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May 1, 2023

Ms. Jennifer Ivory, Secretary
Arkansas Public Service Commission
1000 Center Street
Little Rock, AR 72201-4314

Re: 2021 Energy Efficiency Annual Report
Docket No. 07-081-TF

Dear Ms. Ivory:

Attached please find Summit Utilities Arkansas, Inc.'s 2022 Energy Efficiency Annual Report and SARP workbook. Please do not hesitate to reach out with any questions.

Sincerely,

/s/Brooke South Parsons
Brooke South Parsons

Attachment

cc: Parties of record

Summit Utilities Arkansas, Inc.
Energy Efficiency Program Portfolio Annual Report
2022 Program Year

Filed: May 1, 2023

Contents

1.0 Executive Summary

1.1 Historical Background

On March 14, 2011, CenterPoint Energy Resources Corp. d/b/a CenterPoint Energy Arkansas Gas ("CenterPoint Arkansas")requested approval from the Arkansas Public Service Commission ("APSC" or the "Commission") of a new comprehensive portfolio of conservation improvement programs ("CIP") for implementation starting on July 1, 2011. The APSC approved the program portfolio on June 30, 2011 and subsequently extended that portfolio in various orders. In August of 2015, CenterPoint Arkansas received approval to replace the Arkansas Weatherization Program with the Saving Homes Weatherization Program for the 2016 program year ("PY").[1] On June 1, 2016, CenterPoint Arkansas requested approval of an updated comprehensive CIP Portfolio for PY 2017-2019. The APSC approved this request on October 24, 2016, and CenterPoint Arkansas began delivery of this CIP Portfolio on January 1, 2017. On March 15th of 2019, CenterPoint Arkansas submitted for commission approval a comprehensive CIP Portfolio for PY 2020 - 2022. The Commission approved the CIP Portfolio for PY 2020 - 2022 on June 19, 2019. On January 10, 2022, CenterPoint Arkansas was acquired by Summit Utilities, Inc. and is now operating as Summit Utilities Arkansas, Inc ("SUA or Summit Utilities Arkansas or The Company").

1.2 Current Portfolio of Programs

Summit Utilities Arkansas's PY 2022 CIP Portfolio consisted of the following nine programs:

- Natural Gas Equipment Program
- Low Flow Showerhead and Faucet Aerator Program

[1] Order No. 81 in Docket No. 07-081-TF.

- Home Energy Reports
- Saving Homes Weatherization Program (SHP)
- Low-Income Savings Homes Program (LISHP)
- Commercial Boiler Program
- Commercial Food Service Program
- Energy Efficiency Arkansas
- Natural Gas Commercial and Industrial Solutions Program

1.3 Major Accomplishments and Milestones Reached

Despite a volatile and uncertain economy, Summit Utilities Arkansas delivered a solidly performing CIP Portfolio for PY 2022. The Company achieved 133% of its energy savings target with a net energy savings total of 3,726,152 therms. Home Energy Reports, Low-Income Saving Homes Program, and the C&I Solutions program all exceeded program savings goals. The Company continued to deliver a comprehensive portfolio with offerings that included prescriptive rebates, direct-install equipment, residential and commercial energy audits, weatherization measures, technical assistance, custom project incentives, and energy usage comparisons. Overall, 99,901 residential and commercial participants were reached. All programs delivered in PY 2022 were cost-effective with a Total Resource Cost ("TRC") test ratio of 2.00. Some programs experienced a drop in cost-effectiveness due to lower avoided costs filed for PY 2020 – 2022 and some programs underperformed in PY 2022 which resulted in the Company's overall portfolio TRC to droped to 2.00. Summit Utilities Arkansas's CIP portfolio for PY 2022 generated $11.3 million in net economic benefits.

1.4 Goals and Objectives of the CIP Portfolio

Specific objectives associated with the programs are to:

- Reduce end-use natural gas consumption in a cost-effective manner to minimize the long-term cost of utility service and to conserve resources;
- Protect the environment by encouraging installation of efficiency measures that help reduce carbon dioxide emissions and other air pollutant emissions;

- Increase residential and commercial customer awareness of available energy efficiency programs;
- Generate customer awareness of energy efficiency programs available through Summit Utilities Arkansas;
- Provide hard-to-reach and low-income customers the opportunity to participate in the Company's energy efficiency programs by offering weatherization services specifically for Low-Income Home Energy Assistance Program ("LIHEAP") eligible customers and customers that are older than 65 years of age, in accordance with ACT 1102.
- Educate trade allies on the value of energy efficiency and increase their participation in Summit Utilities Arkansas's programs; and
- Support a more robust local and state-wide economy by using local labor (when possible) and helping Arkansas residents reduce monthly energy expenses.

1.5 Progress Achieved Versus Goals and Objectives

In PY 2022, Summit Utilities Arkansas reached 133% of the Commission-ordered energy savings target while maintaining a comprehensive and cost-effective portfolio. As a result, the Company was successful at efficiently reducing end-use natural gas consumption throughout its service territory. The Company's PY 2022 energy efficiency efforts are also expected to provide significant environmental benefits. Summit Utilities Arkansas utilized the United States Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator[2] to estimate the impact of reduced emissions attributable to the 3,726,152 in therms savings delivered through the PY 2022 CIP Portfolio. Overall, the Company's programs reduced carbon dioxide (CO2) emissions by 19,715 metric tons. This is equivalent to:

Greenhouse gas emissions from:

- 4,387 passenger vehicles driven for one year; or
- 50,540,545 miles driven by an average passenger vehicle.

[2] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Carbon dioxide emissions from:

- Annual energy use of 2,485 homes;
- 22,083,904 pounds of coal burned; or
- 1,936,647 gallons of gasoline consumed

Summit Utilities Arkansas continued to educate its customers and trade allies on the value of energy efficiency and remained focused on creating awareness of the Company's CIP Portfolio offerings. Summit Utilities Arkansas promoted its CIP programs through a variety of channels including its website, email communication, bill inserts, radio, television and print advertising, case studies and supply house displays.

1.6 Portfolio Performance and Prior Year Comparisons

Despite economic instability and uncertainty, Summit Utilities Arkansas' PY 2022 CIP Portfolio had 99,901 distinct participants and measures installed and produced net energy savings of 3,726,152 therms. Overall program expenditure totaled $7,858,634 and reached 77% of budget. The total portfolio TRC was 2.00, and $11,306,284 of net benefits were generated through program activities.

Table 1: Portfolio Performance Results and Prior Year Comparison

2022 Energy Savings Summary			
PY	Commission Established Energy Savings Target (Therms)	Achieved Energy Savings (Therms)	% Reached
2021	2,825,791	4,124,913	146%
2022	2,799,934	3,726,152	133%

Table 2: Portfolio Budget Results and Prior Year Comparison

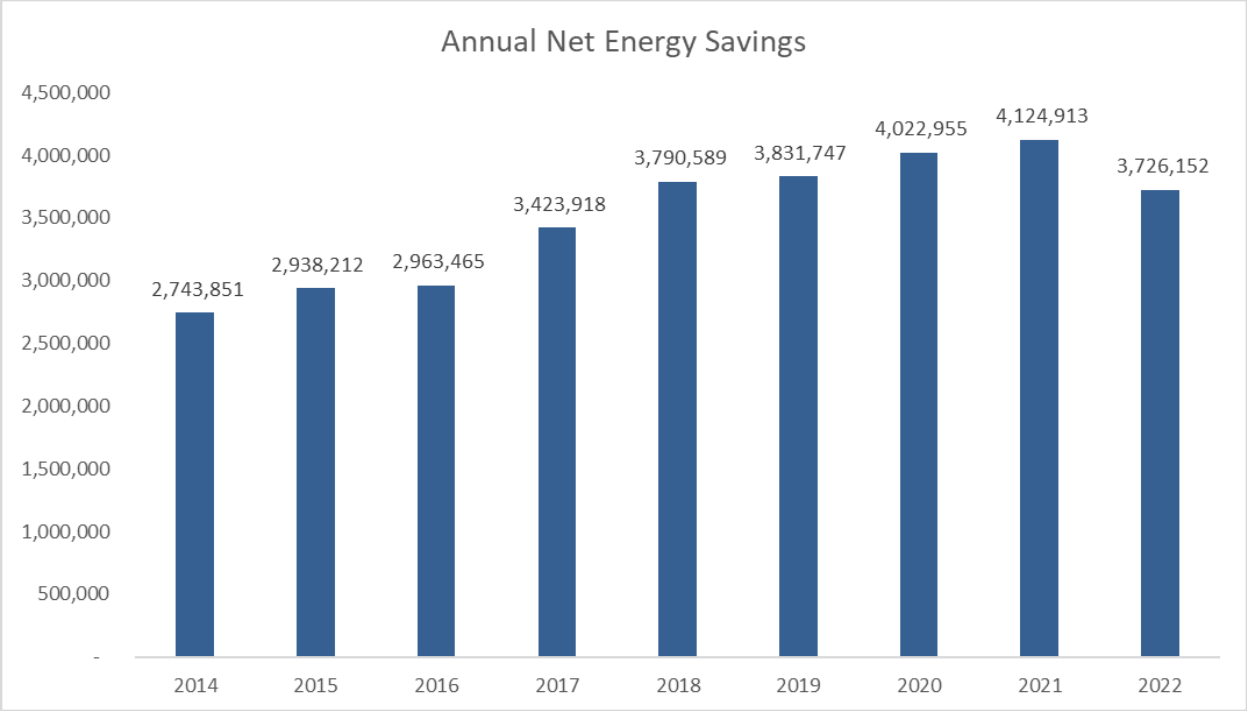
2022 Budget Summary			
PY	Total Portfolio Budget	Total Portfolio Expenditure	% Reached
2021	$10,025,159	$9,130,614	91%
2022	$10,241,331	$7,858,634	77%

Table 3: Portfolio Cost Effectiveness Results and Prior Year Comparison

2022 Cost Effectiveness Summary		
PY	Portfolio TRC	Portfolio Net Benefits
2021	2.10	$14,959,492
2022	2.00	$11,306,284

Summit Utilities Arkansas's CIP Portfolio has experienced growth since 2014, however, PY 2022 saw a decline in participation and savings due to a post-Covid turbulent economy. The cost of goods, labor, and interest rates have risen, creating a barrier to participating in some of the Company's CIP programs.

Figure 1: Annual Net Energy Savings in Therms



1.7 PY 2022 Highlights

Saving Homes Weatherization Program

Summit Utilities Arkansas Saving Homes Weatherization Program continues to be strong each year since its inception in 2016. PY 2022 was a good year for the program resulting in energy savings of 398,991 therms and remains cost-effective with a TRC Score of 6.61. Overall, 1,287 distinct customers participated in the program in PY 2022.

Low- Income Saving Homes Weatherization Program

Summit Utilities Arkansas Low-Income Saving Homes Weatherization Program is a new offering for PY 2020-2022. PY 2022 was a good year for the program resulting in an increase of energy savings of 49,170 therms, and it remained cost-effective with a TRC Score of 3.95. Overall, 167 distinct customers participated in the program. In addition, health and safety (H&S) spending increased from $60.54 to $87.07 per participant, and the percent of

homes with any H&S spending increased from 29% to 43%.Natural Gas Commercial and Industrial Solutions Program

The Natural Gas Commercial Solutions Program continued to be a major source of cost-effective energy savings in PY 2022 contributing 48% of the portfolio's total savings. The program delivered a diverse set of custom projects that produced 1,395,868 net therms savings and 1,431,485 gallons of water savings. The Direct Install portion of the program delivered net savings of 378,138 therms and 425,619 gallons of water. The program continues to achieve over 100% of goal and has a significant impact on the commercial customers it serves. There were over 30 custom projects completed at more than 20 sites across the territory and an additional 30 plus customers received direct install measures in PY 2022. The pipeline of projects for this program continues to grow with both return customers as well as new customers benefiting from this program.

Commercial Boiler Program

The Commercial Boiler Program delivered notably strong performance in PY 2022 with net energy savings totaling 52,301 therms reaching 91% of goal. Program Trade Allies continue to utilize the boiler incentives to up-sale customers to high efficiency boiler units.

Natural Gas Equipment Program

In PY 2022, Summit Utilities Arkansas Natural Gas Equipment Program delivered net energy savings of 325,161 therms. The Company continued to offer the $1,500 (combination) rebate for customers who install both a natural gas tankless water heater (.80 UEF or higher) and a natural gas furnace (.95 Annual Fuel Utilization Efficiency ("AFUE") or higher). Summit Utilities Arkansas staff continues to work to create awareness of this opportunity and the Company has seen the rebates influence builders, homeowners, and housing authorities throughout the state. In total, 473 customers participated producing 66,789 net therms saved. The natural gas equipment PY 2022 experienced a decline in participation. We believe this is a result of supply chain issues and a decline in new housing starts due to rising interest rates.

1.8 Planned Changes to Programs or Budgets

Summit Utilities Arkansas filed a new CIP Portfolio for PY 2020 - 2022, which was filed March 15th, 2019 in Docket No. 07-081-TF. The CIP Portfolio was approved by the APSC on June 17, 2019. Changes in the new CIP Portfolio PY 2020-2022 include the addition of a low-income weatherization program titled Low-Income Saving Homes Program ("LISHP"). In addition to the new program, new measures were added to the Gas Equipment Program, Food Service Program, and rebate amounts increased in the Boiler program. The new CIP Portfolio offerings began January 1, 2020. There were no additional changes to programs or budget for PY 2022.

Table 4: Portfolio Summary

2022 Portfolio Summary										
Net Energy Savings		Costs			Cost-Effectiveness			Goal Achievement		
Demand Therms	Energy Therms	Actual Expenditures	LCFC	Performance Incentives	TRC Net Benefits (NPV)	TRC Ratio	PAC Ratio	Commission Established Target % of Baseline	Actual Savings Achieved % of Baseline	% of Target Achieved (%)
n/a	3,726,152	$ 7,858,634	$ 778,039	$ 819,306	$ 11,306,284	2.00	2.22	0.50%	0.67%	133%

Table 5: Expenditures by Program

EE Portfolio Expenditures by Program					
Program Name	Target Sector	Program Type	2022 Budget ($)	2022 Actual ($)	% of Budget
Home Energy Reports	Residential	Behavior/Education	362,485	359,955	99%
LI Saving Homes Weatherization Program	Residential	Whole Home	316,273	357,919	113%
Low-Flow Showerhead and Faucet Aerator	Residential	Prescriptive/Standard Offer	299,712	72,165	24%
Saving Homes Weatherization Program	Residential	Whole Home	1,736,281	1,857,362	107%
Commercial Boiler Program	Small Business/C&I	Prescriptive/Standard Offer	270,474	190,050	70%
Commercial Foodservice Program	Small Business/C&I	Prescriptive/Standard Offer	179,946	81,932	46%
Natural Gas Commercial Solutions	Small Business/C&I	Custom	3,021,056	2,595,442	86%
Natural Gas Equipment Program	All Classes	Prescriptive/Standard Offer	3,920,500	2,203,985	56%
Energy Efficiency Arkansas	All Classes	Behavior/Education	134,603	139,824	104%
Regulatory	-	-	-	-	-
		Total	10,241,331	7,858,634	77%

Table 6: Expenditure Summary by Cost Type

EE Portfolio Expenditure Summary by Cost Type				
	2022 Total Expenditures			
Cost Type	% of Total	Budget ($)	Actual ($)	% of Total
Planning / Design	1%	111,803	99,230	1%
Marketing & Delivery	33%	3,424,971	2,464,245	31%
Incentives / Direct Install Costs	56%	5,778,591	4,333,496	55%
EM&V	6%	588,429	713,907	9%
Administration	3%	337,537	247,756	3%
Regulatory	0%	-	-	0%
	100%	**10,241,331**	**7,858,634**	100%

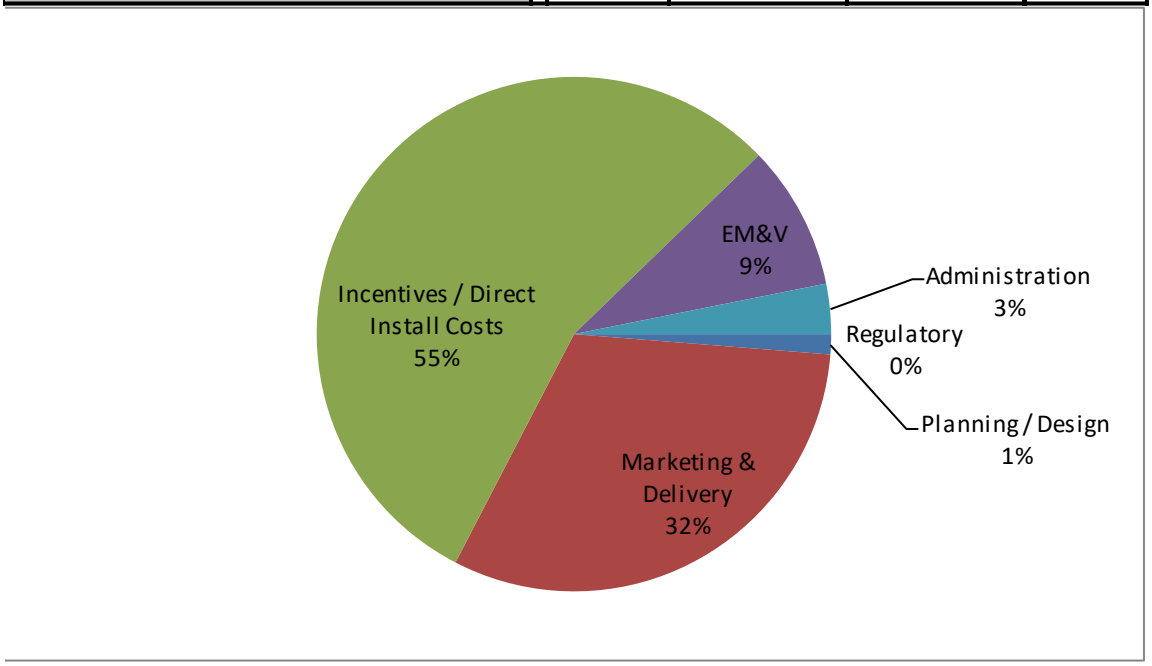
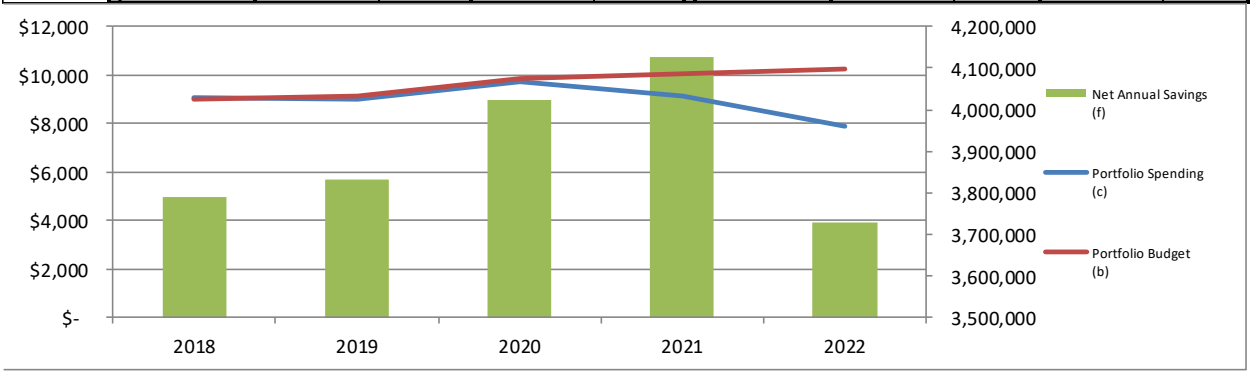


Table 7: Company Statistics

Company Statistics

Program Year	Revenue and Expenditures					Energy				
		Budget		Actual			Plan		Evaluated	
	Total Revenue (a) ($000's)	Portfolio Budget (b) ($000's)	% of Revenue (%=b/a)	Portfolio Spending (c) ($000's)	% of Revenue (%=c/a)	Total Annual Energy Sales (d) (Therms)	Net Annual Savings (e) (Therms)	% of Energy Sales (%=e/d)	Net Annual Savings (f) (Therms)	% of Energy Sales (%=f/d)
2018	$ 374,863	$ 9,011	2.4%	$ 9,056	2.4%	646,361,388	3,544,912	0.55%	3,790,589	0.59%
2019	$ 371,110	$ 9,140	2.5%	$ 8,972	2.4%	646,420,522	3,544,804	0.55%	3,831,747	0.59%
2020	$ 336,115	$ 9,876	2.9%	$ 9,699	2.9%	646,361,388	3,800,225	0.59%	4,022,955	0.62%
2021	$ 380,361	$ 10,025	2.6%	$ 9,131	2.4%	638,961,284	3,832,796	0.60%	4,124,913	0.65%
2022	$ 380,361	$ 10,241	2.7%	$ 7,859	2.1%	628,497,665	3,934,708	0.63%	3,726,152	0.59%



2.0 Portfolio Programs

2.1 Saving Homes Weatherization Program

Program Description

The Summit Utilities Arkansas Saving Homes Program is designed to provide weatherization retrofits that will improve the efficiency and comfort of Summit Utilities Arkansas's residential customers. Implementation of this program began in 2016, and it follows the guidelines developed for the Core Program approach approved by the Arkansas Public Service Commission in Order Nos. 22 and 23 in Docket No. 13-002-U. Under the management of Summit Utilities Arkansas's vendor, contractors conduct whole-home energy assessments for residential customers and identify comprehensive and cost-effective energy efficiency measures eligible for installation. Following measure installation at the premise,

the participating contractor may apply for incentives from Summit Utilities Arkansas, and if applicable, a participating electric utility.

Program Highlights

In PY 2022, the Saving Homes Weatherization Program achieved 91% of the savings target. Overall, 1,287 distinct customers participated in the program, 97% of participants installed at least one measure, and a total of 2,168 energy efficiency improvements were installed overall. The conversion rates, from assessments to measures, achieved by the trade allies was 96.5%.

Program Budget, Savings & Participants

Table 8: Saving Homes Weatherization Program Savings

Summit Utilities Arkansas's customers saved 398,991 annual therms through the program. Evaluated energy savings for the PY 2022 Saving Homes Weatherization Program are below:

Saving Homes Weatherization Program												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 1,612,521	$ 1,717,720	107%	412,800	410,663	99%	n/a	n/a	-	3,272	2,100	64%
Program Year 2021	$ 1,671,364	$ 1,692,627	101%	425,184	436,278	103%	n/a	n/a	-	3,370	2,165	64%
Program Year 2022	**$ 1,736,281**	**$ 1,857,362**	**107%**	**437,939**	**398,991**	**91%**	**n/a**	**n/a**	**-**	**3,471**	**2,168**	**62%**

Table 9: Annual Net and Lifetime Savings

Saving Homes Program	
Annual Net Energy Savings (Therms)	398,991
Lifetime Energy Savings (Therms)	6,848,691

Description of Participants

Participants are Summit Utilities Arkansas customers who have received in-home energy assessments and energy efficiency improvements through the Saving Homes Weatherization Program.

Challenges & Opportunities

The Saving Homes Program was very successful in PY 2022, with demand for the program exceeding the capacity of the program to serve all interested customers. With the strong demand for the program in mind, the Company sees it as a challenge to continue achieving high conversion rates in order to capture higher levels of energy savings and increase cost-effectiveness. There is an opportunity to develop marketing materials for the program, but the Company must be careful to balance increasing awareness of the program with increasing demand that may cause a longer wait for interested customers to be served. The Savings Homes Program achieved 9% lower therm savings when compared to PY 2021 due to lower NTG ratios for PY 2022. Program participation continues to be strong despite the introduction of the Low-Income Saving Homes Program. There were initial concerns that the two programs might dilute the candidate pool; however, the number of eligible participants is large enough to accommodate both programs for now. The Company will continue to monitor the number and type of participants who utilize the program and make adjustments accordingly to make certain all customers receive the appropriate weatherization services for their situation.

Planned or Proposed Changes to Program & Budget

There are currently no planned changes to the program, however, there will be an increase in the budget in our next filing.

2.2 Low-Income Saving Homes Weatherization Program

Program Description

The Summit Utilities Arkansas Low-Income Saving Homes Program is designed to provide weatherization retrofits that will improve the efficiency and comfort of Summit Utilities Arkansas's qualifying residential customers. In addition to weatherization retrofits, the Low-Income Savings Home Program also provides a maximum incentive of $500 toward addressing health and safety issues in the home that might prevent measures from being applied or installed. Implementation of this program began in PY 2020, and it follows the guidelines developed for the Core Program approach approved by the Arkansas Public Service Commission in Order Nos. 22 and 23 in Docket No. 13-002-U. This program specifically addresses hard-to-reach and low-income customers who might not be able to otherwise participate in the Company's energy efficiency programs. This program is administered in accordance with ACT 1102. Under the management of Summit Utilities Arkansas's vendor, contractors conduct whole-home energy assessments for residential customers and identify comprehensive and cost-effective energy efficiency measures eligible for installation. Following measure installation at the premise, the participating contractor may apply for incentives from Summit Utilities Arkansas, and if applicable, a participating electric utility.

Program Highlights

In PY 2022, the Low-Income Saving Homes Weatherization Program achieved 101% of the savings target. Overall, 167 distinct customers participated in the program, 89% of participants installed at least one measure, and a total of 266 energy efficiency improvements were installed. The conversion rates, from assessments to measures, achieved by the trade allies was 87.9%.

Program Budget, Savings & Participants

Table 10: Low-Income Saving Homes Weatherization Program

LI Saving Homes Weatherization Program												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 292,567	$ 299,846	102%	45,867	45,902	100%	n/a	n/a	-	364	235	65%
Program Year 2021	$ 304,168	$ 301,038	99%	47,243	47,516	101%	n/a	n/a	-	374	256	68%
Program Year 2022	**$ 316,273**	**$ 357,919**	**113%**	**48,660**	**49,170**	**101%**	**n/a**	**n/a**	**-**	**386**	**266**	**69%**

Savings

Summit Utilities Arkansas's customers saved 49,170 annual therms through the program. Evaluated energy savings for the PY 2022 Low-Income Saving Homes Weatherization Program are below:

Table 11: Annual Net and Lifetime Savings

Low- Income Saving Homes Program	
Annual Net Energy Savings (Therms)	49,170
Lifetime Energy Savings (Therms)	873,175

Description of Participants

Participants are Summit Utilities Arkansas LIHEAP eligible customers or customers age 65 and over who have received in-home energy assessments and energy efficiency improvements through the Low-Income Saving Homes Weatherization Program.

Challenges & Opportunities

The Low-Income Saving Homes Program was very successful in PY 2022, with demand for the program exceeding the capacity of the program to serve all interested

customers. With the strong demand for the program in mind, the Company sees it as a challenge to continue achieving high conversion rates in order to capture higher levels of energy savings and increase cost-effectiveness. There is an opportunity to develop marketing materials for the program, but the Company must be careful to balance increasing awareness of the program with increasing demand that may cause a longer wait for interested customers to be served. Customer participation dwindled in late Spring/early Summer but ramped back up after the short lull. One opportunity that the Company will address is utilizing more of the health and safety budget to address issues that prevent customers from receiving the full benefits of the weatherization measures implemented or installed. The main reason the Company's implementation contractor did not fully utilize this budget is because of the reluctance of their subcontractors to repair or replace certain items that could put the company in a position of liability. Currently, there is no framework or guidance on how to utilize the health and safety budget. However, the Company, along with the Implementor, created a list of approved health and safety measures for the subcontractors to choose from and implement. The health & safety spend increased from $60.54 to $87.07 per home.

Planned or Proposed Changes to Program & Budget

There are no planned or proposed changes to the program however, there will be an increase in the budget in our next filing.

2.3 Energy Efficiency Arkansas

Program Description

Energy Efficiency Arkansas ("EEA") provides residential and commercial customers in Arkansas with training and information about cost-effective energy efficiency and conservation opportunities. It is managed by the Arkansas Economic Development Commission's Energy Office on behalf of the state's investor-owned public utilities and participating electric cooperatives. For a detailed program description, see the EEA's report filed in Docket No. 07-083-TF.

Program Highlights

Please see the EEA's annual report filed in Docket No. 07-083-TF for this information.

Program Budget, Savings & Participants

The EEA program budget is shown below. While there are no direct, quantifiable energy savings attributable to this program, EEA offers a comprehensive statewide approach to training and offers utilities an additional resource to help promote their respective programs. Please see the EEA's annual report filed in Docket No. 07-083-TF for participation information.

Table 12: Energy Efficiency Arkansas

Energy Efficiency Arkansas												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 134,471	$ 140,904	105%	0	0	-	n/a	n/a	-	0	0	-
Program Year 2021	$ 126,421	$ 37,357	30%	0	0	-	n/a	n/a	-	0	0	-
Program Year 2022	**$ 134,603**	**$ 139,824**	**104%**	**NA**	**0**	**-**	**n/a**	**n/a**	**-**	**NA**	**0**	**-**

Program Events & Training

Please see the EEA's annual report filed in Docket No. 07-083-TF for this information.

