $0 | $0 | $0 | $0 | $0 | $0 | 0.00% |
| **Total** | $0 | $0 | $134 | $0 | $0 | $134 | 0.01% |

# § 165:45-23-7(b)(21): Research and Development Activities

**§ 165:45-23-7(c)(21): A list of research and development activities included in the demand portfolio, their status, and a report on the connection between each activity and effective energy efficiency programs.**

Summit Utilities did not conduct any research and development activities during PY 2022.

# § 165:45-23-7(c)(22): Program Implementers

**§165:45-23-7(c)(22): Identification of program implementers, including names, job titles, business postal addresses, business electronic mail addresses, and business telephone numbers.**

Summit Utilities implements the following programs in-house: CEEP, Low-Flow Showerhead Program, and Natural Gas Equipment Program. The remainder of the programs are vendor implemented.

The contact information is:

Name of Program Implementer: Jose Laboy

Job Title: CIP Implementation Manager

Business Postal Address: 101 Bringer Drive, Maumelle, AR 72113

Business Email Address: jlaboy@summitutilities.com

Business Telephone Number: 501-377-4837

The Home Energy Reports program is implemented by Oracle Utilities (formerly Opower Inc.) with oversight and management by Summit Utilities Oklahoma. The Summit Utilities Oklahoma contact is as above and the Oracle contact is:

Name of Program Implementer: Stef Tollefson

Job Title: Service Delivery Manager

Business Postal Address: 2311 Wilson Blvd., 8th Floor, Arlington, VA  22201

Business Email Address: stef.tollefsen@oracle.com

Business Telephone Number: 847-471-9182


Summit Utilities manages the Low Flow Showerhead and Faucet Aerator program, but it utilizes the fulfillment services of Energy Federation, Inc. (EFI).  The Summit Utilities contact is as above and the EFI contact is:

Name of Program Implementer: Joel Orlando

Job Title: Strategic Account Manager

Business Postal Address: 2031 Progress Way, Kaukauna, WI  54130

Business Email Address: tbartlett-browne@efi.org

Business Telephone Number: 508-870-2277


The Low-Income Saving Homes Program is delivered by our vendor Titan ES, in partnership with Public Service Company of Oklahoma ("PSO").  The Titan ES contact is:

Name of Program Implementer: Brad Cockings

Job Title: Program Manager

Business Postal Address: 9700 S. Pole Rd. Oklahoma City, OK 73160

Business Email Address: bcockings@titanes.us

Business Telephone Number: 405-632-1700


The Natural Gas Commercial Solutions Program is delivered by our vendor, CLEAResult.  The CLEAResult contact is:

Name of Program Implementer: Shelly Baron

Job Title: Program Manager

Business Postal Address: One Allied Dr., Suite 1600, Little Rock, AR 72202

Business Email Address: shelly.baron@clearesult.com

Business Telephone Number: 501-221-4063

## Conclusion

PY 2022 was the final year of the current three-year portfolio plan cycle spanning PY 2020 – 2022. Changes to the portfolio included the consolidation of some underperforming programs and the addition of a low-income weatherization program. These changes have proven to be effective as the savings for PY 2021 and PY 2022 have increased by an average of 16% when compared to the final year (PY 2019) of the previous three-year portfolio plan. Furthermore, due to several changes in the portfolio structure, PY 2022 saw a 5% year-over-year increase in savings. Challenging economic conditions in 2022 continued to put pressure on the labor market and the supply chain, which adversely affected the natural gas equipment programs. Our continued partnership with trade allies and supply houses helped strengthen our relationship resulting in the mitigation of some of the impacts to program participation. Savings from the Low-Flow Program were particularly low due to program maturity, however, the addition of the smart thermostat has helped increase traffic to the marketplace site. Summit Utilities are working with the portfolio evaluator and program implementer to identify additional measures that will increase traffic to the existing marketplace by inducing the customer with new energy savings measures like weatherstripping, door sweeps, and filter changeout alarm. Those new measures are scheduled to be implemented in PY 2023 when the new program year cycle starts.

Despite economic headwinds, participation in the Home Energy Reports, Low-Income Saving Homes Program, and Natural Gas Commercial Solutions Program helped drive savings and net benefits for Summit customers. Overall, the Demand Portfolio achieved strong savings for Oklahoma customers achieving 110,763 MCF in natural gas savings. The low avoided costs filed in the Demand Portfolio for PY 2020 - 2022 continues to suppress the Program Administrator Cost Test ("PACT") net benefits as compared to the previous three-year plan cycle, however, the net benefits have improved every year of the PY 2020-2022 plan. Despite this fact, the portfolio remains cost effective resulting in a TRC ratio of 1.83 and producing $1.77 million in net benefits to Oklahoma customers. As Summit Utilities Oklahoma strives to grow its programs, insights from PY 2022 will help the Company better understand both the strengths of its CIP Portfolio, and the aspects that need improvement. The Company remains committed to building on its successes, addressing its challenges, improving its programs, and delivering a high-performing and comprehensive CIP Portfolio.

# Appendix A – EM&V Report

# Evaluation of Summit Oklahoma Program Year 2022 Demand Side Management Portfolio

Submitted to:

*Summit Oklahoma*

*April 2023*

ADM Associates, Inc.

**Prepared by:**

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ADM Associates Inc.
Energy Research &
Evaluation

# Acknowledgements:

We would like to thank the staff at Summit Oklahoma for their time and effort in contributing to the EM&V of the 2022 programs. This evaluation was conducted with regular coordination with staff at Summit, who provided quick feedback and turnaround to the requests of the evaluation team as well as open and forthright insights into the operations of their programs.

Further, we would like to acknowledge our gratitude towards Summit customers, implementation contractor staff and trade allies. As with the staff at Summit, their active participation allowed for the evaluation team to collect all needed data for this effort.

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# 1. Executive Summary

This report is to provide a summary of the evaluation effort of the 2022 Demand Side Management (DSM) portfolio by Summit Oklahoma (Summit). ADM Associates (the Evaluator) conducted this evaluation. This report provides verified gross and net savings estimates for evaluated programs.

## 1.1 Summary of Summit Demand Side Management Programs

In 2022, the Summit DSM portfolio contained the following programs:

- Natural Gas Equipment Rebates Program,
- High Efficiency Homes Program,
- Commercial and Industrial Solutions Program,
- Home Energy Reports Program,
- Low Income Savings Home Program, and
- Low Flow Showerhead & Faucet Aerator Program.

## 1.2 Evaluation Objectives

The goals of the 2022 EM&V effort are as follows:

- For prescriptive measures, verify that savings are being calculated according to appropriate deemed savings protocols.

- For custom measures, this effort comprises the calculation of savings according to accepted protocols (such as IPMVP). This is to ensure that custom measures are cost-effective and provide reliable savings.

## 1.3 Summary of Findings

### 1.3.1 Impact Findings

Table 1-1 and Table 1-2 present the gross and net impact by program.

*Table 1-1 Gross Impact Summary*

| Program | Annual Energy Savings (Therms) | | Lifetime Energy Savings (Therms) | | Gross Realization Rate |
|---|---|---|---|---|---|
| | Ex Ante | Ex Post | Ex Ante | Ex Post | |
| Natural Gas Equipment Rebates | 91,314 | 91,314 | 1,448,103 | 1,448,103 | 100.0% |
| High Efficiency Homes | 5,888 | 5,888 | 117,770 | 117,770 | 100.0% |
| Commercial Solutions | 475,522 | 475,522 | 6,442,755 | 6,442,755 | 100.0% |
| Home Energy Reports | 476,910 | 476,910 | 476,910 | 476,910 | 100.0% |
| Low Income Savings Homes | 69,420 | 69,420 | 1,170,310 | 1,170,310 | 100.0% |
| Low Flow Showerhead & Faucet Aerator | 5,889 | 5,889 | 61,189 | 61,189 | 100.0% |
| **Total** | **1,124,944** | **1,124,944** | **9,717,037** | **9,717,037** | **100.0%** |

*Table 1-2 Net Impact Summary*

| Program | Annual Energy Savings (Therms) | | Lifetime Energy Savings (Therms) | | NTGR | Net Realization Rate |
|---|---|---|---|---|---|---|
| | Ex Ante | Ex Post | Ex Ante | Ex Post | | |
| Natural Gas Equipment Rebates | 74,842 | 74,842 | 1,174,528 | 1,174,528 | 82.0% | 100.0% |
| High Efficiency Homes | 5,435 | 5,435 | 108,702 | 108,702 | 92.3% | 100.0% |
| Commercial Solutions | 475,522 | 475,522 | 6,442,755 | 6,442,755 | 100.0% | 100.0% |
| Home Energy Reports | 476,910 | 476,910 | 476,910 | 476,910 | 100.0% | 100.0% |
| Low Income Savings Home Program | 69,420 | 69,420 | 1,170,310 | 1,170,310 | 100.0% | 100.0% |
| Low Flow Showerhead & Faucet Aerator | 5,501 | 5,501 | 57,158 | 57,158 | 93.4% | 100.00% |
| **Total** | **1,107,631** | **1,107,631** | **9,430,363** | **9,430,363** | **98.5%** | **100.0%** |

The contribution to portfolio savings by program is summarized in Figure 1-1.
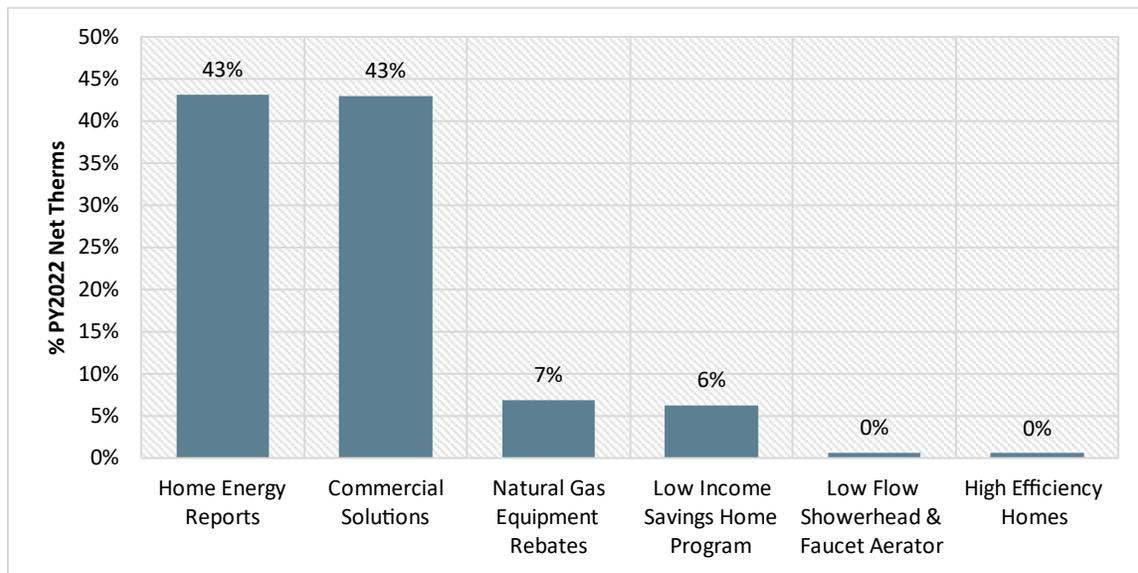


*Figure 1-1 Contribution to Portfolio Net Savings by Program*
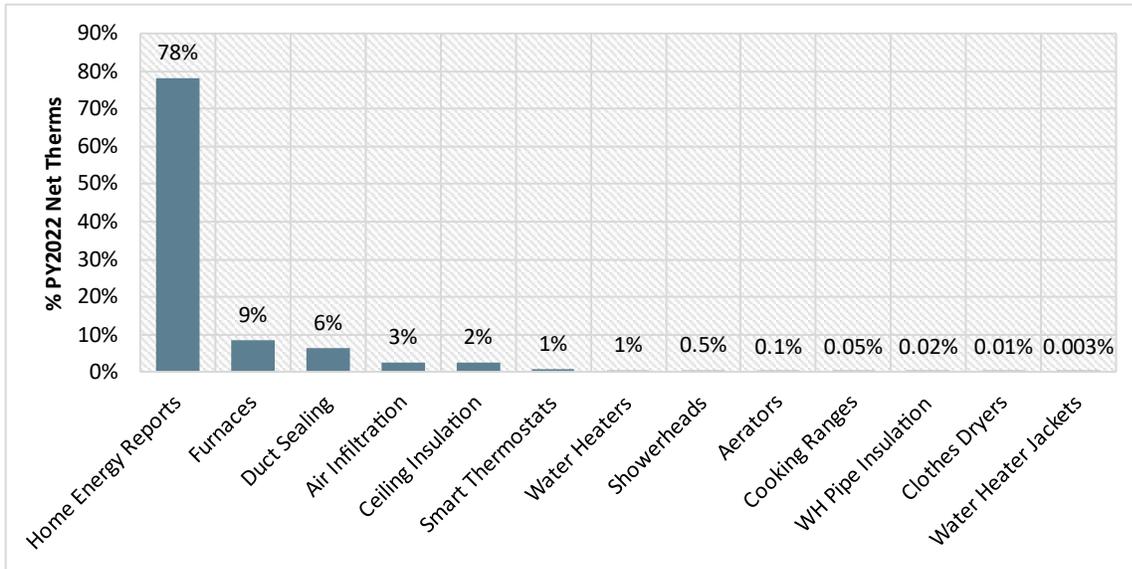
*Figure 1-2 Residential Savings by Measure*

Figure 1-2 and Figure 1-3 summarize the share of savings by measure category for residential and non-residential segments, respectively.
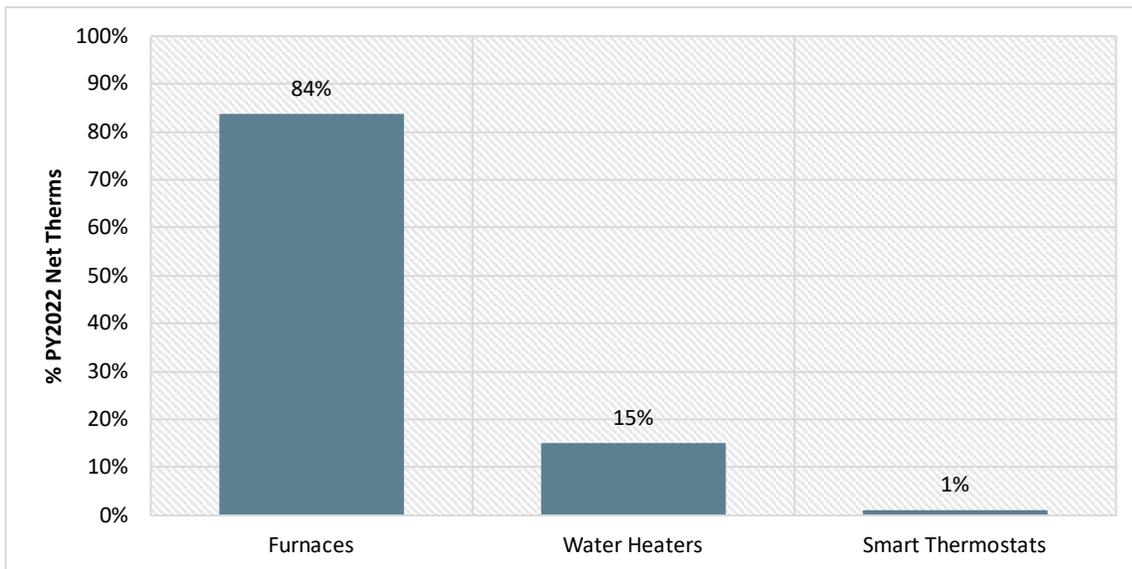


*Figure 1-3 Non-residential Savings by Measure*
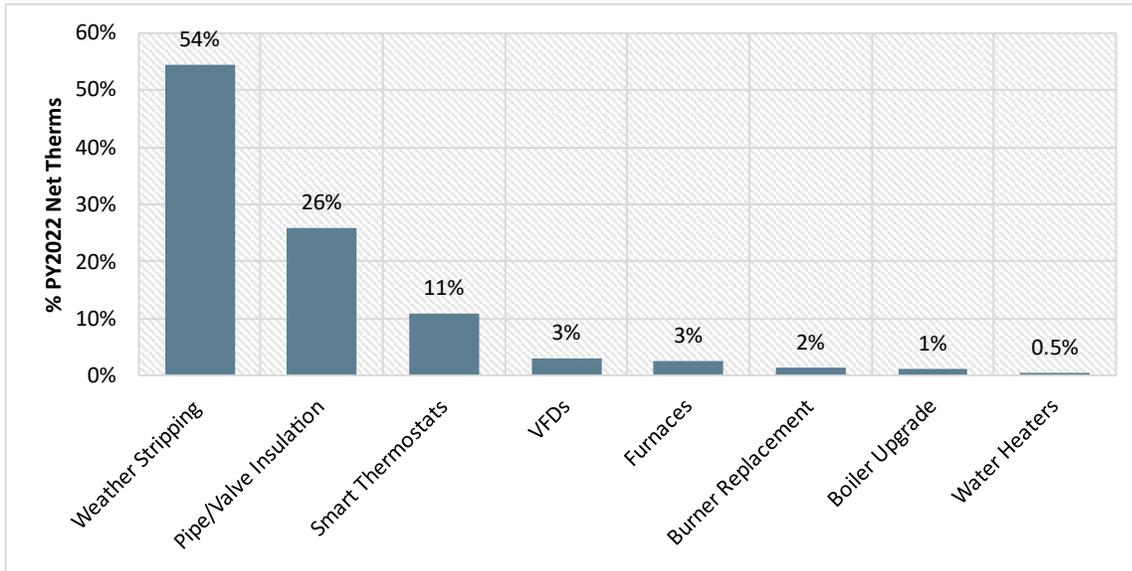
*Figure 1-4 C&I Portfolio Savings Share by Measure*

## 1.4     Summary of EM&V Effort

The evaluation effort consisted of:

- **Review of deemed savings calculations.** For all programs that apply deemed savings, the Evaluator conducted a detailed review on a census of projects to ensure that savings are up to date with the most recently available deemed savings and applicable code inputs from the Arkansas Technical Reference Manual v9.0 (AR TRM 9.0).

- **Analysis of custom projects.** Custom projects within the C&I Solutions Program accounted for 19% of portfolio-level savings. All custom projects received site-level analyses based on International Measurement & Verification Protocols (IPMVP).[1]

- **Analysis of bill impacts from Home Energy Reports.** The Home Energy Reports program accounted for 43% of total portfolio savings. The Evaluator conducted an analysis of impacts on customer bills applying methods vetted through the National Renewable Energy Laboratory Uniform Methods Project Chapter 17: Residential Behavioral Protocol.[2]

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[1] https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp

[2] https://www.energy.gov/sites/prod/files/2015/02/f19/UMPChapter17-residential-behavior.pdf

## 1.5    Report Organization

This report is organized with one chapter providing the full impact and process summary of a specified program. The report is organized as follows:

- Chapter 2 provides general methodology;

- Chapter 3 provides results for the Natural Gas Equipment Rebates Program;

- Chapter 4 provides results for the High Efficiency Homes Program;

- Chapter 5 provides results for the Commercial Solutions Program;

- Chapter 6 provides results for the Home Energy Reports Program;

- Chapter 7 provides results for the Low-Income Savings Home Program;

- Chapter 8 provides results for the Low Flow Showerhead & Faucet Aerator Program;

- Appendix A provides the site-level custom reports for the Commercial Solutions Program.

# 2. General Methodology

This section details general impact evaluation methodologies by program-type as well as data collection methods applied. This section will present full descriptions of:

- Gross Savings Estimation;

- Sampling Methodologies;

- Free ridership determination;

- Process Evaluation Methodologies; and

- Data Collection Procedures.

## 2.1 Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluator provides a glossary of terms to follow:

- Ex Ante – Savings estimates provided by program administrators prior to review from a third party-evaluator (from the Latin for "beforehand")

- Ex Post – Savings estimates reported by an evaluator after the energy impact evaluation has been completed (from the Latin for "from something done afterward")

- Deemed savings – An estimate of an energy savings or demand 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 17.36 therms savings for a low-flow showerhead)

- Gross savings – The change in energy consumption and/or demand that results directly 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* = 15/17.36 = 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

- Spillover – Reductions in energy consumption and/or demand caused by the presence of the energy efficiency program that exceed the program-related gross savings of the participants. There can be participant and/or non-participant spillover rates depending on the rate at which participants (and non-participants) adopt energy efficiency measures

or take other types of efficiency actions on their own (i.e., without an incentive being offered)

- 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 or demand. (e.g., if Free ridership for low-flow showerheads = 50%, net savings = 15 therms x (100% - 50%) = 7.5 therms)

- Net-to-gross-ratio (NTGR) = (1 – Free ridership % + Spillover %), also defined as *net savings / gross savings*

- Ex Ante net savings = Ex Ante gross savings x Ex Ante free ridership rate

- Ex Post net savings = Ex Post gross savings x 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 gross savings x EUL

## 2.2    Overview of Methodology

The proposed methodology for the evaluation of the 2022 Summit DSM Portfolio is intended to provide:

- Net impact results at the 90% confidence and +/-10% precision level, and

- Program feedback and recommendations via process evaluation.

In doing so, this evaluation will provide the verified net savings results, provide recommendations for program improvement, and ensure cost-effective use of ratepayer funds. By leveraging experience and lessons learned from prior evaluations, the 2022 evaluation is streamlined to focus on areas in need of research and improvement.

## 2.3    Sampling

Sampling is necessary to evaluate savings for the Summit DSM portfolio insomuch as verification of a census of program participants is typically cost-prohibitive. Samples are drawn in order to ensure 90% confidence at the +/- 10% precision level. Programs are evaluated on one of three bases:

- Census of all participants
- Simple random sample
- Stratified random sample

## 2.4    Census of Participants

A census of participant data was used for programs where such review is feasible. For example, the Home Energy Reports program's savings estimates are based on a regression model that incorporates billing data for a census of program recipients. Programs that received analysis of a census of participants include:

- Home Energy Reports

- Commercial & Industrial Solutions – Custom Component

## 2.5    Simple Random Sampling

For programs with relatively homogenous measures (largely in the residential portfolio), the Evaluator conducted a simple random sample of participants. The sample size for verification surveys is calculated to meet 90% confidence and 10% precision (90/10). The sample size to meet 90/10 requirements is calculated based on the coefficient of variation of savings for program participants. Coefficient of variation (CV) is defined as:

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

Where x is the average therms savings per participant. Without data to use as a basis for a higher value, it is typical to apply a CV of .5 in residential program evaluations. The resulting 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 = Required precision, 10% in this evaluation

With 10% required precision (RP), this calls for a sample of 68 for programs with a sufficiently large population. However, in some instances, programs did not have sufficient participation to make a sample of this size cost-effective. In instances of low participation, the Evaluator then applied a finite population correction factor, defined as:

$$n = \frac{n_0}{1 + {n_0}/{N}}$$

Where,

  $n_0$ = Sample required for large population

N = Size of population

n = Corrected sample

For example, if a program were to have 100 participants, the finite population correction would result in a final required sample size of 41. The Evaluator applied finite population correction factors in instances of low participation in determining samples required for surveying or onsite verification. Programs subject to *simple random sampling* include:

- Heating System Rebates – Residential,

- Water Heating Rebates – Residential, and

- Low Flow Showerhead & Faucet Aerator Program.