Savings

While there are no direct, quantifiable energy savings attributable to this program, EEA offers a comprehensive statewide approach to training and offers utilities an additional resource to help promote their respective programs.

Challenges & Opportunities

Please see the EEA's annual report filed in Docket No. 07-083-TF for this information.

Outlook for Continuation, Expansion, Reduction or Termination

A comprehensive EEA program has been approved by the Commission through December 31, 2022. Please see filings made in Docket No. 07-083-TF for details.

Planned or Proposed Changes to Program & Budget

There are no planned or proposed changes to the program or budget at this time.

2.4 Residential Home Energy Reports Program

Program Description

The Residential Home Energy Reports (HER) program provides customers with energy usage information, including energy savings tips and personalized energy usage comparisons, to encourage and motivate recipients to lower their energy usage. Summit Utilities Arkansas's HER program is administered by Oracle, and combines technology, direct marketing and behavioral science to deliver its Home Energy Reporting System. The Home Energy Reporting System is a unique software platform that combines energy usage data with customer demographics, housing and GIS data to develop specific, targeted recommendations that educate and motivate consumers to reduce their energy consumption.

Energy savings for the HER program are quantified by taking the difference in energy usage between a control group that receives no program information and a statistically identical group of customers that receive the home energy reports.

Program Highlights

The HER program continues to impact customers' awareness of their energy usage, influence energy-efficient behaviors, and produce a high level of quantifiable energy savings.

- Oracle analyzed customer data and established a control group and participant group, and program participants received four home energy reports throughout the heating season.
- In PY 2022, approximately 90,038 customers were actively enrolled in the program.
- In PY 2022, the program provided annual savings of 1,096,289 therms.

Program Budget, Savings and Participation

Table 13: Home Energy Reports

Home Energy Reports												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 345,700	$ 370,145	107%	850,000	1,136,427	134%	n/a	n/a	-	85,000	90,211	106%
Program Year 2021	$ 345,700	$ 367,313	106%	850,000	1,047,335	123%	n/a	n/a	-	85,000	95,394	112%
Program Year 2022	**$ 362,485**	**$ 359,955**	**99%**	**850,000**	**1,096,289**	**129%**	**n/a**	**n/a**	**-**	**85,000**	**90,038**	**106%**

Program Events and Training

To preserve the scientific integrity of calculating energy savings on the differences in usage between a control group and participant group, customers cannot opt into the program if they are not randomly selected into the participant group. For this reason, the program is not widely promoted to non-participants, and no mass marketing of the program is conducted.

Internal training regarding responses and support for customer requests is provided to Summit Utilities Arkansas representatives. A select group of highly trained customer service representatives and energy efficiency program staff were trained on customer service tools provided by Oracle.

Savings

Oracle calculates the energy savings from the program by comparing the program participants against a similar size control group. The difference in energy usage will show the effect the program had on participating Arkansas customers.

The savings reported by the program are net savings, and there are no free riders because the program does not have an open enrollment process. In 2012, Protocol J of the TRM 2.0 was proposed by the IEM and Parties Working Collaboratively and was adopted by the Commission. Protocol J sets guidelines and standards for behavior-based programs. Savings for the program conform to this guideline. The HER program yielded the following residential energy savings in PY 2022:

Table 14: Annual Net and Lifetime Savings

Residential Home Energy Reports	
Annual Net Energy Savings (Therms)	1,096,289
Lifetime Energy Savings (Therms)	1,096,289

Description of Participants

Participants in the HER program are Summit Utilities Arkansas customers who receive personalized energy reports.

Challenges & Opportunities

In PY 2022, a continued focus was placed on providing customers with information via email and enhanced online resources. These touchpoints are cost-effective ways to engage customers and provide them with gas usage information and recommendations to save energy. The Company will work with the HER implementation contractor to enhance the program to improve the customer experience and get more customer engagement.

Planned or Proposed Changes to Program & Budget

There are no planned or proposed changes to the program or budget at this time.

2.5 Low Flow Showerhead and Faucet Aerator Program

Program Description

The Low Flow Showerhead and Aerator Conservation Improvement Program (Low Flow Program) provides free energy-saving low flow showerheads and faucet aerators to Summit Utilities Energy consumers. Customers can receive up to three low flow showerheads (1.5 GPM) or up to three faucet aerators (1.5 GPM).

Program Highlights

Though the Low Flow Program continues to struggle due to program maturation, it is still a valuable tool for reducing water and natural gas consumption. There were some positive outcomes produced by the Program in PY2022:

- The Low Flow Program distributed 1,021 kits containing low-flow showerheads and faucet aerators to Summit Utilities Arkansas customers in PY 2022.
- The program was promoted through a combination of bill inserts, social media posts, and email campaign. Email promotions have shown to be the most effective means of promoting program participation.
- With a TRC ratio of 3.82, the Low Flow Program is the third most cost-effective offering in Summit Utilities Arkansas's PY 2022 CIP Portfolio.
- Therm savings for the Low Flow Program totaled 8,950.

Program Budget, Savings & Participants

Table 15: Low-Flow Showerhead and Faucet Aerator

Low-Flow Showerhead and Faucet Aerator												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 288,292	$ 198,745	69%	161,622	69,336	43%	n/a	n/a	-	38,100	4,469	12%
Program Year 2021	$ 290,596	$ 157,244	54%	161,622	25,098	16%	n/a	n/a	-	38,100	11,245	30%
Program Year 2022	**$ 299,712**	**$ 72,165**	**24%**	**161,622**	**8,950**	**6%**	**n/a**	**n/a**	**-**	**38,100**	**4,303**	**11%**

Program Events & Training

Most of Summit Utilities Arkansas's customers request low-flow equipment through an online portal, but the Company does provide internal training to its representatives so that customers can request kits and receive support via telephone. Low Flow kits mailed to customers include comprehensive installation instructions. Summit Utilities Arkansas promoted this program through bill inserts and email campaigns.

Savings

The Low Flow program yielded the following residential energy savings:

Table 16: Annual Net and Lifetime Savings

Low-Flow Showerhead and Faucet Aerator Program	
Annual Net Energy Savings (Therms)	8,950
Lifetime Energy Savings (Therms)	89,503

Description of Participants

Participants in the Low-Flow Program are defined as Summit Utilities Arkansas active gas account customers with a natural gas water heater who requested and received kits containing a combination of faucet aerators and showerheads.

Challenges & Opportunities

A historical decline in installation rates has resulted in lower savings. In order to combat this, a greater focus on promotional marketing will drive more customers to the marketplace. Marketing outreach will also engage customers whose eligibility has reset after ten years, bringing additional opportunities for increased installation rates. The Company will implement additional measures, including thermostats, to increase net savings. By offering these additional measures and variability in kit options, the Company aims to attract greater participation while meeting the planned budget for this program.

Planned or Proposed Changes to Program & Budget.

The Company will implement additional measures, including thermostats, to increase net savings. There are no planned or proposed changes to the budget at this time.

2.6 Natural Gas Equipment Program

Program Description

The Natural Gas Equipment Program is designed to promote efficient heating and water heating solutions to residential and commercial customers. Rebates are offered to consumers to encourage the purchase and installation of new high-efficient natural gas furnaces with an AFUE rating of 90% or higher. HVAC contractors can receive a $50 incentive for each qualifying rebate. Customers who receive furnace rebates are also eligible for a $50 incentive for the installation of a qualifying EnergyStar thermostat.

Summit Utilities Arkansas customers can receive a $75 rebate for qualifying storage tank water heaters (.70 UEF or greater; Btu/hr input less than 75,000), or a $500 rebate for tankless water heaters (.80 UEF or greater). For tank water heaters with a Btu/hr input of 75,000 or greater and a thermal efficiency rating of 88%, customers are eligible for a rebate of $200 per 100,000 Btu. Plumbers can receive a $50 incentive for the installation of each natural gas tankless system or commercial tank water heater that qualifies for the rebate. The Company also offers a $1,500 rebate for the combination of a furnace rated at 95% AFUE or higher and a .80 UEF or greater tankless water heater. This rebate was added in 2017 to provide participants with an incentive for comprehensiveness at the highest efficiency level.

Program Highlights

Overall, Summit Utilities Arkansas rebated 843 residential heating systems, 206 commercial heating systems, 1,099 residential water heaters, 118 commercial water heaters, 266 furnace/tankless water heater combination rebates, and 176 smart thermostats. Most program participants chose the highest efficiency option available. In most cases, customers who received rebates for natural gas furnaces elected 95% or greater AFUE models rather than 90%-94.9% AFUE models, and most water heating inducements were for tankless water heaters.

Summit Utilities Arkansas continued to promote these programs through a variety of channels including bill inserts, printed material, mass media, and supply house displays

throughout the state. Events included Home Shows, Home Builder Association events, numerous supply house customer appreciation and open house events, the annual conference for Arkansas Housing Authorities, and the annual summer conference of the Arkansas Association of Educational Administrators. Summit Utilities Arkansas also conducted their annual Scoop Meeting for local HVAC and plumbing contractors. Summit Utilities Arkansas also worked closely with school districts and housing authorities to promote energy efficient space heating and water heating solutions, and these entities comprise a significant portion of the participants utilizing the Company's rebate programs.

Program Budget, Savings & Participants

Table 17: Natural Gas Equipment Program

Natural Gas Equipment Program												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 3,830,750	$ 3,466,070	90%	682,962	559,319	82%	n/a	n/a	-	5,240	4,590	88%
Program Year 2021	$ 3,883,750	$ 3,084,891	79%	699,842	464,240	66%	n/a	n/a	-	5,325	3,888	73%
Program Year 2022	**$ 3,920,500**	**$ 2,203,985**	**56%**	**712,680**	**325,161**	**46%**	**n/a**	**n/a**	**-**	**5,385**	**2,719**	**50%**

Program Events & Training

The Company holds annual "Scoop" meetings for plumbers, HVAC contractors, and other stakeholders. The purpose of these meetings is to network with trade allies, educate them on the value of the Company's CIP Portfolio, and provide industry updates. In PY 2022, the company held only three Scoop Meeting in a virtual format.

Savings

Summit Utilities Arkansas utilized Arkansas TRM 9.0 for all primary heating and water applications. The Natural Gas Equipment program yielded the following results in PY 2022:

Table 18: Annual Net and Lifetime Savings

Natural Gas Equipment Program	
Annual Net Energy Savings (Therms)	325,161
Lifetime Energy Savings (Therms)	5,191,570

Description of Participants

Participants in the Natural Gas Equipment Program are defined as the number of rebates provided to Summit Utilities Arkansas customers.

Challenges & Opportunities

Summit Utilities Arkansas has been successful in growing and educating its trade ally network, and the Company will continue these efforts as a strong base of trade allies is the primary key to program success. Summit Utilities Arkansas is also working to improve its marketing strategy and deliver targeted promotions to customers and trade allies. Two factors lead to lower participation and savings in the Natural Gas Equipment 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.

Planned or Proposed Changes to Program & Budget

There are no planned or proposed changes to the program or budget at this time.

2.7 Commercial Boiler Program

Program Description

The Commercial Boiler program is designed to promote efficient heating solutions to all commercial customer classes. Rebate incentives are offered to consumers to encourage the purchase and installation of new high efficiency natural gas boiler equipment.

Program Highlights

In PY 2022, 25 boilers were rebated, which generated savings in the amount of 52,301 therms reaching 91% of the programs goal. Efforts to educate customers and trade allies on the benefits of the boiler program are paying dividends, and the Summit Utilities Arkansas's CIP staff continues to pursue opportunities to influence the installation of high efficiency equipment in commercial applications.

Program Budget, Savings & Participants

Table 19: Commercial Boiler Program

Commercial Boiler Program												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 270,444	$ 305,217	113%	57,585	82,962	144%	n/a	n/a	-	35	33	94%
Program Year 2021	$ 270,474	$ 260,602	96%	57,585	70,934	123%	n/a	n/a	-	35	25	71%
Program Year 2022	**$ 270,474**	**$ 190,050**	**70%**	**57,585**	**52,301**	**91%**	**n/a**	**n/a**	**-**	**35**	**25**	**71%**

Program Events & Training

Summit Utilities Arkansas CIP staff continues to focus on building and maintaining relationships with boiler manufacturer sales representatives, Engineering and Architecture Firms, key customer accounts, and organizations such as Arkansas Association of Energy Engineers.

Savings

Summit Utilities Arkansas calculated energy savings according to Arkansas TRM 9.1 and yielded the following energy savings:

Table 20: Annual Net and Lifetime Savings

Commercial Boiler Program	
Annual Net Energy Savings (Therms)	52,301
Lifetime Energy Savings (Therms)	1,046,025

Description of Participants

Participants in the Commercial Boiler Program are defined as the number of rebates provided to Summit Utilities Arkansas customers.

Challenges & Opportunities

Summit Utilities Arkansas continues its efforts to build and maintain relationships with trade allies both in and out of state. With a limited number of local boiler trade allies, it is important to keep them engaged and supportive of the program so that opportunities for energy savings are not missed. Also, public sector facilities remain the strongest source of participation and energy savings, and the Company will continue to pursue opportunities at schools, government buildings, and other public organizations.

Planned or Proposed Changes to Program & Budget

There are no planned or proposed changes to the program or budget at this time.

2.8 Commercial Food Service Program

Program Description

The Commercial Food Service program is designed to promote the installation of high-efficiency food service equipment. Rebate incentives are offered to food service operators to encourage the purchase and installation of new, qualifying natural gas food service equipment. There are also Trade Ally incentives offered to equipment dealers to encourage an up-sale to qualifying high-efficiency cooking equipment.

Program Highlights

2023 should show more participants as qualified equipment lead times improve.

Program Budget, Savings & Participants

Table 21: Commercial Foodservice Program

Commercial Foodservice Program												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 172,491	$ 120,124	70%	60,941	21,693	36%	n/a	n/a	-	123	69	56%
Program Year 2021	$ 178,216	$ 150,488	84%	62,873	50,469	80%	n/a	n/a	-	132	108	82%
Program Year 2022	**$ 179,946**	**$ 81,932**	**46%**	**64,641**	**21,283**	**33%**	**n/a**	**n/a**	**-**	**134**	**50**	**37%**

Program Events & Training

Summit Utilities Arkansas CIP staff continues to focus on building and maintaining relationships with food service equipment dealers, manufacturer sales representatives, key customer accounts, and organizations such as the Arkansas Restaurant and Hospitality Association.

Savings

Summit Utilities Arkansas calculated energy savings according to Arkansas TRM 9.0. These savings were evaluated by ADM, and a 77% net-to-gross adjustment was applied. The Commercial Food Service program yielded the following savings:

Table 22: Annual Net and Lifetime Savings

Commercial Food Service Program	
Annual Net Energy Savings (Therms)	21,283
Lifetime Energy Savings (Therms)	255,397

Description of Participants

Participants in the Commercial Food Service program are defined as the number of rebates provided to Summit Utilities Arkansas customers.

Challenges & Opportunities

In PY 2022, the Summit Utilities Arkansas Commercial Foodservice Equipment Program decreased in net energy savings by 58% over last year. The demand for Food Service products has surged as business recovers while supply has lagged due to issues with labor, materials, and transportation. This imbalance has led to hyper-inflation and extraordinarily long lead times. 2023 should show more participants as qualified equipment lead times improve.

Summit Utilities Arkansas will continue to leverage the rebates and educate customers and trade allies on the long-run value of efficient equipment. The Company will continue to seek and evaluate additional food service measures that could be viable additions to its existing program offerings.

Planned or Proposed Changes to Program & Budget

There are no planned or proposed changes to the program or budget at this time.

2.9 Natural Gas Commercial & Industrial Solutions Program

Program Description

The Natural Gas Commercial and Industrial (C&I) Solutions Program encourages C&I customers to use natural gas efficiently by installing energy efficient equipment, adopting energy efficient designs and using energy efficient processes at their facilities. The program is implemented by CLEAResult and includes the direct installation of equipment that reduces energy consumption as well as financial incentives for customers that pursue custom energy efficiency projects. For custom measures, CLEAResult provides customers with technical assistance to identify energy efficiency projects and quantify energy savings, assists the customers through the incentive process and conducts the necessary EM&V work.

Program Highlights

In PY 2022, the Natural Gas Commercial and Industrial Solutions Program remained a high performing program achieving 111% of goal and was again the largest single program contributor to energy savings and net economic benefits. Overall, the program yielded energy savings of 1,774,006 therms, resulting in a TRC of 1.92 and a net benefit total of $5.6 million.

Program Budget, Savings & Participants

Table 23: Natural Gas Commercial Solutions

Natural Gas Commercial Solutions												
	Expenditures			Energy Savings (Therms)			Demand Savings (Therms)			Participants		
Program	Budget	Actual	%	Plan	Evaluated	%	Plan	Evaluated	%	Plan	Actual	%
Program Year 2020	$ 2,928,574	$ 3,080,171	105%	1,528,448	1,696,653	111%	n/a	n/a	-	15,410	18,369	119%
Program Year 2021	$ 2,954,470	$ 3,079,053	104%	1,528,448	1,983,043	130%	n/a	n/a	-	15,410	926	6%
Program Year 2022	**$ 3,021,056**	**$ 2,595,442**	**86%**	**1,601,581**	**1,774,006**	**111%**	**n/a**	**n/a**	**-**	**15,412**	**332**	**2%**

Program Events & Training

Summit Utilities Arkansas and program implementer CLEAResult continuously pursue opportunities to promote the program to customers and trade allies through site visits, trade shows, and other industry events. Summit Utilities Arkansas utilizes its Commercial

and Industrial Transportation Sales Representatives to educate customers on the benefits of the program and identify opportunities for participation. The Company also develops case studies that highlight results of specific custom projects and show the value of the program to customers. In addition, Summit Utilities Arkansas provided training to customers, industry professionals and financial institutions regarding the financial benefits of energy efficiency projects.

Savings

Custom energy efficiency projects and the direct installation of pre-rinse spray valves (PRSV), faucet aerators, low-flow showerheads, and weather stripping produced the energy savings delivered through the PY 2022 Natural Gas Commercial and Industrial Solutions Program. TRM 9.0 was utilized to calculate the savings for the direct install portion of program savings. The methodology for calculating the custom projects savings were evaluated by ADM and are discussed in detail in ADM's report, which can be found in Appendix A. The Natural Gas Commercial and Industrial Solutions Program yielded the following savings:

Table 24: Annual Net and Lifetime Savings

Commercial & Industrial Solutions Program	
Annual Net Energy Savings (Therms)	1,774,006
Lifetime Energy Savings (Therms)	24,801,798

Description of Participants

Participants in the Natural Gas Commercial and Industrial Solutions Program are defined as the number of custom commercial projects as well as facilities that have participated in the direct install component of the program provided to Summit Utilities Arkansas customers.

Challenges & Opportunities

With a suite of direct-install measures, custom project incentives, and technical assistance, the Natural Gas Commercial and Industrial Solutions Program has a successful mix of cost-effective energy efficiency opportunities available to commercial customers. Summit Utilities Arkansas believes there is opportunity to leverage this program to promote its other prescriptive rebate offerings. The program was over goal in PY 2022 and is oversubscribed for the current program year. It may be necessary to reallocate resources from other programs to meet the needs of all customers wishing to participate.

Planned or Proposed Changes to Program & Budget

There are no planned or proposed changes to the program or budget at this time.

3.0 Supplemental Requirements

3.1 Staffing

Summit Utilities Arkansas has five staff members in Little Rock, Arkansas who deliver its comprehensive energy efficiency portfolio. A CIP Implementation Manager oversees the day-to-day activities of the CIP team and assures that the programs are compliant with regulatory requirements. Additionally, two Energy Efficiency Consultants, an Energy Efficiency Coordinator, and an Energy Efficiency Analyst deliver, administer, and maintain compliance of CIP programs.

The Energy Efficiency Consultants' responsibilities are to implement energy efficiency programs that meet regulatory and legislative requirements and respond to customer needs. They manage productivity and build relationships with external vendors and trade allies to maximize the performance of programs and ensure those programs comply with Summit Utilities corporate goals.

The Energy Efficiency Coordinator manages the Low-Flow and Faucet Aerator Program, Home Energy Reports Program, processes rebates paid to commercial Summit

Utilities Arkansas rebate program participants, processes invoices for external vendors, manages the CIP tracking systems, and assists the Energy Efficiency Consultants.

The Energy Efficiency Analyst maintains the program data, supports the regulatory function, and performs analysis to monitor and improve the CIP portfolio. The Energy Efficiency Analyst will also keep up with changes to the TRM and implement changes to ensure accurate calculations of program savings.

3.2 Stakeholder Activities

Summit Utilities Arkansas actively participates in stakeholder collaborative efforts and continues to be an active participant in the collaborative process established by the Commission (also known as the "Parties Working Collaboratively" or PWC).

Summit Utilities Arkansas has also been very active in local trade associations such as home builders associations, HVAC contractors associations, Arkansas Hospitality Associations, Arkansas Association of Healthcare Engineering, Gas Food Equipment Network, Arkansas Education Association, and the local public housing authorities.

Internally, Summit Utilities Arkansas continues to train its Arkansas-based Marketing Consultants to work with local builders and trade allies, and also utilizes field employees to identify potential program participants throughout their day-to-day activities. In addition, Summit Utilities Arkansas has trained Commercial and Industrial Transportation Sales Representatives that actively educate eligible transportation customers on the programs and make referrals to the C&I Solutions program.

3.3 Information Provided to Consumers to Promote EE.

Summit Utilities Arkansas uses a variety of tools to provide information to consumers about energy efficiency programs. These include:

- Printed factsheets for consumers

- Printed factsheets for trade allies
- Supply house displays
- Bill inserts
- Website
- Emails
- Advertisements on TV, radio and in print
- Retail point of purchase displays and promotions

Select examples of each type of information can be found in Appendix B.

APPENDIX A – EM&V CONTRACTOR REPORT

APPENDIX B – CARBON PRICING CALCULATOR INPUTS

Emissions Calculations

Gas	CO2 Equivalent
CO2	1

Conversions for listed units

Conversion factors	
therms per mmBTU	10
kilograms to metric tons	0.001
pounds to metric tons	0.00045

Emissions factors for natural gas

Fuel	kg CO2 per mmBtu
Natural Gas	53.06

Local emissions factors for electricity in Arkansas

Region	Non-Baseload Emission Factors CO2 lb / MWh	
SPSO (SPP South)	1,662.5	Choose the region using dropdown (in cell A18)
Utility Specific (Enter value here==>)		

Calculated emissions per unit

CO2 tons / kWh	0.00075
CO2 tons / therm	0.00531

Scenario	CO2 Price per ton	¢ / kWh	¢ / therm	
Per dollar for calculations	per $	0.08	0.5	
Low case (Enter low case here ==>)	$0	0	0	Utility's lowest value
Middle case (Enter mid case here ==>)	$5	0.4	2.7	Utility's median value
High case (Enter high case here ==>)	$15	1.1	8	Utility's highest value

Rates	¢ / kWh	¢ / therm
Per unit energy charge (per kWh or therm rate)	6.99	81.80

Rate Impacts	% Change per kWh	% Change per therm
Low case	0.0%	0.0%
Middle case	5.7%	3.3%
High case	15.7%	9.8%

APPENDIX C – MARKETING SAMPLES

EVALUATION, MEASUREMENT AND VERIFICATION REPORT FOR THE 2022 CENTERPOINT ENERGY ARKANSAS ENERGY EFFICIENCY PORTFOLIO

SUBMITTED TO: SUMMIT UTILTIES ARKANSAS

SUBMITTED ON: APRIL 27, 2023

SUBMITTED BY: ADM ASSOCIATES, INC.

ADM Associates, Inc

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summit UTILITIES

Acknowledgements

We would like to thank the staff at Summit Utilities Arkansas (SUA) for their time and effort in contributing to the EM&V of the PY2022 programs. This evaluation was conducted with regular coordination with staff at SUA, 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 SUA customers, implementation contractor staff, and trade allies. As with the staff at SUA, their active participation allowed for the evaluation team to collect all needed data for this effort.

In final, we would like to thank staff at the Independent Evaluation Monitor for their involvement in providing thorough answers and clarification to the evaluation team when higher-level questions arose over the course of the PY2022 EM&V effort.

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ADM Associates Inc.

Energy Research & Evaluation

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1 Executive Summary

In March of 2019, CenterPoint Energy Resources Corporation (CenterPoint, or CNP) filed its 2020-2022 Energy Efficiency Plan[1] in response to Commission Order No. 25 in Docket No. 13-002-U.[2] The APSC approved the 2020–2022 programs, which built upon CNP's Quick Start Energy Efficiency programs that have been implemented since late 2007[3] and the Comprehensive programs that have been implemented in Arkansas since 2011.[4] This was filed in compliance with Order No. 31 of Docket No. 13-002-U,[5] which required investor-owned natural gas utilities in Arkansas to capture energy savings equivalent to 0.50% of their 2018 energy sales. In 2021, CNP AR was acquired by Summit Utilities, and is now known as Summit Utilities Arkansas (SUA).

As in previous APSC rulings, the Arkansas utilities retain flexibility to make up to 10% adjustments to program budgets and may adjust energy savings and demand reduction goals as appropriate within the modified budgets. Thus, SUA's 2022 budgets and energy savings goals, reflecting allowable adjustments as described above, serve as the basis against which its portfolio of programs were evaluated in 2022.

SUA's Plan include a portfolio of energy efficiency programs designed to facilitate energy savings in every customer class. CNP services approximately 415,243 customers in Arkansas, and serves southern, central, and northeast Arkansas, including the greater Little Rock metropolitan area, Texarkana, Jonesboro, and Pine Bluff.

The PY2022 SUA evaluation included impact and process analyses that are specified in the APSC rules and follow the Arkansas TRM Version 9.0 protocols and savings algorithms. In addition, ADM developed the program evaluation activities based upon discussions with SUA staff and its implementation contractors, reviews of program tracking and program documentation, a review of prior years' EM&V efforts and SYA annual reports, and input from the IEM.

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[1] PY2017-PY2019 Plan, filed in Docket 07-081-TF: http://www.apscservices.info/pdf/07/07-081-TF_402_1.pdf

[2] Order #25 in Docket 13-002-U: http://www.apscservices.info/pdf/13/13-002-U_198_1.pdf

[3] Quick Start Plan, filed in Docket 07-081-TF: http://www.apscservices.info/pdf/07/07-081-tf_1_1.pdf

[4] Comprehensive Program Plan, filed in Docket 07-081-TF: http://www.apscservices.info/pdf/07/07-081-tf_171_1.pdf

[5] Order #31 in Docket 13-002-U: http://www.apscservices.info/pdf/13/13-002-U_226_1.pdf

This report presents the EM&V results for SUA's energy efficiency programs implemented in PY2022. In accordance with APSC C&EE Rules,[6] SUA selected an independent, third-party EM&V contractor. The selected EM&V team is led by ADM Associates. The ADM staff, collectively referred to as the Evaluators, evaluated the SUA portfolio.

1.1 Summary of SUA Energy Efficiency Programs

In PY2022, the SUA portfolio contained the following programs:

- Residential Equipment Rebates;
- Commercial Equipment Rebates;
- Commercial Boiler Program;
- C&I Solutions;
- Commercial Food Service Program;
- Home Energy Reports;
- Low Flow Showerhead & Faucet Aerator Program;
- Saving Homes Program[7]; and
- Low Income Savings Homes Program[8].

SUA designed its programs to achieve the following objectives:

- Meet or exceed a PY2022 net savings goal of 3,934,708 therms;
- Significant energy-saving opportunities for all customers and market segments;
- Broad ratepayer benefits; and
- Comprehensiveness in seven areas (i.e., comprehensiveness factors) defined by the APSC.[9]

Through its energy efficiency portfolio, SUA also seeks to provide customers with easy program entry points, flexible options for saving energy, and ongoing support for those who want to

[6] APSC C&EE Rules: http://www.apscservices.info/pdf/16/16-075-SD_5_1.pdf

[7] The SHP is CNP's implementation of the Consistent Weatherization Approach (CWA)

[8] The LISHP is CNP's implementation of the Consistent Weatherization Approach (CWA) for Act 1102

[9] As defined by the APSC in the C&EE Rules of Order No. 17 in Docket 08-144-U

pursue deeper energy savings. Refer to Table 1-1 for a list of the SUA programs and targeted customer segments.

Table 1-1: SUA PY2022 Energy Efficiency Portfolio Sectors Serviced

Program	Single Family	Multifamily	Small Business	Large C&I	Municipal	Agricultural
Residential Equipment Rebates	✓	✓			✓	
Commercial Equipment Rebates		✓	✓	✓	✓	✓
Commercial Boiler			✓	✓		
C&I Solutions			✓	✓	✓	✓
Commercial Food Service			✓	✓	✓	
Home Energy Reports	✓	✓				
Low Flow Program	✓	✓				
Saving Homes Program	✓	✓				
Low-Income Savings Homes Program	✓	✓				

1.2 Evaluation Goals

The goals of the PY2022 EM&V effort are as follows:

- **For prescriptive measures,** verify that savings are being calculated according to appropriate TRM guidelines. For most measures, this constitutes applying TRM V9.0 methodologies.
- **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 providing reliable savings.
- **Conduct process evaluations of SUA programs.** Full process evaluations were completed in PY2019 - PY2021 and as a result process evaluation needs in PY2022 were limited.
- **Conduct net-to-gross assessments.** The Evaluators conducted program-specific net-to-gross assessments in from PY2018-PY2021, and as a result, net-to-gross assessment needs in PY2022 were limited.

1.3 Summary of Findings

1.3.1 Impact Findings

Table 1-2 and Table 1-3 present the gross and net impact by program.

Table 1-2: Gross Impact Summary

Program	Annual Therms Savings		Lifetime Therms Savings		Gross Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post	
Residential Equipment Rebates	287,287	287,287	4,248,829	4,248,829	100.0%
Comm. Equipment Rebates	95,323	101,017	1,903,579	2,017,292	106.0%
Commercial Boiler	65,149	65,149	1,302,970	1,302,970	100.0%
C&I Solutions	1,804,635	1,774,006	25,484,325	24,801,798	98.3%
Commercial Food Service	24,283	27,569	291,396	330,828	113.5%
Home Energy Reports	1,096,289	1,096,289	1,096,289	1,096,289	100.0%
Low Flow	27,363	27,363	273,633	273,633	100.0%
Saving Homes Program	437,938	443,323	7,517,222	7,609,656	101.2%
Low-Income Saving Homes	48,031	49,170	852,945	873,175	102.4%
Total	**3,886,298**	**3,871,173**	**42,971,190**	**42,554,470**	**99.6%**

Table 1-3: Net Impact Summary

Program	Annual Therms Savings		Lifetime Therms Savings		NTGR	Net Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post		
Res. Equipment Rebates	247,706	247,706	3,662,834	3,662,834	86.2%	100.0%
Comm. Equipment Rebates	73,115	77,455	1,443,078	1,528,736	76.7%	105.9%
Commercial Boiler	52,301	52,301	1,046,025	1,046,025	80.3%	100.0%
C&I Solutions	1,804,635	1,774,006	25,484,325	24,801,798	100.0%	98.3%
Commercial Food Service	18,747	21,283	224,959	255,397	77.2%	113.5%
Home Energy Reports	1,096,289	1,096,289	1,096,289	1,096,289	100.0%	100.0%
Low Flow	8,950	8,950	89,503	89,503	32.7%	100.0%
Saving Homes Program	426,245	398,991	7,316,509	6,848,691	90.0%	93.6%
Low-Income Saving Homes	48,031	49,170	852,945	873,175	100.0%	102.4%
Total	**3,776,020**	**3,726,152**	**41,216,466**	**40,242,447**	**96.3%**	**98.7%**

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

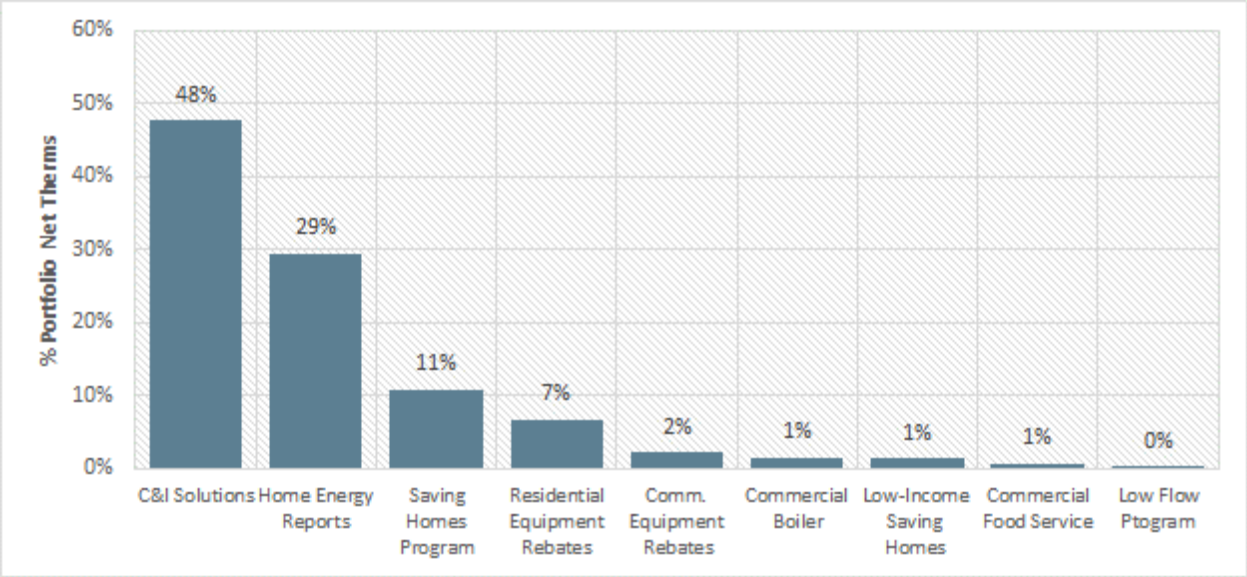


Figure 1-1: Contribution to Portfolio Net Savings by Program

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

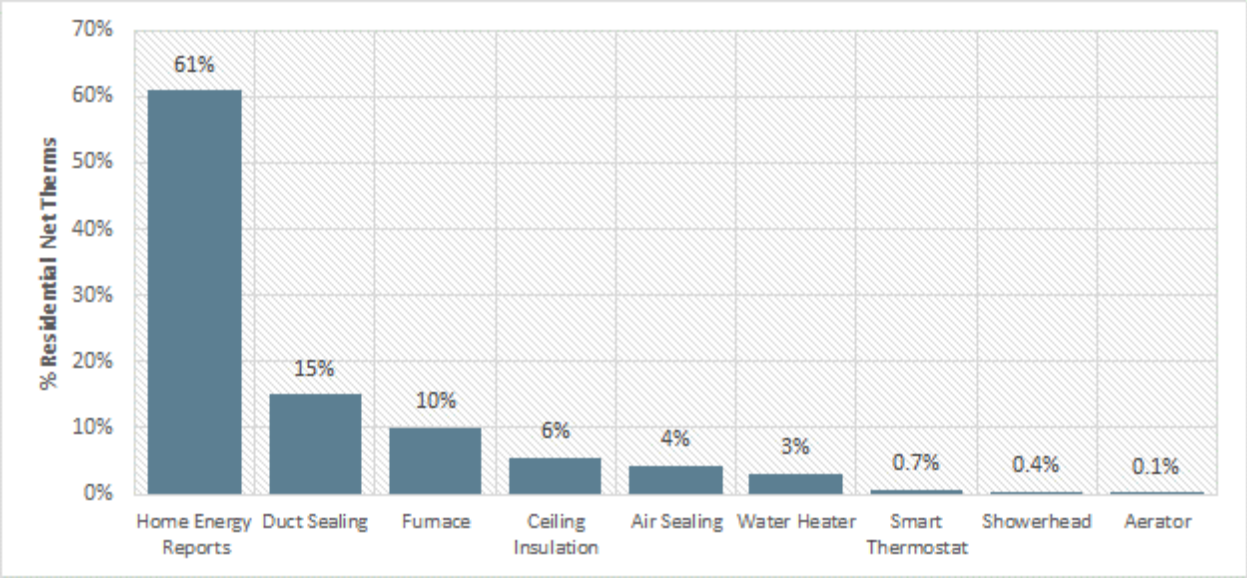


Figure 1-2: Residential Portfolio Savings Share by Measure

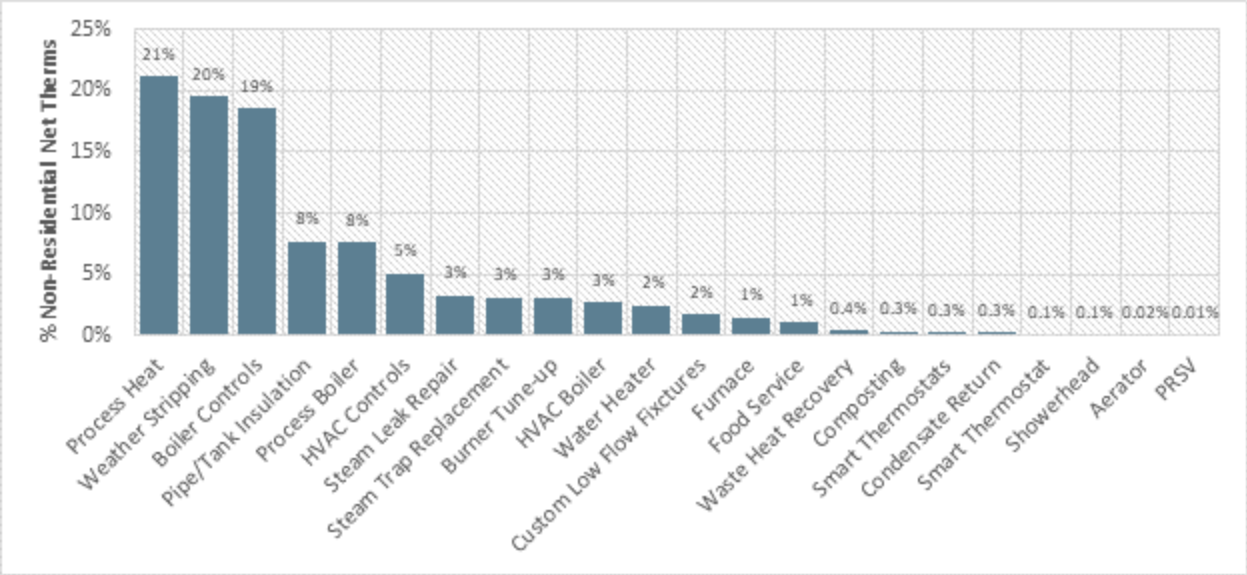


Figure 1-3: C&I Portfolio Savings Share by Measure

From this, the Evaluators have identified the following High Impact Measure (HIMs):

Residential:

- Home Energy Reports;
- Duct Sealing;
- Furnace; and
- Ceiling Insulation.

Non-residential:

- Custom process heating;
- Weather stripping;
- Boiler controls;
- Pipe/tank insulation;
- Process boilers; and
- HVAC controls.

Further, the Evaluators put the net savings into the context of SUA's PY2022 filed goal[10]. Table 1-4 summarizes the performance against goals of programs evaluated in this report.

Table 1-4: SUA PY2022 EE Portfolio Performance against Goals

Program	PY2022 Verified Net Therms	PY2022 Net Therms Goal	% of Goal Attained
Residential Equipment Rebates	247,706	712,680	46%
Commercial Equipment Rebates	77,455		
Commercial Boiler	52,301	57,585	91%
C&I Solutions	1,774,006	1,601,581	111%
Commercial Food Service	21,283	64,641	33%
Home Energy Reports	1,096,289	850,000	129%
Low Flow Program	8,950	161,622	6%
Saving Homes Program	398,991	437,939	91%
Low-Income Saving Homes	49,170	48,660	101%
Total	**3,726,152**	**3,934,708**	**95%**

The SUA portfolio reached 95% of their filed savings goal, compared to 108% in PY2021. There was notably strong performance relative to goals in the Home Energy Reports and C&I Solutions programs. This was achieved while spending 98.2% of the available budget.

Programs with lower performance relative to goal attainment included the Residential/Commercial Equipment Rebates Program, Low-Flow Showerhead and Faucet Aerator Program, and the Commercial Food Service Program. Percent of goal attained and

[10] This differs from the APSC-required target of .5% of sales. CenterPoint's filed goals are designed to exceed APSC targets.

budget spent by program is summarized in

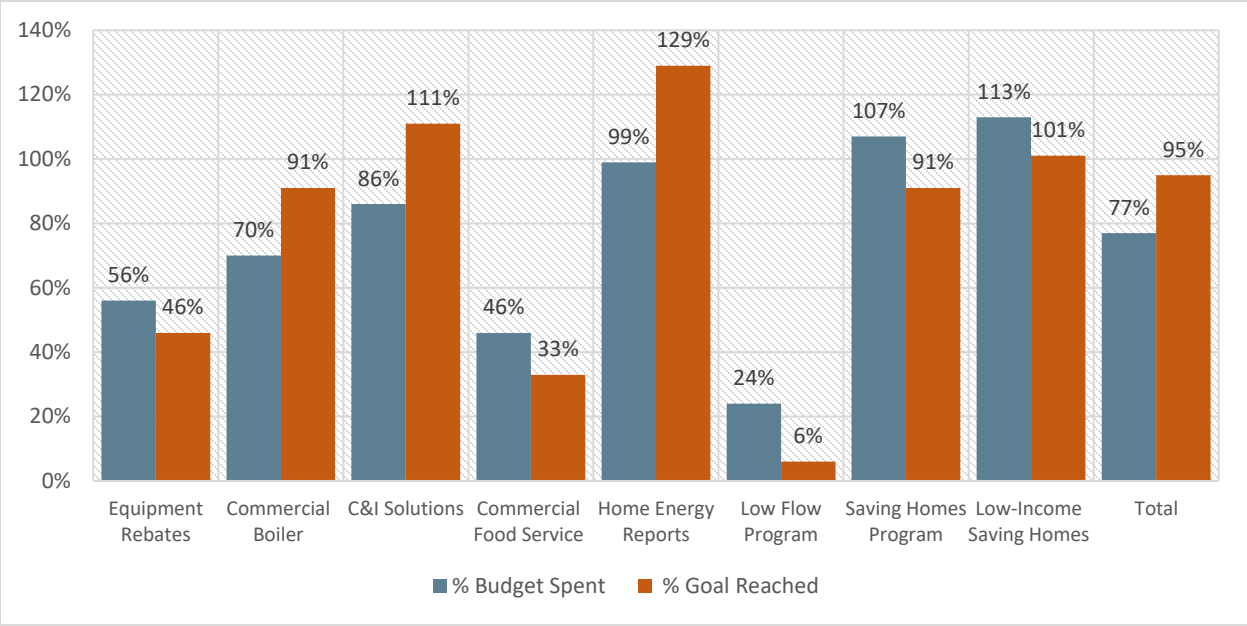


Figure 1-4.

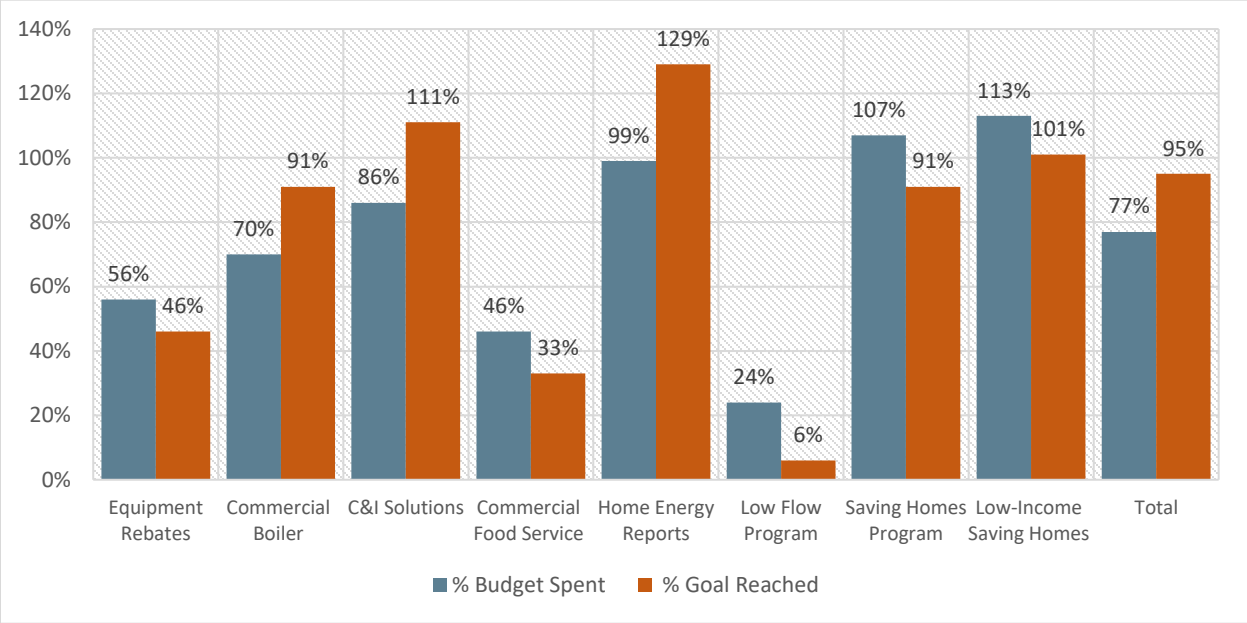


Figure 1-4: Summary of Goal Attainment & Budget Expenditure by Program

The non-energy benefits (NEBs) attained by the SUA portfolio in PY2022 are detailed in the tables to follow.

Table 1-5: SUA PY2022 Verified Electric Savings

Program	Measure	Net Annual kWh	Net Peak kW	Lifetime Net kWh
Res. Equipment Rebates	Smart Thermostats	142,119	-	1,563,305
Comm. Equipment Rebates	Smart Thermostats	13,977	-	153,748
C&I Solutions	Weather Stripping	80	.06	876
Low Flow Program	Aerators	4,044	.42	40,439
	Showerheads	27,921	2.90	279,210
Saving Homes Program	Duct Sealing	669,852	355.96	12,057,337
	Air Infiltration	117,470	251.00	1,292,170
	Ceiling Insulation	302,701	367.51	6,054,022
Low Income Saving Homes	Duct Sealing	122,860	66.08	2,211,474
	Air Infiltration	12,615	9.62	138,768
	Ceiling Insulation	76,238	84.80	1,524,750
Total		**1,489,876**	**1,138.34**	**25,316,099**

Table 1-6: SUA PY2022 Verified Water Savings

Program	Measure	Net Annual Water	Net Lifetime Water
C&I Solutions[11]	Direct Install	425,619	4,530,349
	Custom	1,431,485	18,181,247
Low Flow Program	Aerators & Showerheads	2,503,730	25,037,299
Saving Homes Program	Aerators	3,877	38,772
	Showerheads	10,991	109,908
Total		**4,375,702**	**47,897,575**

Table 1-7: SUA PY2022 Avoided/Deferred Replacement Cost

Program	Measure	Net A/DRC per Unit	Total Net A/DRC
Residential Equipment Rebates	Tankless Water Heater	$304.68	$388,071

[11] Direct Install comprised showerheads, PRSVs, and faucet aerators. Custom comprised of process boilers, boiler controls, steam leak repair, and condensate return improvement.

	Furnace Early Retirement	$721.92	$520,715
Commercial Equipment Rebates	Tankless Water Heater	$124.34	$15,359
Total			**$924,144**

1.4 Program-level Findings

1.4.1 Residential Equipment Rebates

SUA accurately calculates savings per TRM V9.0 protocols.	All projects at 100% gross realization. SUA's tracking system accurately applies TRM V9.0, algorithms and early retirement adjustments.
SUA has endeavored to encourage comprehensiveness via combination rebates.	A rebate of $1,500 is provided for participants who simultaneously install a qualifying furnace and tankless water heater. These rebates comprised 23% of furnace and 14% of water heater projects.

1.4.2 Commercial Equipment Rebates

Tracking data for water heaters has improved significantly.	In PY2020, the Evaluators had to develop DHW load inputs for over 80% of commercial projects. In PY2022, this was only required for a total of 4 projects (3% of total projects).
The program has ARC NEBs from tankless water heaters.	They are lower than observed for residential tankless systems, however, due to a lower volume of units and that the baseline system has an EUL of 15 years, compared to 11 years for residential systems. Further, there was participation from

	master-metered multifamily units which have ARC values similar to residential participants (differing solely by NTGR).

1.4.3 Commercial Boiler Program

The program was closest to meeting its savings goal.	In PY2022, the Commercial Boiler Program reached 91% of its net savings goal.
SUA accurately calculates savings per TRM V9.0 protocols.	All projects at 100% gross realization. SUA's tracking system accurately adjusts baseline to align with code requirements by size category and boiler type.
There was only one participant in the lower efficiency tier.	As found in the prior two program years, There was one boiler in the 85%-92% efficiency tier in PY2022. There were no participants in this tier in PY2020 or PY2021.

1.4.4 C&I Solutions

The program met savings goals and was highly cost-effective.	The program met 111% of its savings goal with 1,774,006 net therms.
	Savings declined by 10.6% compared to PY2021, though PY2021 was the highest-saving year in the history of the program.

1.4.5 Commercial Food Service Program

SUA accurately calculates savings per TRM V9.0 protocols.	All projects other than rack ovens had 100% gross realization. Rack ovens did not have calculations automated in the tracking system as there had never been participation in this measure.
Savings have declined significantly.	Program net therms decreased from 50,469 to 21,283 from PY2021 to PY2022. SUA staff have noted a long struggle for this program to meet participation and savings goals.

1.4.6 Home Energy Reports

The program continues to provide reliable savings as a percent of billed use but faces ongoing issues with customer attrition.	Waves 1-4 are responsible for 36.2%, 23.4%, 19.5%, and 19.9% of program savings, respectively. However, as of the end of 2022, these same waves have 53.4%, 49.4%, 41.6%, and 34.3% attrition. Collecting data on reasons for attrition and conducting an analysis on those data may be worthwhile.
Savings per customer increased for Waves 2-4 compared to prior program years.	For waves 2-4, savings have either been maintained or have increased from PY2020 onwards. Moreover, for all 3 waves savings are at their highest level since PY2019, at 9.3, 14.3, and 14.3 therms per customer respectively. As a result, the Home Energy Reports program outperformed program plan savings.
Data from Waves 5 and 6 are yet to demonstrate significant savings.	Wave 5 and 6 have an RCT start date of 10/02/2020 and 02/06/2022, respectively. Statistically significant differences between the treatment and control groups in these waves are yet to develop. COVID-19 lockdowns extending into the RCT pre period and incomplete post period data for Wave 6 may have had a confounding impact on savings results.

1.4.7 Low Flow Showerhead & Faucet Aerator Program

The program is cost-effective but has had continuously declining participation and savings.	The program expended only 24% of its budget and met 6% of its savings goal. Much of this decline in savings is due to revised NTG findings, but at the prior (higher) NTG, the program still significantly over-expended relative to participation volume.

1.4.8 Saving Homes Program

Realization rates were high overall.	The overall realization rate was 101.2%.
The program is highly cost-effective.	With a significant contribution from NEBs, the program's TRC is 6.61.

NEBs have increased as SUA has expanded participation in areas served by municipal utilities and rural co-ops.	This has been most notable with expanded participation in North Little Rock.
Project comprehensiveness has declined.	The average measures per-project has remained consistent: PY2020: 2.95 PY2021: 1.78 PY2022: 1.78

1.4.9 Low Income Saving Homes Program

The program met savings goals and was highly cost-effective.	The program met 101% of its net savings goal and had a 3.95 TRC.
Progress was made on H&S measures, but the program is not yet meeting Act 1102 requirements.	H&S spending increased from $60.54 to $87.07 per participant, and the percent of homes with any H&S spending increased from 29% to 43%. The program could significantly increase H&S spending and maintain a robust TRC score.

1.4.10 Recommendation Summary

In PY2021, 12 program or portfolio level recommendations were provided to SUA as part of the EM&V of their portfolio. The Evaluators reviewed SUA's response to recommendations from the PY2020 EM&V report and categorized them as follows:

1) **Completed.** Recommendation fully implemented.
2) **Continuing.** Recommendation fully implemented. However, due to the nature of the recommendation, this will be an area monitored throughout the next program year.
3) **Rejected.** This applies to recommendations which are reviewed by BHE and rejected.
4) **In progress.** Recommendation accepted and will be adopted before next program year.
5) **Under consideration.** Recommendation still under review by program staff or implementers and no decision yet made.

6) **Reviewed and rejected.** Recommendation considered and subsequently rejected or no longer applicable due to changes in program design or operations.

The responses recommendations are summarized in Figure 1-5.

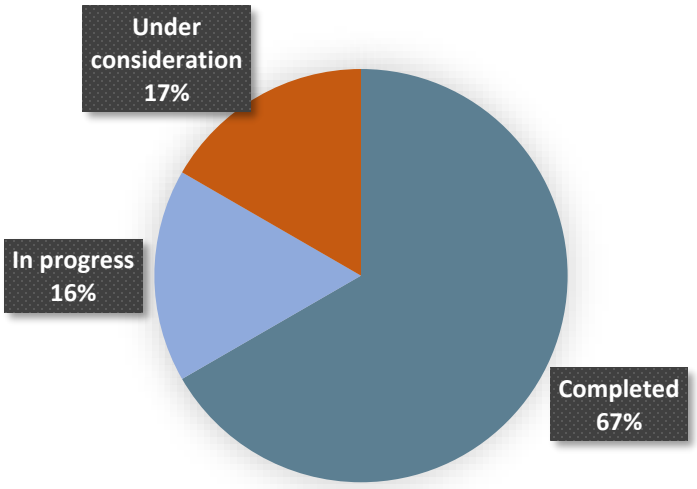


Figure 1-5: Summary of Status of PY2021 Recommendations

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 3 provides portfolio-level and cross-cutting findings;
- Chapter 4 provides results for the Residential Equipment Rebates Program;
- Chapter 5 provides results for the Commercial Equipment Rebates Program;
- Chapter 6 provides results for the Commercial Boiler Program;
- Chapter 7 provides results for the C&I Solutions Program;
- Chapter 8 provides results for the Commercial Food Service Program;
- Chapter 9 provides results for the Home Energy Reports Program;
- Chapter 10 provides results for the Low Flow Showerheads & Faucet Aerators Program;
- Chapter 11 provides the results for the Saving Homes Program;
- Chapter 12 provides results for the Low Income Saving Homes Program.
- Chapter 13 provides a summary of recommendations for TRM updates; and
- Appendix A provides the site-level custom reports for the C&I Solutions Program;
- Appendix B summarizes deferred replacement cost calculations; and
- Appendix C provides sample TRM calculations.

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

A first step to detailing the evaluation methodologies, the Evaluators provide a glossary of terms to follow[12]:

- *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 "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 ADM 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.

[12] Arkansas TRM V9.0, Volume 1, Pg. 86-92

- *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 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 PY2022 SUA EE 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 the recommendations for program improvement, and ensure cost-effective use of ratepayer funds. By leveraging experience and lessons learned from prior evaluations, the PY2022 evaluation is streamlined to focus on areas in needed of research and improvement.

2.2.1 Sampling

Sampling is necessary to evaluate savings for the SUA EE portfolio insomuch as verification of a census of program participants is typically cost-prohibitive. As per evaluation requirements set forth by the Independent Evaluation Monitor (IEM), 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

2.2.1.1 Census of Participants

- A census of participant data was used to select 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

2.2.1.2 Simple Random Sampling

For programs with relatively homogenous measures (largely in the residential portfolio), the Evaluators 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 enough participation to make a sample of this size cost-effective. In instances of low participation, ADM 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 only 100 participants, the finite population correction would result in a final required sample size of 41. The Evaluators 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:

- Residential Commercial Equipment Rebates;
- Commercial Equipment Rebates;
- Low Flow Showerhead & Faucet Aerator Program; and
- Saving Homes Program.

2.2.1.3 Stratified Random Sampling

For the SUA Commercial & Industrial programs, simple random sampling is not an effective sampling methodology as the CV values observed in business programs are typically very high because the distributions of savings are generally positively skewed. Often, a relatively small number of projects account for a high percentage of the estimated savings for the program.

To address this situation, we use a sample design for selecting projects for the M&V sample that takes such skewness into account. With this approach, we select a number of sites with large savings for the sample with certainty and take a random sample of the remaining sites. To further improve the precision, non-certainty sites are selected for the sample through systematic random sampling. That is, a random sample of sites remaining after the certainty sites have been selected is selected by ordering them according to the magnitude of their savings and using systematic random sampling. Sampling systematically from a list that is ordered according to the magnitude of savings ensures that any sample selected will have some units with high savings, some with moderate savings, and some with low savings. Samples cannot result that have concentrations of sites with atypically high savings or atypically low savings.

2.2.2 Free-Ridership

In determining ex post net savings for the SUA EE portfolio, the Evaluators provide 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 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)."[13]

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

2.2.2.1 Residential Free-Ridership

The Evaluators determine free-ridership by measure type and installation type for SUA programs. Free-ridership study groups are delineated by technology, delivery mechanism and target market. The taxonomy of residential free-ridership designations is summarized in Figure 2-1. Blocks marked in light blue indicate a final free-ridership category.

[13] Arkansas TRM V9.0, Pg. 49.