## 2.6    Free Ridership

In determining Ex Post net savings for the Summit DSM portfolio, the Evaluator provides estimates of free ridership for individual programs. Free riders are program participants that would have implemented the same energy efficiency measures at nearly the same time absent from the program. As per TRM guidelines, free riders are defined as:

> "…program participants who received an incentive but would have installed the same efficiency measure on their own had the program not been offered. This includes partial free riders, defined as customers who, at some point, would have installed the measure anyway, but the program persuaded them to install it *sooner* or customers who would have installed the measure anyway, but the program persuaded them to install more efficient equipment and/or more equipment. For the purposes of EM&V activities, participants who would have installed the equipment within one year will be considered full free riders; whereas participants who would have installed the equipment later than one year will not be considered to be free riders (thus no partial free riders will be allowed)."

Given this definition, participants are defined as free riders through a binary scoring mechanism, in being either 0% or 100% free riders.

### 2.6.1  Prescriptive Free Ridership

The general methodology for evaluating free ridership among prescriptive program participants involved examination of four factors:

(1) Demonstrated financial ability to purchase high efficiency equipment absent the rebate.

(2) Importance of the rebate in the decision-making process.

(3) Prior planning to purchase high efficiency equipment.

(4) Importance of the contractor in influencing the decision-making process.

In this methodology, Part (1) is essentially a gateway value, in that if a participant does not have the financial ability to purchase energy efficient equipment absent a rebate, the other components of free ridership become moot. As such, if they could not have afforded the high efficiency equipment absent the rebate, free ridership is scored at 0%. If they did have the financial capability, the Evaluator then examined the other three components. The respondent is determined to be a free rider based upon a preponderance of evidence of these three factors; that is, if the respondent's answers indicate free ridership in two or more of these three components, they are considered free riders. Specific questions and modifications to this general methodology are presented in the appropriate program chapters.

For residential programs, free ridership is calculated as the average score determined for the sample of participants surveyed. This value is then applied to the program-level savings to discount savings attributable to free ridership.

### 2.6.2  Custom Free Ridership

For custom projects from the Commercial Solutions program, free ridership is assessed on a case-study basis, through which the Evaluator conduct an in-depth interview that includes a battery of questions addressing:

- The timing of learning of the program relative to the timing of the planning of the retrofit,

- The impact the program incentive has on measure payback relative to the stated payback requirements by the respondent,

- Whether the respondent learned of the energy efficiency measure from a program-funded audit, and

- Whether any influence the program had in modifying the project affected savings by greater than 50%.

# 3. Natural Gas Equipment Rebates Program

The Natural Gas Equipment Rebates Program provides incentives to customers for high efficiency space and water heating equipment. Eligible measures for this program include:

**Residential:**

- $300 for Gas furnaces with 90%-94.9% AFUE
- $500 for Gas furnaces with 95% or higher AFUE
- $2,000 for placement of electric heating to gas furnaces with 90%-94.9% AFUE
- $2,000 for placement electric heating to gas furnaces with 95% or higher AFUE
- $60 for ENERGY STAR qualified smart thermostats
- $60 for ENERGY STAR qualified smart thermostats intended to be self-installed
- $200 per 100,000 input BTU for larger storage tank water heaters with 88% or greater thermal efficiency
- $500 for tankless water heaters with an EF of 0.80 or greater
- $900 for replacement of electric water heater with natural gas tankless water heaters with an EF of 0.80 or greater
- Up to $300 for replacement of electric to gas cooking ranges
- Up to $450 for replacement of electric to gas clothes dryers

**Non-residential:**

- $300 for Gas furnaces with 90%-94.9% AFUE
- $500 for Gas furnaces with 95% or higher AFUE
- $2,000 for replacement of electric heating to gas furnaces with 90%-94.9% AFUE
- $2,000 for replacement electric heating to gas furnaces with 95% or higher FUE
- $200 per 100,000 input BTU for larger storage tank water heaters with 88% or greater thermal efficiency
- $500 for tankless water heaters with an EF of 0.80 or greater
- $900 for replacement of electric water heater with natural gas tankless water heaters with an EF of 0.80 or greater

The program is targeted at the residential and commercial market sectors and offers incentives for both retrofit and new construction applications. The marketing efforts for the space and

water heating equipment were largely directed at plumbing and HVAC contractors; their involvement is seen as crucial, as they are generally a primary source of information for end-use customers when deciding upon a replacement system.

## 3.1    Program Overview

The Natural Gas Equipment Rebates Program is part of a reorganization of the Summit portfolio to consolidate smaller programs. This program combines the following former programs:

- Space Heating
- Water Heating
- Clothes Dryers
- Cooking Ranges
- Multi-unit Market Transformation

### 3.1.1  Participation Summary

#### 3.1.1.1    Residential Space Heating Participant Summary

The 2022 Natural Gas Equipment Rebates Program had a total of 258 processed rebates for residential space heating. The rebates comprised of:

- 220 single family replacement rebates;
- 23 furnace fuel switch rebates;
- 15 new construction furnace rebates;
    - 4 furnaces installed in small office building, metered as residential; and
- 19 smart thermostats rebates.

Of the 258 furnace replacements included:

- 252 furnaces exceeding 95% AFUE, and
- 6 furnaces between 90-94.99% AFUE.

#### 3.1.1.2    Residential Self-Installed Smart Thermostat Participant Summary

As an additional aspect of the Natural Gas Equipment Rebate Program for 2022, there were a total of 27 stand-alone smart thermostats that were rebated to participants. All the smart thermostat rebates that the program processed were for single-family projects that received $60 as an incentive for self-installation.

### 3.1.1.3    Residential Water Heating Participant Summary

The 2022 Natural Gas Equipment Rebates Program had a total of 61 processed rebates for residential water heating. The rebates are comprised of:

- 54 single family water heater replacement rebates, and

- 7 water heater fuel switch rebates.

All of the 61 residential water heater replacements were tankless water heaters.

There were 7 residential water heater fuel switch rebates and 54 single family (residential) water heater retrofit rebates that were awarded through the Water Heater Fuel Switch and Water Heater Rebate project types, respectively.

### 3.1.1.4    Appliance Participant Summary

Appliance participation comprised:

- 10 cooking ranges, and

- 1 clothes dryer.

### 3.1.1.5    Commercial Participation Summary

There were 91 commercial furnaces rebate in 2022. All 91 commercial furnaces had rated efficiencies of 95% or greater AFUE.

97.8% of commercial rebates were for retrofit projects. 2.2% were for new construction projects. Figure 3-1 summarizes the participation levels by facility type.
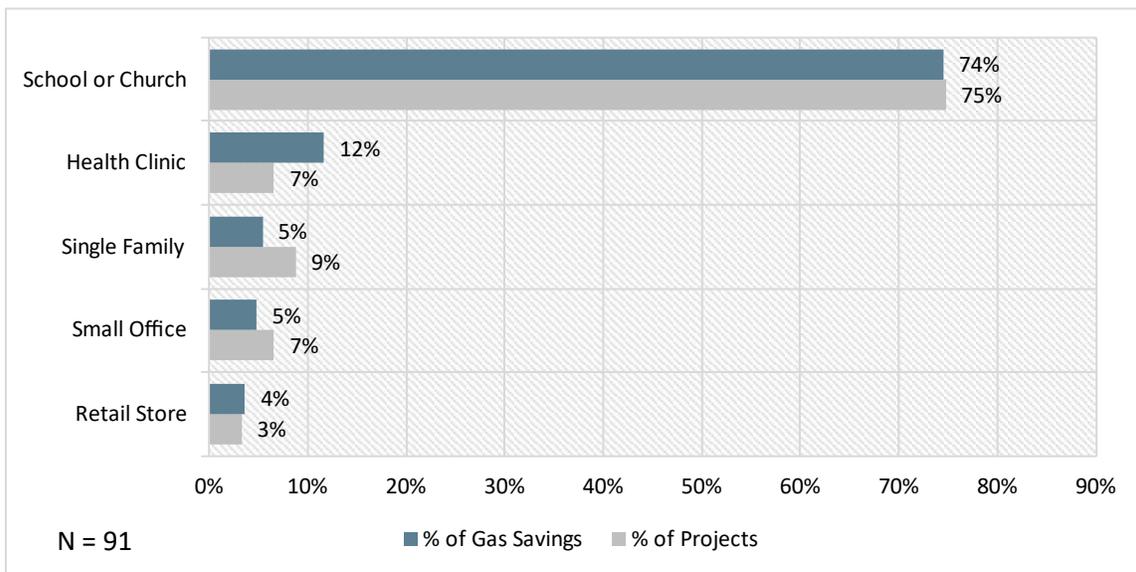


*Figure 3-1 Heating System Rebates Commercial Participation by Facility Type*

The bulk of participation and savings was driven by schools or churches, health clinics, and small business facilities.

There were six commercial water heaters rebated in 2022 that consisted of:

- (5) conventional retrofits; and
- (1) fuel switch rebate.

## 3.2    Impact Evaluation

### 3.2.1  Space Heating Energy Savings Calculations

Savings for residential furnaces are calculated as follows:

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

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

$$therm_{new\ heating\ system} = Heat\ load \times \left(\frac{1}{AFUEnew\ heating\ system}\right)$$

$$Heat\ load = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times site\ area = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times \left(\frac{CAP_H}{30}\right) \times 1.05$$

Where:

*Site area* = square footage of the project site

$CAP_H = \left(\frac{Btu}{hr}\right)$ = Verified heating capacity verified by the Evaluator with AHRI number

$AFUE_{new\ heating\ system}$ = Verified by the Evaluator with AHRI number

Source to site ratio, electric to gas = 3.14

Next the energy use of the removed water heater was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left(\frac{1}{AFUE_{old\ heating\ system}}\right)$$

$$Heat\ load = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times site\ area = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times \left(\frac{CAP_H}{30}\right) \times 1.05$$

Where:

$\left(\frac{\frac{therms}{site\ area}}{yr}\right)$ = 0.233 (Evaluator's estimation, assuming unknown build age)

$CAP_H = \left(\frac{Btu}{hr}\right)$ = rated heating capacity = new furnace heating capacity, see above

$AFUE_{base}$ = 80%

Source to site ratio, electric to gas = 1.05

### 3.2.1.1    Impact of Early Replacement

The method for calculating the impact of early replacement for residential furnaces applies a degradation factor to the performance of a 78 AFUE unit. This is calculated as:

$$AFUE_{base_{early}} = (Base\ AFUE) \times (1 - M)^{age}$$

Where:

$Base\ AFUE$ = efficiency of the existing equipment when new, 78% AFUE
$M$ = maintenance factor, 0.01
$age$ = the age of the existing equipment, in years

Based on the degradation equation and the average age of replaced functional systems of 15.43 years this leads to an early retirement AFUE of:

$$AFUE_{base_{early}} = 0.78 \times (1 - 0.01)^{15.43} = 0.6680$$

The Evaluator applied this baseline to residential retrofits as well as to master-metered multifamily units.

### 3.2.1.2    Net-to-Gross Ratio

The NTGR for the heating equipment rebates residential component are as follows:

- Residential retrofit: 84.95%

- Residential retrofit – multifamily: 84.95%

- Residential new construction (builder production homes): 92.3%

- Residential new construction (custom homes): 48.7%

- Residential fuel switch: 84.95%

- Smart thermostats: 88.90%

Multifamily NTGR is based on the NTGR for the commercial component.

## 3.2.2  Smart Thermostat Energy Savings Calculations

Energy savings values for smart thermostats are calculated as follows:

$$therms_{ex\ post\ savings} = gas\ heating_{default} \times home\ square\ footage$$

Where:

$gas\ heating_{default} = 0.033$ therms per square feet

$home\ square\ footage$ = verified home square footage, or default square footage of 1,484 SF

### 3.2.3   Water Heating Energy Savings Calculations

Energy savings values for storage tank water heaters were developed using installed *energy factor* ratings as determined by the Gas Appliance Manufacturers Association Directory of Certified Water Heating Products. Tank sizing must follow AHRI standards.

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

First the energy use of the new water heater was found.

$therm_{new\ water\ heater} =$

$$\rho \times Cp \times V \times \left(T_{SetPoint} - T_{Supply}\right) \times \frac{1}{EF_{Post}} \times \left(\frac{1}{100,000}\right) \times 1.05$$

Where:

   $\rho$ = Water density = 8.33 lb./gal

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

   $V$ = Calculated estimated annual hot water use (gal) = 21,521 (gal)

   $T_{SetPoint}$ = Water heater set point (124°F for residential, 120°F for commercial)

   $T_{Supply}$ = Calculated average supply water temperature = 63.2°F

   $EF_{Post}$ = Verified *energy factor* of new water heater

   BTU to therms conversion factor = 100,000 $\frac{BTU}{therm}$

   Source to site ratio, gas to gas = 1.05

Energy use of the baseline water heater is calculated with the equation below.

$therm_{baseline\ water\ heater} =$

$$\rho \times Cp \times V \times (TSetPoint - TSupply) \times \frac{1}{EFpre\ electric} \times \left(\frac{1}{100,000}\right) \times 3.14$$

Where:

   $\rho$ = Water density = 8.33 lb./gal

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

   $V$ = Calculated estimated annual hot water use (gal) = 21,521 (gal)

   $T_{SetPoint}$ = Water heater set point (120°F for residential, 120°F for commercial)

   $T_{Supply}$ = Calculated average supply water temperature = 63.2°F

$EF_{post}$ = Verified energy factor of baseline water heater

Volume of water heater = verified water heater's volume, for tankless water heaters the assumed baseline volume is 50 gal

Source to site ratio, gas to gas = 1.05

Source to site ratio, electricity to gas = 3.14

Baseline energy factors are summarized in Table 3-1.

*Table 3-1 Residential Water Heating Baseline Uniform Energy Factors*

| Draw Pattern | Equivalent Gallons | Baseline UEF |
|---|---|---|
| Very Small | 20 | 0.3056 |
| Low | 30 | 0.5412 |
| Medium | 40 | 0.5803 |
| High | 50 | 0.6270 |

### 3.2.3.1 Net-to-Gross Ratio

The Evaluator used 2022 survey results in developing the NTGR for water heaters.

- Residential retrofit: 84.95%

- Residential new construction (builder production homes): 91.70%

- Residential new construction (custom homes): 64.40%

- Residential fuel switch: 84.95%

- Multifamily: 84.95%

Multifamily NTGR is based on the NTGR for the commercial component.

## 3.2.4 Cooking Range Energy Savings Calculations

The energy savings of a gas range are found by subtracting the energy use of the new range from the energy use from the old range.

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

First the energy use of the baseline range was found.

$$therm_{baseline\ electric\ range} = 716 \left(\frac{kWh}{yr}\right) \times 3{,}413 \left(\frac{Btu}{kWh}\right) \times \left(\frac{1}{100{,}000\ \frac{Btu}{therm}}\right) \times 3.14$$

$$therm_{baseline\ gas\ range} = 3{,}986{,}950\ \text{BTU} \times \left(\frac{1}{100{,}000\ \frac{BTU}{therm}}\right) \times 1.05$$

Next the energy use of the newly installed range was found. It is assumed that the installed range uses the same amount of energy as the baseline gas range.

$$\text{therm}_{\text{ex post gas range}} = \text{therm}_{\text{baseline gas range}}$$

Where:

Annual kWh usage of electric range = 716 kWh/yr

Annual BTU usage of gas range = 3,986,950 BTU

kWh to BTU conversion factor = $3413 \frac{\text{BTU}}{\text{kWh}}$

BTU to therms conversion factor = $100,000 \frac{\text{BTU}}{\text{therms}}$

Site-to-source ratio, electricity to gas = 3.14

Site-to-source ratio, gas to gas = 1.05

### 3.2.4.1    Net-to-Gross Ratio

Due to the low participation in the program, the Evaluator used the NTGR from the Oklahoma Natural Gas PY2018 evaluation (80%).

### 3.2.5  Clothes Dryers Energy Savings Calculations

The energy savings of a gas clothes dryer is found by subtraction the energy use of the new dryer from the energy use from the old dryer.

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

First the energy use of the baseline dryer was found.

$$therm_{baseline\ electric\ range} = 942 \left(\frac{kWh}{yr}\right) \times 3,413 \left(\frac{Btu}{kWh}\right) \times \left(\frac{1}{100,000 \frac{Btu}{therm}}\right) \times 3.14$$

$$therm_{baseline\ gas\ range} = 3,216,455 \text{ BTU} \times \left(\frac{1}{100,000 \frac{Btu}{therm}}\right) \times 1.05$$

Next the energy use of the newly installed dryer was found. It is assumed that the installed dryer uses the same amount of energy as the baseline gas dryer.

$$therm_{ex\ post\ gas\ range} = therm_{baseline\ gas\ range}$$

Where:

Annual kWh usage of electric dryer = 942 kWh/yr

Annual BTU usage of gas dryer = 3,216,455 BTU

kWh to BTU conversion factor = $3413 \frac{BTU}{kWh}$

BTU to therms conversion factor = 100,000 $BTU/therm$

Site-to-source ratio, electricity to gas = 3.14

Site-to-source ratio, gas to gas = 1.05

### 3.2.5.1    *Net-to-Gross Ratio*

Due to the low participation in the program, the Evaluator used the net-to-gross ratio from the Oklahoma Natural Gas PY2018 evaluation (80%).

### 3.2.6  Space Heating Energy Savings Calculations

The Evaluator applied AR TRM 9.0 deemed savings parameters in assessing savings of the commercial component.

Savings for commercial furnaces are calculated as follows:

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

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

$$therm_{new\ heating\ system} = Heat\ load \times \left(\frac{1}{AFUEnew\ heating\ system}\right)$$

$$Heat\ load = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times site\ area = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times \left(\frac{CAP_H}{30}\right) \times 1.05$$

Where:

$Site\ area$ = square footage of the project site

$CAP_H = \left(\frac{BTU}{hr}\right)$ = Verified heating capacity verified by the Evaluator with AHRI number

$AFUE_{new\ heating\ system}$ = verified by the Evaluator with AHRI number

Source to site ratio, electric to gas = 3.14

Next the energy use of the removed water heater was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left(\frac{1}{AFUEold\ heating\ system}\right)$$

$$Heat\ load = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times site\ area = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times \left(\frac{CAP_H}{30}\right) \times 1.05$$

Where:

$$\left(\frac{\frac{therms}{site\ area}}{yr}\right) = 0.233 \text{ (Evaluator's estimation, assuming unknown build age)}$$

$$CAP_H = \left(\frac{BTU}{hr}\right) = \text{rated heating capacity = new furnace heating capacity, see above}$$

$AFUE_{base}$ = 80%

Source to site ratio, electric to gas = 1.05

### 3.2.6.1    Impact of Early Replacement

The early retirement procedure described in Section 3.2.1.1 was applied to commercial projects in master-metered multifamily housing.

### 3.2.6.2    Net-to-Gross Ratio

The Evaluator applied the Oklahoma Natural Gas space heating free ridership estimate of 16.4% to the commercial segment. The resulting aggregate NTGR for this group was 83.6%.

### 3.2.7  Water Heating Energy Savings Calculations

Commercial water heater savings calculations incorporate more facility-specific information than the residential methodology. Therm savings for commercial water heaters are calculated as:

$$Therm\ Savings = \frac{\rho * C_P * V * \left(T_{SetPoint} - T_{Supply}\right) * \left(\frac{1}{EF_{pre}} - \frac{1}{EF_{post}}\right) * \frac{Days}{Year}}{100,000 \frac{BTU}{Therm}}$$

Where:

$\rho$ = Water density = 8.33 lb./gal

$C_p$ = Specific heat of water = 1 BTU/lb. °F

$V$ = Calculated estimated annual hot water use

$T_{SetPoint}$ = Water heater set point

$T_{Supply}$ = Calculated average supply water temperature

$EF$ = Verified energy factor of baseline water heater

$Days/Year$ = Days per year of operation

The required facility-specific inputs are volume and days/year. Volume can be calculated based on square footage of the facility or from units served.

Table 3-2 presents the volume and days of usage values for a facility by square footage.  Table 3-3 presents the volume and days of usage values by unit produced or person served.

*Table 3-2 Hot Water Requirements by Facility Size*

| Building Type | Daily Demand (Gallons / Unit / Day) | Unit | Units / 1,000 Sq. Feet | Applicable Days / Year | Gallons / 1,000 Sq. Feet / Day |
|---|---|---|---|---|---|
| Small Office | 1 | Person | 2.3 | 250 | 2.3 |
| Large Office | 1 | Person | 2.3 | 250 | 2.3 |
| Fast Food Rest. | 0.7 | Meal/Day | 784.6 | 365 | 549.2 |
| Sit-down Rest. | 2.4 | Meal/Day | 340 | 365 | 816 |
| Retail | 2 | Employee | 1 | 365 | 2.0 |
| Grocery | 2 | Employee | 1.1 | 365 | 2.2 |
| Warehouse | 2 | Employee | 0.5 | 250 | 1.0 |
| Elementary School | 0.6 | Person | 9.5 | 200 | 5.7 |
| Jr. High/High School | 1.8 | Person | 9.5 | 200 | 17.1 |
| Health | 90 | Patient | 3.8 | 365 | 342 |
| Motel | 20 | Unit (Room) | 5 | 365 | 100.0 |
| Hotel | 14 | Unit (Room) | 2.2 | 365 | 30.8 |
| Other | 1 | Employee | 0.7 | 250 | 0.7 |

*Table 3-3 Hot Water Requirements by Unit or Person*

| Building Type | Size Factor | Average Daily Demand |
|---|---|---|
| Dormitories | Men | 13.1 Gal. per Man |
| | Women | 12.3 Gal. per Woman |
| Hospitals | Per Bed | 90.0 Gal. per Patient |
| Hotels | Single Room with Bath | 50.0 Gal. per Unit |
| | Double Room with Bath | 80.0 Gal. per Unit |
| Motels | # Units: | |
| | Up to 20 | 20.0 Gal. per Unit |
| | 21 to 100 | 14.0 Gal. per Unit |
| | 101 and Up | 10.0 Gal. per Unit |
| Restaurants | Full Meal Type | 2.4 Gal. per Meal |
| | Dive-in Snack Type | 0.7 Gal. per Meal |
| Schools | Elementary | 0.6 Gal. Per Student |
| | Secondary and High School | 1.8 Gal. Per Student |

### 3.2.7.1  Net-to-Gross Ratio

The Evaluator applied the Oklahoma Natural Gas Water Heating free ridership estimate of 16% to the commercial segment. The resulting aggregate NTGR for this group was 84%.

### 3.2.8  Verified Savings

Gross savings are summarized in Table 3-4.