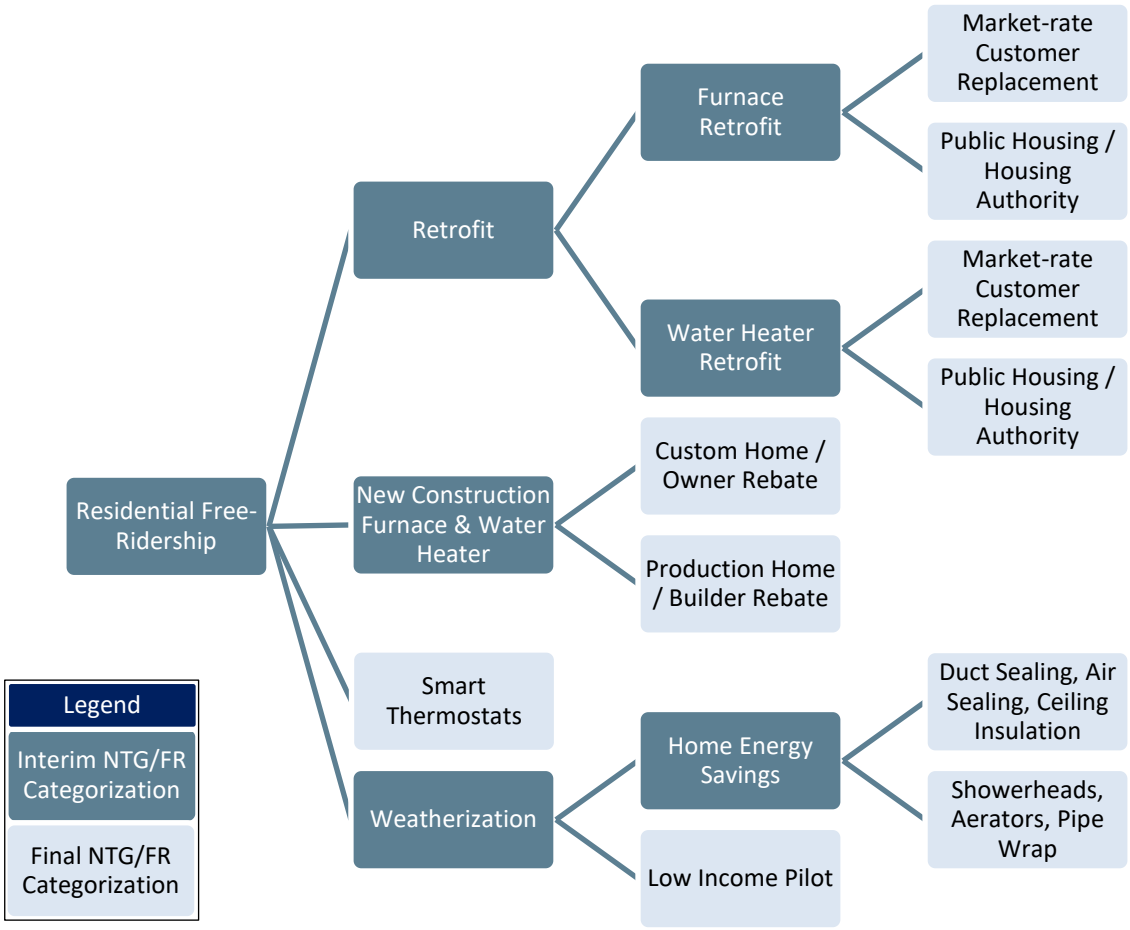


Figure 2-1: Residential Free-ridership Designations

Certain measures were selected to have NTG evaluated by different market segments, as these segments can demonstrate markedly different decision-making processes and cost sensitivities. For example, installation of a high efficiency furnace or tankless water heater is a simpler process in new construction than in retrofit, and the decision is often made by a homeowner. In instances such as this, the Evaluators segmented participation into key subgroups to better-differentiate the impact of SUA program interventions on various customer segments' decision-making.

The general methodology for evaluating free ridership among residential 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) Demonstrated behavior in purchasing similar equipment absent a rebate

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 Evaluators then examine 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. For programs that are contractor-driven, the free rider score of a survey respondent incorporates the relative importance of advice from their contractor, provided that the contractor is a program trade ally that received training from the appropriate program. This value is then applied to the program-level savings to discount savings attributable to free ridership.

2.2.2.2 Prescriptive Non-Residential Free-Ridership

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

- Demonstrated financial ability to purchase high-efficiency equipment absent the rebate
- Importance of the rebate in the decision-making process
- Prior planning to purchase high-efficiency equipment
- 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 Evaluators then examine 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.

2.2.2.3 Custom Free-Ridership

For custom projects from the C&I Solutions program, free ridership is assessed on a case-study basis, through which the Evaluators 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%.

In the C&I Solutions chapter, the free rider "case studies" are provided for every custom project.

2.2.3 Impact Evaluation Activities by Program

The Evaluators used established, industry-standard approaches to estimate energy savings and demand reductions at the measure, program, and portfolio levels. We followed all applicable measure- and program-level guidelines and protocols from the AR TRM 8.0.

To evaluate program impacts, ADM adjusted program-reported gross savings using the results of our research, relying primarily on engineering desk reviews, TRM deemed savings calculation, and onsite verification and metering for applicable programs. To calculate deemed savings, we verified the appropriateness of savings algorithms and values in program tracking data as compared to guidelines in the TRM V9.0. Where sampling was used (for surveys and site visits), we designed a sampling plan to achieve a minimum precision of ±10% of the gross realized savings estimate with 90% confidence at the program-level.

Impact evaluation activities by program are summarized in Table 2-1.

Table 2-1: PY2022 Impact Evaluation Activities by Program

Program	Database / Document Review	Engineering Desk Review	Deemed Savings Review	On-site Verification / Metering	Simulation Modeling	Billing Analysis
Res. Equipment Rebates	✓		✓			
Comm. Equipment Rebates	✓	✓	✓			
Commercial Boiler	✓		✓			
C&I Solutions	✓	✓	✓	✓	✓	✓
Comm. Food Service	✓		✓			
Home Energy Reports	✓					✓
Low Flow Program	✓		✓			
Saving Homes Program	✓		✓	✓		

2.2.3.1 Net-to-Gross Approach by Program

For the PY2022 evaluation, the evaluation team conducted data collection and analysis to support Net-to-Gross (NTG) calculations. Table 2-1 shows the NTG approach the Evaluators followed for each program based on our assessment of specific program needs and the availability of accurate, existing information. These data collection and analysis activities comply with one of the five accepted approaches listed in the TRM V9.0, Protocol F.

Table 2-2: PY2022 NTG Approaches by Program

Program	Assigned PY2021 Value	Literature Review	SUA-specific Survey	Multi-utility Survey	Control Group Billing Analysis
Residential furnace retrofit	✓				
Residential DHW retrofit	✓				
Residential smart thermostats	✓				
Housing authority furnace & DHW	✓				
New construction – builders	✓				
New construction – custom	✓				
Multifamily	✓				
Commercial Equipment Rebates	✓				
Commercial Boiler	✓				
C&I Solutions					
Direct install	✓				
Custom			✓		
Commercial Food Service	✓				
Home Energy Reports					✓
Low Flow Showerhead / Aerator	✓				
Saving Homes Program			✓		

2.3 Process Evaluation

2.3.1 General Approach

The Evaluators' general approach to process evaluation begins with a review of the tests for timing and appropriateness of process evaluation as defined in Protocol C of the TRM V9.0. In this review, the Evaluators determine what aspects of the program warrant a process evaluation (due to issues identified in the PY2021 evaluations). CenterPoint was in the process of going through an acquisition in PY2021 that took effect for PY2022 with the company now operating as Summit Utilities Arkansas. The process evaluation activities focused on areas of research to support potential program redesign for the next triennial, allowing for adjustments by SUA to address under-performing programs.

The PY2022 process overviews began with interviews of program staff. These interviews, along with guidance from IEM protocols, inform the establishment of goals for the process evaluation, provide background history of programs, and introduce portfolio-level issues. From this, the Evaluators then develop a list of data collection activities. The data collection procedures for process evaluations typically included:

- *Participant Surveying*. The Evaluators surveyed statistically significant samples of participants in each program in order to provide feedback for the program and provide an assessment of participant satisfaction.
- *In-Depth Interviews*. The Evaluators conducted in-depth interviews with high-level program actors, including SUA program staff, third-party implementation staff, and program Trade Allies. These interviews are semi-structured, in having general topics to be covered, with a general question and answer outline.

3 Portfolio-Level Findings

This chapter provides a summary of the portfolio-level findings and any cross-cutting evaluation activities that occurred over the course of the PY2022 EM&V Effort. Specifically, this chapter includes:

- A summary of program and portfolio performance in PY2022;
- A summary of EM&V activities and expenditures in PY2022; and
- High-level findings that cut across programs.

3.1 Summary of EM&V Effort

Table 3-1 summarizes the data collection efforts for the PY2022 EM&V effort. "Interviews" should be distinguished from "Surveys" in that "Interviews" reflect semi-structured, in-depth discussions with high-level program actors (such as utility staff and third-party implementation staff) whereas surveys are fully-structured and typically conducted with program participants.

Table 3-1: Summary of Data Collection Efforts

Program	# Site Visits	# Surveys	# Interviews
Residential Equipment Rebates	0	0	2
Commercial Equipment Rebates	0	0	2
C&I Boiler	0	0	2
C&I Solutions	19	19	3
Commercial Food Service	0	0	2
Home Energy Reports	0	0	1
Low Flow Showerhead & Faucet Aerator Program	0	0	1
Saving Homes Program	40	22	1
Low Income Saving Homes Program	0	20	1
Total	59	61	15

3.2 Tests of Portfolio Comprehensiveness

The Arkansas Public Service Commission has in place a set of criteria in order to determine whether an EE portfolio qualifies as "Comprehensive". These criteria are:

- **Factor 1:** Whether the programs and/or portfolio provide, either directly or through identification and coordination, the education, **training**, marketing, or outreach needed to address market barriers to the adoption of cost-effective energy efficiency measures;

- **Factor 2:** Whether the programs and/or portfolio, have adequate **budgetary**, management, and program delivery resources to plan, design, implement, oversee and evaluate energy efficiency programs;
- **Factor 3:** Whether the programs and/or portfolio, reasonably address all major **end-uses** of electricity or natural gas, or electricity and natural gas, as appropriate;
- **Factor 4:** Whether the programs and/or portfolio, to the maximum extent reasonable, comprehensively address the needs of customers at one time, in order to avoid **cream-skimming** and lost opportunities
- **Factor 5:** Whether such programs take advantage of opportunities to address the comprehensive needs of **targeted customer sectors** (for example, schools, large retail stores, agricultural users, or restaurants) or to leverage non-utility program resources (for example, state or federal tax incentive, rebate, or lending programs)
- **Factor 6:** Whether the programs and/or portfolio enables the delivery of all achievable, **cost-effective** energy efficiency within a reasonable period of time and maximizes net benefits to customers and to the utility system;
- **Factor 7:** Whether the programs and/or portfolio, have evaluation, measurement, and verification ("EM&V") procedures **adequate** to support program management and improvement, calculation of energy, demand and revenue impacts, and resource planning decisions.

The Evaluators reviewed the SUA programs and portfolio in order to assess whether it complied with the APSC Comprehensiveness Goals. In assessing these metrics, the Evaluators score them on numerous subcomponents. The scoring methodology is as follows:

■: Meets all requirements and is in full compliance with this performance indicator

◒: Meets some requirements and is in partial compliance with this performance indicator

■: Is not in compliance with this performance indicator.

NA: Performance indicator is not applicable to this program.

3.2.1 Factor 1: Education, Training, Marketing, and Outreach

3.2.1.1 Assessment of Education

The Evaluators assessed the educational components of the SUA programs, in order to identify whether the programs were providing potential participants with the needed information to guide their decision-making, and whether the channels used to reach the target markets are appropriate. The Evaluators found that:

- SUA's programs used a range of channels to provide educational materials to their programs' target markets. The educational materials included brochures, case studies, and presentations to trade & industry groups.

- SUA program staff conducts outreach and education through a wide range of potential program partners, including contractors, retailers, home builders, and local governments.

The breadth of educational materials by program is summarized in Table 3-2.

Table 3-2: Assessment of Customer Education by Program

Program	Provides Educational Materials	Outreach Through Multiple Channels	Education Targeted to Specific Market Barriers	Coordination of Education by Multiple Entities
Gas Equipment Rebates	●	●	●	●
Commercial Boiler	●	●	●	●
Commercial Food Service	●	●	●	●
C&I Solutions	●	●	●	●
Home Energy Reports	●	NA	●	NA
Low Flow Program	●	●	●	NA
Saving Homes Program	●	●	●	●
Low Income Saving Homes Program	●	NA	●	NA

● Educational materials broadly provided
◒ Program budgeting includes educational materials, but materials not broadly provided
○ Educational materials not offered

3.2.1.2 Assessment of Training

The Evaluators reviewed each SUA program to assess whether:

1) Whether the program is trade ally-driven;
2) If not, is it a program that could or should be trade ally-driven;
3) The program provides training classes to support their program offerings; and
4) Whether the programs need trade ally certification.

Table 3-3: Assessment of Trade Ally Training by Program

Program	Trade Ally Training Offered	Training Requirements Adhere to Best Practices	Trade Allies Participate in Training
Gas Equipment Rebates	●	●	●
Commercial Boiler	●	●	●
Commercial Food Service	●	NA	●
C&I Solutions	●	●	●
Home Energy Reports	NA	NA	NA
Low Flow Program	NA	NA	NA
Saving Homes Program	●	●	●
Low Income Saving Homes Program	●	◒	●

● Category fulfilled in most instances (deviations are an exception)
◒ Category fulfilled in some instances (deviations occur regularly)
○ Category not offered not offered/not fulfilled at all

The Commercial Food Service Program has several categories marked as "NA" in that it is driven by equipment vendors, but that their training only constitutes being informed on identifying qualifying equipment and instruction on the application process. Technical training was not provided (and was not needed).

SUA does not require trade ally registration to participate, except for in the Saving Homes and Low Income Savings Homes Programs. Their approach has been to allow all licensed dealers or contractors to apply for the appropriate equipment rebates. The Evaluators have concluded that this has not to-date affected the quality assurance of the programs.

The Evaluators assigned a half Harvey Ball for the Low Income Saving Homes Program due to the lack of health and safety measure installations. This has improved over PY2021 performance but has not yet met expectations of Act 1102.

3.2.1.3 Marketing & Outreach

The Evaluators reviewed the marketing and outreach strategies associated with each of the SUA programs. These strategies were reviewed to assess whether they adequately addressed the relevant participant barriers, the extent to which trade allies were actively marketing the program (where appropriate), and whether the materials were correctly targeted in marketing a comprehensive approach to energy efficiency.

A summary of the Evaluators' assessment of SUA's marketing and outreach is presented in Table 3-4.

Table 3-4: Assessment of Marketing & Outreach by Program

Program	Marketing Addresses Specific Barriers	Trade Allies Promote Program	Marketing Support Provided to Trade Allies	Marketing Performed Through Diverse Channels
Gas Equipment Rebates	●	●	●	●
Commercial Boiler	●	●	●	●
Commercial Food Service	●	●	●	●
C&I Solutions	●	●	●	●
Home Energy Reports	●	NA	NA	NA
Low Flow Program	●	NA	NA	●
Saving Homes Program	●	●	●	●
Low Income Saving Homes Program	N/A	●	●	N/A

● Category fulfilled in most instances (deviations are an exception)

◒ Category fulfilled in some instances (deviations occur regularly)

○ Category not offered not offered/not fulfilled at all

After reviewing the marketing and outreach materials, the Evaluators concluded that:

- Most programs have marketing materials that address specific barriers associated with the targeted segments or technologies.
- SUA has initiated sector-specific marketing, including fact sheets for restaurants and food processing plants.
- The SUA programs are marketed through a diverse range of channels, including mass-media advertising, online advertising, meetings and training sessions with professional organizations and trade groups, and partnered marketing with municipal governments.
- The Low Income Saving Homes Program is not broadly marketed during pilot phase and as a result the Evaluators have assigned “N/A” to some categories.

3.2.2 Factor 2: Budgetary, Management, and Program Delivery Resources

Several performance indicators were assessed in reviewing the adequacy of budgetary, management, and program delivery resources. This included:

- Self-reports from program management staff
- Cost per Therm saved
- Review of trade ally resources dedicated to program promotion.

Table 3-5: Assessment of Budgetary, Management, and Program Delivery Resources by Program

Program	Budget is Sufficient to Support Program Goals	Cost per-Therm Aligns with Program Plan	Program Has Sufficient Staffing	Program Has Sufficient Trade Ally Support
Gas Equipment Rebates	●	○	●	●
Commercial Boiler	●	●	●	●
Commercial Food Service	●	○	●	●
C&I Solutions	●	●	●	●
Home Energy Reports	●	●	●	N/A
Low Flow Program	●	○	●	N/A
Saving Homes Program	●	◒	●	●
Low Income Saving Homes Program	◒	◒	●	●

● Quantitative: meets of expectation/requirement

Qualitative: Category fulfilled in most instances (deviations are an exception)

◒ Quantitative: value no lower than 80% of expectation/requirement

Qualitative: Category fulfilled in some instances (deviations occur regularly)

○ Quantitative: value is lower than 80% of expectation/requirement

Qualitative: Category not offered not offered/not fulfilled at all

From this review, the Evaluators concluded that the SUA portfolio overall has the adequate budget and staff allocations. Programs were credited with full compliance if acquisition costs exceeded plan values by no more than 10%. Programs were credited with partial compliance if

acquisition costs exceeded program plan values by no more than 20%.

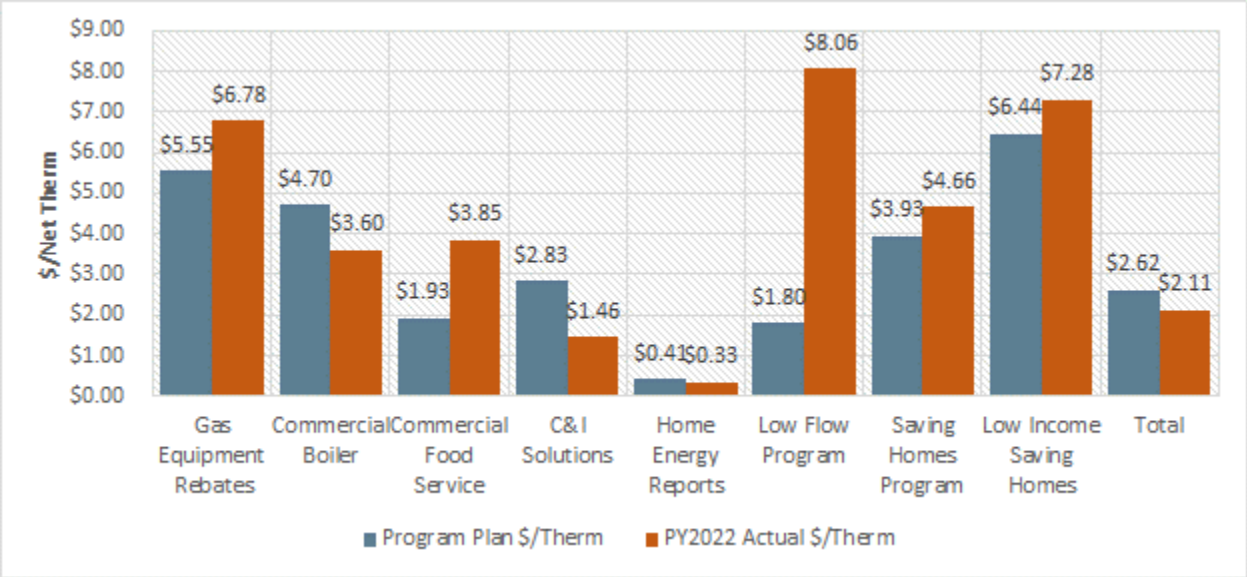


Figure 3-1 summarizes the planned and actual first-year savings acquisition costs.

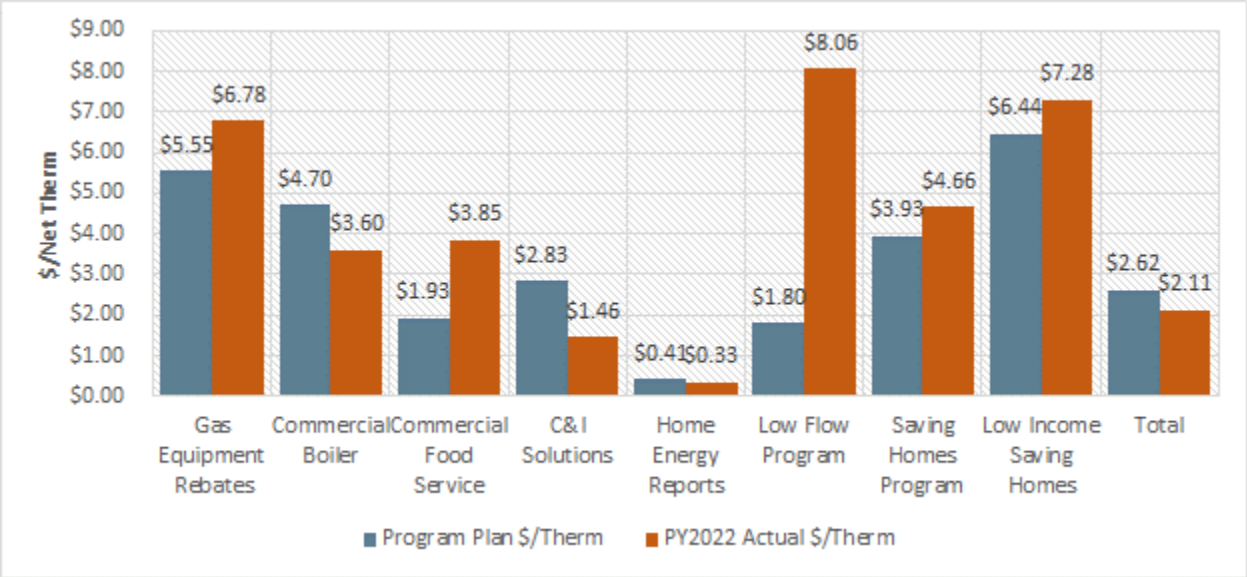


Figure 3-1: Planned vs. Actual Acquisition Costs

- The portfolio overall had acquisition costs that were 20% lower than the program plan. This is due largely to the effects of the Home Energy Reports and C&I Solutions Programs. Home Energy Reports' acquisition costs were 20% lower than the program plan and C&I Solutions' costs were 49% lower than program plan. Additionally, Commercial Boilers had acquisition costs 24% lower than the program plan value.

- All other programs had costs that were at least 10% higher than planned: Gas Equipment Rebates, Low Flow Showerhead & Aerators, Saving Homes, Low Income Saving Homes, Commercial Food Service.
- The Evaluators note that while Saving Homes and Low Income Saving Homes had acquisition costs that were more than 10% higher than the program plan estimates, the programs were highly cost-effective (with TRC scores of 6.61 and 3.95 respectively). Though by this metric of comprehensiveness that has been consistently applied since 2012, the programs were assigned "partial compliance", with benefit-cost ratios this high it is perhaps emblematic that the acquisition cost estimate should be adjusted rather than program strategy.

3.2.3 Factor 3: Addressing Major End-Uses

The Evaluators identified the end-uses served by each of the SUA programs. Most SUA programs are designed around a specific technology or end-use. Table 3-6 summarizes the end-uses addressed by each program.

Table 3-6: End-Uses Addressed by Program

Program	HVAC	Hot Water	Food Service	Building Envelope	Industrial Process	Behavioral
Gas Equipment Rebates	●	●	○	○	○	○
Commercial Boiler	●	◒	○	○	○	○
Commercial Food Service	○	○	●	○	○	○
C&I Solutions	●	●	◒	●	●	○
Home Energy Reports	○	○	○	○	○	●
Low Flow Program	○	●	○	○	○	○
Saving Homes Program	●	◒	○	●	○	○
LI Saving Homes Program	●	◒	○	●	○	○

● Measure targeted ◒ Measure offered ○ Measure not offered

3.2.4 Factor 4: Comprehensively Addressing Customer Needs

To assess Factor 4, the Evaluators reviewed SUA programs to discern the extent of:

- Program-provided technical assistance;
- Incentives of comprehensive projects/measure suites; and
- Tiered incentives for higher efficiency levels.

The SUA portfolio has no specific requirements for installation of multiple measures. Customers can participate to an extent of their choice. This is a program best-practice in enabling customers to engage in energy efficiency in a manner in accordance with their budget constraints.

Table 3-7 summarizes the comprehensiveness of offerings for each program.

Table 3-7: Assessment of Project Comprehensiveness by Program

Program	Technical Assistance and/or Audits	Information Provided Comprehensive for Efficiency	Bundled Incentives for Multiple Measures	Tiered Incentives for Premium Efficiency	Trade Ally Incentives for Premium Efficiency
Gas Equipment Rebates	◒	◒	●	●	●
Commercial Boiler	◒	◒	○	●	●
Commercial Food Service	◒	◒	○	●	●
C&I Solutions	●	●	●	●	●
Home Energy Reports	○	◒	NA	NA	NA
Low Flow Program	○	○	NA	NA	NA
Saving Home Program	●	●	NA	NA	NA
Low Income Saving Homes	●	●	NA	NA	NA

● Broadly provided ◒ Available ○ Not offered

Findings from the assessment of this factor included:

- Most SUA prescriptive programs offer incentives to trade allies for installation of top-tier efficiency measures. This has included incentives for condensing furnaces, tankless water heaters, and high-efficiency food service equipment, and boilers.

- The SUA portfolio offers tiered incentives for premium efficiency across all of their rebate programs. This includes:
  - The incentives for efficient furnaces increase from $400 to $600 for units with 95% AFUE or greater.
  - Incentives for efficient water heaters range from $75 for storage tank water heaters to $500 for tankless water heaters, and large commercial water heaters have an incentive that scales with system size ($200 per 100,000 input BTU).
  - High-efficiency boiler incentives are $1,800/MMBtuh for units < 92% efficient and $3,500/MMBtuh for units with 92% efficiency or greater.
  - The Commercial Food Service now offers tiered incentives for different system capacities and efficiencies for key measures (ovens, fryers).
  - The C&I Solutions program pays an incentive per verified Therm, and as a result projects with higher savings are by design paid a higher incentive.
- The SUA portfolio has programs that bundle on-site technical assistance with direct installation.
- The range of technical assistance varies by program. Equipment Rebates and Commercial Boiler Programs offer technical assistance through program trade allies. The level of on-site technical assistance is lower for the Commercial Food Service Program in that the market is driven by in-store contact with vendors rather than by on-site assessment. C&I Solutions, Saving Homes, and Low Income Saving Homes provide on-site technical assistance that is directly funded by the program. SHP and LISHP received half a Harvey Ball due to declining comprehensiveness in PY2022 (as measure by total energy-saving measures installed per home).
- The programs have procedures for following up with customers after their participation, which includes thank-you calls or emails and verification inspection.
- Marketing materials typically make attempts at cross-promotion of programs.

3.2.5 Factor 5: Targeting Market Sectors & Leveraging Opportunities

The Evaluators reviewed whether the SUA portfolio offered a comprehensive range of energy efficiency opportunities to all major customer sectors. Table 3-8 summarizes the market sectors and what programs target or allow each sector.

Table 3-8: Assessment of Targeted Customer Sectors by Program

Program	Residential	Multifamily	Mobile Home	Small Commercial	Large Commercial	Industrial	Agricultural	Public Sector
Gas Equipment Rebates	●	●	◒	●	●	◒	◒	●
Commercial Boiler	○	◒	○	◒	●	◒	◒	●
Commercial Food Service	○	◒	○	●	●	◒	◒	●
C&I Solutions	○	◒	○	●	●	●	●	●
Home Energy Reports	●	◒	◒	○	○	○	○	○
Low Flow Program	●	◒	◒	○	○	○	○	○
Saving Homes Program	●	◒	◒	○	○	○	○	◒
Low Income Saving Homes Program	●	◒	◒	○	○	○	○	◒

● Program targets this sector

◒ Sector is eligible for this program

○ Sector is ineligible for this program

Each sector has several programs for which they are eligible, and at least one program that targets them. Segments with fewer targeted outreach avenues include:

- Mobile/manufactured housing is often not targeted as there is a much higher prevalence of electric space and water heating.
- Agriculture and Industrial sectors are not specifically targeted by the Commercial Equipment Rebates Program as the equipment used by these facilities generally requires custom calculations.
- Public Sector facilities are targeted with a wide range of programs. This has included residential programs that reach out to public housing authorities.

In addition, the Evaluators reviewed the extent of collaboration and leveraging of available partnership opportunities by SUA.

Examples of cross-utility coordination included:

- The Evaluators provide EM&V to SUA, Black Hills Energy, and Arkansas Oklahoma Gas. This allows for sharing of fixed EM&V costs (such as development of data collection instruments) and more seamless comparison of program offerings and lessons learned across the natural gas energy efficiency portfolio. This has reduced the overall cost of EM&V across all three natural gas utilities.
- SUA has brought on a third-party implementer (CLEAResult) for their C&I Solutions, Saving Homes, and Low Income Saving Homes Programs. This implementer uses the

same program design and similar incentive levels for Black Hills Energy and AOG. This has allowed for reduced program costs for C&I Solutions, which is the largest program in each of the three gas utility portfolios.

- SUA engages in several joint-marketing efforts with the other gas utilities as well as with Entergy Arkansas, Inc. (EAI) and Southwestern Electric Power Company (SWEPCO). This has included joint-implementation of education and promotional opportunities when interests with the other gas or electric utilities align.

Examples of coordination with non-utility partners included:

- SUA's programs are marketed through industry partners including professional organizations, trade groups, universities, and homeowners' associations.
- SUA works with a local technical college to help provide training opportunities to trade allies and students interested in careers related to energy efficiency.

3.2.6 Factor 6: Cost-Effectiveness of Energy Efficiency

To assess this factor, the Evaluators reviewed whether:

- Programs met net savings goals;
- Whether the NTG ratios were in line with industry norms; and
- Whether programs passed cost-effectiveness (TRC) testing.

Table 3-9: Assessment of Cost-Effectiveness

Program	NTGR	NTGR Within Industry Norms	Met Net Savings Goal	Program TRC
Residential Equipment Rebates	86.6%	Yes	○	1.06
Commercial Equipment Rebates	77.6%	Yes		
Commercial Boiler	80.3%	Yes	●	1.67
C&I Solutions	100.0%	Yes	●	1.92
Commercial Food Service	77.2%	Yes	○	1.14
Home Energy Reports	100.0%	Yes	●	1.33
Low Flow Showerhead & Aerator	50.5%	Yes	○	3.82
Saving Homes Program	90.0%	Yes	●	6.61
Low Income Saving Homes Program	100.0%	Yes	●	3.95

Programs were assessed as meeting net savings goal if they had at least 90% of goal. Programs were assessed as "partial" if they met at least 80% of their savings goal. All programs passed TRC.

3.2.7 Factor 7: Adequacy of EM&V Procedures

The Evaluators conducted a review of EM&V procedures by program as implemented by several parties:

- Quality Assurance and Quality Control (QA/Q)C and EM&V procedures by SUA program staff;
- QA/QC and EM&V procedures by third-party implementation staff (where applicable)
- QA/QC and EM&V procedures by the Evaluators.

The EM&V of the SUA programs incorporated industry best practices and was conducted in an iterative process that incorporated feedback from SUA and implementation contractors as well as the Independent Evaluation Monitor (IEM). The Evaluators developed EM&V plans that corresponded to protocols set out in the Arkansas TRM V9.0.

Finally, the Evaluators reviewed the quality of program tracking data in order to assess whether the data allowed for complete evaluation. Further, the Evaluators reviewed the extent to which individual savings calculations were performed using facility-specific inputs into the TRM V9.0 algorithms versus the use of simplifying assumptions[14]. The results of the review are summarized in Table 3-10.

Table 3-10 Assessment of Data & QA/QC Procedures by Program

Program	Tracking Contains Necessary Fields	Savings Calculations Performed and Reported	Savings Calculations Based on Facility Data	QA/QC Inspections by Program Staff
Residential Equipment Rebates	●	●	●	●
Commercial Equipment Rebates	●	●	●	●
Commercial Boiler	●	●	●	●
Commercial Food Service	●	●	●	●
C&I Solutions	●	●	●	●
Home Energy Reports	●	◒	●	NA

[14] Examples of this could include assuming average facility square footage for commercial water heating and using that as an input to the savings calculation, as opposed to collecting facility-specific square footage.

Low Flow Program	●	●	●	NA
Saving Homes Program	●	●	●	●
Low Income Saving Homes	●	●	●	●

● Data and QA/QC procedures conform to all AR TRM V9.0 guidelines

◒ Data and QA/QC procedures conform to most AR TRM V9.0 guidelines

○ Data and QA/QC procedures fail to conform to most AR TRM V9.0 guidelines

Findings of this review included:

- Water heating projects in Commercial Equipment Rebates had significantly improved data compared to prior program years.
- Home Energy Reports has savings calculations performed at the end of the program year. This is not tracked mid-year, though that might not be necessary given the program's existing verified performance.
- C&I Solutions tracking data contained all needed fields for evaluation and recreation of energy savings calculations.
- The Saving Homes and Low Income Saving Homes Program tracking data contained all needed fields for evaluation and recreation of energy savings calculations.
- QA/QC inspections are in place for all programs other than Home Energy Reports (where it is not needed) and the Low Flow Showerhead & Faucet Aerator Program. For the Low Flow Showerhead & Faucet Aerator Program, post-inspection of participant residences is not likely to add value, and savings calculations by SUA already incorporate expected in-service rates. QA/QC is performed by the Evaluators via telephone survey.

3.3 NEBs Summary

NEBs claimed by-program are as follows:

- **Residential Equipment Rebates:** avoided replacement costs, deferred replacement costs, kWh;
- **Commercial Equipment Rebates:** avoided replacement costs, kWh, kW;
- **C&I Solutions:** water, kWh;
- **Commercial Food Service:** water;
- **Low Flow Showerhead & Faucet Aerator:** water, kWh, kW; and
- **Saving Homes Program:** water, kWh, kW.
- **Low Income Saving Homes Program:** water, kWh, kW.

Table 3-11: Residential NEBs

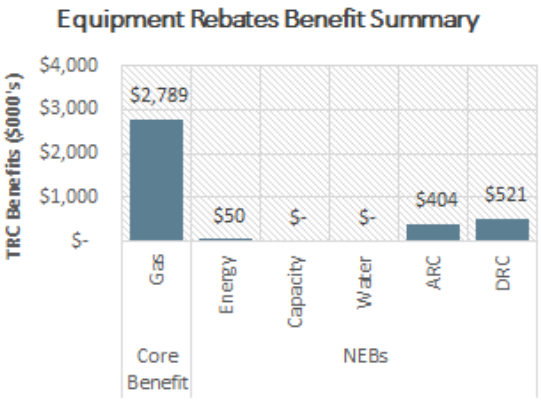
Measure	Water	kWh / kW	ARC / DRC	AR TRM V9.0 Section
Smart thermostat		✓		2.1.12
Furnace (early retirement only)			✓	2.1.3
Duct sealing		✓		2.1.11
Ceiling insulation		✓		2.2.2
Air infiltration		✓		2.2.9
Tankless water heater			✓	2.3.1
Faucet aerators	✓			2.3.4
Low-flow showerheads	✓			2.3.5

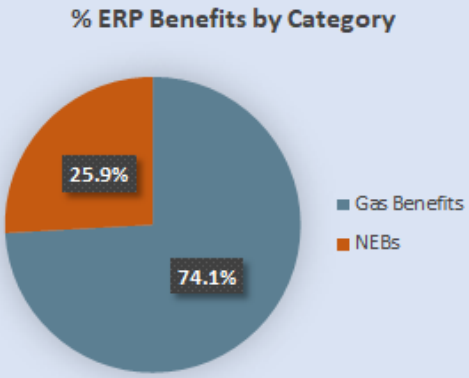
Table 3-12: Commercial NEBs

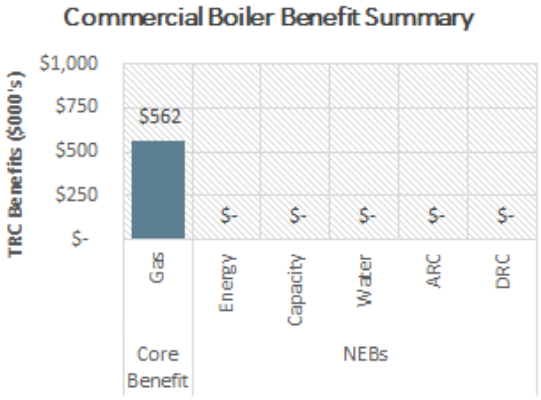
Measure	Water	kWh / kW	ARC / DRC	AR TRM V9.0 Section
Furnace (early retirement only) [15]			✓	2.1.3
Smart thermostat[15]		✓		2.1.12
Tankless water heater[15]			✓	3.3.1
Faucet aerators	✓			3.3.2
Low-flow showerheads	✓			3.3.5
Pre-rinse spray valves	✓			3.8.11
Condensate return	✓			N/A - Custom
Steam leak repair	✓			N/A - Custom

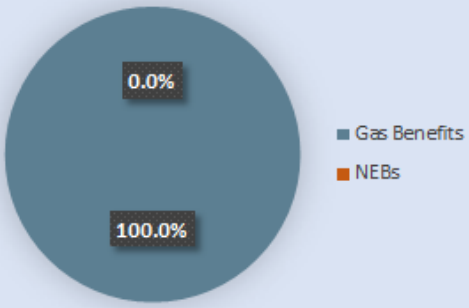
NEBs were a significant contributor to program benefits in PY2022, accounting for 14% of portfolio-level TRC benefits. Summaries of benefits by program are presented below.

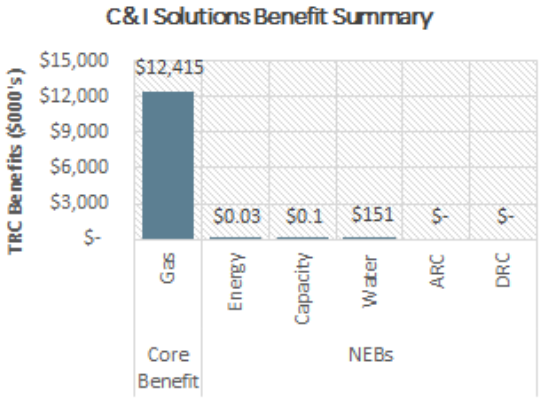
[15] Furnace and smart thermostat projects were residential end-use space types (e.g., multifamily) under a commercial meter. Tankless water heaters included both residential end-use space types and commercial space types.

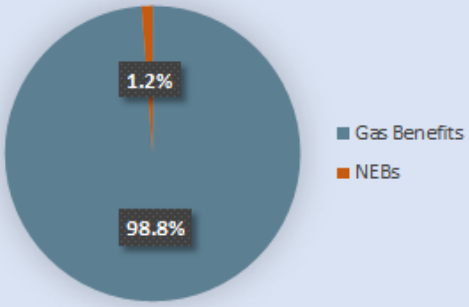

Equipment Rebates Benefit Summary
TRC Benefits ($000's)
$4,000
$3,000
$2,000
$1,000
$-
$2,789
$50
$-
$-
$404
$521
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs

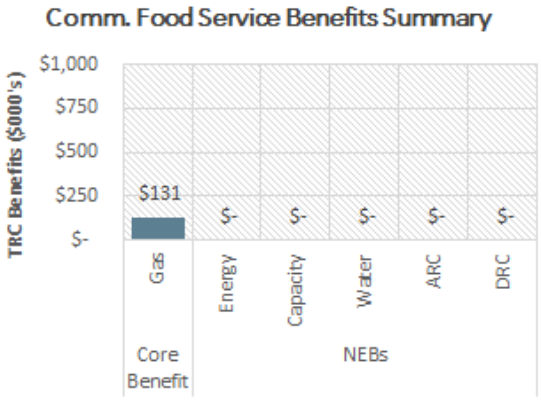

% ERP Benefits by Category
25.9%
74.1%
Gas Benefits
NEBs

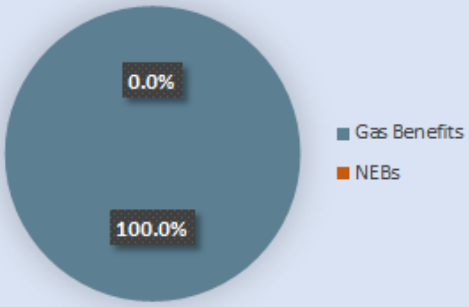

Commercial Boiler Benefit Summary
TRC Benefits ($000's)
$1,000
$750
$500
$250
$-
$562
$-
$-
$-
$-
$-
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs

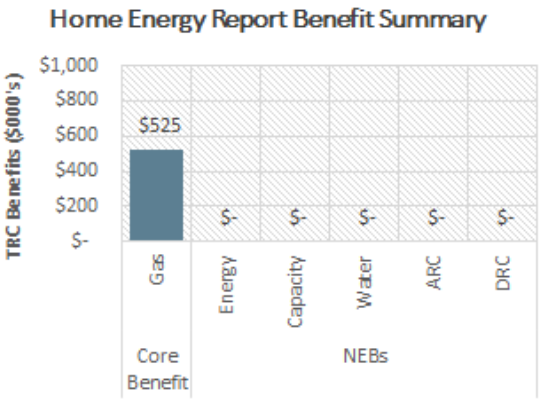

% Boiler Benefits by Category
0.0%
100.0%
Gas Benefits
NEBs

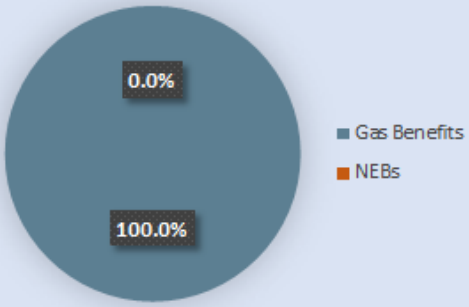

C&I Solutions Benefit Summary
TRC Benefits ($000's)
$15,000
$12,000
$9,000
$6,000
$3,000
$-
$12,415
$0.03
$0.1
$151
$-
$-
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs

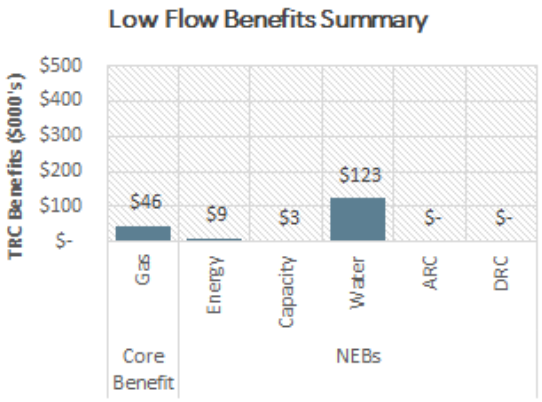

% CIS Benefits by Category
1.2%
98.8%
Gas Benefits
NEBs

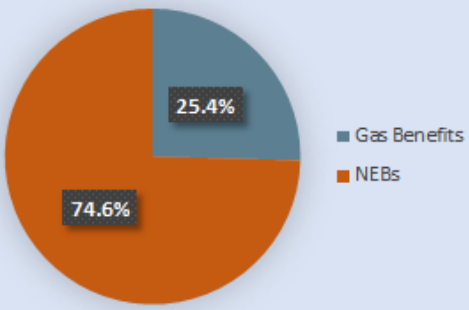

Comm. Food Service Benefits Summary
TRC Benefits ($000's)
$1,000
$750
$500
$250
$-
$131
$-
$-
$-
$-
$-
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs

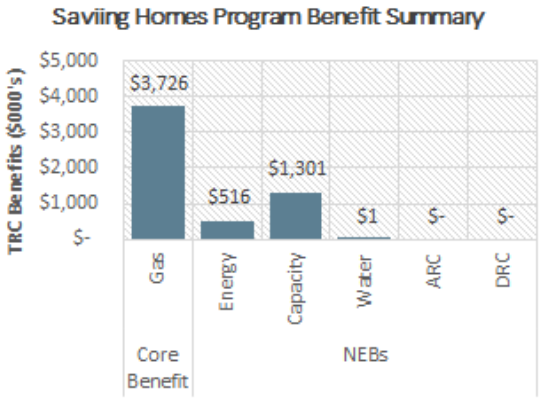

% FS Benefits by Category
0.0%
100.0%
Gas Benefits
NEBs

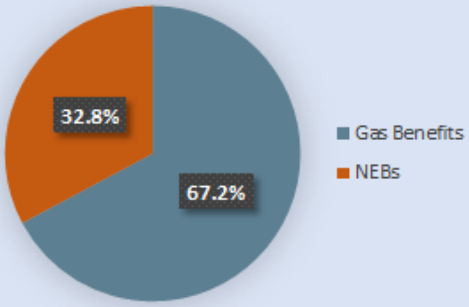

Home Energy Report Benefit Summary
TRC Benefits ($000's)
$1,000
$800
$600
$400
$200
$-
$525
$-
$-
$-
$-
$-
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs

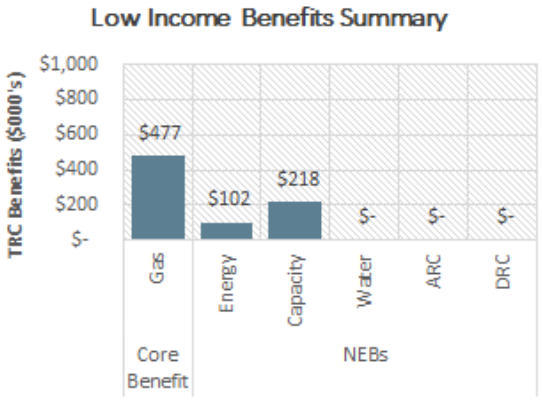

% HER Benefits by Category
0.0%
100.0%
Gas Benefits
NEBs

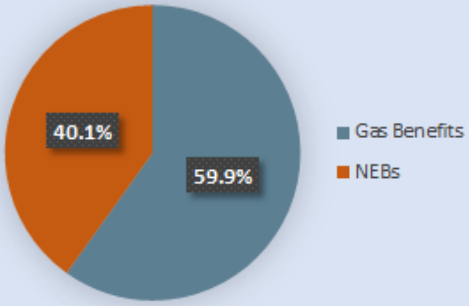

Low Flow Benefits Summary
TRC Benefits ($000's)
$500
$400
$300
$200
$100
$-
$46
$9
$3
$123
$-
$-
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs


% Low Flow Benefits by Category
25.4%
74.6%
Gas Benefits
NEBs


Saviing Homes Program Benefit Summary
TRC Benefits ($000's)
$5,000
$4,000
$3,000
$2,000
$1,000
$-
$3,726
$516
$1,301
$1
$-
$-
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs


% SHP Benefits by Category
32.8%
67.2%
Gas Benefits
NEBs


Low Income Benefits Summary
TRC Benefits ($000's)
$1,000
$800
$600
$400
$200
$-
$477
$102
$218
$-
$-
$-
Gas
Energy
Capacity
Water
ARC
DRC
Core Benefit
NEBs


% LISHP Benefits by Category
40.1%
59.9%
Gas Benefits
NEBs

3.4 Portfolio-Level Recommendations

Increase rebates to account for recent increased inflation.	Many SUA program rebates are unchanged from program inception in 2011. Others received their last update from 3-5 years ago. With significant cost increases borne by all market sectors, program incentives should be increased to stay in line with market prices. As costs have increased, incentives have accounted for a relatively lower percent of project costs and could be seen as less appealing.
Develop low, medium, and high incentive values in the next triennial plan, allowing for incentive variations mid-cycle without refiling.	If SUA embeds incentive flexibility into the filed program design, this could allow for incentive levels to be ratcheted up or down based on market demand / program saturation. This design would also allow for short-term “seasonal promotions” for specific measures.

4 Residential Equipment Rebates

The Residential Natural Gas Equipment Rebates Program is a component of the Natural Gas Equipment Rebates Program. The program provides prescriptive incentives for space heating and water heating equipment. Eligible measures for this program include:

- $400 for gas furnaces with 90%-94.9% AFUE;
- $600, $1,000, or $1,5000 for gas furnaces with 95% or higher AFUE;
- $50 for a smart thermostat installed;
- $75 for storage tank water heaters with rated at less than 75,000 BTU with an EF of .70 or greater;
- $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;
- $1500 for simultaneous installation of a 95% AFUE furnace and a tankless water heater; and
- $1500 for a combi boiler with 95% AFUE.

The program is targeted at the residential market sector and offers rebates for retrofit and new construction applications. The space heating equipment utilizes an 80% baseline AFUE, while the water heating equipment utilizes the same baseline Uniform Energy Factors as determined through equipment capacity. 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. During the staff interview, Summit AR staff expressed concerns about potential Department of Energy changes that will require all new furnaces to be 95% efficient, as this change would reduce the types of equipment eligible for rebates.

4.1.1 Participation Summary

4.1.1.1 Space Heating Participation Summary

In PY2022, the space heating channel had a total of 1,257 processed rebates. The participation comprised:

- 695 single family furnace retrofits;
- 66 multifamily furnace retrofits;
- 361 new construction rebates; and
- 162 smart thermostats.

4.1.1.2 Water Heating Participation Summary

In PY2022, Water Heating equipment had a total of 1,280 processed rebates. The participation comprised:

- 632 retrofit rebates;
- 565 new construction rebates;
- 92 rebated units for housing authorities; and

All rebates were for tankless water heaters.

4.2 Process Evaluation

Table 4-1 and

Table 4-2 summarize the Evaluators' review of the Residential Equipment Rebates program compared to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 4-1: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and Innovative Components	No. The program is unchanged from PY2021.
No Previous Process Evaluation	No. The program received a full process evaluation in PY2021.
New Vendor or Contractor	Yes. CenterPoint AR was acquired by Summit in 2021. 2022 marked the first year the program was managed by Summit. Despite the acquisition, program staff remained largely the same from 2021.

Table 4-2: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	Yes. The program reached only 45.4% of the PY2021 savings goal.
Are the educational or informational goals not meeting program goals?	No. The programs have had successful consumer and contractor outreach & education.
Are the participation rates lower or slower than expected?	Yes. The program reached only 49.5% of the PY2021 savings goal.
Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	No. Past process evaluations found that operational and management structure to be up to speed and efficient in administering the program.
Is the program's cost-effectiveness less than expected?	No, the program's cost-effectiveness was within expected boundaries given participation rates.
Do participants report problems with the programs or low rates of satisfaction?	No. 2017 - 2021 participant surveys found high satisfaction levels.
Is the program producing the intended market effects?	Yes. Interviews with participating contractors found significant market transformation occurring.

A limited process evaluation was conducted in PY2022.

4.2.1 Data Collection Activities

The process evaluation of the Residential Equipment Rebates Program included the following data collection activities:

- *Summit AR Program Staff Interviews.* The Evaluators interviewed staff at Summit AR involved in the administration of the Residential Equipment Rebates. These interviews

were to collect information from program staff as to any changes or developments, as well as response to program recommendations.

Table 4-3 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, timeframe of data collection.

Table 4-3: Summit AR Residential Equipment Rebates Data Collection Summary

Target	Component	Activity	N	Sample Precision	Role
Summit AR Program Staff	Portfolio Manager Residential Programs Program Manager Senior Engineer Consultant Energy Efficiency Analyst Rebate Program Coordinator	Interview	1	NA	Overall administration of Summit EE programs. The Portfolio manager is involved in the larger strategic decisions associated with the EE portfolio. The other staff are responsible for day-to-day operation of the program on the part of Summit, marketing and outreach, data tracking, and rebate processing.

4.2.2 Process Results & Findings

This section will present the results and key findings from the data collection activities. These findings are based upon interviews with utility staff, implementation staff, and surveys with participants, and a literature review.

4.2.3 Response to Program Recommendations

Table 4-4 summarizes the status of issues and recommendations identified in the PY2021 process evaluation.

Table 4-4: Equipment Rebates Response to PY2021 Recommendations

Recommendation	Status of Issue
Develop a standalone rebate for smart thermostats. This recommendation was made in PY2020 but is reiterated here. SUA has indicated concern that a standalone thermostat rebate may be perceived as "competition" by their trade allies. However, if this is offered solely as a rebate for customer purchase from retailers and not via the CenterPoint website/marketplace, this concern could be alleviated at project launch. Further, this rebate is offered by AOG and BHE without negative consequences with their HVAC trade ally networks.	Completed
Reassess furnace tune-ups for program inclusion Furnace tune-ups have been rejected in the past due to not being cost-effective. Summit should consider this rebate if contractors are willing to provide the service for $90 or less or if incremental costs are forecasted to increase significantly in the upcoming planning cycle. Alternatively, this measure could be pilot tested with a sample of homes receiving pre-and post-tune-up combustion efficiency testing to address whether the TRM assumption of a 75% baseline AFUE and post-tune-up 78% AFUE is accurate; early retirement analysis for furnace retrofits showed an AFUE of 65% so there is a possibility of TRM assumptions being overly conservative	Under Consideration

4.2.4 Program Design Changes

The program added a standalone incentive for smart thermostats, no longer requiring that they are paired with a furnace installation.

4.2.5 Program Data Collection

The Evaluators reviewed the application forms for Residential Equipment Rebates:

- The current application form is not collecting the data needed to comply with TRM V9.0 requirements. The form should add check-off boxes for construction date[16] and home square footage.
- The current application does not collect data to support residential early replacement calculations. The application would need to include fields to collect whether the replaced unit was functioning and to collect the age of the replaced unit (though those fields should be optional rather than mandatory for a rebate to be approved).

4.2.6 Adherence to Protocol A

Summit maintains an internal tracking system based on the SAP platform.

During PY2022, the Evaluators received quarterly tracking data updates as well as final tracking exports. The tracking system includes necessary inputs as per AR TRM V9.0. The Evaluators reviewed program tracking data to assess its compliance with Protocol A of the AR TRM V9.0 which specifies that tracking data should be checked for:

- Participating customer information;
- Measure specific information;
- Vendor specific information;
- Program tracking information;
- Program costs; and
- Marketing and outreach activities.

The Evaluators conducted a review of each of the above factors within PY2022 tracking data except for marketing and outreach activities as these are outside the scope of the tracking system's reporting.

4.2.6.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.0. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was complete for nearly all participants.
- Projects contained complete information on the contractor that completed the installation.

[16] According to the TRM V9.0 guidelines, these would be 1979 & earlier, 1980-1989, 1990-1999, and 2000-present.

- Weather zones were provided in the tracking data.
- All inputs needed to re-calculate savings according to TRM V9.0 protocols were present in the database.

4.2.6.2 Measure Specific Information

Measure data was enough to support deemed savings calculations.

4.2.7 Measure Offerings

The Evaluators reviewed Summit program offerings compared to other programs in Arkansas as well as by other regional gas utilities. Key measures that could be considered by Summit include:

4.2.7.1 Smart Thermostats

As of PY2022, smart thermostats are offered as an add-on to a furnace, as well as a standalone measure. This change resulted from a recommendation from evaluators who noted that BHE, AOG, and other utilities have had success offering smart thermostats a standalone measures. Although Summit had previously expressed concern that trade allies may see a standalone incentive as competing with their current offerings, because of their relatively low project volume for smart thermostats in previous years, Summit opted to adopt the recommendation.

4.3 Impact Evaluation

The impact evaluation effort of the Residential Equipment Rebates Program included the following:

- *Desk review of residential calculations.* The Evaluators utilized TRM V9.0 values in assessing savings from residential furnaces.

4.3.1 Summary of Non-Energy Benefits

Evaluators conducted a limited process evaluation in PY2022; this limited process evaluation did not include surveys. However, evaluators included non-energy benefit calculations from PY2022 below. Table 4-5 summarizes the non-energy benefits by measure that were credited to the Equipment Rebates Program in PY2022.

Table 4-5: Equipment Rebates Non-Energy Benefits

Measure	Electric Savings	Water Savings	Propane Savings	Avoided Replacement Cost	Deferred Replacement Cost
Furnace Early Replacement					✓
Tankless Water Heater				✓	

Smart Thermostat	✓				

4.3.1.1 Furnace Early Retirement

Furnace early retirement is eligible for the Deferred Replacement Cost Non-Energy Benefit. This benefit is the present value of the perpetuity of the deferred installation of new equipment. The inputs are as follows:

- Full installed cost of efficient furnace: $2,548
- Full installed cost of baseline furnace: $2,011
- Remaining useful life of existing furnace: 4 years
- Nominal Discount Rate: 5.7%
- Inflation Rate: 1.9%
- Real Discount Rate: 3.7%

The resulting deferred replacement cost is $717.22. This is parsed out proportionally to furnace retrofits based on the rate of early retirement and appropriate NTGR. There were 845 units for which DRC is applicable. The total net DRC is $522,146.

4.3.1.2 Tankless Water Heaters

Residential tankless water heaters have an EUL of 20 years. The baseline system has an EUL of 11 years. This makes the systems eligible for the Avoided Replacement Cost Non-Energy Benefit. This NEB was calculated using the IEM calculation tool[17]. This is then scaled by the NTG ratio for the water heater. The input assumptions were as follows:

- Full installed cost of tankless system: $1,219
- Full installed cost of baseline storage tank system: $614
- Nominal Discount Rate: 5.7%
- Inflation Rate: 1.9%
- Real Discount Rate: 3.7%

[17] Protocol L Avoided & Deferred Replacement Cost_08_31_16.xlsx

The resulting deferred replacement cost is $303.05. This is parsed out proportionally to water heater retrofits based on the rate of early retirement and appropriate NTGR. The calculator for this is provided in Appendix B of this report.

There were 1,280 residential tankless systems rebated in PY2022, and the resulting net ARC value is $388,071.

4.3.2 Free Ridership

Figure 4-1 summarizes the free ridership scoring scheme for residential furnaces and water heaters.