*Table 3-4 Verified Gross Therm Savings*

| Measure Group | Measure Category | Expected Therm Savings | Verified Therm Savings | Realization Rate | EUL | Lifetime Therm Savings |
|---|---|---|---|---|---|---|
| Space Heating | Single-Family Retrofit | 50,149 | 50,149 | 100.0% | 14.5 | 726,916 |
| | NC - Builder | 345 | 345 | 100.0% | 20.0 | 6,909 |
| | NC – Owner/Custom | 555 | 555 | 100.0% | 20.0 | 11,095 |
| | Multifamily | 0 | 0 | N/A | N/A | 0 |
| | Fuel Switch | 10,974 | 10,974 | 100.0% | 14.4 | 157,658 |
| | Smart Thermostats | 1,795 | 1,795 | 100.0% | 11.0 | 19,747 |
| | Self-Install Smart Thermostat | 2,241 | 2,241 | 100.0% | 11.0 | 24,647 |
| Water Heating | Single-Family Retrofit | 1,284 | 1,284 | 100.0% | 20.0 | 25,690 |
| | NC - Builder | 882 | 882 | 100.0% | 20.0 | 17,641 |
| | NC – Owner/Custom | 183 | 183 | 100.0% | 20.0 | 3,663 |
| | Fuel Switch | 1,374 | 1,374 | 100.0% | 20.0 | 27,474 |
| Appliances | Cooking Range | 349 | 349 | 100.0% | 15.0 | 5,230 |
| | Clothes Dryer | 82 | 82 | 14.3% | 16.0 | 1,319 |
| Commercial | Furnace | 18,156 | 18,156 | 100.0% | 20.0 | 363,126 |
| | Smart Thermostats | 210 | 210 | 100.0% | 11.0 | 2,311 |
| | Water Heater | 2,734 | 2,734 | 100.0% | 20.0 | 54,676 |
| | **Overall:** | **91,314** | **91,314** | **100.0%** | **15.9** | **1,448,103** |

Net savings are summarized in Table 3-5.

*Table 3-5 Verified Net Therm Savings*

| Measure Group | Measure Category | NTGR Ex Ante | NTGR Ex Post | Net Annual Savings Ex Ante | Net Annual Savings Ex Post | Net Realization Rate | Net Lifetime Therm Savings |
|---|---|---|---|---|---|---|---|
| Space Heating | Single-Family Retrofit | 84.9% | 84.9% | 42,602 | 42,602 | 100.0% | 617,516 |
| | NC - Builder | 88.9% | 88.9% | 307 | 307 | 100.0% | 6,140 |
| | NC - Owner | 48.7% | 48.7% | 270 | 270 | 100.0% | 5,403 |
| | Multifamily Retrofit | N/A | N/A | 0 | 0 | N/A | 0 |
| | Fuel Switch | 85.0% | 85.0% | 9,323 | 9,323 | 100.0% | 133,930 |
| | Smart Thermostats | 88.9% | 88.9% | 1,596 | 1,596 | 100.0% | 17,555 |
| | Self-Install Smart Thermostat | 88.9% | 88.9% | 1,992 | 1,992 | 100.0% | 21,911 |
| Water Heating | Single-Family Retrofit | 85.0% | 85.0% | 1,091 | 1,091 | 100.0% | 21,823 |
| | NC - Owner | 91.7% | 91.7% | 809 | 809 | 100.0% | 16,177 |
| | NC - Builder | 64.4% | 64.4% | 118 | 118 | 100.0% | 2,359 |
| | Fuel Switch | 85.0% | 85.0% | 1,167 | 1,167 | 100.0% | 23,339 |
| Appliances | Cooking Range | 80.0% | 80.0% | 279 | 279 | 100.0% | 4,184 |
| | Clothes Dryer | 80.0% | 80.0% | 66 | 66 | 100.0% | 1,055 |
| Commercial | Furnace | 70.3% | 70.3% | 12,769 | 12,769 | 100.0% | 255,387 |
| | Smart Thermostats | 70.3% | 70.3% | 148 | 148 | 100.0% | 1,625 |
| | Water Heater | 84.4% | 84.4% | 2,306 | 2,306 | 100.0% | 46,123 |
| | **Overall:** | **82.0%** | **82.0%** | **74,842** | **74,842** | **100.0%** | **1,174,528** |

# 4. High Efficiency Homes Program

The High Efficiency Homes Program provides incentives to new construction home builders. Eligible measures for this program include:

- $1,000 for gas furnaces (primary source) with 95% or higher AFUE,

- Natural gas water heating, and

- At least one additional natural gas burner tip.

## 4.1 Program Overview

The High Efficiency Homes Program is designed to encourage new home builders to choose energy efficient natural gas water heating and space heating equipment. The program is marketed to consumers, builders, and developers through local publication, bill inserts, various media avenues, and direct contact.

## 4.2 Participation Summary

In 2022, program participation consisted of 45 total furnaces – all furnaces were rated at 95% AFUE or greater.

There were no rebates for furnaces with a 90 – 94.9% AFUE, water heaters, smart thermostats, or natural gas burner tips.

## 4.3 Impact Evaluation

### 4.3.1 Space Heating Energy Savings Calculations

Savings for residential furnaces are calculated as follows:

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

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

$$therm_{new\ heating\ system} = Heat\ load \times \left( \frac{1}{AFUEnew\ heating\ system} \right)$$

$$Heat\ load = \left( \frac{\frac{therms}{site\ area}}{yr} \right) \times site\ area = \left( \frac{\frac{therms}{site\ area}}{yr} \right) \times \left( \frac{CAP_H}{30} \right) \times 1.05$$

Where:

*Site area* = square footage of the project site

$CAP_H = \left( \frac{BTU}{hr} \right)$ = verified heating capacity verified by the Evaluator with AHRI number

$AFUE_{new\ heating\ system}$ = verified by the Evaluator with AHRI number

Source to site ratio, electric to gas = 3.14

Next the energy use of the removed heater was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left(\frac{1}{AFUE_{old\ heating\ system}}\right)$$

$$Heat\ load = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times site\ area = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times \left(\frac{CAP_H}{30}\right) \times 1.05$$

Where,

$\left(\frac{\frac{therms}{site\ area}}{yr}\right)$ = 0.233 (Evaluator's estimation, assuming unknown build age)

$CAP_H = \left(\frac{BTU}{hr}\right)$ = rated heating capacity = new furnace heating capacity, see above

$AFUE_{base}$ = 80%

Source to site ratio, electric to gas = 1.05

### 4.3.2   Net-to-Gross Ratio

The net-to-gross rates for the High Efficiency Homes Program was 92.3%.

### 4.4   Verified Savings

Gross therms are summarized in Table 4-1.

*Table 4-1 Gross Therm Savings*

| Measure | Expected Therm Savings | Verified Therm Savings | Gross Realizations Rate | Lifetime Therm Savings |
|---|---|---|---|---|
| Total Gross Savings | 5,888 | 5,888 | 100.0% | 117,770 |

Net savings are summarized in Table 4-2.

*Table 4-2 Net Therm Savings*

| Measure | NTGR | | Net Annual Savings | | Net Realization Rate | Net Lifetime Therm Savings |
|---|---|---|---|---|---|---|
| | Ex Ante | Ex Post | Ex Ante | Ex Post | | |
| Total Net Savings | 92.3% | 92.3% | 5,435 | 5,435 | 100.0% | 108,702 |

# 5. Commercial Solutions Program

The Commercial Solutions Program is directed at developing and incenting custom energy efficiency projects for which deemed values are not applicable or feasible. It is implemented by CLEAResult Consulting on behalf of Summit. CLEAResult handles program administration, marketing and outreach, direct installation of water conservation and air infiltration measures, and technical review of custom efficiency projects. Program participants are provided:

(1) No-cost direct installation of low-flow faucet aerators, showerheads, door air infiltration and pre-rinse spray valves (PRSVs), if they have gas water heating or comfort heating;

(2) Prescriptive incentives for boiler and food service measures; and

(3) $0.95 per therm for custom projects.

## 5.1 Commercial Solutions Program Overview

The Commercial Solutions Program is designed to provide no-cost direct installation of water saving and comfort heating measures, energy audits, and incentives for custom projects. The Commercial Solutions Program participants fall into one of four categories:

- Direct install,

- Prescriptive,

- Custom audit recipients, and

- Closed custom projects.

In 2022, custom projects accounted for 43.9% of program savings and direct install accounted for 56.1%. These participants are detailed in the subsections to follow.

### 5.1.1 Direct Install Participation Summary

In 2022, 16 distinct premises participated in the direct install component of Commercial Solutions Program. Automotive facilities accounted for the majority (59.9%) of the program component savings while the other two facility types, manufacturing and industrial equipment supply, accounted for 20.6% and 19.5% of program component savings, respectively. Figure 5-1 summarizes the participation by facility type, quantified in percent of participation as well as percent of total savings by facility type.
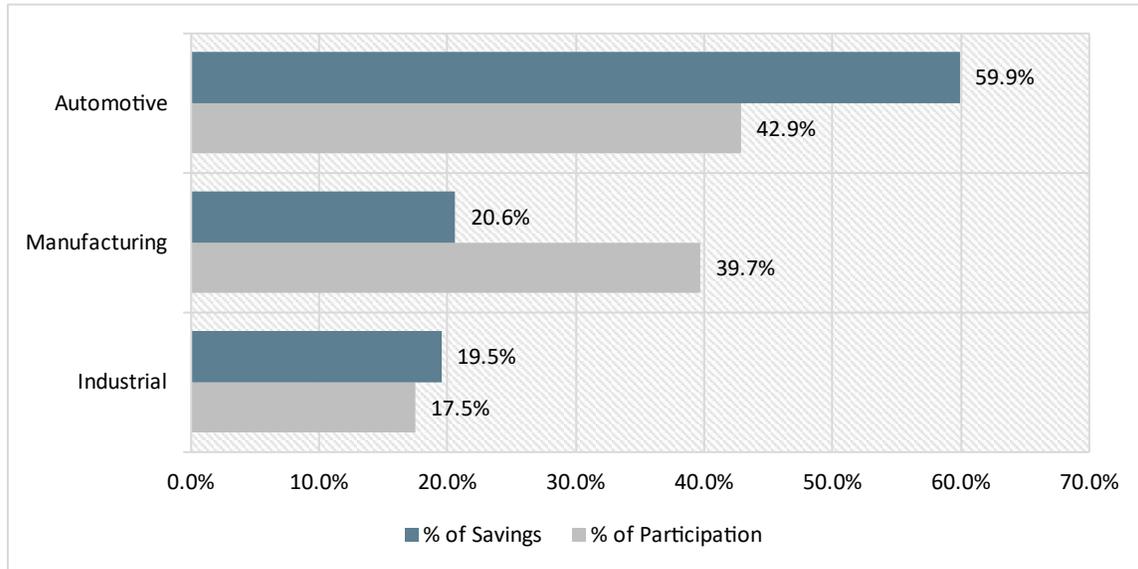
*Figure 5-1 Commercial Solutions Direct Install Participant Summary by Facility Type*

The number of measures is consistent with the number of rebates issued through the program. In 2022, there were 20 rebates issued through the Direct Install category. Overhead door weather stripping (OHD WS) accounted for the majority (98.5%) of the program savings while the remainder of the savings (1.5%) were from weather stripping (WS).

Figure 5-2 summarizes the participation by measure type, quantified in percent of measure type as well as percent of total savings.
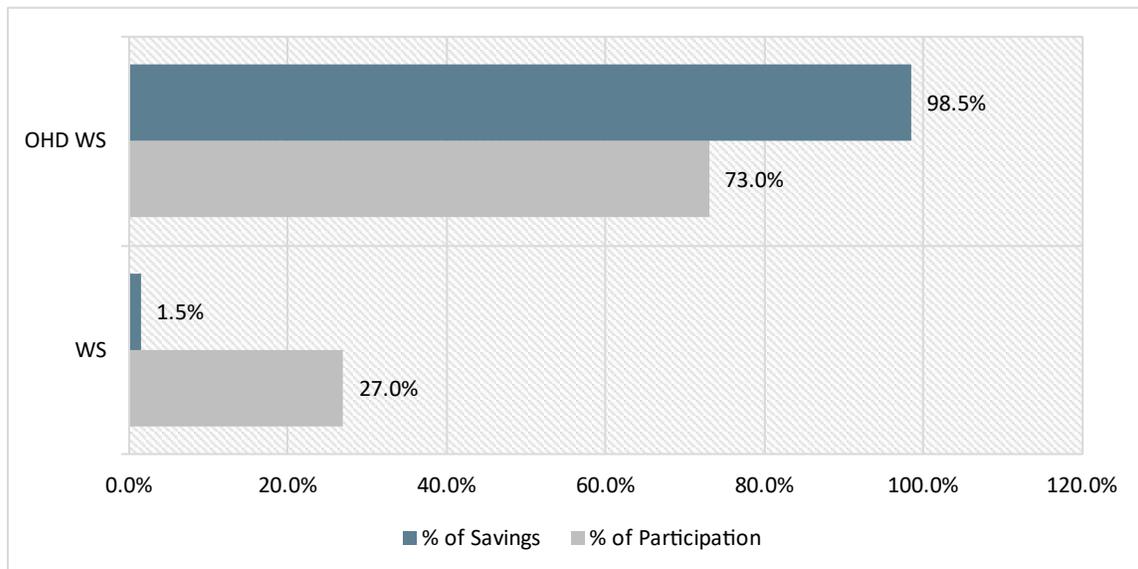


*Figure 5-2 Commercial Solutions Direct Install Participant Summary by Measure Type*

Additionally, compared to PY2022, the types of business that participated in the direct install program were less diverse and almost completely automotive (92.2%). The only other type of business was manufacturing (7.8%).

### 5.1.2  Prescriptive Participation Summary

#### 5.1.2.1    Boilers

In 2022, the Commercial Boiler Program did not have any program participation.

#### 5.1.2.2    Food Service

In 2022, the Food Service Program did not have any program participation.

## 5.2    Commercial Solutions Custom Impact Evaluation

The impact evaluation of the Commercial Solutions Program included the following:

- *Custom Project M&V*. The Evaluator conducted project-specific M&V on a census of the seven projects completed through the Commercial Solutions Program (accounting for 100% of program custom savings). Each project included an M&V plan and project-specific report. The reports are provided in Appendix A.

## 5.3    Commercial Solutions Direct Install Impact Evaluation

### 5.3.1  Energy Savings Calculations

The AR TRM 9.0 includes commercial faucet aerators, pre-rinse spray valves, low-flow showerheads, and weather stripping. The evaluation of the Commercial Solutions program incorporated these deemed values. They are detailed in the subsections to follow. Direct Install projects completed in PY2022 included the installation of weather stripping only.

#### 5.3.1.1    Weather Stripping

Deemed savings calculations for weather stripping were based upon:

- Air infiltration,
- Cooling and heating equivalent full-load hours, and
- Change in temperature between interior and exterior spaces.

Savings are calculated as follows:

$$Annual\ therms =$$

$$\frac{\left(CFM_{pre,day} * Hours_{day} + CFM_{pre,night} * Hours_{night}\right)\left(CFM_{reduction} * 1.08 * \Delta T * \frac{1.0kW}{ton}\right)}{80\%\ AFUE * \frac{100,000Btu}{therm}}$$

$$Peak\ therms = Annual\frac{therms}{ELFH_H}$$

The inputs for this equation are defined in Table 5-2.

*Table 5-1 DI Weather Stripping Savings Calculation Parameters*

| Parameter | Description | Value |
|---|---|---|
| $CFM_{pre}$ | Calculated pre-retrofit air infiltration rate (ft³/min) | |
| CFMreduction | Average infiltration reduction | 79% |
| ΔT | Change in temperature across gap barrier | |
| $Hours_{day}$ | 12-hour cycles per day, per month | 4,380 hours |
| $Hours_{night}$ | 12-hour cycles per day, per month | 4,380 hours |
| $EFLH_H$ | Average heating equivalent full-load hours | Table 5-3 |

*Table 5-2 EFLH$_H$ By Weather Zone*

| Building Type | Zone 6 | Zone 7 | Zone 8 | Zone 9 |
|---|---|---|---|---|
| Assembly | 575 | 798 | 855 | 824 |
| College/University | 630 | 874 | 936 | 902 |
| Fast Food Restaurant | 288 | 440 | 474 | 455 |
| Full Menu Restaurant | 181 | 328 | 370 | 336 |
| Grocery Store | 688 | 935 | 995 | 965 |
| Health Clinic | 646 | 885 | 922 | 895 |
| Lodging | 389 | 587 | 635 | 605 |
| Large Office (>30k Sq. Ft.) | 811 | 1,014 | 1,054 | 1,036 |
| Small Office (≤30k Sq. Ft.) | 353 | 538 | 568 | 538 |
| Religious Worship | 537 | 745 | 798 | 769 |
| Retail | 780 | 1,041 | 1,131 | 1,099 |
| School | 774 | 1,026 | 1,089 | 1,064 |

These values translate into per linear foot savings values by weather zone, detailed in Table 5-4.

*Table 5-3 Deemed Annual Therms Savings per Linear Foot*

| Weather Zone | Gap Width (inches) | | | |
|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 |
| Zone 9 | 5.34 | 10.80 | 21.43 | 32.16 |
| Zone 8 | 4.64 | 9.38 | 18.62 | 27.96 |
| Zone 7 | 3.91 | 7.92 | 15.71 | 23.58 |
| Zone 6 | 2.89 | 5.86 | 11.62 | 17.44 |

## 5.4     Net-to-Gross Ratios

The Evaluator applied the Oklahoma Natural Gas NTGR of 97.9% for Direct Install projects.

The Evaluator applied NTGR of 100% for custom and prescriptive projects.

## 5.5    Verified Savings

Table 5-9 presents the gross savings results of the evaluation of the 2022 Commercial Solutions Program. Total gross savings summarizes the savings calculations performed by AR TRM 9.0 protocols and custom analyses.

*Table 5-4 Commercial Solutions Verified Therm Savings*

| Component | Measure | Expected Therm Savings | Verified Therm Savings | EUL | Lifetime Therm Savings |
|---|---|---|---|---|---|
| Direct Install | Weather Stripping | 266,956 | 266,956 | 11 | 2,936,521 |
| Custom | Various | 208,566 | 208,566 | 16.8 | 3,506,234 |
| **Total Gross Savings** | | **475,522** | **475,522** | **13.5** | **6,442,755** |

Net savings for the Commercial Solutions program were calculated using free ridership rates based on participant surveys for the direct install and custom components. The resulting net savings are presented in Table 5-10.

*Table 5-5 Commercial Solutions Net Savings Summary*

| Component | NTGR | | Net Annual Savings | | Net Realization Rate | Net Lifetime Therms Savings |
|---|---|---|---|---|---|---|
| | Ex Ante | Ex Post | Ex Ante | Ex Post | | |
| Direct Install | 100.00% | 100.00% | 266,956 | 266,956 | 100.00% | 2,936,521 |
| Custom | 100.00% | 100.00% | 208,566 | 208,566 | 100.00% | 3,506,234 |
| **Overall:** | **100.00%** | **100.00%** | **475,522** | **475,522** | **100.00%** | **6,442,755** |

# 6. Home Energy Reports Program

The Home Energy Reports Program is an educational program run by Oracle, a third-party implementer for Summit. The program provides educational materials to a sample of Summit's residential customers, in which their usage is compared against similar households. The program is designed to encourage behavioral change and program participation on the part of the recipients of the Home Energy Report.

## 6.1    Participation Summary

The Home Energy Reports Program began in October 2011. The program is designed to generate quantifiable behavioral savings that cannot be feasibly attained through standard DSM efforts. The program differs from standard energy conservation marketing efforts in that it provides unique reports to each customer, comparing their gas bills against those of similar-sized homes in their neighborhood. The comparison against their neighbors is intended to have a jarring effect; when informed that their usage is above average, the program theory would assert that they are then driven to engage in conservation behaviors.

Over time, the population of recipients faces attrition. This occurs mostly due to members of the recipient group moving to a new residence. Table 6-1 summarizes the participation counts present for the 2022 program year.

*Table 6-1 Home Energy Reports Number of Accounts*

| Program Year | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 | Total |
|---|---|---|---|---|---|---|
| 2022 | 17,483 | 10,694 | 10,351 | 13,705 | 12,793 | 65,026 |

### 6.1.1  Savings Calculation Methodologies

The post-program regression (PPR) model combines both cross-sectional and time series data in a panel dataset. This model uses only the post-program data, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the participant and control customers. In particular, energy use in calendar month *t* of the post-program period is framed as a function of both the participant variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between participants and controls will be reflected in differences in their past energy use, which is highly correlated with their current energy use. The version we estimate includes monthly fixed effects and interacts these monthly fixed effects with the pre-program energy use variable. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month.

The model specification is as follows:

$$Usage_{it} = \alpha_0 + \beta * treatment_i$$

$$+\alpha_1 * PreUsage_i$$

$$+\alpha_2 * PreUsageSummer_i$$

$$+\alpha_3 * PreUsageWinter_i$$

$$+\gamma * mm_t$$

$$+\delta_1 * mm_t * PreUsage_i$$

$$+\delta_2 * mm_t * PreUsageSummer_i$$

$$+\delta_3 * mm_t * PreUsageWinter_i$$

$$+\varepsilon_{it}$$

Where:

- *i* denotes the *i*th customer

- *t* denotes the first, second, third, etc. month of the post-treatment period

- *Usage$_{it}$* is the average daily use for reading *t* for household *i* during the post-treatment period

- *PreUsage$_i$* is the average daily usage across household *i's* available pre-treatment billing reads

- *mm$_t$* is a vector of month-year dummies

And parameter definitions are:

- $\alpha_0$ is an intercept term

- $\alpha_1, \alpha_2, \alpha_3$ are effects of control variables *PreUsage$_i$*, *PreUsageSummer$_i$*, and *PreUsageWinter$_i$* on *Usage$_{it}$* in the reference month

- $\delta_1, \delta_2, \delta_3$ are the effect of the control variables *PreUsage$_i$*, *PreUsageSummer$_i$*, and *PreUsageWinter$_i$* in each month-year (*mm$_t$*) of the post period

- $\varepsilon_{it}$ is an error term

In this specification, savings are calculated by:

- Savings = ∑ (Treatment Coeff * Number of recipients in month *i* * Number of days in month *i*)

Where:

- Treatment Coeff = Coefficient for treatment parameter (daily use is the dependent variable, a negative value for treatment reflects the difference in therms/day used by the recipient group after report delivery)

- Number of recipients in month $i$ = Total recipients in the Wave, after accounting for attrition, for each month

- Number of days in month $i$ = For month $i$, the number of days in the month

### 6.1.2 Home Energy Report Net Savings

The HER program uses a randomized control trial, comparing recipients to non-recipients. As a result, the savings estimates from the model are net savings estimates, and no further deduction of free ridership is taken.

## 6.2 Model Output Results

Table 6-2 shows the pre-period interval for each wave, based on one year of billing data before the program start date. For each wave, the same interval was found for both recipient and controls groups, which allows for a proper comparison of pre-usage.

*Table 6-2 Pre-period Interval*

| Wave | Start Year/Month | End Year/Month |
|:---:|:---:|:---:|
| 1 | 2010-07 | 2011-09 |
| 2 | 2013-06 | 2014-08 |
| 3 | 2015-11 | 2017-01 |
| 4 | 2018-07 | 2019-09 |
| 5 | 2022-03 | 2023-02 |

### 6.2.1 Wave 1

Table 6-3 provides the model coefficients for the regression of customer billing data in the analysis of Wave 1.