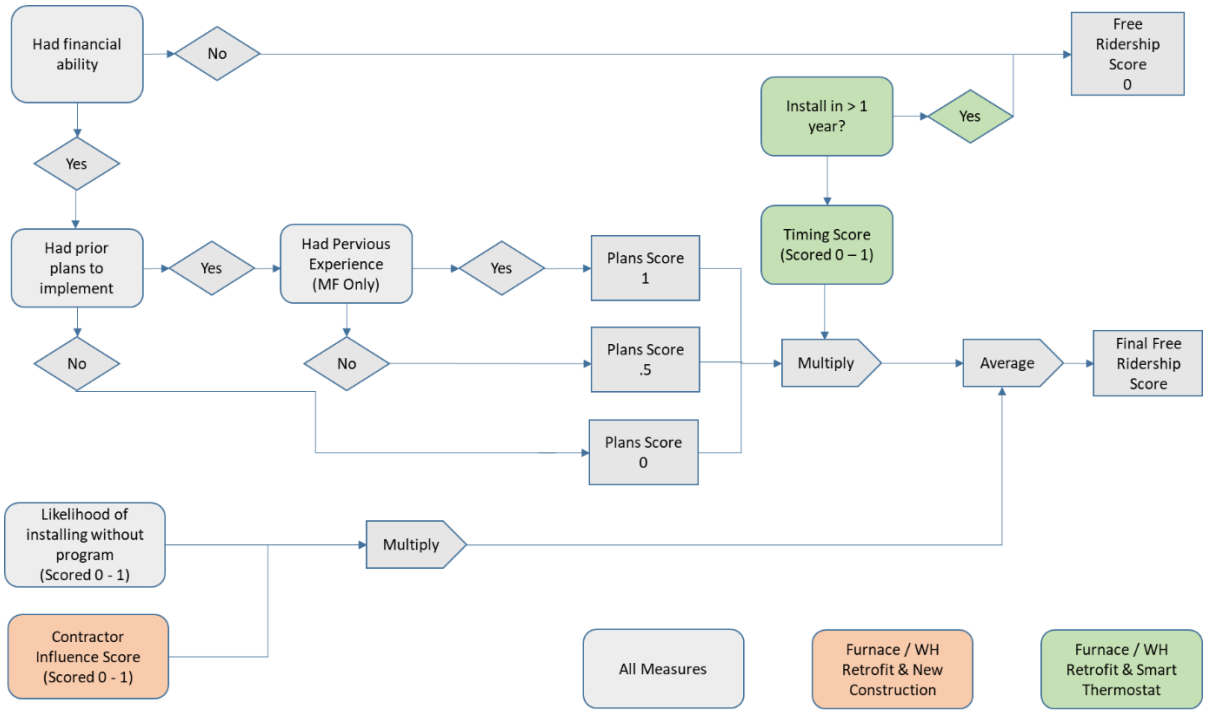


Figure 4-1: Residential Equipment Rebates FR Diagram

The plans score was factored by the programs impact on timing. Specifically,

- If the respondent stated that they would have installed the measure more than one year after the measure was installed, the prior plan score reduced to zero.
- If the respondent stated that they would have installed the measure in 6 months to one year, then the prior plans score was reduced by one-half.
- If the respondent stated that they would have installed the measure at the same time or within 6 months of when it was installed, the prior plans score was not adjusted.

A likelihood of installing the measure in the absence of the program was developed based on respondents stated likelihood of installing a measure. Specifically, responses to this question were scored as follows:

- Very likely: 1
- Somewhat likely: .75
- Neither particularly likely nor unlikely: .5
- Somewhat unlikely: .25
- Very unlikely: 0

Contractor Influence: This score is first determined via respondent answers to Question 18. The scores are as follows:

- Very influential: .5
- Somewhat influential: .25
- All other answers: .00

This value is then scaled by .667 due to contractor estimates that the rebate assisted them in upselling to a high-efficiency model two-thirds of the time.

The resulting NTGRs from PY2020 surveying are as follows:

- Residential furnace retrofit: 86.0%
- Housing authority furnace retrofit: 100.0%
- Residential water heating retrofit: 74.7%
- Housing authority water heating retrofit: 100.0%

For new construction applications, we apply a similar scoring mechanism as-completed in the multi-utility survey effort for owner-built custom homes. For homes from production builders, we apply the PY2017 values developed as part of the new construction builder survey effort completed for CenterPoint Energy Arkansas, now Summit AR. The values are:

- New construction: owner-built custom: 64.4%
- New construction: builder production homes: 91.0%

Lastly, values for multifamily furnace retrofits NTG cite PY2016 survey efforts. The Multifamily NTG is 89.6%.

4.3.3 Impact of Early Replacement

Evaluators conducted a limited process evaluation in PY2022; this limited process evaluation did not include surveys. However, evaluators included early retirement calculations from PY2021 below. For residential furnaces, early retirement AFUE is calculated by a degradation factor of a 78% AFUE unit. This is calculated as:[18]

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

$Base\ AFUE$ = efficiency of the existing equipment when new, 78% AFUE.

M[19] = maintenance factor, 0.01.

age = the age of the existing equipment, in years.

Following this, lifetime savings are determined based on the Remaining Useful Life (RUL) of the old equipment. The TRM V9.0 updated the RUL table, which has been reflected in Table 4-6.[20]

Table 4-6: Residential Furnace RUL

Unit Age	RUL	Unit Age	RUL
5	14.7	19	3.6
6	13.7	20	3.2
7	12.7	21	2.9
8	11.8	22	2.6
9	10.9	23	2.4
10	10.0	24	2.1
11	9.1	25+	0.0
12	8.3		
13	7.5		
14	6.8		
15	6.2		
16	5.5		
17	4.5		

[18] Arkansas TRM V9.0 Volume 2, Section 2.1.3 Gas Furnace Replacement, Pg. 41

[19] Maintenance factor of 0.01 is the average maintenance factor for gas furnaces taken from the October 2010 National Renewable Energy publication "Building America House Simulation Protocols", table 30.

[20] AR TRM V9.0 Volume 2, Section 2.1.3, Pg. 43

18	4.0

To assess whether a unit qualified for early retirement, the Evaluators examined the following survey questions:

7. Was the replaced [BASELINE]….(READ LIST)?

1. Fully functional and not in need of repair?
2. Functional, but needed minor repairs?
3. Functional, but needed major repairs?
4. Not functional?

98. DON'T KNOW
99. REFUSED

8. How old was the [BASELINE] at the time you replaced it?

1. ___ # Years

98. DON'T KNOW
99. REFUSED

1.

9. How long do you think your [BASELINE] would have lasted if you had not replaced it?

1. ___ # Years

98. DON'T KNOW

Figure 4-2 summarizes the scoring for early retirement based on these three questions.

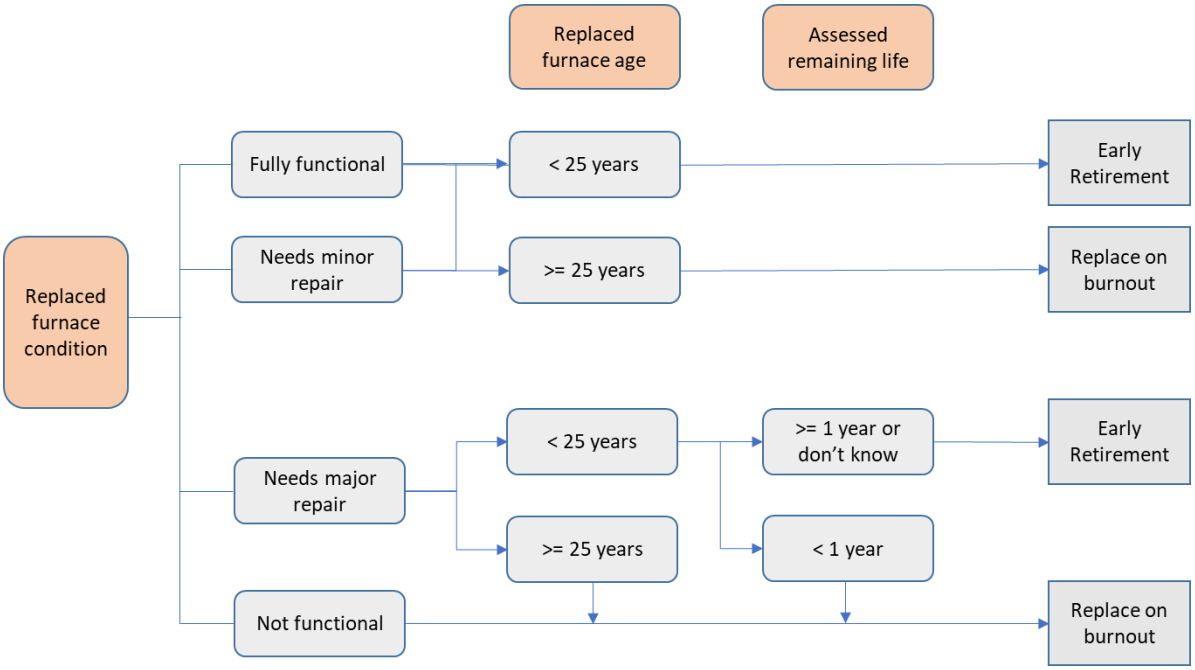


Figure 4-2: Residential Furnace Early Retirement Flowchart

In total, in the PY2022 survey the Evaluators found that 67.65% of Summit furnace retrofits were early retirement. The average age of functioning and failed units was as follows:

- 16.08 for functioning units
- 28.40 for failed units

Based on the degradation equation from TRM V9.0[21], this leads to an Early Retirement AFUE of:

$$AFUE_{base_{early}} = (.78) \times (1 - .01)^{16.08} = .6636$$

Further, based on the values in Table 4-6, the RUL of the early replacement units is four years. For years 5-20 of the unit EUL, the normal replacement baseline applies. The savings for each residential retrofit unit were calculated using both the normal and early replacement baselines, and final savings reflect a weighted average of these two values based on participant survey data findings. These values were then applied on a weighted basis to the residential retrofit

[21] AR TRM V9.0 Vol. 2 Pg. 44

units using weights of 67.65% early replacement and 35.14% normal replacement. The resulting weighted average baseline is:

$$AFUE_{base_{early\_weighted}} = 67.65\% \times .6636 + 32.35\% \times .80 = .7077$$

4.3.4 Residential Water Heating Impact Evaluation

Savings from tankless water heaters were calculated using protocols from Arkansas TRM V9.0 Vol. 2 Section 2.3.1. For sample calculations see Appendix C.

4.3.5 Ex Post Savings

Table 4-7 presents the gross savings results of the evaluation of the PY2022 Equipment Rebates Program. Total gross savings summarizes the savings calculations performed by TRM V9.0 protocols.

Table 4-7: Equipment Rebates Ex Post Gross Therms Savings

Measure Category	Ex Ante Therms Savings	Ex Post Therms Savings	Gross Realization Rate	EUL	Lifetime Therms Savings
Furnace	209,826	209,826	100.0%	13.4	2,820,510
Water Heater	64,028	64,028	100.0%	20	1,280,552
Smart Thermostat	13,433	13,433	100.0%	11	147,767
Total	**287,287**	**287,287**	**100.0%**	**14.7**	**4,248,829**

The resulting net savings are presented in Table 4-8.

Table 4-8: Equipment Rebates Net Savings Summary

Project Category	Free Ridership Rate*		Net Annual Savings		Net Realization Rate	Net Lifetime Therms Savings
	Ex Ante	Ex Post	Ex Ante	Ex Post		
Furnace	13.9%	13.3%	180,325	180,325	100.0%	2,420,984
Water Heater	14.1%	14.1%	55,628	55,628	100.0%	1,112,554
Smart Thermostat	12.5%	12.5%	11,754	11,754	100.0%	129,296
Overall:	**13.9%**	**13.4%**	**247,706**	**247,706**	**100.0%**	**3,662,834**

4.3.6 Furnace Early Retirement

Furnace early retirement is eligible for the Deferred Replacement Cost Non-Energy Benefit. This benefit is the present value of the perpetuity of the deferred installation of new equipment. The inputs are as follows:

- Full installed cost of efficient furnace: $2,548
- Full installed cost of baseline furnace: $2,011
- Remaining useful life of existing furnace: 4 years
- Nominal Discount Rate: 5.7%
- Inflation Rate: 1.9%
- Real Discount Rate: 3.7%

The resulting deferred replacement cost is $1,484.68. This is parsed out proportionally to furnace retrofits based on the rate of early retirement and appropriate NTGR. There were 732 units for which DRC is applicable. The total net DRC is $520,715.

4.3.7 Tankless Water Heaters

Residential tankless water heaters have an EUL of 20 years. The baseline system has an EUL of 11 years. This makes the systems eligible for the Avoided Replacement Cost Non-Energy Benefit. This NEB was calculated using the IEM calculation tool[22]. This is then scaled by the NTG ratio for the water heater. The input assumptions were as follows:

- Full installed cost of tankless system: $1,219
- Full installed cost of baseline storage tank system: $614
- Nominal Discount Rate: 5.7%
- Inflation Rate: 1.9%
- Real Discount Rate: 3.7%

The resulting deferred replacement cost is $348.90. This is parsed out proportionally to water heater retrofits based on the rate of early retirement and appropriate NTGR. The calculator for this is provided in Appendix B of this report.

There were 1,099 residential tankless systems rebated in PY2021, and the resulting net ARC value is $388,071

4.3.8 Electric Savings

The Evaluators credited smart thermostats with electric savings. Smart thermostats are offered in the program as standalone measures and as an add-on to a furnace retrofit; all thermostats

[22] Protocol L Avoided & Deferred Replacement Cost_08_31_16.xlsx

in PY2022 were add-ons for furnace retrofits or new construction. There were 162 units rebated in the program, with total net electric impacts of:

- 142,119 kWh;
- 0 kW; and
- 1,563,305 lifetime kWh.

The kWh savings resulted in an additional $57,920 in TRC benefits.

4.4 Conclusions

SUA accurately calculates savings per TRM V9.0 protocols.	All projects at 100% gross realization. SUA's tracking system accurately applies TRM V9.0, algorithms and early retirement adjustments.
SUA has endeavored to encourage comprehensiveness via combination rebates.	A rebate of $1,500 is provided for participants who simultaneously install a qualifying furnace and tankless water heater. These rebates comprised 23% of furnace and 14% of water heater projects.

4.5 Recommendations

Increase incentives where the Utility Cost Test allows for it.	Many program incentives have remain unchanged for a significant period of time, though costs have increased with higher inflation in recent years. In SUA's next triennial plan, incentives should be increased for residential equipment if increases in SUA's avoided costs allow for the measures to pass Utility Cost Test screening at an increased incentive level.

5 Commercial Equipment Rebates

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

- $400 for Gas furnaces with 90%-94.9% AFUE;
- $600 for Gas furnaces with 95% or higher AFUE;
- $500 for tankless water heaters with an UEF of .80 or greater;
- $75 for a tank unit rated lower than 75,000 BTUh with an UEF of .70 or higher; and
- $200 per 100,000 BTUh for large storage tank units exceeding 88% thermal efficiency.

The program is targeted at the small commercial market sector and retrofit and new construction applications are both allowed. The space heating equipment utilizes an 80% baseline AFUE, while the water heating equipment utilizes the same baseline Energy Factors as determined through equipment capacity. 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. During the staff interview, Summit AR staff expressed concerns about potential Department of Energy changes that will require all new furnaces to be 95% efficient, as this change would reduce the types of equipment eligible for rebates.

5.1 Program Overview

5.1.1 Participation Summary

5.1.1.1 Space Heating Participation Summary

206 furnaces were rebated in PY2022. Ninety percent of commercial rebates were for retrofit projects (89.8%, n=185), while 10.2% (n=21) were for new construction projects. Figure 5-1 summarizes the participation levels by facility type.

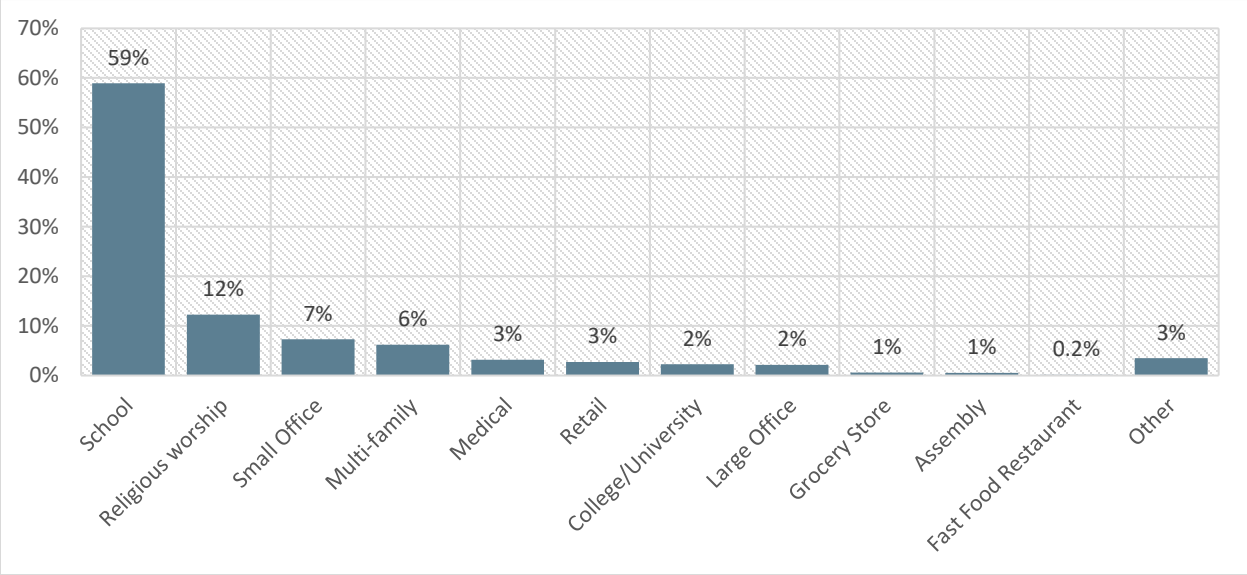


Figure 5-1: Space Heating Participation Summary

5.1.1.2 Water Heating Participation Summary

In PY2022, Water Heating equipment had 146 commercial rebates. Commercial participation comprised:

- 3 high-efficiency storage tank water heater; and
- 143 tankless water heaters.

Fifty-eight percent of commercial rebates were for retrofit projects and 42% were for new construction projects. Figure 5-2 summarizes the participation by facility type, denominated both in terms of percent of units rebated and percent of savings. Further, the savings acquisition cost is summarized in the overlain line graph (total rebate spending divided by total annual net therms).

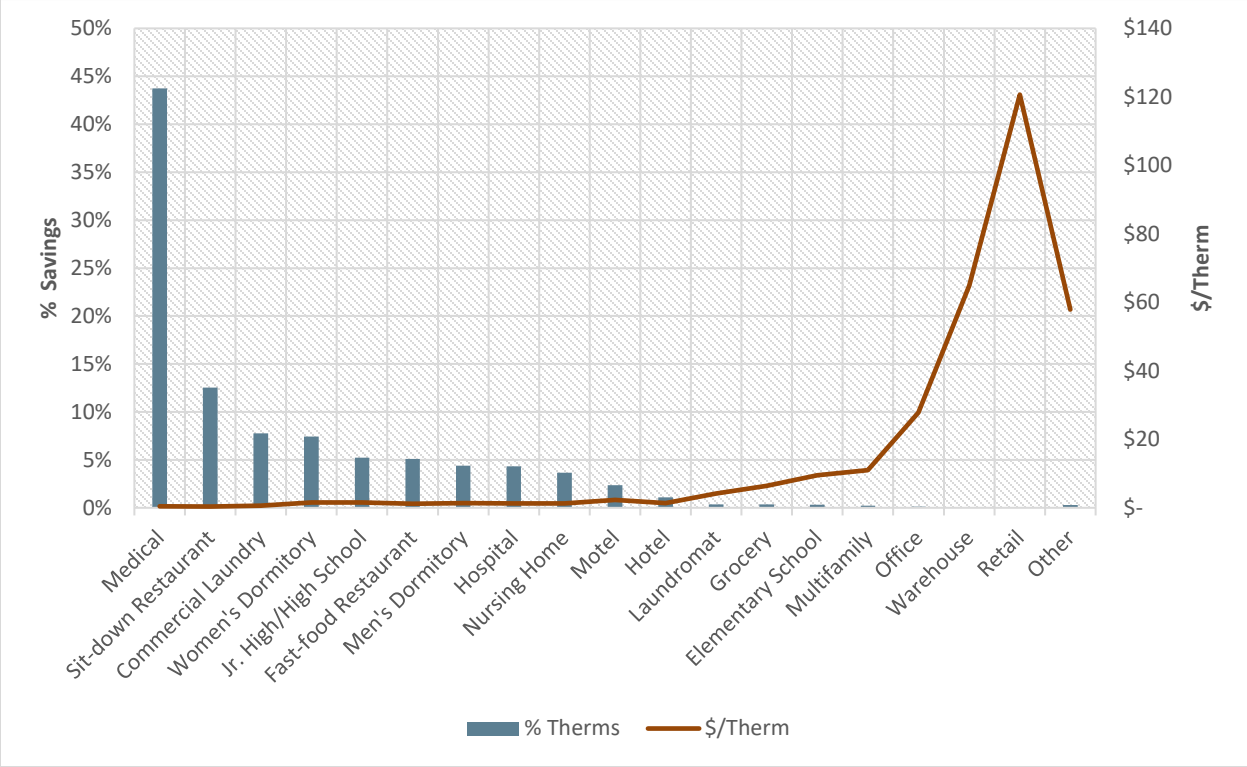


Figure 5-2: Water Heating Participation Summary

As seen in the figure above, the bulk of program savings was driven by medical clinics, sit-down restaurants, and commercial laundry facilities.

Key takeaways include:

- **Mean acquisition cost was $1.12 per therm.**
- **Men's dormitories comprised a significant share of participation (21.9%) while also being a large contributor to overall savings (23.2%) for this measure.** This is a high-use building type that is among facilities that was as a result had a below-median acquisition cost per-therm ($2.21).
- **Office, Warehouse, Retail, and Other facilities had significantly higher acquisition costs.** Their costs ranged from $27.79 to $120.65 per therm.

5.2 Process Evaluation

The Evaluators conducted a formal process evaluation of the program in the last triennial cycle found that the program was successful in meeting participation, savings, and satisfaction goals. Table 5-1 and Table 5-2 summarize the Evaluators' review of the Commercial Equipment

Rebates Program in comparison to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 5-1: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and Innovative Components	No. The program is designed in a manner consistent with similar programs elsewhere and applies deemed savings values from the TRM.
No Previous Process Evaluation	No. The program received a comprehensive process evaluation in PY2017 and a limited process evaluation in PY2021
New Vendor or Contractor	Yes. CenterPoint AR was acquired by Summit in 2021. 2022 marked the first year the program was managed by Summit. Despite the acquisition, program staff remained largely the same from 2021.

Table 5-2: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	No. The program exceeded its savings goal in PY2021.
Are the educational or informational goals not meeting program goals?	No. The programs have had successful consumer and contractor outreach & education.
Are the participation rates lower or slower than expected?	No. The program exceeded its participant goal in PY2021.
Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	No. Data issues that had been identified in prior evaluations had been corrected.
Is the program's cost-effectiveness less than expected?	No, the program's cost-effectiveness was within expected boundaries.
Do participants report problems with the programs or low rates of satisfaction?	No. Prior participant surveys found exceedingly high satisfaction levels.
Is the program producing the intended market effects?	Yes. Interviews with participating contractors in prior process evaluations found significant market transformation occurring.

On this basis, the Evaluators conducted a limited process evaluation addressing response to recommendations.

5.2.1 Data Collection Activities

The process evaluation of the Commercial Equipment Rebates Program included the following data collection activities:

- *Summit AR Program Staff Interviews.* The Evaluators interviewed staff at Summit AR involved in the administration of the Commercial Equipment Rebates Program. These interviews were to collect information from program staff as to any changes or developments, as well as response to program recommendations.

Table 5-3 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, timeframe of data collection.

Table 5-3: Summit AR Commercial Equipment Rebates Data Collection Summary

Target	Component	Activity	N	Precision	Role
Summit AR Program Staff	Portfolio Manager C&I Programs Program Manager Senior Engineer Consultant Energy Efficiency Analyst Rebate Program Coordinator	Group interview	1	NA	Overall administration of Summit EE programs. The Portfolio manager is involved in the larger strategic decisions associated with the EE portfolio. The other staff are responsible for day-to-day operation of the program on the part of Summit, marketing and outreach, data tracking, and rebate processing.

5.2.2 Process Results & Findings

This section will present the results and key findings from the data collection activities. These findings are based upon interviews with utility staff, implementation staff, and surveys with participants, and a thorough and in-depth literature review.

5.2.2.1 Response to Program Recommendations

Table 5-4 summarizes the status of issues and recommendations identified in the PY2021 process evaluation.

Table 5-4: Commercial Equipment Rebates Response to PY2021 Recommendations

Recommendation	***Status of Recommendation***
Engage the Evaluators earlier when there are ambiguities in water heater calculation inputs for certain facilities that don't have explicitly deemed inputs per AR TRM 8.2. There are examples of facility reclassifications that are reasonable; the Evaluators found that 5 commercial laundry facilities that were missing inputs needed to calculate daily hot water usage. The Evaluators reviewed the facilities and reassigned the majority as 'Health Clinic' based on deemed water usage. This may also identify facilities that require custom billing analysis approaches.	Completed

5.2.2.2 Program Design Changes

No changes were made to the program in 2022.

5.2.3 Adherence to Protocol A

Summit maintains an internal tracking system based on the SAP platform.

During PY2022, the Evaluators received quarterly tracking data updates as well as final tracking exports. The tracking system includes necessary inputs as per AR TRM V9.0. The Evaluators reviewed program tracking data in PY2022 to assess its compliance with Protocol A of the AR TRM V9.0 which specifies that tracking data should be checked for:

- Participating Customer Information;
- Measure Specific Information;
- Vendor Specific Information;
- Program Tracking Information;
- Program Costs; and
- Marketing & Outreach Activities.

5.2.3.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.0. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was incomplete; addresses and phone numbers were provided but data did not include a contact name.

- Projects contained complete information on the contractor that completed the installation.
- Weather zones were provided in the tracking data.
- All inputs needed to re-calculate savings according to TRM V9.0 protocols were present in the database for space heating, but not for water heating.

5.2.3.2 Measure Specific Information

Though largely improved over prior program years, program tracking for commercial water heaters was missing the necessary input data to calculate therms savings for some projects. The Evaluators determined that there were four projects that did not have any premise-specific inputs, neither square feet nor units of production, needed to perform proper calculations. Measure-specific capacity, efficiency, and weather zone was included, however. Although there were no ex ante savings that were calculated for these projects, the Evaluators gathered the necessary inputs to calculate ex post savings.

5.3 Impact Evaluation

5.3.1 Space Heating

The impact evaluation effort of the Space Heating measures included the following:

- *Commercial Verification*. The Evaluators applied TRM V9.0 deemed savings parameters in assessing savings of the commercial component.
- *Free-Ridership Estimation.* The Evaluators utilized NTGR estimates developed in PY2020.

Energy savings calculation protocols for commercial furnaces are summarized in Appendix C.

5.3.2 Water Heating

For the equipment rebates component, savings were calculated using methodologies detailed in Section 3.3.1 of the TRM Version 9.0 for commercial applications. The details of this methodology are presented in Appendix C.

5.3.3 Commercial Desk Review Findings

In past program years, the data submitted by SUA to the Evaluators was often missing energy savings inputs (such as units of production or square feet) and the evaluation of the program necessitated large-scale data collection by the Evaluators to support deemed savings estimates. This was improved significantly in PY2022, with SUA collecting the required inputs for over 95% of commercial projects.

The approaches used for projects with missing inputs were as follows:

- **Residential housing under commercial meter:** these premises had savings calculated using protocols detailed in Section 2.3.1 of the TRM V9.0. Though they are on a commercial meter, if it is a space intended for residential occupancy the residential protocols are appropriate to establish baseline and DHW load.
- **Commercial facilities with a square foot multiplier available in the TRM:** for these facility types[23] the Evaluators first searched for public records detailing facility square footage. This was found documented in building permit and realtor records. If this was not available, facility square footage was instead measured using Google Maps and street view mode. This was feasible for buildings without significant roof space covered by foliage and for buildings with a rectangular shape. Street view was used to confirm the number of stories for the premise.
- **Commercial facilities using per unit multipliers:** some facilities had researchable production units:
    a. **Hotel / Motel:** The Evaluators were able to identify the number of rooms available through publicly available information (typically hotel marketing collateral)
    b. **K-12 Education:** The Evaluators were able to research publicly available enrollment totals to apply the per-student multipliers.
    c. **Medical:** The total beds in medical facilities is often publicly available information.
    d. **Dormitories:** The Evaluators were similarly able to research number of dormitory beds available at university facilities that participated.

5.3.4 Net Savings Estimation

Evaluators conducted a limited process evaluation in PY2022; this limited process evaluation did not include surveys. However, evaluators included free ridership calculations from PY2020 below. Figure 5-3 summarizes the scoring mechanism for commercial free ridership.

[23] AR TRM V9.0 Vol. 2 Table 346, Pg. 362

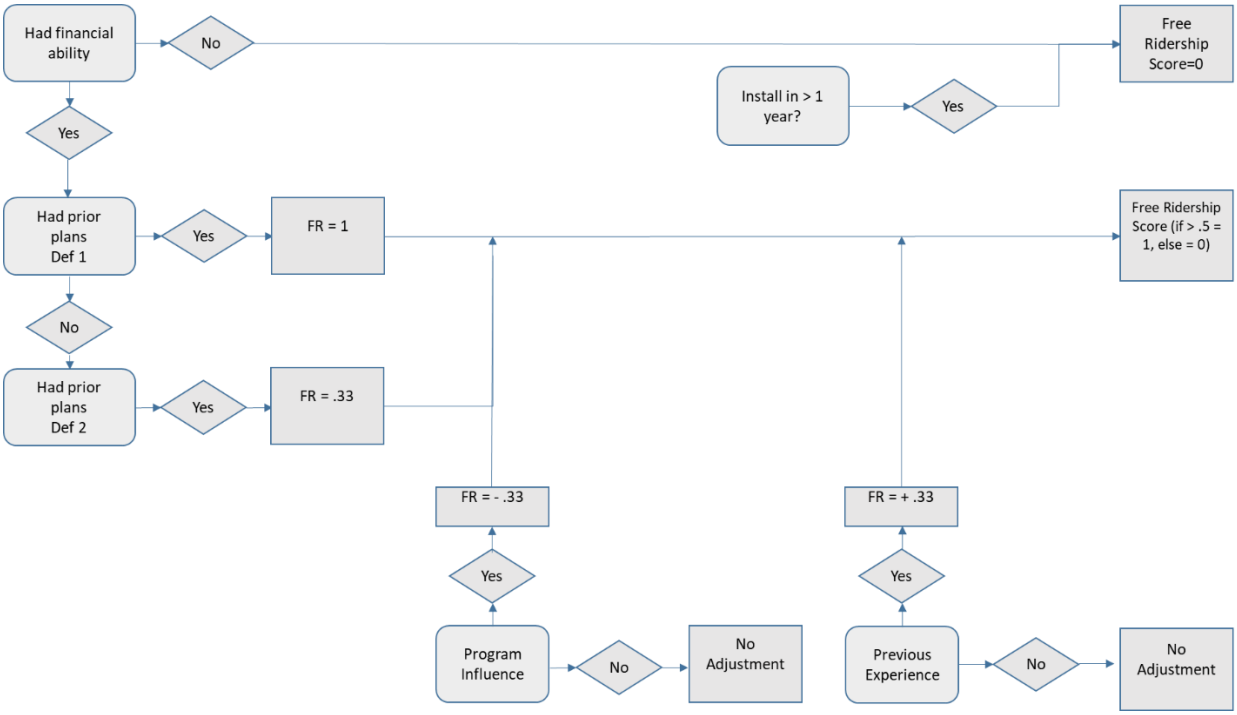


Figure 5-3: Nonresidential Free ridership Scoring Flow Chart

The resulting NTGRs from PY2020 surveys were 76.2%.

5.3.5 Verified Savings

Gross Therms are summarized in Table 5-5. Net therms are summarized in

.

Table 5-5: Gross Therms Savings

Measure	Ex Ante Gross Therms	Ex Post Gross Therms	Gross Realization Rate	Lifetime Therms Savings
Furnace	37,192	37,192	100.0%	739,092
Smart Thermostat	1,321	1,321	100.0%	35,602
Water Heater	56,810	62,504	110.0%	1,242,597
Total	**95,323**	**101,017**	**106.0%**	**2,017,292**

Table 5-6: Net Therms Savings Summary

Measure	Free Ridership*		Ex Ante Net Therms	Ex Post Net Therms	Net Realization Rate	Lifetime Therms Savings
	Ex Ante	Ex Post				
Furnace	24.7%	21.4%	28,659	28,659	100.0%	568,912
Smart Thermostat	12.5%	12.5%	1,156	1,156	100.0%	12,716
Water Heater	11.8%	23.8%	43,300	47,640	109.9%	947,108
Total	**18.7%**	**22.4%**	**73,115**	**77,455**	**105.9%**	**1,528,736**

Commercial furnaces had 100.0% net realization.

For commercial end-use water heaters, net realization was 109.9%.The Evaluators collected the input data required for all water heaters in the program, as described in Section . As a result, there were four units that had an ex ante therms of 0.

5.3.6 Non-Energy Benefits Summary

5.3.6.1 Commercial Tankless Water Heaters.

Commercial tankless water heaters have an EUL of 20 years. The baseline system has an EUL of 15 years. This makes the systems eligible for the Avoided Replacement Cost Non-Energy Benefit. This NEB was calculated using the IEM calculation tool[24]. The input assumptions were as follows:

- Full installed cost of tankless system: $1,219
- Full installed cost of baseline storage tank system: $614
- Nominal Discount Rate: 5.7%
- Inflation Rate: 1.9%
- Real Discount Rate: 3.7%

[24] Protocol L Avoided & Deferred Replacement Cost_08_31_16.xlsx

The resulting deferred replacement cost is $140.91 per unit. This is then scaled by the project NTG ratio. The calculator for this is provided in Appendix B of this report.

There were 143 commercial tankless systems rebated in PY2022, and the resulting net ARC value is $15,359.

5.3.6.2 Smart Thermostats

The program rebated fourteen smart thermostats. Five thermostats were for small offices, five were for religious buildings, and four were for single-family buildings. The smart thermostats had TRM V9.0 residential smart thermostat inputs used to estimate energy savings. Net kWh from this is as follows:

- 1,156 annual kWh;
- 0 kW; and
- 1,2,716 lifetime kWh.

The kWh savings resulted in an additional $4,472 in TRC benefits.

5.4 Conclusions

Tracking data for water heaters has improved significantly.	In PY2020, the Evaluators had to develop DHW load inputs for over 80% of commercial projects. In PY2022, this was only required for a total of 4 projects (3% of total projects).
The program has ARC NEBs from tankless water heaters.	They are lower than observed for residential tankless systems, however, due to a lower volume of units and that the baseline system has an EUL of 15 years, compared to 11 years for residential systems. Further, there was participation from master-metered multifamily units which have ARC values similar to residential participants (differing solely by NTGR).

5.5 Recommendations

Consider consolidating space heating and water heating equipment with boilers and food service into a Commercial Prescriptive Program.	This consolidation would align the program offerings, give greater budget flexibility, and make the program more reliably cost-effective as shortfalls in one measure group could be overcome by increased participation in others.

6 Commercial Boiler Program

The Commercial Boiler Program provides incentives for boilers and boiler controls used in HVAC applications. Eligible measures include:

- $1,800/MMBtuh input for boilers that are 83% - 91.9% efficient;
- $3,500/MMBtuh input for boilers that are 92% efficient or greater; and
- $1,000/MMBtuh for Burner replacement – 6 step modulation or fully modulating.

In addition, trade ally incentives range from $200 to $300 per unit.

The Commercial Boiler Program is targeted at large commercial facilities using boilers in HVAC applications. Boilers serving process loads are required to enter the custom component of the Commercial Boiler Program. During the staff interview, neither Summit staff nor CLEAResult staff expressed concerns with the performance of the boiler program.

6.1 Program Overview

The Commercial Boiler Program began in 2010. The program is designed to incentivize the purchase of high-efficiency HVAC boiler equipment. This program originally included boilers serving process loads, but with the development of the Arkansas TRM, HVAC boilers were set as prescriptive measures while process boilers require custom calculation. Given this, Summit AR developed a separate custom program to cover non-HVAC loads. The history of program performance and expenditures is presented in Table 6-1.

Table 6-1: Commercial Boiler Program Historical Performance against Goals

Program Year	Budget			Net Therms		
	Spent	Allocated	%	Achieved	Goal	%
2010	$334,785	$380,074	88%	16,988	171,304	10%
2011	$220,321	$377,967	58%	24,845	128,277	19%
2012	$221,585	$464,618	48%	100,322	371,696	27%
2013	$184,937	$551,650	34%	65,390	580,890	11%
2014	$150,113	$551,661	27%	21,213	92,160	23%
2015	$259,477	$251,650	103%	80,476	92,160	87%
2016	$232,857	$251,650	93%	67,491	92,160	73%
2017	$234,592	$329,879	71%	55,756	83,740	67%
2018	$225,907	$329,496	69%	52,335	83,735	63%
2019	$306,128	$329,301	93%	100,802	83,735	120%
2020	$305,235	$270,444	113%	82,962	59,710	139%
2021	$260,602	$270,474	96%	70,934	57,585	123%
2022	$177,593	$270,474	66%	52,301	57,585	91%

6.2 Participation Summary

In PY2022, the Commercial Boiler Program had 13 participants and received 25 boiler rebates.

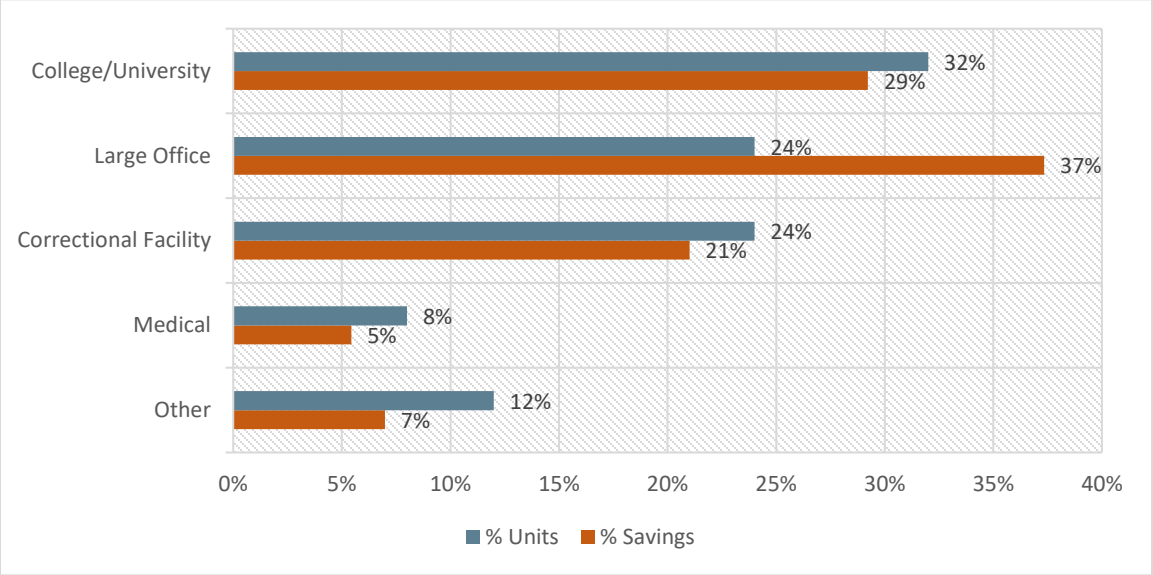


Figure 6-1 summarizes the Commercial Boiler Program participation by facility type.

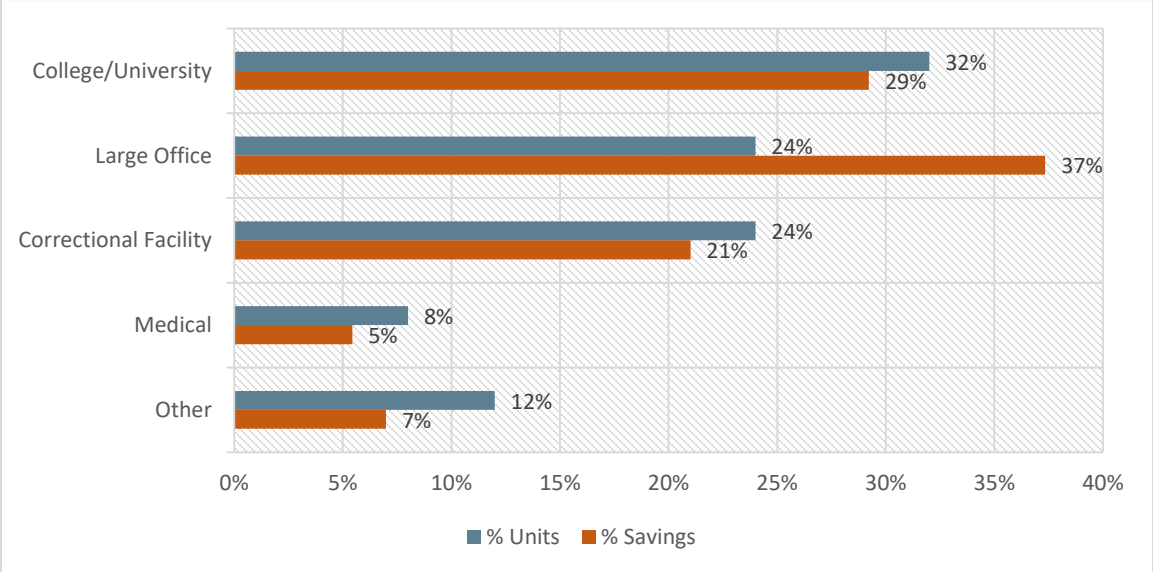


Figure 6-1: C&I Boiler Equipment Participation by Facility Type

The participant in the “Assembly” category included a visitors' center, and the participants in the “University” category included colleges, and correctional facilities. All rebates were boiler

replacements. 96% percent of these rebated boilers were a minimum of 92% efficient, qualifying for the higher program incentive of $3,500/MMBtuh.

6.3 Commercial Boiler Program Process Evaluation

Table 6-2 and Table 6-3 summarize the Evaluators' review of the Commercial Boiler Program in comparison to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 6-2: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and Innovative Components	No. The program is implemented in the same manner as PY2021.
No Previous Process Evaluation	No. The program received a comprehensive process evaluation in 2012 and 2013, and process overviews in 2014, 2020, and 2021.
New Vendor or Contractor	Yes. CenterPoint AR was acquired by Summit Utilities in 2020. 2022 marked the first year the program was managed under Summit. Despite the acquisition, program staff remained largely the same from 2021.

Table 6-3: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	No. The program exceeded goals in PY2021.
Are the educational or informational goals not meeting program goals?	No. The program has successfully engaged trade allies.
Are the participation rates lower or slower than expected?	No. The program exceeded goals in PY2021.

Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	No. Prior process evaluations found that operational and management structure to be up to speed and efficient in administering the program.
Is the program's cost-effectiveness less than expected?	No, the program's cost-effectiveness was within expected boundaries.
Do participants report problems with the programs or low rates of satisfaction?	No. Prior participant surveys found exceedingly high satisfaction levels.
Is the program producing the intended market effects?	Yes. The program is encouraging adoption of efficient boiler technology.

The program received a limited process evaluation in PY2022.

6.3.1 Data Collection Activities

The process evaluation of the Commercial Boiler Program included the following data collection activities:

- *Summit Program Staff Interviews*. The Evaluators interviewed staff at Summit involved in the administration of the Commercial Boiler Program. These interviews were to collect information from program staff as to any changes or developments, as well as response to program recommendations.

Table 6-4 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, timeframe of data collection.

Table 6-4: Summit Commercial Boiler Program Data Collection Summary

Target	Component	Activity	N	Precision	Role
Summit AR Program Staff	Portfolio Manager C&I Programs Program Manager Senior Engineer Consultant Energy Efficiency Analyst	Group interview	1	NA	Overall administration of Summit EE programs. The Portfolio manager is involved in the larger strategic decisions associated with the EE portfolio. The other staff are responsible for day-to-day operation of the program on the part of Summit, including assisting in outreach and marketing efforts of the program.

6.3.2 Process Results & Findings

This section will present the results and key findings from the data collection activities. These findings are based upon interviews with utility staff, implementation staff, and surveys with participants, and a literature review.

6.3.3 Response to Program Recommendations

No boiler program recommendations were identified in the PY2021 process evaluation.

6.3.4 Program Design Changes

No changes were made to the program in 2022.

6.3.5 Adherence to Protocol A

Summit maintains an internal tracking system based on the SAP platform.

During PY2022, the Evaluators received quarterly tracking data updates as well as final tracking exports. The tracking system includes necessary inputs as per AR TRM V9.0. Protocol A of the AR TRM V9.0 specifies that tracking data should be checked for:

- Participating Customer Information;
- Measure Specific Information;
- Vendor Specific Information;
- Program Tracking Information;
- Program Costs; and
- Marketing & Outreach Activities.

6.3.5.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.0. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was complete for all projects.
- Projects contained complete information on the contractor that completed the installation.
- Weather zones were provided in the tracking data.
- All inputs needed to re-calculate savings according to TRM V9.0 protocols were present in the database.

6.3.5.2 Measure Specific Information

The content of tracking data was found to include sufficient information for all measures in PY2022. The Evaluators found the tracking data to contain all data needed to recreate TRM V9.0 deemed savings calculations.

6.4 Commercial Boiler Program Impact Evaluation

Savings calculations were reviewed to validate compliance with TRM V9.0 protocols. The Evaluators to verify energy savings through two ways: a desk review adhering to methods outlined in AR TRM V9.0 and through linear regression billing analysis.

6.4.1 Commercial Boiler Program Energy Savings Calculations

Therms savings calculations for commercial boilers require facility type, weather zone, and baseline efficiency. Baseline efficiency for boilers is detailed in Table 6-5.[25]

Table 6-5: Commercial Boiler Minimum Efficiency Levels

Project Type	Size Category (BTU/hr.)	Subcategory	Minimum Efficiency
Replace-on-Burnout	< 300,000	Hot Water	82% AFUE
		Steam	80% AFUE
	> 300,000 and ≤ 2,500,000	Hot Water	80% E_t
		Steam	79% E_t
	>2,500,000	Hot Water	82% Ec
		Steam	79% E_t
Early Retirement	< 300,000	Hot Water	80% AFUE
		Steam	75% AFUE
	> 300,000 and ≤ 2,500,000	Hot Water	75% E_t
		Steam	75% E_t
	> 2,500,000	Hot Water	80% Ec
		Steam	79% E_t[26]

[25] Arkansas TRM V9.0 Pg. 250-255

[26] Arkansas TRM V9.0, Pg. 251

Savings for commercial boilers are calculated as[27]:

$$Therms\ Savings = \frac{BTU\ Capacity * EFLH_H * \left(\frac{1}{Effic_{pre}} - \frac{1}{Effic_{post}}\right)}{100{,}000\ Therms/BTU}$$

The EFLH for a facility is a function of facility type and weather zone. The EFLH values from TRM V9.0 are summarized in Table 6-6.

Table 6-6: Commercial EFLH Values

Building Type	Zone 6	Zone 7	Zone 8	Zone 9
Assembly	615	854	915	1,032
College/University	674	936	1,002	1,130
Fast Food Restaurant	287	439	472	549
Full Menu Restaurant	178	321	362	438
Grocery Store	692	941	1,001	1,129
Health Clinic	641	878	915	1,045
Lodging	391	589	637	722
Large Office (> 30k SqFt)	816	1,020	1,060	1,157
Small Office (≤ 30k SqFt)	351	534	564	644
Religious Worship	575	798	854	963
Retail	781	1,043	1,133	1,287
School	777	1,030	1,094	1,236

[27] Arkansas TRM V9.0, Pg. 252

For example, if a Grocery Store in Little Rock (Zone 7) installed an 800,000 BTU 96% efficient hot water boiler that was a replacement on burnout, the resulting Therms savings are calculated as:

$$Therms\ Saving = \frac{800{,}000\ BTU * 941\ EFLH * \left(\frac{1}{.80} - \frac{1}{.96}\right)}{100{,}000\ BTU/Therm} = 1{,}568\ Therms$$

SUA correctly calculated energy savings in accordance with TRM V9.0 protocols.

6.4.1.1 Commercial Boiler Program Commercial Free-Ridership

There were no significant changes in program delivery in PY2022 and as a result the Evaluators opted to apply the ex-ante NTGR of 80.28%.

6.4.2 Verified Therms

Table 6-7 and Table 6-8 present the gross and net savings results of the evaluation of the PY2022 Commercial Boiler Program.

Table 6-7: Commercial Boiler Program Gross Therms Savings

Equipment Type	Expected Therms Savings	Verified Therms Savings	EUL	Realization Rate
Boiler	65,149	65,149	20	100.00%
Burner	0	0	12	-
Total	65,149	65,149	20	

Table 6-8: Commercial Boiler Program Net Therms Savings

Net-to-Gross Ratio		Net Annual Savings		Net Realization Rate	Net Lifetime Therms Savings
Ex-Ante	Ex-Post	Ex-Ante	Ex-Post		
80.28%	80.28%	52,301	52,301	100.00%	1,046,025

6.5 Conclusions

The program was closest to meeting its savings goal.	In PY2022, the Commercial Boiler Program reached 91% of its net savings goal.
SUA accurately calculates savings per TRM V9.0 protocols.	All projects at 100% gross realization. SUA's tracking system accurately adjusts baseline to align with code requirements by size category and boiler type.

There was only one participant in the lower efficiency tier.	As found in the prior two program years, There was one boiler in the 85%-92% efficiency tier in PY2022. There were no participants in this tier in PY2020 or PY2021.

6.6 Recommendations

The Evaluators have no recommendations for this program.

7 Commercial and Industrial (C&I) Solutions Program

The C&I 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 install of water conservation measures and weather stripping, and technical review of custom efficiency projects. Program participants are provided:

- No-cost direct installation of low flow faucet aerators, showerheads, door air infiltration, pre-rinse spray valves (PRSVs), steam traps, and DrySmart controls;
- $.70 per therm for custom projects; and
- $.90 per therm for custom projects for customers using less than 200,000 Therms per year.

7.1 C&I Solutions Program Overview

The C&I Solutions program began in September 2011. The program is designed to provide no-cost direct installation of water saving and air infiltration measures, energy audits, and incentives for custom projects to large commercial and industrial customers. The C&I Solutions program's historical performance is summarized in Table 7-1.

Table 7-1: C&I Solutions Program Historical Performance against Goals

Program Year	Budget			Net Therms		
	Spent	Allocated	%	Achieved	Goal	%
2011	$1,047,763	$1,152,104	91%	500,906	451,808	111%
2012	1,102,780	$1,257,083	88%	549,005	521,072	105%
2013	$1,643,311	$1,811,073	91%	1,220,261	1,020,310	120%
2014	$1,788,563	$1,811,074	99%	1,019,296	1,020,310	100%
2015	$2,194,215	$2,211,074	99%	1,224,628	1,320,150	93%
2016	$1,989,847	$2,211,074	90%	1,273,739	1,320,150	97%
2017	$2,573,025	$2,688,568	96%	1,505,052	1,534,490	98%
2018	$2,874,811	$2,738,688	105%	1,589,563	1,604,492	99%
2019	$2,869,734	$2,744.123	105%	1,614,082	1,604,491	101%
2020	$2,928,574	$3,080,171	105%	1,696,653	1,528,450	111%
2021	$2,954,470	$3,079,053	104%	1,983,043	1,528,458	130%
2022	$2,595,442	$3,021,056	95%	1,774,006	1,601,581	111%

The C&I Solutions program participants fall into one of three categories:

- Direct install;
- Custom audit recipients; and
- Closed custom projects.

In PY2022, custom projects accounted for 76.9% of program savings and direct install accounted for 23.1%. These participants are detailed in the subsections to follow.

7.1.1 Direct Install Participation Summary

In PY2022, 35 facilities participated in the direct install component of C&I Solutions.

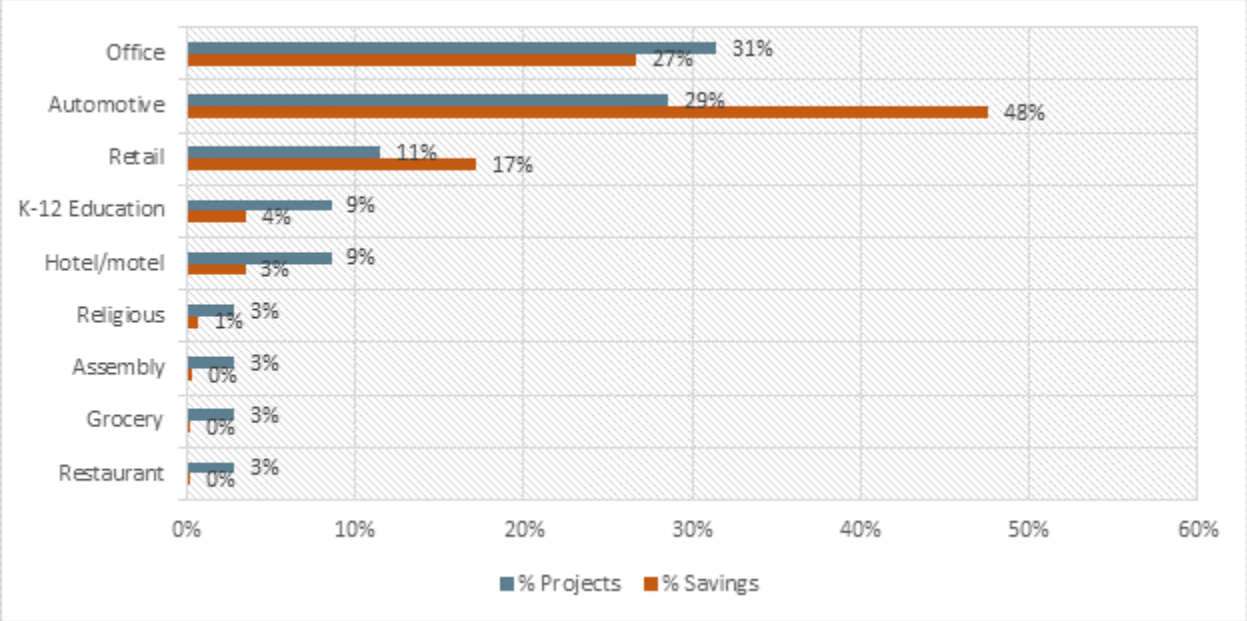


Figure 7-1 summarizes the participation by facility type, quantified in percent of participating facilities as well as percent of total savings.

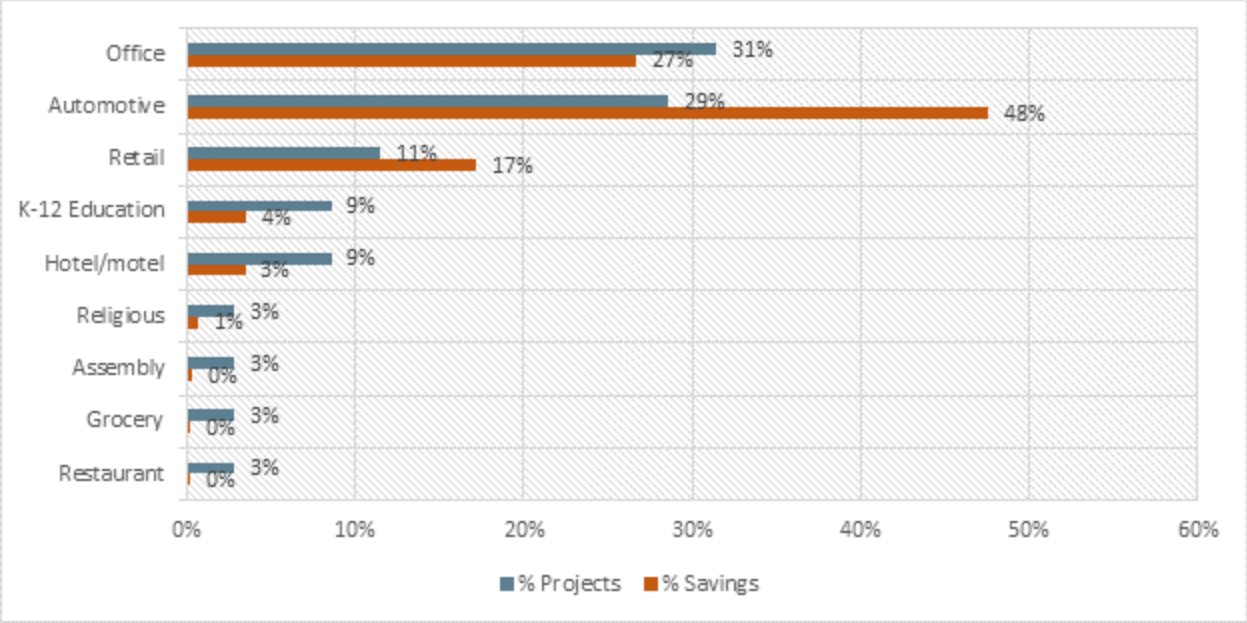


Figure 7-1: C&I Solutions Direct Install Participant Summary

7.1.2 Closed Custom Project Participation Summary

Table 7-2 summarizes completed custom projects for the PY2022 C&I Solutions program.

Table 7-2: Large Custom Project Participation Summary

Facility Type	Project ID	Measure	Therms Savings
Asphalt Plant	EA-0000365928	Insulation	12,405
Asphalt Plant	EA-0000365932	Insulation	26,948
Asphalt Plant	EA-0000365930	Insulation	29,152
Medical	EA-0000589963	Steam Leak Repair	56,700
		Insulation	19,301
Food Processing	EA-0000376553	Insulation	3,120
Manufacturing	EA-0000492934	Steam Leak Repair	923
Food Processing	EA-0000392669	Smart Thermostats	5,226

Food Processing	EA-0000625288	Steam Leak Repair	3,703
		Insulation	9,679
		Condensate Return	5,072
Manufacturing	EA-0000362789	Process Oven	137,884
Medical	EA-0000589963	Steam Trap Replacement	29,601
Medical	EA-0000589964	Steam Trap Replacement	30,059
Asphalt Plant	EA-0000362919	Insulation	19,072
Manufacturing	EA-0000386133	Burner Tune-up	59,567
Manufacturing	EA-0000669400	Boiler Replacement	7,828
		Blowdown Heat Recovery	8,260
Waste Processing	EA-0000370105	Boiler Retrofit	138,003
Food Processing	EA-0000362784	Process Oven	269,354
Asphalt Plant	EA-0000363860	Insulation	18,819
Correctional Facility*	EA-0000377012	Low Flow Fixtures	32,589
		DHW Reduction through Food Waste Reduction	6,267
		Waste Steam & Hot Water Reduction	98,192
Food Processing*	EA-0000583141	Boiler Controls	301,343
Food Processing	EA-0000403527	Burner Replacement	55,622
Food Processing	EA-0000625288	Insulation	3,849
Food Processing	EA-0000669712	Insulation	5,949
		Steam Leak Repair	1,381
*Denotes PY2022 partial payment & claim. Project will close in PY2023.			