*Table 6-3 Regression Coefficients & Model Details – Wave 1*

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|:---:|:---:|:---:|:---:|:---:|
| Intercept | 0.76 | 0.03 | 28.53 | <0.00001 |
| Treatment | -0.03 | 0.01 | -5.03 | <0.00001 |
| February | 0.14 | 0.01 | 9.92 | <0.00001 |
| March | 0.03 | 0.02 | 1.17 | 0.24 |
| April | 0.62 | 0.02 | 35.90 | <0.00001 |
| May | 0.03 | 0.04 | 0.90 | 0.37 |
| June | -0.28 | 0.04 | -7.28 | <0.00001 |

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|---|---|---|---|---|
| July | -0.62 | 0.04 | -16.08 | <0.00001 |
| August | -0.64 | 0.04 | -16.56 | <0.00001 |
| September | -0.66 | 0.04 | -16.89 | <0.00001 |
| October | -0.61 | 0.04 | -15.75 | <0.00001 |
| November | -0.64 | 0.04 | -16.41 | <0.00001 |
| December | -0.69 | 0.04 | -17.76 | <0.00001 |
| Pre-usage | -0.70 | 0.04 | -17.79 | <0.00001 |
| Pre-summer | -0.39 | 0.04 | -9.96 | <0.00001 |
| Pre-winter | -0.09 | 0.04 | -2.28 | 0.02 |
| Pre-usage: February | -0.15 | 0.02 | -7.81 | <0.00001 |
| Pre-usage: March | -0.07 | 0.02 | -3.72 | 0.00 |
| Pre-usage: April | 0.14 | 0.02 | 6.03 | <0.00001 |
| Pre-usage: May | 0.04 | 0.02 | 1.52 | 0.13 |
| Pre-usage: June | 0.31 | 0.04 | 7.00 | <0.00001 |
| Pre-usage: July | -0.48 | 0.07 | -7.22 | <0.00001 |
| Pre-usage: August | -0.39 | 0.06 | -7.04 | <0.00001 |
| Pre-usage: September | -0.02 | 0.04 | -0.46 | 0.65 |
| Pre-usage: October | 0.10 | 0.02 | 4.42 | <0.00001 |
| Pre-usage: November | -0.02 | 0.02 | -1.08 | 0.28 |
| Pre-usage: December | -0.20 | 0.02 | -9.46 | <0.00001 |
| Pre-summer: February | 0.04 | 0.03 | 1.07 | 0.28 |
| Pre-summer: March | 0.19 | 0.03 | 5.54 | <0.00001 |
| Pre-summer: April | 0.18 | 0.03 | 5.27 | <0.00001 |
| Pre-summer: May | 0.28 | 0.04 | 7.41 | <0.00001 |
| Pre-summer: June | 0.00 | 0.05 | -0.09 | 0.93 |
| Pre-summer: July | 0.66 | 0.07 | 9.06 | <0.00001 |
| Pre-summer: August | 0.61 | 0.06 | 9.49 | <0.00001 |
| Pre-summer: September | 0.32 | 0.05 | 6.96 | <0.00001 |
| Pre-summer: October | 0.19 | 0.03 | 5.55 | <0.00001 |
| Pre-summer: November | 0.07 | 0.03 | 2.00 | 0.05 |
| Pre-summer: December | 0.02 | 0.03 | 0.55 | 0.58 |
| Pre-winter: February | 0.15 | 0.02 | 7.08 | <0.00001 |
| Pre-winter: March | -0.16 | 0.02 | -8.41 | <0.00001 |
| Pre-winter: April | -0.49 | 0.02 | -26.60 | <0.00001 |
| Pre-winter: May | -0.58 | 0.02 | -32.04 | <0.00001 |

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|---|---|---|---|---|
| Pre-winter: June | -0.61 | 0.02 | -33.44 | <0.00001 |
| Pre-winter: July | -0.62 | 0.02 | -34.00 | <0.00001 |
| Pre-winter: August | -0.61 | 0.02 | -33.91 | <0.00001 |
| Pre-winter: September | -0.60 | 0.02 | -32.95 | <0.00001 |
| Pre-winter: October | -0.51 | 0.02 | -27.89 | <0.00001 |
| Pre-winter: November | -0.20 | 0.02 | -10.55 | <0.00001 |
| Pre-winter: December | 0.15 | 0.02 | 6.18 | <0.00001 |
| Adjusted R-Square: 0.766 | | | | |

The resulting annual savings are:

- Annual Savings =

  $\sum$ (0.02873 * Number of customers in month i * Number of days in month i) =

  177,303 Therms

- 95% Confidence Interval: +/- 58,011 (32.7%)

## 6.2.2  Wave 2

Table 6-4 provides the model coefficients for the regression of customer billing data in the analysis of Wave 2.

*Table 6-4 Regression Coefficients & Model Details – Wave 2*

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|---|---|---|---|---|
| Intercept | 0.48 | 0.02 | 19.86 | <0.00001 |
| Treatment | -0.03 | 0.00 | -6.82 | <0.00001 |
| February | -0.30 | 0.03 | -9.81 | <0.00001 |
| March | 0.00 | 0.02 | -0.13 | 0.90 |
| April | 1.04 | 0.03 | 32.26 | <0.00001 |
| May | 0.08 | 0.03 | 2.31 | 0.02 |
| June | -0.13 | 0.03 | -3.78 | 0.00 |
| July | -0.36 | 0.03 | -10.62 | <0.00001 |
| August | -0.39 | 0.03 | -11.44 | <0.00001 |
| September | -0.38 | 0.03 | -11.14 | <0.00001 |
| October | -0.35 | 0.03 | -10.24 | <0.00001 |
| November | -0.36 | 0.03 | -10.66 | <0.00001 |
| December | -0.38 | 0.03 | -11.17 | <0.00001 |

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|---|---|---|---|---|
| Pre-usage | -0.38 | 0.03 | -11.03 | <0.00001 |
| Pre-summer | -0.20 | 0.03 | -5.94 | <0.00001 |
| Pre-winter | 0.02 | 0.03 | 0.59 | 0.55 |
| Pre-usage: February | 0.36 | 0.04 | 9.16 | <0.00001 |
| Pre-usage: March | 0.50 | 0.04 | 13.89 | <0.00001 |
| Pre-usage: April | 0.62 | 0.04 | 17.58 | <0.00001 |
| Pre-usage: May | 0.50 | 0.04 | 12.47 | <0.00001 |
| Pre-usage: June | 0.17 | 0.09 | 1.90 | 0.06 |
| Pre-usage: July | 0.40 | 0.19 | 2.12 | 0.03 |
| Pre-usage: August | 0.54 | 0.10 | 5.24 | <0.00001 |
| Pre-usage: September | 0.38 | 0.04 | 9.58 | <0.00001 |
| Pre-usage: October | 0.51 | 0.04 | 14.14 | <0.00001 |
| Pre-usage: November | 0.41 | 0.03 | 11.87 | <0.00001 |
| Pre-usage: December | 0.42 | 0.04 | 10.82 | <0.00001 |
| Pre-summer: February | -0.08 | 0.03 | -2.30 | 0.02 |
| Pre-summer: March | 0.20 | 0.03 | 5.88 | <0.00001 |
| Pre-summer: April | 0.35 | 0.04 | 10.01 | <0.00001 |
| Pre-summer: May | 0.36 | 0.04 | 7.95 | <0.00001 |
| Pre-summer: June | 0.61 | 0.10 | 6.29 | <0.00001 |
| Pre-summer: July | 0.26 | 0.19 | 1.40 | 0.16 |
| Pre-summer: August | 0.16 | 0.09 | 1.70 | 0.09 |
| Pre-summer: September | 0.35 | 0.04 | 9.54 | <0.00001 |
| Pre-summer: October | 0.21 | 0.03 | 5.96 | <0.00001 |
| Pre-summer: November | 0.08 | 0.03 | 2.52 | 0.01 |
| Pre-summer: December | -0.05 | 0.03 | -1.49 | 0.14 |
| Pre-winter: February | -0.39 | 0.04 | -9.55 | <0.00001 |
| Pre-winter: March | -0.71 | 0.03 | -20.78 | <0.00001 |
| Pre-winter: April | -0.95 | 0.03 | -29.10 | <0.00001 |
| Pre-winter: May | -1.00 | 0.03 | -30.67 | <0.00001 |
| Pre-winter: June | -1.02 | 0.03 | -31.15 | <0.00001 |
| Pre-winter: July | -1.03 | 0.03 | -31.45 | <0.00001 |
| Pre-winter: August | -1.02 | 0.03 | -31.41 | <0.00001 |
| Pre-winter: September | -1.02 | 0.03 | -31.13 | <0.00001 |
| Pre-winter: October | -0.95 | 0.03 | -29.00 | <0.00001 |
| Pre-winter: November | -0.67 | 0.03 | -19.94 | <0.00001 |

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > |T| |
|---|---|---|---|---|
| Pre-winter: December | -0.52 | 0.04 | -12.72 | <0.00001 |
| Adjusted R-Square: 0.784 | | | | |

The resulting annual savings are:

- Annual Savings =

  $\sum$ (0.03375 * Number of customers in month i * Number of days in month i) =

  126,711 Therms

- 95% Confidence Interval: +/- 30,552 (24.1%)

### 6.2.3  Wave 3

Table 6-5 provides the model coefficients for the regression of customer billing data in the analysis of Wave 3.

*Table 6-5 Regression Coefficients & Model Details – Wave 3*

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > |T| |
|---|---|---|---|---|
| Intercept | 0.61 | 0.02 | 34.92 | <0.00001 |
| Treatment | -0.02 | 0.00 | -3.95 | 0.00 |
| February | -0.41 | 0.02 | -24.72 | <0.00001 |
| March | -0.17 | 0.03 | -5.95 | <0.00001 |
| April | 1.45 | 0.02 | 72.61 | <0.00001 |
| May | 0.04 | 0.02 | 1.77 | 0.08 |
| June | -0.19 | 0.02 | -7.68 | <0.00001 |
| July | -0.53 | 0.02 | -21.22 | <0.00001 |
| August | -0.63 | 0.02 | -25.28 | <0.00001 |
| September | -0.60 | 0.02 | -23.96 | <0.00001 |
| October | -0.54 | 0.03 | -21.61 | <0.00001 |
| November | -0.57 | 0.02 | -23.21 | <0.00001 |
| December | -0.60 | 0.02 | -24.03 | <0.00001 |
| Pre-usage | -0.49 | 0.03 | -19.62 | <0.00001 |
| Pre-summer | -0.28 | 0.03 | -10.98 | <0.00001 |
| Pre-winter | -0.06 | 0.02 | -2.28 | 0.02 |
| Pre-usage: February | 0.58 | 0.02 | 25.38 | <0.00001 |
| Pre-usage: March | 0.54 | 0.02 | 23.65 | <0.00001 |
| Pre-usage: April | 0.64 | 0.02 | 28.35 | <0.00001 |

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > |T| |
|---|---|---|---|---|
| Pre-usage: May | 0.69 | 0.03 | 25.61 | <0.00001 |
| Pre-usage: June | 1.08 | 0.07 | 14.38 | <0.00001 |
| Pre-usage: July | 0.36 | 0.11 | 3.40 | 0.00 |
| Pre-usage: August | 0.52 | 0.09 | 5.95 | <0.00001 |
| Pre-usage: September | 0.78 | 0.04 | 21.09 | <0.00001 |
| Pre-usage: October | 0.77 | 0.03 | 27.59 | <0.00001 |
| Pre-usage: November | 0.47 | 0.03 | 18.72 | <0.00001 |
| Pre-usage: December | 0.75 | 0.03 | 29.07 | <0.00001 |
| Pre-summer: February | 0.00 | 0.04 | 0.10 | 0.92 |
| Pre-summer: March | 0.24 | 0.04 | 5.59 | <0.00001 |
| Pre-summer: April | 0.74 | 0.05 | 16.06 | <0.00001 |
| Pre-summer: May | 0.88 | 0.05 | 17.14 | <0.00001 |
| Pre-summer: June | 0.23 | 0.09 | 2.43 | 0.02 |
| Pre-summer: July | 0.78 | 0.10 | 7.88 | <0.00001 |
| Pre-summer: August | 0.70 | 0.09 | 7.54 | <0.00001 |
| Pre-summer: September | 0.56 | 0.06 | 9.81 | <0.00001 |
| Pre-summer: October | 0.39 | 0.05 | 7.98 | <0.00001 |
| Pre-summer: November | 0.25 | 0.04 | 5.77 | <0.00001 |
| Pre-summer: December | 0.18 | 0.04 | 4.44 | <0.00001 |
| Pre-winter: February | -0.61 | 0.02 | -25.59 | <0.00001 |
| Pre-winter: March | -0.89 | 0.02 | -41.40 | <0.00001 |
| Pre-winter: April | -1.29 | 0.02 | -61.54 | <0.00001 |
| Pre-winter: May | -1.40 | 0.02 | -67.69 | <0.00001 |
| Pre-winter: June | -1.42 | 0.02 | -68.57 | <0.00001 |
| Pre-winter: July | -1.43 | 0.02 | -69.14 | <0.00001 |
| Pre-winter: August | -1.43 | 0.02 | -68.97 | <0.00001 |
| Pre-winter: September | -1.42 | 0.02 | -68.55 | <0.00001 |
| Pre-winter: October | -1.33 | 0.02 | -63.90 | <0.00001 |
| Pre-winter: November | -0.90 | 0.02 | -39.82 | <0.00001 |
| Pre-winter: December | -0.94 | 0.03 | -31.97 | <0.00001 |
| Adjusted R-Square: 0.798 | | | | |

The resulting annual savings are:

- Annual Savings =

  $\sum$     (0.01798 * Number of customers in month i * Number of days in month i) =

64,820 Therms

- 95% Confidence Interval: +/- 26,995 (41.6%)

### 6.2.4 Wave 4

Table 6-6 provides the model coefficients for the regression of customer billing data in the analysis of Wave 4.

*Table 6-6 Regression Coefficients & Model Details – Wave 4*

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|---|---|---|---|---|
| Intercept | 0.44 | 0.02 | 29.43 | <0.00001 |
| Treatment | -0.03 | 0.00 | -7.16 | <0.00001 |
| February | -0.30 | 0.03 | -10.29 | <0.00001 |
| March | 0.12 | 0.02 | 5.89 | <0.00001 |
| April | 1.15 | 0.03 | 39.11 | <0.00001 |
| May | 0.06 | 0.02 | 3.08 | 0.00 |
| June | -0.17 | 0.02 | -7.91 | <0.00001 |
| July | -0.36 | 0.02 | -16.91 | <0.00001 |
| August | -0.37 | 0.02 | -17.81 | <0.00001 |
| September | -0.36 | 0.02 | -17.20 | <0.00001 |
| October | -0.35 | 0.02 | -16.73 | <0.00001 |
| November | -0.35 | 0.02 | -16.46 | <0.00001 |
| December | -0.35 | 0.02 | -16.36 | <0.00001 |
| Pre-usage | -0.34 | 0.02 | -15.57 | <0.00001 |
| Pre-summer | -0.24 | 0.02 | -11.21 | <0.00001 |
| Pre-winter | -0.09 | 0.02 | -4.07 | 0.00 |
| Pre-usage: February | 0.54 | 0.03 | 16.25 | <0.00001 |
| Pre-usage: March | 0.68 | 0.03 | 20.98 | <0.00001 |
| Pre-usage: April | 0.94 | 0.03 | 28.29 | <0.00001 |
| Pre-usage: May | 0.74 | 0.04 | 20.73 | <0.00001 |
| Pre-usage: June | 0.53 | 0.05 | 9.68 | <0.00001 |
| Pre-usage: July | 0.34 | 0.09 | 3.72 | 0.00 |
| Pre-usage: August | 0.29 | 0.07 | 4.12 | 0.00 |
| Pre-usage: September | 0.47 | 0.04 | 11.58 | <0.00001 |
| Pre-usage: October | 0.60 | 0.03 | 18.45 | <0.00001 |
| Pre-usage: November | 0.45 | 0.03 | 14.08 | <0.00001 |
| Pre-usage: December | 0.10 | 0.03 | 3.06 | 0.00 |
| Pre-summer: February | 0.04 | 0.03 | 1.26 | 0.21 |

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|---|---|---|---|---|
| Pre-summer: March | 0.18 | 0.03 | 6.21 | <0.00001 |
| Pre-summer: April | 0.11 | 0.03 | 3.37 | 0.00 |
| Pre-summer: May | 0.18 | 0.04 | 4.87 | <0.00001 |
| Pre-summer: June | 0.28 | 0.06 | 4.86 | <0.00001 |
| Pre-summer: July | 0.32 | 0.09 | 3.65 | 0.00 |
| Pre-summer: August | 0.36 | 0.07 | 5.08 | <0.00001 |
| Pre-summer: September | 0.27 | 0.04 | 7.09 | <0.00001 |
| Pre-summer: October | 0.28 | 0.03 | 9.19 | <0.00001 |
| Pre-summer: November | 0.16 | 0.03 | 5.43 | <0.00001 |
| Pre-summer: December | 0.04 | 0.03 | 1.41 | 0.16 |
| Pre-winter: February | -0.59 | 0.03 | -17.01 | <0.00001 |
| Pre-winter: March | -0.89 | 0.03 | -28.53 | <0.00001 |
| Pre-winter: April | -1.11 | 0.03 | -37.14 | <0.00001 |
| Pre-winter: May | -1.13 | 0.03 | -37.88 | <0.00001 |
| Pre-winter: June | -1.13 | 0.03 | -38.10 | <0.00001 |
| Pre-winter: July | -1.13 | 0.03 | -38.19 | <0.00001 |
| Pre-winter: August | -1.13 | 0.03 | -38.19 | <0.00001 |
| Pre-winter: September | -1.13 | 0.03 | -38.05 | <0.00001 |
| Pre-winter: October | -1.10 | 0.03 | -36.81 | <0.00001 |
| Pre-winter: November | -0.76 | 0.03 | -24.14 | <0.00001 |
| Pre-winter: December | -0.21 | 0.03 | -6.06 | <0.00001 |
| Adjusted R-Square: 0.823 | | | | |

The resulting annual savings are:

- Annual Savings =

  $\sum$ (0.02673 * Number of customers in month i * Number of days in month i) =

  124,163 Therms

- 95% Confidence Interval: +/- 28,533 (23.0%)

## 6.2.5  Wave 5

Table 6-7 provides the model coefficients for the regression of customer billing data in the analysis of Wave 5.

Although the treatment coefficient for Wave 5 is not statistically significant, the Evaluator has opted to include the findings for the newly established wave. Like previous waves that were

reported on just after launching (Wave 4 in PY2020), patterns of increased difference in usage between participant and control groups will show over time.

*Table 6-7 Regression Coefficients & Model Details – Wave 5*

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > \|T\| |
|---|---|---|---|---|
| Intercept | 0.41 | 0.02 | 26.12 | <0.00001 |
| Treatment | 0.00 | 0.00 | 1.05 | <0.00001 |
| February | 0.20 | 0.01 | 26.10 | <0.00001 |
| March | 0.14 | 0.02 | 8.24 | <0.00001 |
| April | 0.77 | 0.01 | 102.38 | <0.00001 |
| May | N/A | N/A | N/A | N/A |
| June | N/A | N/A | N/A | N/A |
| July | -0.48 | 0.02 | -22.12 | <0.00001 |
| August | -0.45 | 0.02 | -21.13 | <0.00001 |
| September | -0.35 | 0.02 | -16.28 | <0.00001 |
| October | -0.30 | 0.02 | -14.00 | <0.00001 |
| November | -0.28 | 0.02 | -13.19 | <0.00001 |
| December | -0.30 | 0.02 | -14.01 | <0.00001 |
| Pre-usage | -0.26 | 0.02 | -11.81 | <0.00001 |
| Pre-summer | 0.17 | 0.02 | 7.91 | <0.00001 |
| Pre-winter | 0.68 | 0.02 | 30.90 | <0.00001 |
| Pre-usage: February | N/A | N/A | N/A | N/A |
| Pre-usage: March | N/A | N/A | N/A | N/A |
| Pre-usage: April | -0.01 | 0.01 | -1.07 | 0.28 |
| Pre-usage: May | 0.14 | 0.02 | 7.96 | <0.00001 |
| Pre-usage: June | 0.00 | 0.04 | -0.08 | 0.93 |
| Pre-usage: July | -0.06 | 0.08 | -0.74 | 0.46 |
| Pre-usage: August | -0.03 | 0.04 | -0.84 | 0.40 |
| Pre-usage: September | 0.20 | 0.02 | 8.32 | <0.00001 |
| Pre-usage: October | 0.00 | 0.02 | 0.16 | 0.87 |
| Pre-usage: November | -0.39 | 0.02 | -15.63 | <0.00001 |
| Pre-usage: December | 0.40 | 0.03 | 15.60 | <0.00001 |
| Pre-summer: February | N/A | N/A | N/A | N/A |
| Pre-summer: March | N/A | N/A | N/A | N/A |
| Pre-summer: April | 0.47 | 0.03 | 18.74 | <0.00001 |
| Pre-summer: May | 0.33 | 0.03 | 11.26 | <0.00001 |
| Pre-summer: June | 0.30 | 0.05 | 6.08 | <0.00001 |

| Variable Description | Regression Coefficient | Standard Error | T-Stat | PR > |T| |
|---|---|---|---|---|
| Pre-summer: July | 0.23 | 0.08 | 2.91 | 0.00 |
| Pre-summer: August | 0.19 | 0.04 | 4.48 | <0.00001 |
| Pre-summer: September | 0.07 | 0.03 | 2.42 | 0.02 |
| Pre-summer: October | 0.12 | 0.03 | 4.59 | <0.00001 |
| Pre-summer: November | -0.13 | 0.02 | -5.18 | <0.00001 |
| Pre-summer: December | -0.22 | 0.03 | -8.78 | <0.00001 |
| Pre-winter: February | N/A | N/A | N/A | N/A |
| Pre-winter: March | N/A | N/A | N/A | N/A |
| Pre-winter: April | -0.47 | 0.01 | -46.22 | <0.00001 |
| Pre-winter: May | -0.69 | 0.01 | -73.18 | <0.00001 |
| Pre-winter: June | -0.73 | 0.01 | -77.93 | <0.00001 |
| Pre-winter: July | -0.75 | 0.01 | -80.29 | <0.00001 |
| Pre-winter: August | -0.76 | 0.01 | -80.79 | <0.00001 |
| Pre-winter: September | -0.75 | 0.01 | -79.21 | <0.00001 |
| Pre-winter: October | -0.58 | 0.01 | -54.30 | <0.00001 |
| Pre-winter: November | 0.21 | 0.02 | 9.30 | <0.00001 |
| Pre-winter: December | -0.33 | 0.03 | -10.96 | <0.00001 |
| Adjusted R-Square: 0.844 | | | | |

The resulting annual savings are:

- Annual Savings =

    $\sum$ (-0.00394 * Number of customers in month i * Number of days in month i) =

    -16,087 Therms

- 95% Confidence Interval: +/- 25,285 (157.2%)

The negative sign in the annual savings denotes an increase in gas usage.

## 6.3 Group Comparison

The difference in consumption between the recipient and control groups is observable when presented graphically. Figure 6-1 presents the monthly differences in consumption between the two groups. Reports were first delivered in October of 2011, and at that point, the magnitude of difference in consumption increases. Further, the difference in use between the recipient and control group increases every year thereafter.
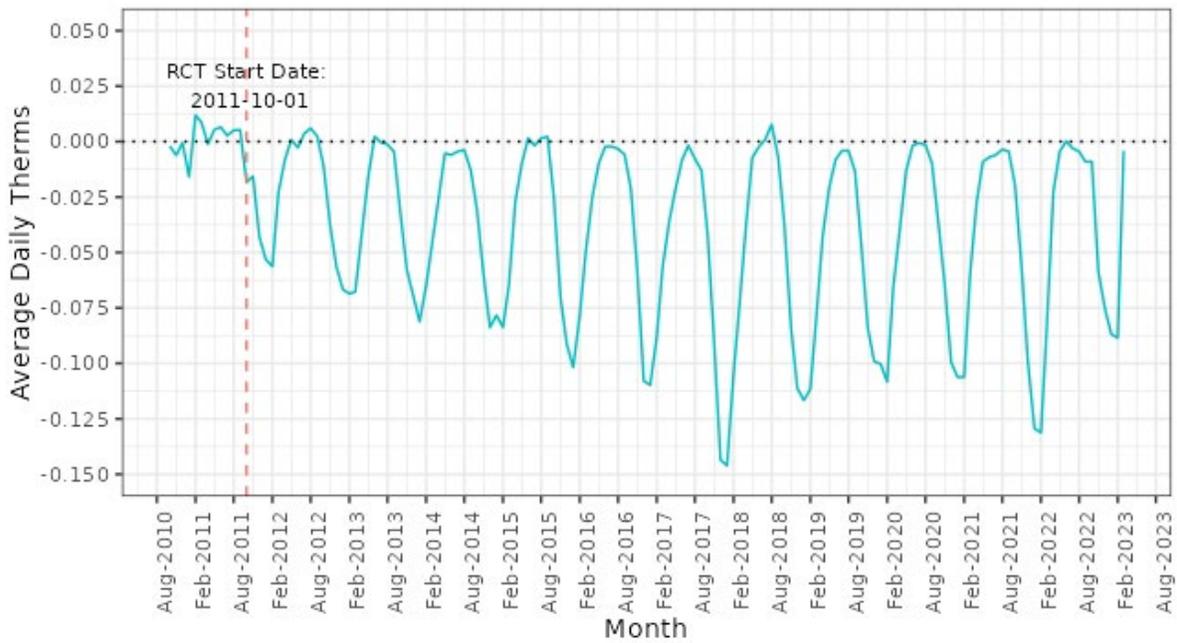
*Figure 6-1 Daily Consumption between Recipient & Control Group – Wave 1*

Similar representations for Wave 2, Wave 3, Wave 4, and Wave 5 are presented in Figure 6-2, Figure 6-3, Figure 6-4, and Figure 6-5 respectively. The impacts of the reports for Wave 3, Wave 4, and Wave 5 are somewhat lower than Wave 1 and 2. Wave 1 and Wave 2 show a pattern of increased difference in usage between participant and control groups over time, where this pattern is slowly starting to become recognizable in Wave 3, Wave 4, and Wave 5.

*Figure 6-2 Daily Consumption between Recipient & Control Group – Wave 2*



*Figure 6-3 Daily Consumption between Recipient & Control Group – Wave 3*
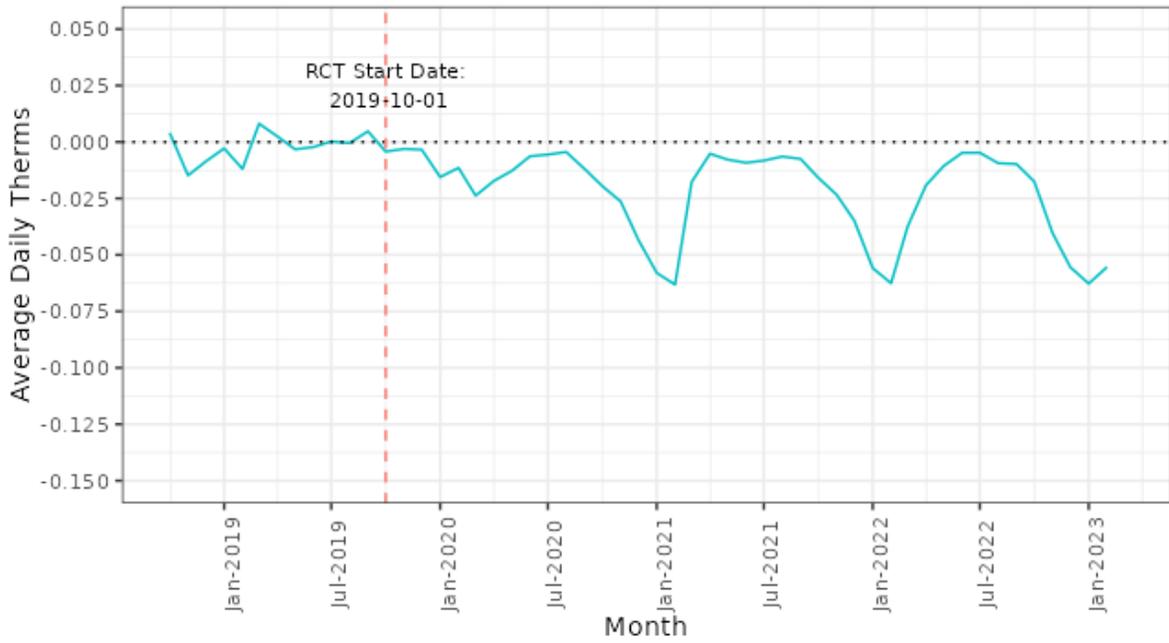
*Figure 6-4 Daily Consumption between Recipient & Control Group – Wave 4*
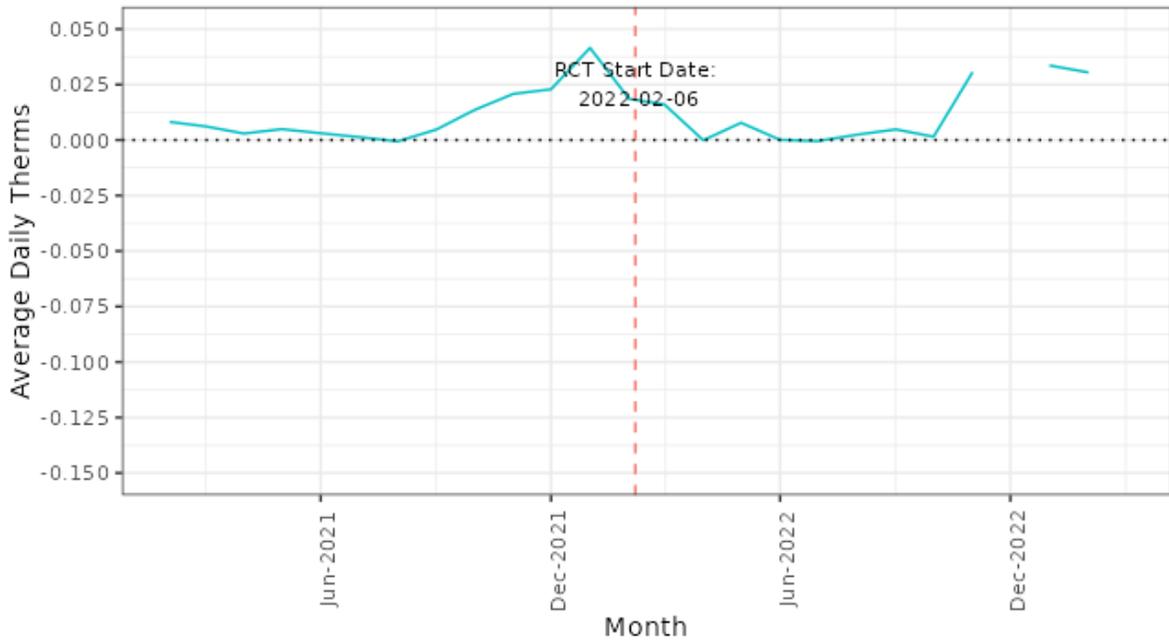


*Figure 6-5 Daily Consumption between Recipient & Control Group – Wave 5*
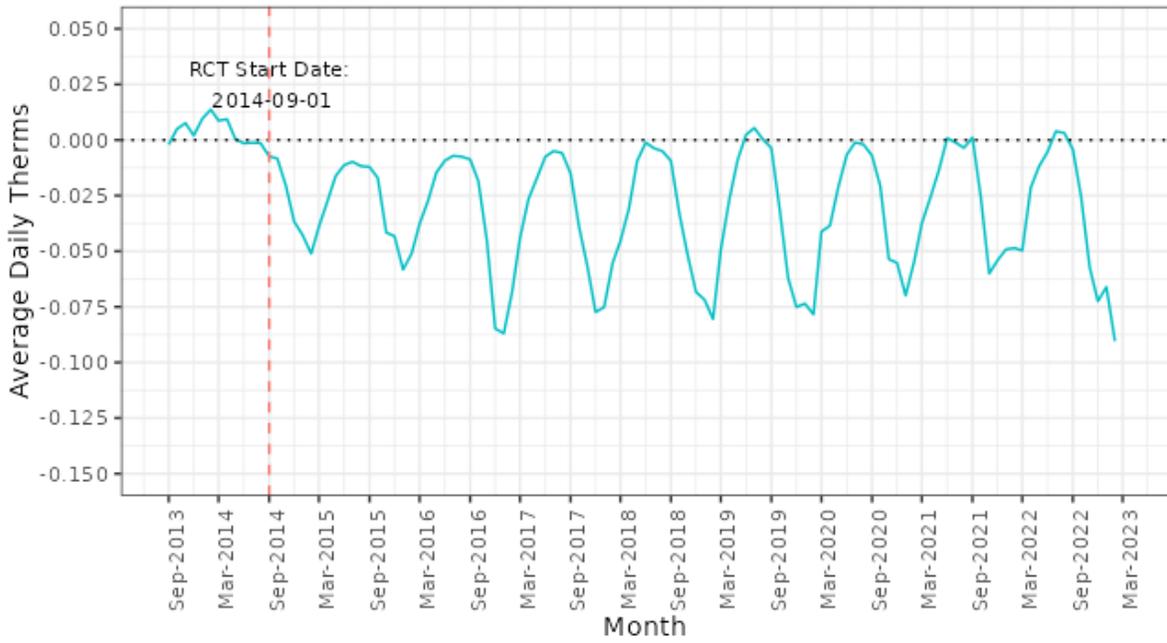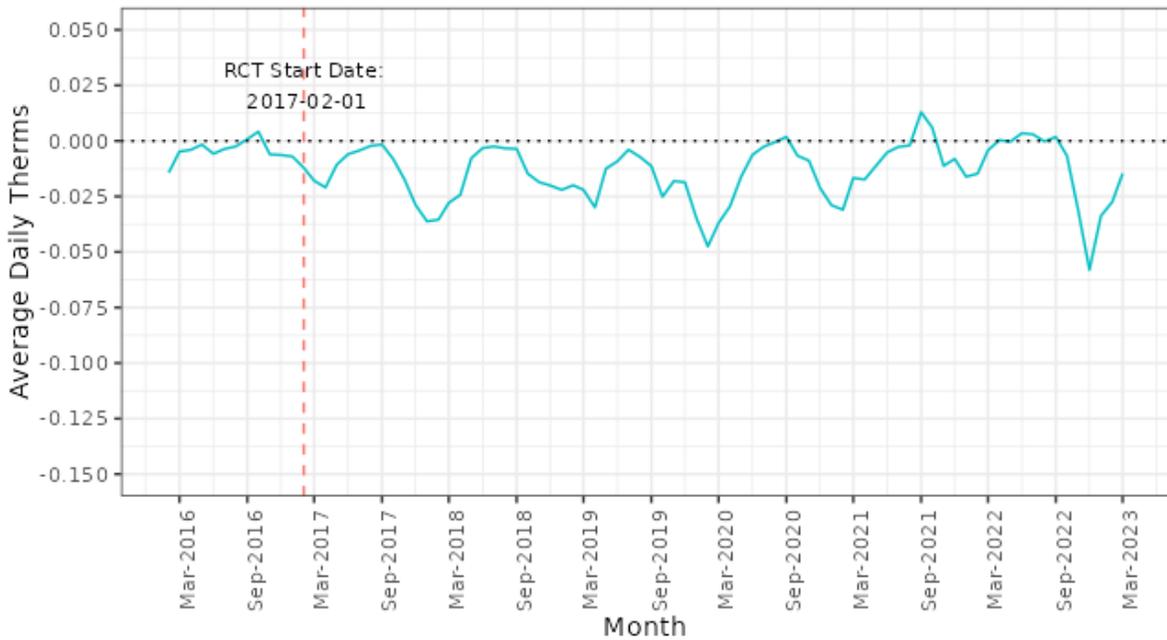
## 6.4    Per-Customer Performance

The annual savings per recipient for each wave is shown in Figure 6-5. In PY2022, Wave 2 had the highest savings at 12.33 therms per recipient. The savings for Wave 1 were 10.49 therms. The savings for Wave 3 were 6.57 therms. Wave 4 had savings of 9.76 therms per participant. Finally, the Wave 5 savings were -1.21 therms, with the negative sign in the value denoting an actual increase in gas usage. Additionally, Waves 1 – 4 outperformed savings from PY2021.

Of all the PY2022 waves, Wave 3 had the lowest savings.



*Figure 6-6 Savings per Recipient*

Table 6-7 shows the savings per recipient for each wave at the both the lower and upper boundaries of the 95% confidence interval. Additionally, the annual pre-period usage per recipient and the percent of annual usage is provided below. The savings for each wave were calculated in the 1.41 – 1.74% range, consistent with expected general program performance and program performances in previous years.

*Table 6-8 Pre-Period Usage per Recipient and Percent of Annual*

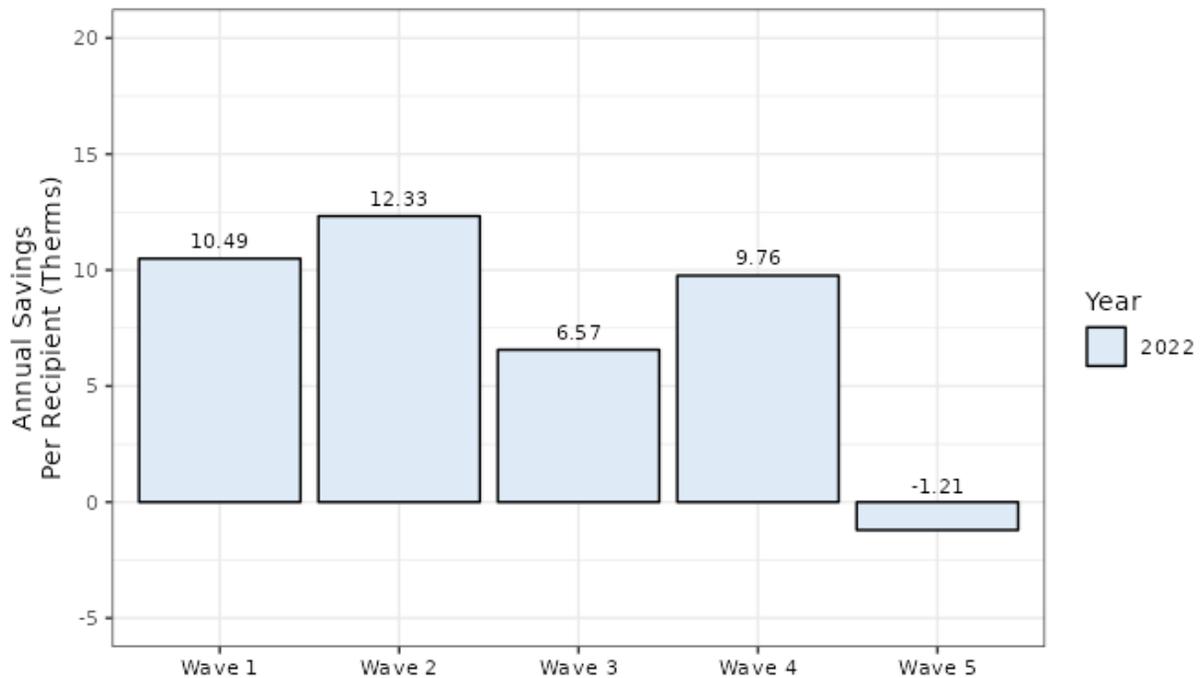| Wave | Annual Savings per Recipient | Annual Savings (Lower 95% CI) | Annual Savings (Upper 95% CI) | Annual Pre-Period Usage per Recipient | Percent Weight of Total Participants | Percent of Annual Therms |
|---|---|---|---|---|---|---|
| 1 | 10.50 | 6.40 | 14.59 | 744.07 | 36.69% | 1.41% |
| 2 | 12.33 | 8.78 | 15.87 | 728.27 | 15.68% | 1.69% |
| 3 | 6.57 | 3.31 | 9.82 | 439.61 | 13.75% | 1.49% |
| 4 | 9.76 | 7.09 | 12.44 | 559.89 | 17.58% | 1.74% |
| 5 | -1.21 | -3.46 | 1.05 | 352.43 | 16.30% | -0.34% |
| **All** | **8.21** | **4.86** | **11.50** | **603.49** | - | **1.36%** |

## 6.5    Double Counting Analysis

Protocol J in AR TRM 9.0 specifies double counting as the difference in per-participant other-program savings.

Double counted savings is the difference in other-program-savings for the recipient and control groups, and this difference is subtracted from a behavioral program estimate to avoid double counting. If a program has more recipients than non-recipients in the analysis, then taking the straight sum of savings from other-program-savings would dramatically inflate the double counting effect.

However, double counted savings could not be verified for PY2022. The Evaluator noted that the cross-referencing file that is usually provided did not have the needed fields to help map customers across program data and billing data.

Taking the same approach that was taken for PY2021, the Evaluator calculated the average percent difference between the ex post savings before a double count analysis and the ex post savings after a double count analysis. Program Years 2018, 2019, and 2020 had an average percent difference of -1.70%. In all three years, the double counted ex post savings were more than the ex post savings before the double count.

Table 6-8 shows the calculated PY2022 program savings after adjusting for double counting.

*Table 6-9 PY2022 Program Savings Before and After Double Counting*

| Program Year | Ex post Therms Before Double Counting | Percent Difference | Ex post Therms After Double Counting |
|---|---|---|---|
| 2022 | 476,910 | + 1.70% | 485,038 |

Although the double counted savings are provided above, the Evaluator believes that the conservative approach for PY2022 is to report the ex post therms before double counting since the appropriate method of double counting was not possible to perform with the mapping file that was provided this year.

## 6.6    Verified Savings

The Home Energy Reports Program has 476,910 annual therms savings in 2022, shown in Table 6-9.

*Table 6-10 HER Program Savings*

| Ex-ante Therms | Ex post Therms | Realization Rate | 95% Confidence Therms | Precision |
|---|---|---|---|---|
| 476,910 | 476,910 | 100.0% | 169,377 | 9.4% |

The overall program realization rate for PY2022 is 100.0%.

Additionally, the overall program savings are shown on a per-wave basis in Table 6-10 where the lower and upper bounds at the 95% confidence interval are calculated.

*Table 6-11 HER Program Savings at 95% Confidence*

| Wave | Weighted Number of Participants | Ex post Therms | Ex post Therms (Lower 95% CI) | Ex post Therms (Upper 95% CI) |
|---|---|---|---|---|
| 1 | 17,483 | 177,303 | 119,292 | 235,313 |
| 2 | 10,694 | 126,711 | 96,159 | 157,264 |
| 3 | 10,351 | 64,820 | 37,825 | 91,816 |
| 4 | 13,705 | 124,163 | 95,630 | 152,697 |
| 5 | 12,793 | -16,087 | -41,373 | 9,198 |
| **All** | **65,026** | **476,910** | **307,533** | **646,287** |

Table 6-11 summarizes the annual gross and net savings by wave.

*Table 6-12 Therms Savings Summary by Wave*

| Wave | Number of Total Participants | Annual Therms Usage | Ex post Savings | Savings as a Percent of Annual |
|---|---|---|---|---|
| 1 | 17,483 | 13,008,527 | 177,303 | 1.41% |
| 2 | 10,694 | 7,788,153 | 126,711 | 1.69% |
| 3 | 10,351 | 4,550,427 | 64,820 | 1.49% |
| 4 | 13,705 | 7,673,327 | 124,163 | 1.74% |
| 5 | 12,793 | 4,508,683 | -16,087 | -0.34% |
| **All** | **65,026** | **33,020,433** | **476,910** | **1.49%** |

When aggregating across all waves, the Evaluator found that the overall 95% confidence interval was ± 9.4% of program savings. In addition, across all waves, the overall program savings were 1.49% of annual usage.

# 7. Low-Income Saving Homes Program

The Low-Income Saving Homes Program (LISHP) provides weatherization services to hard-to-reach customers. The program is administered in partnership with Public Service Company of Oklahoma (PSO).

Direct install measures include:

- Water heater pipe insulation, and
- Water heater jackets.

Weatherization measures include:

- Air infiltration,
- Duct sealing, and
- Ceiling insulation.

The program is implemented by Titan ES in partnership with PSO.

## 7.1    Program Background

The LISHP is intended to be primarily vendor-driven program, with the marketing targeted at contractors in the Summit Energy service territory.

## 7.2    Participation Summary

The LISHP had 228 participants in PY2022, and a total of 612 energy efficiency improvements were installed overall.

Figure 7-1 summarizes the share of program savings contributed by each measure. Most of the program savings were generated by duct sealing, ceiling insulation, and air infiltration.
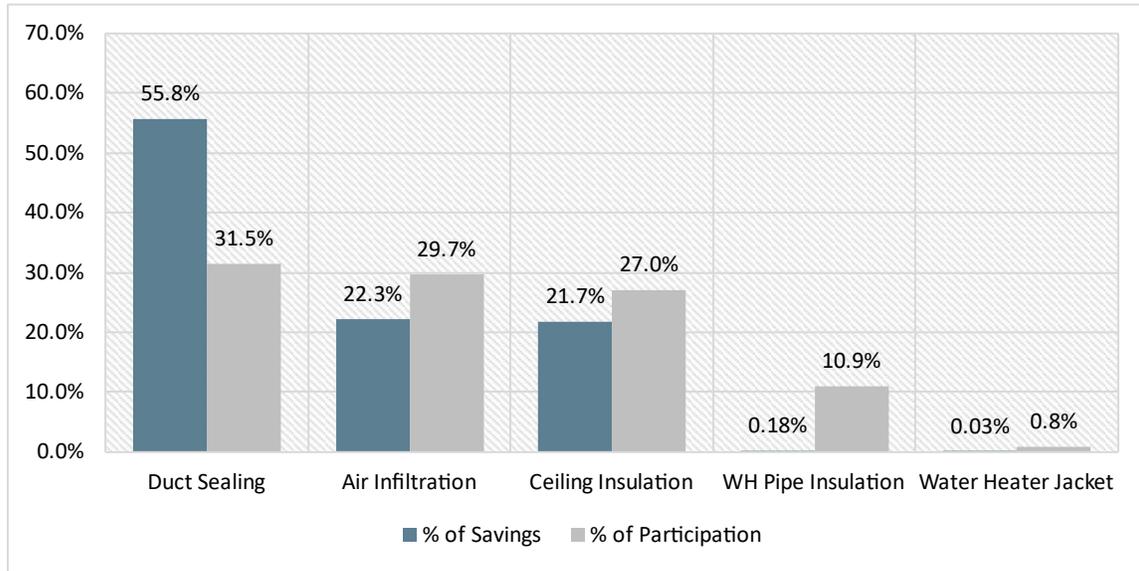
*Figure 7-1 Program Summary by Savings Share and Participation*

In addition, incentives were provided for 201 Health & Safety assessment measures at 201 homes. These types of Health & Safety measures included carbon monoxide detectors and vent pipe installations to improve home air flow quality.

### 7.2.1  Participation Timing

Figure 7-2 summarizes the premises by month as determined by the date of rebate delivery as well as the cumulative savings from the program.
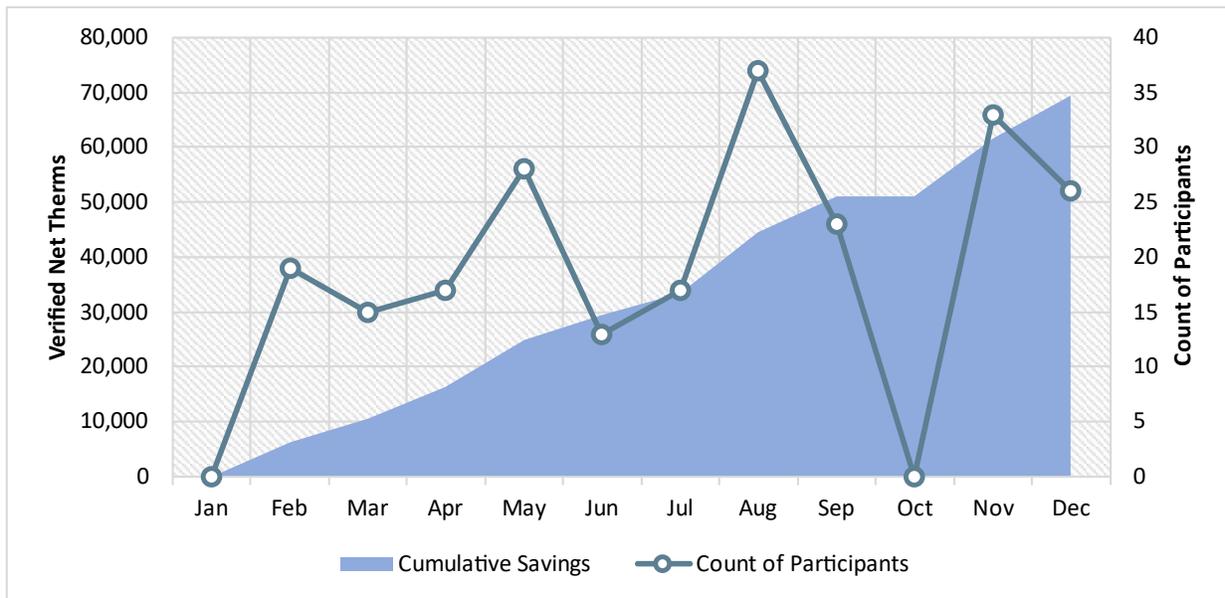


*Figure 7-2 LISHP Cumulative Savings and Participants by Month*

### 7.2.2 Quality Assurance

Staff at Titan ES conduct post inspections of a minimum of 10% of the projects completed by each trade ally. Post inspections are conducted by a quality assurance specialist. The post-inspection procedure includes designations of major violations and minor violations for each measure.

- Major violations require immediate resolution which may include charging the contractor back for the coupon amount.

- Minor violations may be resolved without coupon chargeback.

The definition of major and minor violations by measure are summarized in Table 7-1.

*Table 7-1 QA Violation Definitions by Measure*

| Measure | Definitions |
|---|---|
| Direct install | Major violation examples:<br>■ Verified devices installed do not match claimed devices installed.<br>■ Device installed on an appliance of non-eligible fuel type<br>■ Installation of direct install equipment results in damage or inoperability of existing equipment<br>Minor violation examples:<br>■ None |
| Insulation | Major violation examples:<br>■ Stated existing R-value: error > 1 step difference in R-value range chart on the coupon.<br>■ Stated finished R-value: error of > 10% in R-value<br>■ Stated square footage: error of >10% in square feet<br>Minor violation examples:<br>■ Improper installation of new insulation (such as varying depths)<br>■ Bag count card not properly displayed<br>■ Depth markers not properly displayed |
| Duct sealing/air sealing | Major violation examples:<br>■ Starting vs. finished air leakage rate: verification reveals discrepancy > 20%<br>■ Minimum Ventilation Requirement (MVR): failure to identify correct MVR or take proper action in the event of the MVR not being met<br>■ Duct sealing or air sealing materials: use of improper materials<br>■ Combustion Safety Test (CST): not performing the CST or failing to take proper action on the results.<br>Minor violation examples:<br>■ None |

**7.3      LISHP Impact Evaluation**

The evaluation effort of the LISHP included a desk review of residential calculations. The Evaluator utilized AR TRM 9.0 values in assessing savings from measures included in the program.

**7.3.1  Tracking Data Review**

The impact evaluation began with a review of program tracking data. The tracking data included a separate row for each measure installed. Every premise in the program had a unique rebate identifier, and thus one premise would have multiple rows to reflect the different measures completed. Table 7-2 summarizes ex ante savings by measure for the LISHP.

*Table 7-2 LISHP Ex Ante Summary*

| Measure | Ex Ante Therm |
|---|---|
| Duct Sealing | 38,728 |
| Ceiling Insulation | 15,062 |
| Air Infiltration | 15,481 |
| WH Pipe Insulation | 128 |
| Water Heater Jacket | 20 |
| **Total** | **69,420** |

The tracking data provided measured values for duct pressurization testing and blower door tests, allowing for the recreation of ex ante calculations based on leakage reduction. Further, the tracking data was found to include detailed parameters for all measures, such as baseline R-value for ceiling insulation.

**7.3.2  Net Savings Estimates**

The NTGR for the LISHP is 100% due to the program's emphasis on targeting hard-to-reach customers.

**7.3.3  Verified Savings**

Table 7-4 presents the gross savings results of the evaluation of the PY2022 Low-Income Saving Homes Program. Total gross savings summarizes the savings calculations performed by AR TRM 9.0 protocols for program measures.

*Table 7-3 LISHP Verified Savings Summary*

| Measure | Ex Ante Therms | Ex Post Therms | Gross Realization | EUL | Lifetime Therms |
|---|---|---|---|---|---|
| Duct Sealing | 38,728 | 38,728 | 100.0% | 18 | 697,111 |
| Ceiling Insulation | 15,062 | 15,062 | 100.0% | 20 | 301,239 |
| Air Infiltration | 15,481 | 15,481 | 100.0% | 11 | 170,291 |
| Pipe Insulation | 128 | 128 | 100.0% | 11 | 1,412 |
| Water Heater Jacket | 20 | 20 | 100.0% | 13 | 257 |
| **Total** | **69,420** | **69,420** | **100.0%** | **16.9** | **1,170,310** |

*Table 7-4 LISHP Net Savings Summary*

| Free-Ridership Rate | | Net Annual Savings | | Net Realization Rate | EUL | Net Lifetime Therms Savings |
|---|---|---|---|---|---|---|
| *Ex Ante* | *Ex Post* | *Ex Ante* | *Ex Post* | | | |
| 0.00% | 0.00% | 69,420 | 69,420 | 100.0% | 16.9 | 1,170,310 |

# 8.  Low Flow Showerhead & Aerators Program

The Low Flow Showerhead & Faucet Aerator Program provides no-cost mailer kits to Summit residential customers. These kits may contain:

- Up to three 1.5 gallons per minute (GPM) low flow showerheads, available in chrome and ivory finish; and

- Up to three faucet aerators, with options including 1.5 GPM kitchen aerators (with a shutoff valve) and 1.0 GPM bathroom aerators (without a shutoff valve).

- New for PY2022, the option to request up to one self-install smart thermostat was added in for the kits.

## 8.1    Program Background

The Low Flow Showerhead and Faucet Aerator Program is designed to provide no-cost kits containing low flow showerheads and faucet aerators to Summit residential customers. These kits are then self-installed. The program has been markedly popular among Summit customers.

## 8.2    Low Flow Showerhead and Faucet Aerator Program Participation Summary

In 2022, Summit distributed 179 kits to their residential customers. Table 8-1 presents a summary of the composition of the kits installed. The table is organized showing first the number of customers by showerhead, then how many aerators were ordered by customers that ordered that specified number of showerheads.

*Table 8-1 Low Flow Kit Composition*

| Showerheads | | Bathroom Aerators | | Kitchen Aerators | |
|---|---|---|---|---|---|
| Quantity | % Selected | Quantity | % Selected | Quantity | % Selected |
| 0 | 27.4% | 0 | 100.0% | 0 | 98.0% |
|  |  | 1 | 0.0% | 1 | 2.0% |
|  |  | 2 | 0.0% | 2 | 0.0% |
|  |  | 3 | 0.0% | 3 | 0.0% |
| 1 | 21.8% | 0 | 59.0% | 0 | 48.7% |
|  |  | 1 | 38.5% | 1 | 51.3% |
|  |  | 2 | 2.6% | 2 | 0.0% |
|  |  | 3 | 0.0% | 3 | 0.0% |
| 2 | 22.9% | 0 | 31.7% | 0 | 26.8% |
|  |  | 1 | 4.9% | 1 | 73.2% |
|  |  | 2 | 63.4% | 2 | 0.0% |
|  |  | 3 | 0.0% | 3 | 0.0% |
| 3 | 21.2% | 0 | 10.5% | 0 | 10.5% |
|  |  | 1 | 5.3% | 1 | 86.8% |
|  |  | 2 | 81.6% | 2 | 2.6% |
|  |  | 3 | 2.6% | 3 | 0.0% |

| | | 0 | 0.0% | 0 | 0.0% |
|---|---|---|---|---|---|
| 4 | 5.0% | 1 | 0.0% | 1 | 88.9% |
| | | 2 | 88.9% | 2 | 11.1% |
| | | 3 | 11.1% | 3 | 0.0% |
| 5 | 0.6% | 0 | 0.0% | 0 | 0.0% |
| | | 1 | 0.0% | 1 | 100.0% |
| | | 2 | 100.0% | 2 | 0.0% |
| | | 3 | 0.0% | 3 | 0.0% |
| 6 | 1.1% | 0 | 0.0% | 0 | 0.0% |
| | | 1 | 0.0% | 1 | 100.0% |
| | | 2 | 50.0% | 2 | 0.0% |
| | | 3 | 50.0% | 3 | 0.0% |

## 8.3    Low Flow Showerhead & Faucet Aerator Program Impact Evaluation

### 8.3.1   Energy Savings Calculations

Savings from low flow showerheads are calculated by the following process:

■  First, the Evaluator calculated the per-unit savings as determined by AR TRM 9.0 algorithms which incorporate weather-zone specific ground water temperatures, and an assumed mixed water temperature of 104.3 deg. F for the water heater.

■  Further, these values are scaled down by the verified In-Service Rate. This is the percentage of distributed equipment installed. This is determined separately for each item in the kit (showerheads, kitchen aerators, and bathroom aerators).

■  The Evaluator then parsed out the savings based on the percentage of electric vs. gas water heating as determined through the participant surveys. This serves to provide a weighted average value of energy savings based upon the electric and natural gas savings algorithms for each measure as indicated in AR TRM 9.0.

### 8.3.2   Unit Energy Savings

#### 8.3.2.1    Faucet Aerators

Savings from faucet aerators are based upon AR TRM 9.0 values. Savings for faucet aerators are calculated as follows:

$$Energy\ Savings\ = \frac{\rho \times C_P \times V \times (T_{Mixed} - T_{Supply}) \times \left(\frac{1}{RE}\right)}{Conversion\ Factor}$$

Where,

$\rho$ = Water density, 8.33 lbs./gal.

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

$V$ = DHW gallons saved / yr. / faucet

$V = $ gallons of hot water saved per year per faucet
$$= 533 \times (2.2 - gpm) \text{ where GPM is the flow rate of the new aerator.}$$

This formula is a linear extrapolation of values in.

$T_{SetPoint}$ = Mixed water temperature (default value 102.6°F)

$T_{Supply}$ = Average supply water temperature

$RE$ = Recovery efficiency of water heater, excluding standby losses (0.98 electric / 0.79 Gas).

$Conversion\ Factor$ = 3,412 BTU/kWh for electric water heating or 100,000 BTU/Therms for gas water heating.

*Table 8-2 Faucet Aerator Volume of Use*

| Parameter | Value |
|---|---|
| Faucet use gallons/person/day (baseline) | 9.7 |
| Faucet use gallons/person/day (1.5 GPM) | 8.2 |
| Faucet use gallons/person/day (1.0 GPM) | 7.2 |
| Occupants per home | 2.53 |
| Faucets per home | 3.86 |
| Gal./yr./faucet (Baseline) | 2,321 |
| Gal./yr./faucet (1.5 GPM) | 1,962 |
| Gal./yr./faucet (1.0 GPM) | 1,722 |
| Mixed Water Temperature | 105.3°F |
| DHW gallons saved/yr./faucet for 1.5 GPM (V) | 359 |
| DHW gallons saved/yr./faucet for 1.0 GPM (V) | 599 |

### 8.3.2.2    Low Flow Showerheads

Savings for low flow showerheads are detailed in Section 2.3.5 of the AR TRM 9.0. They are calculated in the same manner as faucet aerators, differing only in the volume of use estimates.

*Table 8-3 Showerhead Volume of Use*

| Parameter | Value |
|---|---|
| Average Shower Duration (minutes) | 8.3 |
| Gallons/shower @ 2.5 GPM (baseline | 20.7 |
| Gallons/shower @ 2.0 GPM | 16.5 |
| Gallons/shower @ 1.5 GPM | 12.4 |
| Showers/person/day (baseline) | 0.69 |
| Showers/person/day(post) | 0.72 |
| Occupants per home | 2.53 |
| Showers/home/day (baseline) | 1.62 |
| Showers/home/day(post) | 1.93 |
| Showerheads per home | 1.62 |
| Showers per showerhead per day (baseline) | 1.16 |
| Showers per showerhead per day (post) | 1.19 |
| Gal./yr./showerhead @ 2.5 GPM (baseline) | 8,142 |
| Gal./yr./showerhead @ 1.5 GPM | 5,089 |
| Mixed Water Temperature | 107.1 °F |
| 1.5 GPM showerhead DHW gallons saved/yr. (V) | 3,053 |

In addition, to account for the customers with electric water heating, the Evaluator incorporated the AR TRM 9.0.

### 8.3.3  In-Service Rates

The Evaluator applied in-service rates developed by Summit Utilities:

- Showerhead: 85.5%

- Kitchen aerator 80.0%

- Bathroom aerator: 85.5%

- Self-install smart thermostat: 100.0%

## 8.4     Net-to-Gross

The Evaluator used CenterPoint Arkansas free ridership of 96.3% with spillover of 0.639 therms per kit.

## 8.5     Verified Savings

Table 8-4 summarizes the total gross savings and Table 8-5 summarizes the total net savings for the Low Flow Showerhead & Faucet Aerator Program.

*Table 8-4 Low Flow Showerhead & Faucet Aerator Program Verified Gross Savings*

| Measure Category | Annual Gross Therms Savings | | EUL | Lifetime Gross Therms Savings | | Gross Realization Rate |
|---|---|---|---|---|---|---|
| | Ex Ante | Ex Post | | Ex Ante | Ex Post | |
| Aerators | 448 | 448 | 10 | 4,483 | 4,483 | 100.0% |
| Showerheads | 3,144 | 3,144 | 10 | 31,436 | 31,436 | 100.0% |
| Smart Thermostats | 2,297 | 2,297 | 11 | 25,269 | 25,269 | 100.0% |
| **Total Gross Savings** | **5,889** | **5,889** | **10.4** | **61,189** | **61,189** | **100.0%** |

*Table 8-5 Low Flow Showerhead & Faucet Aerator Program Verified Net Savings*

| Measure Category | Net-to-Gross Ratio | | Annual Net Therms Savings | | EUL | Lifetime Net Therms Savings | |
|---|---|---|---|---|---|---|---|
| | Ex Ante | Ex Post | Ex Ante | Ex Post | | Ex Ante | Ex Post |
| Kit Savings | 93.4% | 93.4% | 5,501 | 5,501 | 10 | 57,158 | 57,158 |
| **Total Net Savings** | | | **5,501** | **5,501** | **10** | **57,158** | **57,158** |

Table 8-6 summarizes the net non-energy benefits from the 2022 Low Flow Showerhead & Faucet Aerator Program.

*Table 8-6 Low Flow Showerhead & Faucet Aerator Program Net Non-Energy Benefits Summary*

| Non-Energy Benefit | Annual | EUL |
|---|---|---|
| Water Savings (Gallons) | 832,220 | 10 |

# 9. Appendix A: Site Reports

This appendix contains the individual site reports for the Commercial Solutions Program.

| | |
|---:|:---|
| **Program** | C&I Solutions |
| **Project ID** | PRJ-2546763 |
| **Facility SIC Code** | 3499 - Fabricated Metal Products, Not Elsewhere Classified |
| **Measures** | Exhaust System VFD |

## Project Background

The participant is a livestock equipment manufacturing plant that received incentives from Summit Energy for:

- **ECM #1 – Exhaust System VFD**

The participant uses natural gas at their facility to run a powder coat oven for livestock equipment. The negative pressure created by the induced-draft fan in an oven draws cold air through the openings (leaks) and into the oven. The cold air becomes heated to the oven exhaust gas temperature and then exits through the flue system, wasting valuable fuel. It might also cause excessive oxidation of metals or other materials in the oven.

Reducing the speed on the exhaust fans with a variable frequency drive (VFD) to a more appropriate flow reduced the infiltration, thus reducing waste energy. This measure involved installing (1) VFD on the #2 exhaust fan. It was found that with a VFD installed, only one fan was needed so Exhaust Fan #3 was removed from service. For additional information see table below. Note: #1 exhaust fan was removed from scope after the M&V plan was written.

Table 1. Stack Temperature and CFM by Exhaust Fan

| Exhaust | Stack Temp | Square Feet | FPM Reading | CFM | Measure Effects |
|:---:|:---:|:---:|:---:|:---:|:---:|
| #2 | 351 | 2.25 | 3,661 | 8,237 | VFD Installed |
| #3 | 154 | 2.00 | 3,677 | 7,354 | Removed from Service |
| Total: | | | | 15,591 | |

## M&V Methodology

The M&V effort for this project follows the guidelines of the 2022 International Performance Measurement and Verification Protocol (IPMVP) Option A – Key Parameter Measurement. ADM evaluated the savings associated with this site during a desk review. Clear Result provided the following data for the desk review process: stack temperature, stack area, stack air flow rates, exhaust fan amperage (2 weeks), max fan amps, and fan

amps at 40 Hz. After a testing period, the customer set the VFD to 40 Hz and was pleased with the performance.

The following calculations were used to determine the annual therm savings associated with this project.

<div align="center">Equation 1: Annual Energy Savings</div>

$$Annual\ Savings\left(\frac{CCF}{yr}\right) = Stack\ Savings_{Stack\ 2}\left(\frac{CCF}{yr}\right) + Stack\ Savings_{Stack\ 3}\left(\frac{CCF}{yr}\right)$$

$$Annual\ Savings\left(\frac{CCF}{yr}\right) = 7{,}285\left(\frac{CCF}{yr}\right) + 7{,}239\left(\frac{CCF}{yr}\right) = 14{,}524\left(\frac{CCF}{yr}\right)$$

<div align="center">Equation 2: Annual Stack Energy Savings</div>

$$Stack\ Savings\left(\frac{CCF}{yr}\right)$$

$$= \frac{A\left(\frac{BTU\ min}{°F\ ft^3\ hr}\right) \times (CFM_{Pre} - CFM_{Post}) \times \left(T_{Stack}(°F) - T_{Ambient}(°F)\right) \times AOH\left(\frac{hrs}{yr}\right)}{100{,}000\left(\frac{BTU}{CCF}\right) \times Efficiency(\%)}$$

Where:

A = Density at Stack Temp (btu/$lb/F$) × Cp at Stack Temp(lbs/$CFM$) × 60 ($min/hr$)

$CFM_{Pre}$ = see table 1

$$CFM_{Post} = \frac{CFM_{pre}}{\left(Amps_{pre}/Amps_{Post}\right)^{1/2.8}}$$

$T_{Stack}$ = Stack temperature

$T_{Ambient}$ = Average indoor temperature for indoor manufacturing = 75°F

AOH = annual operating hours, assumed to be 1,076 hours per year based on logged data in the post-install testing period.

100,000 = Conversion factor from BTU to CCF

Efficiency = Assumed heating efficiency = 80%

The post CFM was calculated using the fan affinity law equation below.

Equation 3: Fan Affinity Law

$$\frac{Power_{Pre}}{Power_{Post}} = \left(\frac{CFM_{Pre}}{CFM_{Post}}\right)^{2.8}$$

Where:

$Power_{Pre}$
= Rated full load power of fan motor. Correlates with peak recorded amps ($Amps_{pre}$).

$Power_{Post} = \text{power at 40 hz} = \left(\dfrac{Amps_{Post}}{Amps_{Pre}}\right) \times Power_{Pre}$

$CFM_{Pre} = \text{listed in table 1}$
2.8 = Affinity law exponent assumption, never 3 in practice

**Measure Life**

Table 2. Estimated Useful Life for Respective Measures

| Measure | EUL |
|---------|-----|
| VFD | 15 years |

**Calculated Savings:**

Overall, project savings are as follows:

Table 3. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---------|------|------|------|------|
| Exhaust System VFD | 12,870 | 14,519 | 113% | 217,860 |
| TOTAL | 12,870 | 14,519 | 113% | 217,860 |

The ex post savings calculations performed by ADM were quite similar to the ex ante savings calculations with one notable difference. The ex ante used a different value for constant "A" the energy savings calcs for Stack #2. The ex ante used 0.55 but ADM calculated 0.72 which increased the energy savings by 13%. The ex ante calculated 0.55 by using a curve-fit to simulate the Cp and density at a range of stack temperatures. The air density data used in this curve fit only covered temperatures up to 200 F but the air temp for Stack #2 is well above that. This resulted in the density for Stack #2 savings calculations being extrapolated and loosing accuracy because of higher stack temperatures.

## Measure Cost, Incentive, & Payback

The Evaluator reviewed the invoices associated with this project and verified a cost of $7,565. Measure payback is summarized in the table below.

Table 2. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Incremental Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|
| 14,519 | $0.796 | $11,557 | $7,565 | $7,565 | $7,565 | 0.4 | 0.7 |

|  |  |
|---|---|
| **Program** | C&I Solutions |
| **Project ID** | PRJ-2622026 |
| **Facility SIC Code** | 3479- Coating, Engraving, and Allied Services |
| **Measures** | Tank Insulation |
| **Annual Consumption** | 76,600 Therms |

## Project Background

The participant is a coatings manufacturer that received incentives from Summit Energy for:

- ECM #1 –Tank Insulation

The tank insulation measure saved energy by reducing the heat loss from the tanks, thus reducing the gas consumption.

## M&V Methodology

The M&V effort for this project follows the guidelines of the 2022 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 4,160 hours
- Combustion efficiency is assumed 80% (for both pre-retrofit and post-retrofit condition)

### Tank 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: 4 in**

- **Insulation material type: Delta-4 Mineral Wool Board**

- **Process temperature is 352.5°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 tank (pre-retrofit) and tank with 4 in insulation (post-retrofit). The software required these inputs: process temperature, ambient temperature, tank 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 1. Tank Insulation Parameters

| Entry # | Description | Object to Insulate | Quantity | Surface Area (ft^2) |
|---|---|---|---|---|
| 1 | Oven Burner Box - West Side | Rectangular Tank | 1 | 16.44 |
| 2 | Oven Burner Box - North Bottom | Rectangular Tank | 1 | 24.33 |
| 3 | Oven Burner Box - South Top | Rectangular Tank | 1 | 14.67 |
| 4 | Oven Burner Box - North Top | Rectangular Tank | 1 | 14.67 |
| 5 | Oven Burner Box - South Bottom | Rectangular Tank | 1 | 24.33 |
| 6 | Oven Burner Box - East Side | Rectangular Tank | 1 | 16.44 |

**Measure Life**

Table 2. Estimated Useful Life for Respective Measures

| Measure | EUL |
|---|---|
| Pipe and Tank Insulation | 20 years |

**Calculated Savings:**

*Tank Insulation*

Table 3. Tank Insulation Annual Energy Savings

| Entry # | Description | Object to Insulate | Temperature (°F) | Pre Heat Loss | Post Heat Loss | Therms Savings |
|---|---|---|---|---|---|---|
| 1 | Oven Burner Box - West Side | Rectangular Tank | 353 | 786 | 23 | 653 |
| 2 | Oven Burner Box - North Bottom | Rectangular Tank | 353 | 786 | 23 | 966 |
| 3 | Oven Burner Box - South Top | Rectangular Tank | 353 | 786 | 23 | 582 |
| 4 | Oven Burner Box - North Top | Rectangular Tank | 353 | 786 | 23 | 582 |
| 5 | Oven Burner Box - South Bottom | Rectangular Tank | 353 | 786 | 23 | 966 |
| 6 | Oven Burner Box - East Side | Rectangular Tank | 353 | 786 | 23 | 653 |
| **Total** | | | | | | **4,401** |

Overall, project savings are as follows:

Table 3. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---|---|---|---|---|
| Tank Insulation | 4,694 | 4,695 | 100% | 93,892 |
| **TOTAL** | **4,694** | **4,695** | **100%** | **93,892** |

## Measure Cost, Incentive, & Payback

The Evaluator reviewed the invoices associated with this project and verified a cost of $6,814. Measure payback is summarized in the table below.

Table 4. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Incremental Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|

| 4,695 | $0.620 | $2,911 | $6,814 | $4,459 | $3,287 | 1.1 | 2.3 |
|---|---|---|---|---|---|---|---|

| | |
|---|---|
| **Program** | C&I Solutions |
| **Project ID** | PRJ-2953389 |
| **Facility SIC Code** | 2047 – Dog and Cat Food |
| **Measures** | Insulation |
| **Annual Consumption** | 329,740Therms |

## Project Background

The participant is an 80,000 square feet, manufacturing facility that received incentives from Summit Energy for:

- **ECM #1 – Steam Pipe Insulation**
- **ECM #2 – Condensate Pipe Insulation**
- **ECM #1 – Tank Insulation**

A dryer is the primary source of consumption during the production process for this facility, as well as radiant heaters located to the side of the plant.

This ECM saved energy by installing insulation on uninsulated areas of pipe and tanks where hot steam or water flows. The key variables that affected the realization of energy savings were fluid temperatures, insulation R value, and the dimensions of the objects being insulated.

## M&V Methodology

The M&V effort for this project follows the guidelines of the 2022 International Performance Measurement and Verification Protocol (IPMVP) Option A – Key Parameter Measurement. ADM evaluated the savings associated with this site during a desk review. Savings were determined using custom calculations that were based off 3EPlus Software.

ADM used 3EPlus to determine the pre and post heat loss through two pipes and one cylindrical tank. Table 1 shows the per-foot pre heat loss, post heat loss, and Btu/h/ft savings for each pipe, valve, and fitting affected by the insulation measure.

Table 1. 3EPlus Heat Loss and Gas Savings

| Object to Insulate | Measure Description | Temp (F) | Pre Heat Loss (from 3EPlus) | Post Heat Loss (from 3EPlus) | Gas Savings (CCF) |
|---|---|---|---|---|---|
| Pipe | 2" Steam Pipe | 337.9 | 501.0 | 47.6 | 7341 |
| Pipe | 1" Condensate Pipe | 200 | 107.2 | 19.4 | 1563 |
| Cylindrical Tank | Hx Wall | 200 | 261.2 | 31.3 | 231 |

The following calculations were used to determine the annual CCF savings associated with this project. In this program, a CCF is equivalent to a therm.

Equation 2: Annual Gas Savings

$$Annual\ CCF_{Savings} = Pipe\ CCF_{Savings} + Valve\ and\ Fitting\ CCF_{Savings} + Tank\ CCF_{Savings}$$

The pipe and tank savings are shown below:

Equation 2: Pipe Annual Gas Savings

$$Pipe\ CCF_{Savings} = \frac{\sum(Gas\ Savings\ per\ Foot_i \times Lenght\ (ft)_i \times AOH_i)}{100,000\ Btu/CCF \times Eff_{Heating}}$$

Equation 3: Tank Annual Gas Savings

$$Tank\ CCF_{Savings} = \frac{\sum(Gas\ Savings\ per\ Square\ Foot_i \times Surface\ Area\ (ft^2)_i \times AOH_i)}{100,000\ Btu/CCF \times Eff_{Heating}}$$

Where:
$AOH = 6,800\ hours\ (for\ all\ insulated\ equipment)$
$Btu\ to\ Therms\ Conversion = 100,000\ Btu/CCF = 100,000\ Btu/therm$
$Eff_{Heating} = 84\%$

The heating efficiency was determined during a boiler test in the ex ante assessment. Since two boilers are present and share the heating load, the average efficiency of the boilers was used for savings calculations.

**Measure Life**

Table 2. Estimated Useful Life for Respective Measures

| Measure | EUL |
|---|---|
| Insulation | 20 years |

## Calculated Savings:

Overall, project savings are as follows:

Table 3. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---|---|---|---|---|
| Insulation Measures | 9,135 | 9,138 | 100% | 182,752 |
| **TOTAL** | **9,135** | **9,138** | **100%** | **182,752** |

# Measure Cost, Incentive, & Payback

Measure payback is summarized in the table below.

Table 4. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|
| **9,135** | $0.54 | $4,963 | $17,500 | $8,681 | $8,678 | 1.3 | 3.5 |

| Program | C&I Solutions |
|---|---|
| Project ID | PRJ-2617645 |
| Facility SIC Code | 2952 - Asphalt Felts and Coatings |
| Measures | Pipe Insulation |

# Project Background

The participant is an asphalt plant hat received incentives from Summit Energy for:

- ECM #1 – Pipe and Tank 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 2022 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 8,760 hours
- Combustion efficiency is 85% (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, C1393-14**

- **Process temperature is 360°F and 450°F**

- **The average annual ambient air temperature is 75°F**

- **The average wind speed is 12.9 mph**

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 3. 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 1. Pipe/Vale/Tank Insulation Parameters

| Entry # | Description | Pipe or Valve | Quantity | Diameter (in) |
|---------|-------------|---------------|----------|---------------|
| 1 | Asphalt Silo | Cylindrical Tank | 1 | 10 |
| 2 | Kiln Barrel Section  1 | Cylindrical Tank | 1 | 8 |
| 3 | Kiln Barrel Section  2 | Cylindrical Tank | 1 | 8 |
| 4 | Kiln Barrel Section  3 | Cylindrical Tank | 1 | 8 |
| 5 | Asphalt Tank 2 | Cylindrical Tank | 1 | 10 |
| 6 | Asphalt piping to silo | Pipe | 1 | 4 |
| 7 | Asphalt Silo Tank 1 Bottom | Cylindrical Tank | 1 | |
| 8 | Asphalt Silo Tank 1 metal Body | Cylindrical Tank | 1 | 10 |
| 9 | Asphalt Silo Tank 2 Bottom | Cylindrical Tank | 1 | |
| 10 | Asphalt Silo Tank 2 metal Body | Cylindrical Tank | 1 | 10 |

**Measure Life**

Table 2. Estimated Useful Life for Respective Measures

| Measure | EUL |
|---------|-----|
| Pipe and Tank Insulation | 20 years |

**Calculated Savings:**

*Pipe Insulation*

Table 3. Pipe Insulation Annual Energy Savings

| Entry # | Description | Pipe or Valve | Temperature (°F) | Pre Heat Loss | Post Heat Loss | Therms Savings |
|---|---|---|---|---|---|---|
| 1 | Asphalt Silo | Cylindrical Tank | 360 | 1,056 | 53.58 | 2,085.14 |
| 2 | Kiln Barrel Section  1 | Cylindrical Tank | 450 | 1,487 | 77.28 | 2,541.38 |
| 3 | Kiln Barrel Section  2 | Cylindrical Tank | 450 | 1,487 | 77.28 | 2,541.38 |
| 4 | Kiln Barrel Section  3 | Cylindrical Tank | 450 | 1,487 | 77.28 | 2,736.87 |
| 5 | Asphalt Tank 2 | Cylindrical Tank | 360 | 1,056 | 53.58 | 59,753.15 |
| 6 | Asphalt piping to silo | Pipe | 430 | 2,923 | 119.00 | 12,303.29 |
| 7 | Asphalt Silo Tank 1 Bottom | Cylindrical Tank | 360 | 1,056 | 53.58 | 55.31 |
| 8 | Asphalt Silo Tank 1 metal Body | Cylindrical Tank | 360 | 1,056 | 53.58 | 7,124.21 |
| 9 | Asphalt Silo Tank 2 Bottom | Cylindrical Tank | 360 | 1,056 | 53.58 | 55.31 |
| 10 | Asphalt Silo Tank 2 metal Body | Cylindrical Tank | 360 | 1,056 | 53.58 | 9,209.35 |
| | | | | | **Total:** | **98,405** |

Overall, project savings are as follows:

Table 5. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---|---|---|---|---|
| Pipe and Tank Insulation | 98,393 | 98,405 | 100% | 1,968,108 |
| **TOTAL** | **98,393** | **98,405** | **100%** | **1,968,108** |

## Measure Cost, Incentive, & Payback

The Evaluator reviewed the invoices associated with this project and verified a cost of $68,761.80. Measure payback is summarized in the table below.

Table 4. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|
| **98,405** | $0.52 | $51,170 | $68,761 | $68,761 | $68,883 | 0.6 | 1.3 |

| | |
|---|---|
| **Program** | C&I Solutions |
| **Project ID** | PRJ-2295197 |
| **Facility SIC Code** | 8062 – General Medical and Surgical Hospitals |
| **Measures** | Insulation |
| **Annual Consumption** | 271,541 therms |

# Project Background

The participant is a hospital that received incentives from Summit Energy for:

- **ECM #1 – Insulation**

The participant is a full-service surgical hospital in Oklahoma. The facility is 230,000 square feet and houses dental, x-ray, CT and MRI scanning, Mammography, ultrasound, pharmacy, primary medical care, surgical, emergent care, physical and respiratory therapy, transportation, women's health, pediatrics, podiatry, telemedicine, and ophthalmology. Most of the natural gas used in the facility is attributed to cleaning, sanitization, direct hot water, HVAC heating, and kitchen appliances. Steam is produced using (2) Cleaver Brooks 250 HP identical boilers. This steam is distributed through the facility at point-of-use or converted to hot water for end uses.

This ECM saved energy by installing insulation on uninsulated areas of pipe, stem valves, traps, fittings, and tanks where hot steam or water flows. The key variables that affected the realization of energy savings were fluid temperatures, insulation R value, and dimensions of pipe.

# 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 – Key Parameter Measurement. ADM evaluated the savings associated with this site during a desk review. Savings were determined using custom calculations that were based off 3EPlus Software.

ADM used 3EPlus to determine the pre and post heat loss through the pipes, valves, fittings and one rectangular tank. Table 1 shows the per-foot pre heat loss, post heat loss, and Btu/h/ft savings for each pipe, valve, and fitting affected by the insulation measure.

Table 1. 3EPlus Heat Loss and Gas Savings

| Object to Insulate | Measure Description | Temp (F) | Pre Heat Loss (from 3EPlus) | Post Heat Loss (from 3EPlus) | Gas Savings (Btu/h/ft) |
|---|---|---|---|---|---|
| Pipe | BOILER ROOM (HEAT EXCH) / 14'' / STEAM | 331.2 | 2615.3 | 185.7 | 1,534.74 |
| Valve or Fitting | BOILER ROOM / 6'' / STEAM | 331.2 | 1271.7 | 97.0 | 459.88 |
| Valve or Fitting | BOILER ROOM / 6'' / STEAM | 331.2 | 1271.7 | 97.0 | 459.88 |
| Valve or Fitting | BOILER ROOM / 4'' / STEAM | 331.2 | 879.6 | 71.8 | 288.59 |
| Pipe | BOILER ROOM / 6'' / STEAM | 331.2 | 1271.7 | 97.0 | 742.02 |
| Pipe | BOILER ROOM / 3'' / STEAM | 331.2 | 693.6 | 60.2 | 1,400.50 |
| Valve or Fitting | BOILER ROOM / 3'' / STEAM | 331.2 | 693.6 | 60.2 | 1,687.38 |
| Pipe | BOILER ROOM / 1.5 / STEAM | 331.2 | 392.7 | 37.9 | 747.07 |
| Valve or Fitting | BOILER ROOM / 1.5 / STEAM | 331.2 | 392.7 | 37.9 | 97.37 |
| Pipe | BOILER ROOM / 6'' / STEAM | 331.2 | 1271.7 | 97.0 | 371.01 |
| Valve or Fitting | BOILER ROOM / 6'' / STEAM | 331.2 | 1271.7 | 97.0 | 459.88 |
| Pipe | IN HOSPITAL HALLWAY / 4'' / STEAM | 331.2 | 879.6 | 71.8 | 255.13 |
| Valve or Fitting | AIR UNIT #7 / 4'' / STEAM | 331.2 | 879.6 | 71.8 | 288.59 |
| Valve or Fitting | AIR UNIT #7 / 2.5'' / STEAM | 331.2 | 576.8 | 48.5 | 157.83 |
| Pipe | BOILER ROOM / 2'' / CODENSATE | 179 | 145.1 | 15.8 | 326.81 |
| Valve or Fitting | BOILER ROOM / 2'' / CODENSATE | 179 | 145.1 | 15.8 | 77.28 |
| Valve or Fitting | BOILER ROOM / 1'' / CODENSATE | 179 | 84.9 | 11.2 | 53.14 |
| Pipe | BOILER ROOM / 2'' COOPER / D.H.W | 110 | 127.2 | 15.8 | 985.33 |
| Valve or Fitting | BOILER ROOM / 2'' COOPER / D.H.W | 110 | 127.2 | 15.8 | 299.56 |
| Pipe | BOILER ROOM / 3'' COPPER / H.W. | 160 | 181.3 | 20.5 | 761.49 |
| Valve or Fitting | BOILER ROOM / 3'' COPPER / H.W. | 160 | 181.3 | 20.5 | 588.71 |
| Pipe | BOILER ROOM / 1'' / CODENSATE | 179 | 84.9 | 11.2 | 116.46 |
| Valve or Fitting | BOILER ROOM / 1'' / CODENSATE | 179 | 84.9 | 11.2 | 70.86 |
| Pipe | BOILER ROOM / 2'' / CODENSATE | 179 | 145.1 | 15.8 | 204.25 |
| Valve or Fitting | BOILER ROOM / 2'' / CODENSATE | 179 | 145.1 | 15.8 | 77.28 |
| Pipe | BOILER ROOM / 6'' / CONDESATE | 179 | 378.8 | 33.1 | 218.35 |
| Pipe | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 96 | 10.4 | 1.9 | 18.68 |
| Valve or Fitting | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 96 | 10.4 | 1.9 | 5.47 |
| Pipe | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 96 | 10.4 | 1.9 | 26.68 |

| Object to Insulate | Measure Description | Temp (F) | Pre Heat Loss (from 3EPlus) | Post Heat Loss (from 3EPlus) | Gas Savings (Btu/h/ft) |
|---|---|---|---|---|---|
| Valve or Fitting | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 96 | 10.4 | 1.9 | 18.24 |
| Pipe | BOILER ROOM / 1.5'' / CONDENSATE | 179 | 118.3 | 13.0 | 232.70 |
| Valve or Fitting | BOILER ROOM / 1.5'' / CONDENSATE | 179 | 118.3 | 13.0 | 115.55 |
| Pipe | BOILER ROOM / 1.5'' / CONDENSATE | 178 | 116.9 | 12.8 | 328.83 |
| Valve or Fitting | BOILER ROOM / 1.5'' / CONDENSATE | 178 | 116.9 | 12.8 | 171.44 |
| Pipe | IN HOSPITAL HALLWAY / 2.5'' / HOT WATER | 160 | 134.4 | 13.2 | 76.51 |
| Pipe | IN HOSPITAL HALLWAY / 3'' / HOT WATER | 160 | 161.3 | 16.4 | 91.51 |
| Pipe | IN HOSPITAL HALLWAY / 1-1/4'' / CONDENSATE | 179 | 104.7 | 13.2 | 28.88 |
| Rectangular Tank | Condensate Receiver | 179 | 235.7 | 14.7 | 604.96 |

The following calculations were used to determine the annual CCF savings associated with this project. In this program, a CCF is equivalent to a therm.

### Equation 4: Annual Gas Savings

$$Annual\ CCF_{Savings} = Pipe\ CCF_{Savings} + Valve\ and\ Fitting\ CCF_{Savings} + Tank\ CCF_{Savings}$$

The pipe, valve/fitting, and tank savings are shown below:

### Equation 2: Pipe Annual Gas Savings

$$Pipe\ CCF_{Savings} = \frac{\sum(Gas\ Savings\ per\ Foot_i \times Lenght\ (ft)_i \times AOH_i)}{100,000\ Btu/CCF \times Eff_{Heating}}$$

### Equation 3: Valve and Fitting Annual Gas Savings

$$Valve\ and\ Fitting\ CCF_{Savings}$$
$$= \frac{\sum(Gas\ Savings\ per\ Square\ Foot_i \times Equivalent\ Length\ (ft)_i \times AOH_i)}{100,000\ Btu/CCF \times Eff_{Heating}}$$

### Equation 4: Tank Annual Gas Savings

$$Tank\ CCF_{Savings} = \frac{\sum(Gas\ Savings\ per\ Square\ Foot_i \times Surface\ Area\ (ft^2)_i \times AOH_i)}{100,000\ Btu/CCF \times Eff_{Heating}}$$

Where:

$AOH = 8760\ hours\ (for\ all\ insulated\ equipment)$

$Btu\ to\ Therms\ Conversion = 100{,}000\ \text{Btu/CCF} = 100{,}000\ \text{Btu/therm}$

$Eff_{Heating} = 83.205\%$

The heating efficiency was determined during a boiler test in the ex ante assessment. Since two boilers are present and share the heating load, the average efficiency of the boilers was used for savings calculations.

The insulation savings for each measure and for the whole project are listed in Table 2 below:

### Table 2. Induvial and Combined Gas Savings

| Object to Insulate | Measure Description | Gas Savings (Btu/h/ft) | Pipe Length (feet) | Pipe Size (Diameter) | Valve or Fitting Size | Tank Surface Area |
|---|---|---|---|---|---|---|
| Pipe | BOILER ROOM (HEAT EXCH) / 14" / STEAM | 1,534.74 | 6 | 14 | - | - |
| Valve or Fitting | BOILER ROOM / 6" / STEAM | 459.88 | - | - | 6 | - |
| Valve or Fitting | BOILER ROOM / 6" / STEAM | 459.88 | - | - | 6 | - |
| Valve or Fitting | BOILER ROOM / 4" / STEAM | 288.59 | - | - | 4 | - |
| Pipe | BOILER ROOM / 6" / STEAM | 742.02 | 6 | 6 | - | - |
| Pipe | BOILER ROOM / 3" / STEAM | 1,400.50 | 21 | 3 | - | - |
| Valve or Fitting | BOILER ROOM / 3" / STEAM | 1,687.38 | - | - | 3 | - |
| Pipe | BOILER ROOM / 1.5 / STEAM | 747.07 | 20 | 1.5 | - | - |
| Valve or Fitting | BOILER ROOM / 1.5 / STEAM | 97.37 | - | - | 1.5 | - |
| Pipe | BOILER ROOM / 6" / STEAM | 371.01 | 3 | 6 | - | - |
| Valve or Fitting | BOILER ROOM / 6" / STEAM | 459.88 | - | - | 6 | - |
| Pipe | IN HOSPITAL HALLWAY / 4" / STEAM | 255.13 | 3 | 4 | - | - |
| Valve or Fitting | AIR UNIT #7 / 4" / STEAM | 288.59 | - | - | 4 | - |
| Valve or Fitting | AIR UNIT #7 / 2.5" / STEAM | 157.83 | - | - | 2 | - |
| Pipe | BOILER ROOM / 2" / CODENSATE | 326.81 | 24 | 2 | - | - |
| Valve or Fitting | BOILER ROOM / 2" / CODENSATE | 77.28 | - | - | 2 | - |
| Valve or Fitting | BOILER ROOM / 1" / CODENSATE | 53.14 | - | - | 1 | - |
| Pipe | BOILER ROOM / 2" COOPER / D.H.W | 985.33 | 84 | 2 | - | - |
| Valve or Fitting | BOILER ROOM / 2" COOPER / D.H.W | 299.56 | - | - | 2 | - |
| Pipe | BOILER ROOM / 3" COPPER / H.W. | 761.49 | 45 | 3 | - | - |
| Valve or Fitting | BOILER ROOM / 3" COPPER / H.W. | 588.71 | - | - | 3 | - |
| Pipe | BOILER ROOM / 1" / CODENSATE | 116.46 | 15 | 1 | - | - |
| Valve or Fitting | BOILER ROOM / 1" / CODENSATE | 70.86 | - | - | 1 | - |
| Pipe | BOILER ROOM / 2" / CODENSATE | 204.25 | 15 | 2 | | - |

| Object to Insulate | Measure Description | Gas Savings (Btu/h/ft) | Pipe Length (feet) | Pipe Size (Diameter) | Valve or Fitting Size | Tank Surface Area |
|---|---|---|---|---|---|---|
| Valve or Fitting | BOILER ROOM / 2'' / CODENSATE | 77.28 | - | - | 2 | - |
| Pipe | BOILER ROOM / 6'' / CONDESATE | 218.35 | 6 | 6 | - | - |
| Pipe | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 18.68 | 21 | 0.75 | - | - |
| Valve or Fitting | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 5.47 | - | - | 0.75 | - |
| Pipe | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 26.68 | 30 | 0.75 | - | - |
| Valve or Fitting | BOILER ROOM / 3/4'' / MAKEUP TO D.A. | 18.24 | - | - | 0.75 | - |
| Pipe | BOILER ROOM / 1.5'' / CONDENSATE | 232.70 | 21 | 1.5 | - | - |
| Valve or Fitting | BOILER ROOM / 1.5'' / CONDENSATE | 115.55 | - | - | 1.5 | - |
| Pipe | BOILER ROOM / 1.5'' / CONDENSATE | 328.83 | 30 | 1.5 | - | - |
| Valve or Fitting | BOILER ROOM / 1.5'' / CONDENSATE | 171.44 | - | - | 1.5 | - |
| Pipe | IN HOSPITAL HALLWAY / 2.5'' / HOT WATER | 76.51 | 6 | 2.5 | - | - |
| Pipe | IN HOSPITAL HALLWAY / 3'' / HOT WATER | 91.51 | 6 | 3 | - | - |
| Pipe | IN HOSPITAL HALLWAY / 1-1/4'' / CONDENSATE | 28.88 | 3 | 1.25 | - | - |
| Rectangular Tank | Condensate Receiver | 604.96 | - | - | - | 26 |

## Measure Life

### Table 2. Estimated Useful Life for Respective Measures

| Measure | EUL |
|---|---|
| Insulation | 20 years |

## Calculated Savings:

Overall, project savings are as follows:

### Table 3. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---|---|---|---|---|
| Insulation Measures | 14,599 | 14,449 | 99% | 288,977 |
| **TOTAL** | **14,599** | **14,449** | **99%** | 288,977 |

# Measure Cost, Incentive, & Payback

The Evaluator reviewed the invoices associated with this project and verified a cost of $34,772. Measure payback is summarized in the table below.

Table 4. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|
| **14,449** | $1.012 | $14,622 | $34,772 | $13,726 | $10,114 | 1.4 | 2.4 |

| | |
|---:|:---|
| **Program** | C&I Solutions |
| **Project ID** | PRJ-2295197 |
| **Facility SIC Code** | 8062 – General Medical and Surgical Hospitals |
| **Measures** | Boiler Tune-Up |
| **Annual Consumption** | 271,541 therms |

## Project Background

The participant is a hospital that received incentives from Summit Energy for:

- **ECM #1 – Boiler Tune-up**

The participant uses natural gas at their facility to operate (2) boilers for space heating, facility operations, kitchen equipment and a gas-heated MAU. The customer upgraded the boilers with new, high efficiency 10:1 turndown burner with linkless controls in 2021. Originally the facility planned to install O2 trim, but that was postponed to now. The high turndown burner allowed for more incremental control of the boiler and operates at lower load without cycling off, saving the purge losses and cycle on time. In addition, linkless controls improved the system energy use by using an exhaust gas analyzer to continuously monitor CO and now excess oxygen, and the information is fed back to the linkless combustion control unit which adjusts the air-damper position in small increments.

This ECM saved energy by installing O2 sensors that allowed the boilers to be tuned so that optimal burner combustion could be maintained. The key variables that affected the realization of energy savings were boiler staging, boiler efficiencies, boiler capacities, and heating degree days (HDD).

## 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 – Key Parameter Measurement. ADM evaluated the savings associated with this site during a desk review. Savings were determined using custom calculations that were based off TRM equations. ADM used equations from the Boiler Tune Up section of the AR TRM v9.0 but instead of using deemed values for % savings and EFLH, they were calculated using site-specific data.

The following calculations were used to determine the annual baseline CCF consumption associated with this project. In this program, a CCF is equivalent to a therm. The latest 12 months of usage data were added up to get the baseline annual usage.

Equation 5: Annual CCF~Pre~

$$Annual\ CCF_{Pre} = Annual\ MBU_{Pre} \times 10 = 271{,}541\ \frac{CCF}{yr}$$

The baseline energy use was broken into baseline consumption and variable (heating) consumption to determine the loads on the gas equipment. The following table shows the monthly break out of base load and heating load:

Table 1. Disaggregated Gas Usage

| Month/Year | Base Load CCF | Heating Load CCF |
|---|---|---|
| July-2018 | 12,247 | 0 |
| August-2018 | 13,529 | 0 |
| September-2018 | 14,784 | 0 |
| October-2018 | 16,477 | 3,356 |
| November-2018 | 16,477 | 12,043 |
| December-2018 | 16,477 | 15,183 |
| January-2019 | 16,477 | 15,123 |
| February-2019 | 16,477 | 10,647 |
| March-2019 | 16,477 | 13,222 |
| April-2019 | 16,477 | 4,241 |
| May-2019 | 16,477 | 5,703 |
| June-2019 | 16,477 | 3,170 |
| **TOTAL** | **188,857** | **82,684** |

The gas-consuming equipment was broken into two categories to correlate with base loads and heating loads. The equipment was assigned hours of use based on customer testimony and HDD analysis for the project location. The load factors for kitchen equipment and the makeup air unit were assumed to be 50% and which resulted in 7% of the overall energy consumption. The load factors for each boiler during base loads and variable heating loads were then optimized to match modeled energy use with historical utility data. The equipment load factors are shown in Table 2 below:

Table 2. Cost, Incentive, and Payback

| Equipment | Base/Variable Loads | MBH | Hours | LF | Total Base CCF | Total Variable CCF |
|---|---|---|---|---|---|---|
| Boiler 1 | Base | 10,461 | 4,368 | 19% | 88,932 | 0 |
| Boiler 2 | Base | 10,461 | 4,368 | 19% | 88,932 | 0 |
| Kitchen | Base | 604 | 3,640 | 50% | 10,993 | 0 |
| Boiler 1 | Variable | 10,461 | 3,684 | 10% | 0 | 37,658 |

| Equipment | Base/Variable Loads | MBH | Hours | LF | Total Base CCF | Total Variable CCF |
|---|---|---|---|---|---|---|
| Boiler 2 | Variable | 10,461 | 3,684 | 10% | 0 | 37,658 |
| MAU | Variable | 400 | 3,684 | 50% | 0 | 7,368 |
| Total | | | | | 188,857 | 82,684 |

The ex ante analysis included a pre-install boiler efficiency test and a post-install boiler efficiency test performed by the contractor. The average pre and post install efficiencies were 83.22% and 85.0% respectively.

Once the annual boiler usage is determined from the load analysis, the following equation was used to calculate EFLH:

Equation 2: Equivalent Full Load Hours

$$EFLH = Annual\ Boiler\ CCF \times \frac{100,000\ (\frac{BTU}{CCF})}{Heating\ Capacity\ (\frac{BTU}{hr})} = 1,210\ hours$$

The boiler CCF savings were calculated using Equations 3 and 4 as shown below:

Equation 3: Boiler 1 CCF Savings

$$Boiler\ 1\ Savings = \frac{Heating\ Capacity\ (\frac{BTU}{hr}) \times EFLH \times \left(\frac{1}{Eff_{pre}} - \frac{1}{Eff post}\right)}{100,000\ BTU/CCf} = 3,203\ CCF$$

Equation 4: Boiler 2 CCF Savings

$$Boiler\ 2\ Savings = \frac{Heating\ Capacity\ (\frac{BTU}{hr}) \times EFLH \times \left(\frac{1}{Eff_{pre}} - \frac{1}{Eff post}\right)}{100,000\ BTU/CCf} = 2,966\ CCF$$

The total savings are the sum of the individual boiler savings.

Equation 5: Total Annual CCF Savings

$$Annual\ CCF_{savings} = Boiler\ 1\ Savings + Boiler\ 2\ Savings = 6,169\ CCF$$

**Measure Life**

Table 3. Estimated Useful Life for Respective Measures

| Measure | EUL |
|---|---|
| Boiler Tune-Up | 2 years |

**Calculated Savings:**

Overall, project savings are as follows:

Table 4. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---|---|---|---|---|
| Boiler Tune-Ups | 6,169 | 6,169 | 100% | 12,339 |
| **TOTAL** | **6,169** | **6,169** | **100%** | **12,339** |

# Measure Cost, Incentive, & Payback

The Evaluator reviewed the invoices associated with this project and verified a cost of $228,470. Measure payback is summarized in the table below.

Table 5. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|
| **6,169** | $1.012 | $6,243 | $228,470 | $5,861 | $5,861 | 35.7 | 36.6 |

| | |
|---:|:---|
| **Program** | C&I Solutions |
| **Project ID** | PRJ-2546763 |
| **Facility SIC Code** | 3499 - Fabricated Metal Products, Not Elsewhere Classified |
| **Measures** | HVAC Controls – Schedule Optimization |

## Project Background

The participant is a manufacturing facility that received incentives from Summit Energy for:

- ECM #1 – HVAC Controls – Schedule Optimization

The energy conservation measures implemented at this facility is the upgrade to the facilities HVAC units to allow for a set schedule to be used on the facilities 15 heaters. The initial heaters would supply heat to the facility any time the ambient air temperature dropped below 60°F year-round, regardless of if the facility was occupied or not. The newly implemented HVAC controls allowed for the facilities heaters to supply heat to the facility when it was occupied and the ambient air temperature was below 55°F, the heaters would then supply heat to the facility when it was unoccupied whenever the ambient air temperature fell below 45°F.

## M&V Methodology

The M&V effort for this project follows the guidelines of the 2022 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement.

Annual therms savings was calculated using the following equations:

Equation 6. Unoccupied Supply Air Temperature

$$T_{SA,H,Unocc}(°F) = T_{SA,H}(°F) - T_{Setback}(°F)$$

Equation 2. Mixed Air Temperature

$$\text{mixed air temperature} = \begin{cases} \text{when occupied, } T_{MA.H,Occ} = \dfrac{(V_{SA}-V_{OA}) \times T_{RA,H} + V_{OA} \times T_{OA}}{V_{SA}} \\ \text{when unoccupied, } T_{MA.H,Unocc} = T_{RA,H} \end{cases}$$

Equation 3. Occupied BTUs

$$\text{BTU} = 1.08 \left(\frac{\text{Btu·Min}}{\text{Ft}^3 \text{·°F·Hr}}\right) \times V_{SA} \times \text{Load}_{H,Occ} \times \left(T_{SA,H}(°F) - T_{MA,H,Occ}(°F)\right)$$

Equation 4. Unoccupied BTUs

$$\text{BTU} = 1.08 \left(\frac{\text{Btu·Min}}{\text{Ft}^3 \text{·°F·Hr}}\right) \times V_{SA} \times \text{Load}_{H,Unocc} \times \left(T_{SA,H,Unocc}(°F) - T_{MA,H,Unocc}(°F)\right)$$

Equation 5. Therms Savings

$$\text{Natural Gas Savings (Therms)} = \frac{\text{BTU}_{Existing} - \text{BTU}_{Proposed}}{100,000 \left(\frac{\text{BTU}}{\text{Therm}}\right) \times \text{Efficiency}_{Heating}(\%)}$$

Where:

$T_{SA,H}$ = Supply Air Temperature

$T_{setback}$ = Setback temperature

$V_{SA}$ = Supply Air Flow Rate (CFM)

$V_{OA}$ = Outdoor Air Flow Rate

$T_{RA,H}$ = Return Air Temperature

$T_{OA}$ = Outside Air Temperature

$T_{RA}$ = Return Air Temperature

$\text{Load}_{H,Occ}$ = Occupied Heating Load

$\text{Load}_{H,Unocc}$ = Unoccupied Heating Load

$T_{MA,H,Occ}$ = Mixed Air Temperature

**Measure Life**

Table1. Estimated Useful Life

| Measure | EUL |
|---|---|
| HVAC Controls | 11 years |

Overall, project savings are as follows:

Table 2. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---|---|---|---|---|
| HVAC Controls | 8,260 | 17,967 | 218% | 197,640 |
| **Total** | **8,260** | **17,967** | **218%** | **197,640** |

## Measure Cost, Incentive, & Payback

The Evaluator reviewed the invoices associated with this project and verified a cost of $14,395. Measure payback is summarized in the table below.

Table 5. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|
| **17,967** | $.796 | $14,302 | 14,395 | $14,395 | $14,395 | 0 | 0 |

| | |
|---|---|
| **Program** | C&I Solutions |
| **Project ID** | PRJ-3105993 |
| **Facility SIC Code** | 3499 - Fabricated Metal Products, Not Elsewhere Classified |
| **Measures** | HVAC Controls – Schedule Optimization |
| | Hight Efficiency Burner |

## Project Background

The participant is a manufacturing facility that received incentives from Summit Energy for:

- ECM #1 – HVAC Controls – Schedule Optimization
- ECM #2 – Higher Efficiency Burners

The energy conservation measures implemented at this facility is the upgrade to the facilities HVAC units to allow for a set schedule to be used on the facilities 15 heaters. The initial heaters would supply heat to the facility any time the ambient air temperature dropped below 60°F year-round, regardless of if the facility was occupied or not. The newly implemented HVAC controls allowed for the facilities heaters to supply heat to the facility when it was occupied and the ambient air temperature was below 55°F, the heaters would then supply heat to the facility when it was unoccupied whenever the ambient air temperature fell below 45°F.

## M&V Methodology

The M&V effort for this project follows the guidelines of the 2022 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement.

### *HVAC Controls*

Annual therms savings for ECM#1 HVAC were calculated using the following equations:

Equation 7. Unoccupied Supply Air Temperature

$$T_{SA,H,Unocc}(°F) = T_{SA,H}(°F) - T_{Setback}(°F)$$

Equation 2. Mixed Air Temperature

$$\text{mixed air temperature} = \begin{cases} \text{when occupied, } T_{MA.H,Occ} = \dfrac{(V_{SA}-V_{OA}) \times T_{RA,H} + V_{OA} \times T_{OA}}{V_{SA}} \\ \text{when unoccupied, } T_{MA.H,Unocc} = T_{RA,H} \end{cases}$$

Equation 3. Occupied BTUs

$$BTU = 1.08 \left(\frac{Btu \cdot Min}{Ft^3 \cdot {}^\circ F \cdot Hr}\right) \times V_{SA} \times Load_{H,Occ} \times \left(T_{SA,H}({}^\circ F) - T_{MA,H,Occ}({}^\circ F)\right)$$

Equation 4. Unoccupied BTUs

$$BTU = 1.08 \left(\frac{Btu \cdot Min}{Ft^3 \cdot {}^\circ F \cdot Hr}\right) \times V_{SA} \times Load_{H,Unocc} \times \left(T_{SA,H,Unocc}({}^\circ F) - T_{MA,H,Unocc}({}^\circ F)\right)$$

Equation 5. Therms Savings

$$\text{Natural Gas Savings (Therms)} = \frac{BTU_{Existing} - BTU_{Proposed}}{100,000 \left(\frac{BTU}{Therm}\right) \times Efficiency_{Heating}(\%)}$$

Where:

$T_{SA,H}$ = Supply Air Temperature

$T_{setback}$ = Setback temperature

$V_{SA}$ = Supply Air Flow Rate (CFM)

$V_{OA}$ = Outdoor Air Flow Rate

$T_{RA,H}$ = Return Air Temperature

$T_{OA}$ = Outside Air Temperature

$T_{RA}$ = Return Air Temperature

$Load_{H,Occ}$ = Occupied Heating Load

$Load_{H,Unocc}$ = Unoccupied Heating Load

$TMA_{,H,Occ}$ = Mixed Air Temperature

## High Efficiency Burner

The annual therm savings for ECM#2 High Efficiency Burner were calculated following Arkansas TRMv9.0 Section 3.1.5 Burner Replacement for Commercial Boilers. The following equations were used in the ex post analysis:

$$\% \ Savings = \frac{Combustion \ Eff \ Post - Combustion \ Eff \ Pre}{Combustion \ Eff \ Pre} \tag{1}$$

Where:
Combustion Eff Post = %, from spec sheet
Combustion Eff Pre = 80%, from AR TRM 9.0

$$Annual \ Energy \ Savings \left(\frac{CCF}{yr}\right) \tag{2}$$

$$= \frac{Output \ Capacity(BTU) * EFLH \left(\frac{hrs}{yr}\right) * \% \ Savings}{100,000 \left(\frac{BTU}{CCF}\right) \times Combustion \ Eff \ Pre(\%)}$$

Where:
Output Capacity =BTU, from spec sheet
EFLH = estimated annual equivalent full load operating hours, assumed to be 1,015 hours per year (for the MAU) and 1,175 for the heaters, based on customer conversation
$100,000 = Conversion \ factor \ from \ BTU \ to \ CCF$
Combustion Eff Pre = 80%, from AR TRM 9.0

### Table 1. Burner Upgrade Savings

| Unit | AOH | Input Capacity (BTU/hr) | Output Capacity (BTU/hr) | EFLH-H | EC-Base | EC-Efficiency | % Savings | Therm Savings |
|---|---|---|---|---|---|---|---|---|
| 1 | 2030 | 4108696 | 3780000 | 1015 | 80.00% | 92% | 15% | 7,194 |
| 2 | 2030 | 400000 | 332000 | 1175 | 80.00% | 83% | 4% | 183 |
| 3 | 2030 | 400000 | 332000 | 1175 | 80.00% | 83% | 4% | 183 |
| Total | | | | | | | | 7,560 |

**Measure Life**

Table6. Estimated Useful Life for Respective Measures

| Measure | EUL |
|---|---|
| HVAC Controls | 11 years |
| High Efficiency Burner | 12 years |

Overall, project savings are as follows:

Table 3. Overall Project Savings

| Measure | Expected Annual therms Savings | Realized Annual therms Savings | Realization Rate | Lifetime therms Savings |
|---|---|---|---|---|
| HVAC Controls | 35,659 | 35,659 | 100% | 392,249 |
| High Efficiency Burner | 7,560 | 7,560 | 100% | 90,720 |
| **Total** | **43,219** | **43,219** | **100%** | **482,969** |

## Measure Cost, Incentive, & Payback

The Evaluator reviewed the invoices associated with this project and verified a cost of $60,614. Measure payback is summarized in the table below.

Table 5. Cost, Incentive, and Payback

| Annual Therms Savings | Cost per Therm | Annual Energy Cost Savings | Cost | Base Incentive | Adjusted Incentive | Payback w/Incentive | Payback w/o Incentive |
|---|---|---|---|---|---|---|---|
| **43,219** | $0.619 | $26,752 | $60,614 | $41,058 | $41,058 | 0.9 | 2.3 |

# Appendix B – Marketing Samples

## Make the switch from electric to natural gas

By switching to safe and reliable natural gas appliances, you'll receive greater energy–efficiency, cost savings, and a more comfortable home with 35% less $CO_2$ emissions.

| Equipment | Rebate |
|---|---|
| Heating system | $2,000 |
| Water heater | $900 |
| Clothes dryer | Up to $450 |
| Cooking range | Up to $300 |

To learn more, visit **SummitUtilities.com/Rebates**.

**summit** UTILITIES

## summit UTILITIES

# New company, same great savings!

# New year, new ways to save energy and money all year long

## Energy savings for your home

**Heating systems:** Receive up to a **$500 rebate** when you replace your furnace or boiler with a high–efficiency model.

**Smart thermostats:** Get a **$60 rebate** when you install a Wi–Fi learning thermostat.

**Water heaters:** Avoid preventable problems by replacing an aging water heater before it leaks with a safe, reliable natural gas tankless unit and receive a rebate of **up to $500**.

**Electric to gas:** You can get rebates of more than $2,000 when replacing an electric resistance heating system, water heater, cooking range, or clothes dryer with a qualifying natural gas model.

**Money–saving showerheads:** Choose up to 3 free showerheads and faucet aerators to help you keep your family comfortable while saving you energy and money.

## Order today at SummitUtilities.com/Rebates.

Terms and conditions apply. Limit of 3 showerheads and 3 aerators per customer/household. All other products have a limit of 1 per customer/household per lifetime. To qualify for any product, natural gas must be your primary water heating source.

# Treat your home and yourself with these limited-time offers!

By upgrading to a smart thermostat, you'll lower your energy bills and be able to set your heating and cooling around your schedule. Enjoy extra savings on a new thermostat this season, in addition to our instant **$60 rebate**.

## Order today!

Offer valid through 2/20/2022

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# Time to spring forward into savings

Enjoy bonus rebates
and incentives for jobs
already completed
in 2022!

## summit
UTILITIES

# *Spring into savings with rebates!*

Now that heating season is over, it's a great time to submit your rebate applications for high-efficiency natural gas equipment installations already completed in 2022. Submit them today and you'll get your rebates faster!

Commercial rebates include:

- Boiler systems
- Forced-air furnaces
- Water heaters
- Foodservice equipment

Find complete rebate program details, including fill-and-print applications at **SummitUtilities.com/OKRebates**.

**Questions? Contact your energy efficiency consultant**
**ROBIN SLATER:**
580-250-5426 • Rslater@SummitUtilities.com

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# Spring into savings with customer rebates and trade ally incentives!

Now that heating season is over, it's a great time to submit your customers' rebate applications for high-efficiency natural gas equipment installations already completed in 2022. Submit applications today. Customers will spring into rebates faster and you'll receive incentives!

**Commercial rebates include:**

- Boiler systems
- Forced-air furnaces*
- Water heaters*
- Foodservice equipment*

*Trade ally incentives are available only on the equipment marked with an asterisk.*

**Rebate details and applications**

**Questions? Contact your energy efficiency consultant:**
**Robin Slater**
580-250-5426

*Your mid-year reminder*

# Promote heating system upgrades and prevent the rebate rush

**summit**
UTILITIES

# Are your customers updating their AC units?

Don't forget to remind them about the benefit of upgrading their heating system at the same time to ensure peak performance. Plus, they can receive a rebate for a forced-air natural gas furnace and an **extra rebate** when you install a smart thermostat.

# Save time and submit applications online!

Get your rebates faster when you submit rebates online. As a reminder, **double-check** the invoice you're attaching to confirm it has the following information:

- Customer name
- Installation address
- Equipment brand
- Model number
- Serial number

If your contractors need to mail their rebates in, please mail them to the following address:

**Summit Rebate Program**
**1400 Centerview Dr., Ste. 100**
**Little Rock, AR 72211**

**Kirk Pierce, 501-412-9610**
**Robin Slater, 580-215-8024**

For more information or to get started, visit **SummitUtilities/Rebates**.

# We make it easy to improve energy savings

**summit** UTILITIES

## FREE
**1.5 gpm Multi-Function Chrome Showerhead**

## FREE
**1.0 gpm Bath Aerator**

## FREE
**1.5 gpm Multi-Function Ivory Showerhead**

## ONLY $6
**1.5 gpm Handheld Chrome Showerhead**

Did you know that hot water is the second-largest energy user in your home, accounting for 15% of your total energy use? By using our easy-to-install showerheads and faucet aerators, you can reduce hot water use and extend the life of your water heater without sacrificing comfort.

Order today at
**SummitUtilities.com/Rebates**.

**summit** UTILITIES

## Enjoy hot water while saving money!

## FREE
*1.5 gpm Wide Head Chrome Showerhead*

# *Make the switch*

**Now is a great time to upgrade or replace your water heating system!**

### Replacing a water heater?

Do you have an electric water heating system that has become costly for you to run? Convert to a natural gas high-efficiency tankless water heating system and receive a **rebate of up to $900**.

### Already have a natural gas water heater?

Upgrade to a tankless water heater today and receive a **$500 rebate**.

For more information, visit
**SummitUtilities.com/Rebates**.

# Do you have DIY products in your home toolkit?

We have easy-to-install no-cost or low-cost products to help you increase your energy and money savings!
Check out our products below:

- Water & energy-saving bathroom bundles for 1-3 bathrooms!

- A stylish handheld chrome showerhead for those looking for a multi-functional showerhead

- Weatherization products: rope caulk, weatherstripping and outlet and switch plate gasket covers to prevent air leaks

**Order today!**

*Please have your Summit Utilities account number available before checking out. You can find your account number on your current bill or by logging into your account.*

Terms and conditions apply. Limit of 3 showerheads and 3 aerators per customer/household. All other products have a limit of 1 per customer/household per lifetime. To qualify for any product or rebate, you must be a Summit Utilities residential natural gas customer.



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