Savings within the custom component are presented by facility type in Figure 7-2.

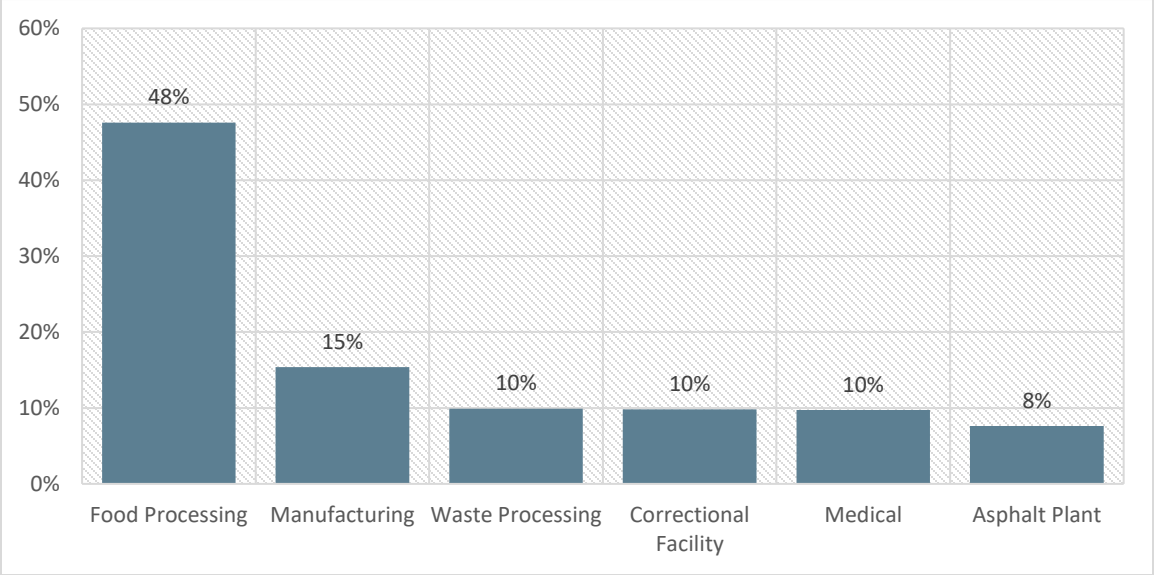


Figure 7-2: C&I Solutions Share Custom Savings by Facility Type

7.2 C&I Solutions Process Evaluation

The Evaluators conducted a formal process evaluation of the C&I Solutions Program in 2017 and found that the program was successful in meeting participation, savings, and satisfaction goals. Table 7-3 and Table 7-4 summarize the Evaluators' review of the C&I Solutions Program in comparison to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 7-3: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and Innovative Components	No. The program is unchanged from PY2021.
No Previous Process Evaluation	No. The program received a comprehensive process evaluation in the prior cycle and a partial process evaluation in PY2021.
New Vendor or Contractor	No. The program has been implemented by CLEAResult since 2011.

Table 7-4: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	No. The program met savings goals in PY2021.
Are the educational or informational goals not meeting program goals?	No. The program has an established trade ally network.
Are the participation rates lower or slower than expected?	No. The program met participant goals in PY2021.
Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	No. Prior process evaluations found that operational and management structure to be up to speed and efficient in administering the program.
Is the program's cost-effectiveness less than expected?	No. The program's cost-effectiveness vastly exceeded expectations.
Do participants report problems with the programs or low rates of satisfaction?	No. Participant surveys found exceedingly high satisfaction levels.
Is the program producing the intended market effects?	Yes. Interviews with participants and trade allies have shown market transformation is occurring.

A partial process evaluation was conducted for PY2022.

7.2.1 Data Collection Activities

The process evaluation of the C&I Solutions Program included the following data collection activities:

- *Program Actor In-Depth Interviews*. The Evaluators conducted in-depth interviews with a series of program actors. These interviews covered a range of topics, including marketing efforts, feedback on program delivery, an assessment of barriers to program implementation and success, and recommendations for program improvement. Program Actors interviewed include:
  - *Summit Program Staff*. The Evaluators interviewed staff at Summit involved in the administration of the C&I Solutions Program. These interviews built upon interviews conducted in PY2020, keeping apprised of Summit's involvement as the C&I Solutions Program develops.
  - *Third Party Implementation Staff Interviews.* The Evaluators conducted interviews with CLEAResult involved with the C&I Solutions Program. These interviews addressed the development of the program over PY2022 as well as CLEAResult's perspective on a variety of implementation issues, including

conversion of audits to completed projects and the process flow for direct install and custom projects.

Table 7-5 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, timeframe of data collection.

Table 7-5: SUA C&I Solutions Data Collection Summary

Target	Component	Activity	n	Role
Summit AR Program Staff	Portfolio Manager C&I Programs Program Manager Senior Engineer Consultant Energy Efficiency Analyst	Group interview	1	Overall administration of Summit EE programs. The Portfolio manager is involved in the larger strategic decisions associated with the EE portfolio. The other staff are responsible for day-to-day operation of the program on the part of Summit, including assisting in outreach and marketing efforts of the program.
CLEAResult Staff	Senior Program Manager	Interview	1	Senior Program Manager oversees the program implementation for Summit and AOG, handling cross-cutting issue. The Program Manager also handles day-to-day operations, including tracking of outreach and implementation activities, payments for direct installation, and interfacing with Evaluation staff.

7.2.2 Process Results & Findings

This section will present the results and key findings from the data collection activities.

7.2.2.1 Response to Program Recommendations

Table 7-6 displays updates on recommendations for the C&I Solutions Program in 2021.

Table 7-6: C&I Response to PY2021 Recommendations

Recommendation	*Summit Response*	*Status of Issue*
Estimate water impacts in customer audit report payback calculations/ROI for relevant projects. Projects that save water can have significantly more rapid payback periods than just based solely on their gas savings. CLEAResult should factor this into audit report calculations when the opportunity presents itself (steam leak repair, condensate return, etc.).	Reaching out to evaluators for more information.	Under consideration

7.2.2.2 Program Theory & Design

The C&I Solutions Program was designed to provide outreach in hard-to-reach sectors of the C&I markets. The main bullets below list program activities and their expected outcomes as determined through prior process evaluations.

- **Direct installation of high-return measures.** The C&I Solutions program provides no-cost direct installation of door sweeps, low flow faucet aerators, pre-rinse spray valves, showerheads, and steam traps. These measures have a high return of savings relative to their cost and as such can be provided free-of-charge and remain cost-effective. The provided savings are unlikely to occur absent the program; generally, if a respondent does not already have the equipment in place, the direct install activities induce an action that was not planned. It is also the intention that these activities will serve as an introductory teaser to energy efficiency for the recipients, and that they will then be further interested in participating in the custom component of the program.
- **Energy audits to medium and large customers.** These audits are conducted by CLEAResult staff, providing recommendations for energy efficiency improvements and an audit report. These audits are intended to generate the bulk of the program savings, yielding high-return custom projects.
- **Incentives for custom measures.** The C&I Solutions Program provides incentives of $0.70 per Therm for verified savings from custom projects completed by large commercial and industrial customers. Incentives for small businesses receive $0.90 per

Therm. These projects may be driven by a program-funded audit, generated by a trade ally, or be customer-directed.

- **Referral to Summit prescriptive programs.** There are instances where the CLEAResult audit identifies energy savings opportunities that qualify for a prescriptive incentive from one of the above-mentioned programs. In these instances, the project is referred to the appropriate program and savings are not credited to the C&I Solutions Program.

7.2.2.3 Program Administration

The C&I Solutions program is overseen by a Program Manager at Summit. This Manager's responsibilities primarily include interfacing with CLEAResult, who directly implements the program. Other activities by this Manager include providing updated customer lists to CLEAResult to better facilitate their implementation, review of custom applications, and at times assisting CLEAResult in customer interactions.

Internally, this Manager is supported by Energy Efficiency Engineers at Summit. These engineers are responsible for custom program implementation and assist the Arkansas team by providing separate review of custom project M&V plans and reports. The program is further supported by rebate processing staff at Summit who handles incentive payments and provide the rebate checks to custom participants at the close of the projects.

At CLEAResult's end, the program overall is led by the Senior Program Manager, who oversees the implementation of the C&I Solutions Program for all three AR natural gas utilities. This director handles high-level issues across the programs, including regulatory compliance and reporting, as well as some level of intervention on the larger projects.

Much of the day-to-day activity is handled by the Senior Program Manager, who reviews direct install and audit activity, and coordinates with the Evaluators in facilitating EM&V activities.

Audit activities are run by engineering staff at CLEAResult. Titles for staff that engage in this activity may vary depending upon the complexity of the facility[28]. These engineers conduct the energy audits. Additionally, their responsibilities include development of the audit report and recommendations. The Direct Install Program Manager oversees crews that perform direct

[28] Examples include (but are not limited to) Energy Engineer, Senior Energy Engineer, and Senior Program Consultant.

installation. Further, the Senior Account Manager follows up with customers to gauge interest in completing a project.

7.2.2.4 Program Implementation and Delivery

CLEAResult provides the Evaluators with updates regarding their pipeline of custom projects. These updates listed the full scope of facility audits, expected savings with associated recommended measures, and what stage the project was in. These stages are:

- *Pipeline*. Projects listed as Pipeline are in the first phase of involvement in the CISP. These participants are customers that have discussed the possibility of a facility audit and indicated interest to CLEAResult. These facilities will receive a Pre-Inspection at a later date and have not signed a project application.
- *Pre-Inspected*. Projects listed as Pre-Inspected are in the phase where CLEAResult has completed a facility audit. During these audits, CLEAResult conducts a comprehensive review of the facility's systems and operational practices. On this basis, CLEAResult then formulates initial recommendations for energy efficiency improvements. These are discussed with facility staff during the audit in order to address the feasibility of recommended measures.
- *Pre-Installation Calculation*. At this phase, CLEAResult is compiling high-level data needed to provide an initial estimate of energy savings. This step of the process compiles the information collected in the site audit, which are then used in the development of an Audit Report.
- *Audit Report Complete*. In this phase, feasible measures from the Pre-Inspection are compiled into a formal audit report, providing the participant with further detail as to the scope of the project, initial savings estimates, associated incentives, expected project costs, and the payback period of the measure. Additionally, should the measure provide operational benefits to the facility (such as improved comfort or product reliability), these are included as well to provide the customer with a full scope of the benefits of the project. This report is provided at no cost to the participant.
- *Project Application*. At this point, the customer has informed CLEAResult and Summit that they intend to install a program-recommended measure. When this occurs, CLEAResult then involves the Evaluators. CLEAResult provides the Evaluators with an M&V plan for the facility, detailing the project scope and proposed data collection and analysis. The Evaluators' engineering staff then reviews the M&V plan and makes recommendations for any changes needed. A project application is then signed, in which the reserved incentive amount is detailed and reflects the estimated savings in the MV plan.
- *Post-Inspection*. This phase marks the completion of post-inspection for an installed measure. CLEAResult has, at this point, post-inspected a measure and revised savings

accordingly if the installed project differs from the proposed project. In some instances, the participant may then be paid out for 40% of the reserved incentive, with the remainder held in reserve to true-up the final incentive amount after M&V is completed. There are times when this may occur for a project with an M&V period at extends across the calendar year. This occurs for a small number of projects overall. Otherwise, 100% of the incentive is paid upon approval from the Evaluator.

- *M&V*. M&V marks the phase when post-installation data is collected for an installed project to allow for calculation of a final savings estimate, from which the remaining incentive to the customer is determined. There are some measures that do not require post-retrofit data; for such measures, the M&V phase is short and requires completion of calculations based upon inputs verified during the Post-Inspection. For facilities that require post-installation data, the data collection period can range from 30 days to 12 months.
- *Complete*. Facilities marked as Complete have received their full incentive. As stated previously, 60% of the reserved funds for the incentive are available to pay the remaining incentive amount or 100% of the reserved funds are available to pay the incentive amount owed to the customer. If the verified savings are below the Project Application savings, the customer's incentive is reduced accordingly, to keep incentive levels at $.70 or $.90/therm (with higher incentives offered if a customer's annual use is less than 200,000 therms). If the verified savings are higher than the Project Application amount, CLEAResult and Summit then see if there are available incentive funds left for the program year. If the program has available funds, the customer receives a total incentive higher than the initial agreement. If the funds are not available, the customer's incentive is capped at the Project Application amount.

Summit and CLEAResult staff indicated that high gas prices have resulted in high demand for more efficient equipment. As of the end of quarter three, CLEAResult staff expected the C&I program to go 35% over goal from a savings perspective but notes there is budget left in the larger C&I portfolio due to the struggling food service program.

C&I custom and direct install programs do not have an active marketing initiative as it is able to garner enough projects without it. Staff want to balance helping those in need, with not having to turn customers away due to a depleted budget. Summit AR uses the same trade ally network for C&I projects as neighboring Black Hills Energy and AOG utilities. Customers are free to use whomever they want for their projects, but Summit AR and CLEAResult will provide a list of trade allies upon request. Staff indicated that there are about 30 trade allies on the list, with five to seven active participants.

The process flow for the C&I Solutions Program is displayed in Figure 7-3.

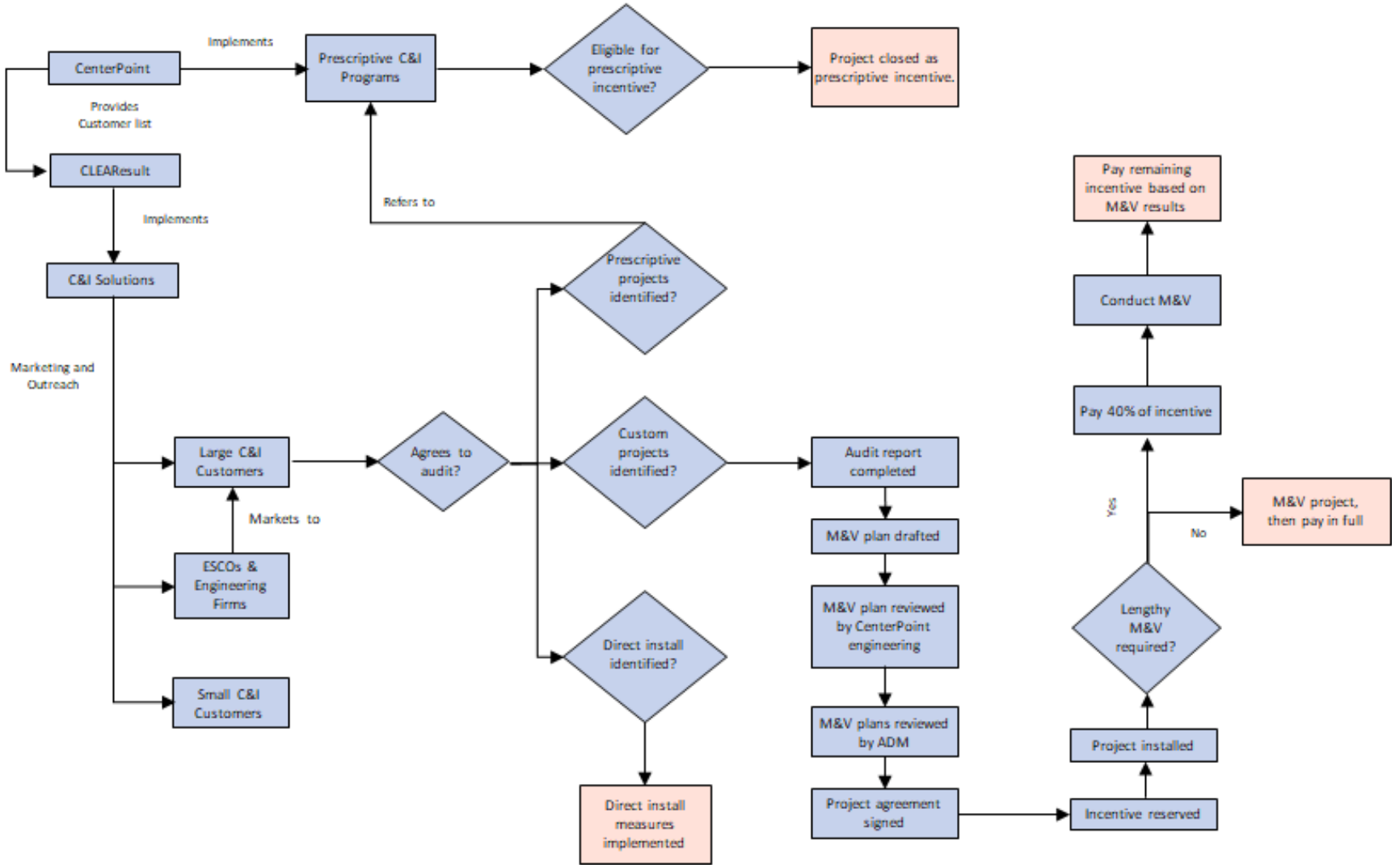


Figure 7-3: C&I Solutions Process Flow

7.2.3 Adherence to Protocol A

The CLEAResult tracking system contained full detail with project addresses, contact information, and measure inputs. Further, the tracking system provided the Therms savings for each line item.

During PY2022, the Evaluators received monthly tracking data updates as well as final tracking exports. There were no major updates to the structure or content of program tracking data. The Evaluators reviewed program tracking data in PY2022 to assess its compliance with Protocol A of the AR TRM V9.0 which specifies that tracking data should be checked for:

- Participating Customer Information;
- Measure Specific Information;
- Vendor Specific Information;
- Program Tracking Information;
- Program Costs; and
- Marketing & Outreach Activities.

The Evaluators conducted a review of each of the above factors within PY2022 tracking data except for marketing and outreach activities as these are outside the scope of the tracking system's reporting.

7.2.3.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.02. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was complete for nearly all participants.
- Custom and prescriptive projects contained complete information on the contractor that completed the installation. This was not needed for direct install as this is done in-house with CLEAResult staff.
- Tracking data included the measure and project costs for each project.
- Weather zones were provided in the tracking data.
- All inputs needed to re-calculate savings according to TRM V9.0 protocols were present in the direct install database.

7.2.3.2 Measure Specific Information

The content of tracking data was found to include enough information for all measures in PY2022.

7.3 C&I Solutions Impact Evaluation

The impact evaluation of the C&I Solutions Program included the following:

- *Custom Project M&V*. The Evaluators conducted project-specific M&V on 17 of 19 custom projects completed through the C&I Solutions program. Two projects received a partial payment and savings claim, and will have M&V completed in PY2023. Each project included an M&V plan and project-specific report. The reports are provided in Appendix A.
- *Free-Ridership Estimation.* A free ridership rate for custom participants was estimated through participant surveying.

7.3.1 Summary of Non-Energy Benefits

Table 7-7 summarizes the non-energy benefits by measure that will be credited to the C&I Solutions Program.

Table 7-7: C&I Solutions Non-Energy Benefits

Measure	Electric Savings	Water Savings	Propane Savings	Deferred Replacement Cost
Steam Leak Repair		✓		
Faucet Aerators		✓		
Low Flow Showerheads		✓		
Low Flow PRSVs		✓		
Weather Stripping	✓			
Condensate Return		✓		

7.3.1.1 Water Savings Calculation Procedure

The TRM V9.0 provides detail for calculation of water savings for the following measures:

- Faucet Aerators (3.3.2);
- PRSVs (3.8.11); and
- Low Flow Showerheads (3.3.5).

The deemed savings procedures for these measures require calculation of water savings, and the water savings claims comply with TRM protocols.

7.3.1.2 Electric Savings Calculation Procedure

Electric savings were claimed for commercial weather stripping in facilities served by municipal utilities and co-ops. For these projects, SUA is credited with the cooling savings from weather stripping specified in AR TRM V9.0 Section 3.2.11.

7.3.2 C&I Solutions Direct Install Impact Evaluation

7.3.2.1 Deemed Savings Calculations

For examples TRM calculations, see Appendix C.

7.3.2.2 Direct Install Free-Ridership

The methodology for DI Free-Ridership was focused on the participants' past experiences with the appropriate equipment and whether they had organizational policies in place to install such equipment. Respondents were asked:

Q22. Before to participating in the C&I Solutions Program, did you have plans to install [LIST MEASURE]?

Q23 Would you have gone ahead with this planned project even if you had not participated in the program?

Twenty percent of respondents stated that they were aware of the savings potential from such equipment.

Q27 If the [PROGRAM] program representative had not recommended installing the [PROJECT_DESCRIPTION], how likely is it that you would have installed it anyway?

1. Definitely would have installed
2. Probably would have installed
3. Probably would not have installed
4. Definitely would not have installed

98. Don't know

These are combined into the following factors:

A. **Prior Plans:** If the respondent indicated plans to install prior to participation, they receive a "1" for this metric.

B. **Installation counterfactual:** If they respondent states that they would have gone ahead with this project without the program, they receive a "1" for this factor.

C. **Program Influence:** If a respondent states that they "Definitely would have" or "probably would have" installed this equipment without the program, they receive a "1" for this factor.

To be found a free rider, a respondent must receive a "1" score for all three factors. The direct install channel was found to have 100% NTGR.

7.3.2.3 Direct Install Spillover

No instances of spillover were identified among the C&I Solutions DI survey respondents.

7.3.3 C&I Solutions Custom Project Impact Evaluation

The Evaluators opted for a census of custom projects in order to capture the full variability associated with these projects; the measures are often unique with idiosyncratic issues, and as such extrapolation from the M&V of other projects would be inappropriate. Table 7-8 summarizes the custom projects completed and evaluated in PY2022. In this table, “Reserved Savings” are the savings used to determine the amount of incentive funds reserved for the project at the time of signing a Project Application. 40% of this amount may paid at the time of verification of installation, with the remaining held in reserve until the M&V of the project is complete. “Expected Savings” is the value calculated by CLEAResult after M&V. “Verified Savings” is the savings calculation completed by the Evaluators.

Table 7-8: SUA C&I Solutions Large Custom Project Summary

Facility Type	Project ID	Measure	Expected Therms	Verified Therms	Realization Rate
Asphalt Plant	EA-0000365928	Insulation	12,809	12,405	97%
Asphalt Plant	EA-0000365932	Insulation	26,980	26,948	100%
Asphalt Plant	EA-0000365930	Insulation	29,780	29,152	98%
Medical	EA-0000589963	Steam Leak Repair	56,700	56,700	100%
		Insulation	19,381	19,301	100%
Food Processing	EA-0000376553	Insulation	3,120	3,120	100%
Manufacturing	EA-0000492934	Steam Leak Repair	923	923	100%
Food Processing	EA-0000392669	Smart Thermostats	6,747	5,226	77%
Food Processing	EA-0000625288	Steam Leak Repair	7,135	3,703	52%
		Insulation	9,539	9,679	101%
		Condensate Return	5,106	5,072	99%
Manufacturing	EA-0000362789	Process Oven	137,884	137,884	100%
Medical	EA-0000589963	Steam Trap Replacement	29,601	29,601	100%
Medical	EA-0000589964	Steam Trap Replacement	29,949	30,059	100%
Asphalt Plant	EA-0000362919	Insulation	19,534	19,072	98%
Manufacturing	EA-0000386133	Burner Tune-up	62,328	59,567	96%
Manufacturing	EA-0000669400	Boiler Replacement	7,828	7,828	100%
		Blowdown Heat Recovery	8,264	8,260	100%
Waste Processing	EA-0000370105	Boiler Retrofit	138,003	138,003	100%
Food Processing	EA-0000362784	Process Oven	286,325	269,354	94%
Asphalt Plant	EA-0000363860	Insulation	19,361	18,819	97%
Correctional Facility*	EA-0000377012	Low Flow Fixtures	32,589	32,589	100%
		DHW Reduction through Food Waste Reduction	6,267	6,267	100%
		Waste Steam & Hot Water Reduction	98,192	98,192	100%
Food Processing*	EA-0000583141	Boiler Controls	301,343	301,343	100%
Food Processing	EA-0000403527	Burner Replacement	56,622	55,622	100%
Food Processing	EA-0000625288	Insulation	3,849	3,849	100%
Food Processing	EA-0000669712	Insulation	5,965	5,949	100%
		Steam Leak Repair	1,384	1,381	100%
		Total	1,423,508	1,395,868	98%
*Denotes PY2022 partial payment & claim. Project will close in PY2023.					

Individual site reports detailing these analyses are provided in Appendix A. All custom projects were post-inspected with M&V as described the site-level analyses.

7.3.3.1 Custom Project Free-Ridership Methodology

The custom project free ridership methodology is more complicated than that of the DI participants, owing to the more complex nature of the projects and the effects of the facility audit and project incentive. The methodology used by the Evaluators in determining the free ridership rates for custom projects examined the following factors:

- *Knowledge gained from program outreach*. If the project originated from program outreach (which may include program-sponsored training courses or facility audits), the respondent is asked if they had prior knowledge of the energy-saving opportunity recommended and eventually installed. If the respondent learned of the measure through the program audit or program–sponsored training, then they are considered to not have been free riders, in that in the absence of the program, the likelihood of the facility receiving a similarly detailed audit are low. Questions used in evaluating this criteria include:

FI-1 Prior to participating in the C&I Solutions Program, did your organization install any equipment similar to [EQUIPMENT/MEASURE] at your facility without financial incentives or rebates?

- ❑ Yes
- ❑ No

FI-1a Did you learn of this measure through your participation in the Commercial & Industrial Solutions Program?

- ❑ Yes [IF YES, ASK FI-1b] Do you recall how you learned of the measure?
- ❑ No

- *Prior plans for a similar measure*. This component is examined in instances where the respondent knew of the measure prior to receiving and technical assistance through the C&I Solutions Program. Respondents are asked a series of questions related to whether they had plans for installing this equipment prior to having learned of the available financial incentives from the C&I Solutions program. Questions used in this component include:

FI-2 Did you have plans to install the [EQUIPMENT/MEASURE] that was upgraded through C&I Solutions before participating in the program?

- ❑ Yes
- ❑ No

If Yes: FI-2a Would you have gone ahead with this planned installation

without the program rebates?

- ❑ Yes
- ❑ No

FI-2b Would this installation have included the same equipment without the program rebates?

- ❑ Yes
- ❑ No

- *Analysis of measure payback*. Respondents are asked to indicate what their required payback period is for energy efficiency improvements. This value is compared against the measure payback with and without the program incentive. If the financial incentive brings the project from over the threshold to under the threshold, then the project is considered to have been sufficiently influenced by the program incentive. This includes the following questions:

DM-5 Does your organization require a specific payback period in order to implement energy efficiency improvements?

- ❑ Yes [ASK DM-5A]
- ❑ No [SKIP TO DM-6]
- ❑ Don't know [DON'T READ]

DM-5a What **payback** *length of time* do you normally require in order to consider an energy investment cost effective?

___ Years

- ❑ Don't know

The stated payback requirement by the respondent is then compared against the payback of the recommended project with and without the program incentive.

- *Modification of the project*. Respondents are asked a series of questions addressing whether they modified the project as a result of their program participation. This includes changes in equipment quantity and/or efficiency level (where appropriate for the measure) and a change in project timing. Questions used to analyze this component include:

FI-5 If the C&I Solutions through C&I Solutions Program were not available, would you have installed the…

- ❑ Same quantity of energy efficient equipment,
- ❑ A lower quantity, or

- ❑ No energy efficient equipment at all?

[IF FI-5 = "Lower Quantity"]: FI-5a: By percentage, how much lower?

FI-6 If the C&I Solutions program were not available, would you have installed …

- ❑ The same equipment with the same efficiency level,
- ❑ The same equipment with a lower energy efficiency level, but still above minimum code, or
- ❑ standard efficiency equipment?

[IF FI-6 = "Lower efficiency level, but still above minimum code"]: FI-6a: By percentage, how much lower?

FI-7 Did the C&I Solutions rebate allow you to install [EQUIPMENT/MESURE] sooner than you otherwise would have?

- ❑ Yes
- ❑ No
- ❑ Don't know

IF YES: FI-7a When would you otherwise have installed the equipment? (READ IF NEEDED)

- ❑ In less than 6 months later
- ❑ In 6-12 months later
- ❑ In 1-2 years later
- ❑ In 3-5 years later
- ❑ In more than 5 years later
- ❑ No, did not affect timing of purchase and installation

The scoring mechanism for custom projects is presented in Figure 7-4.

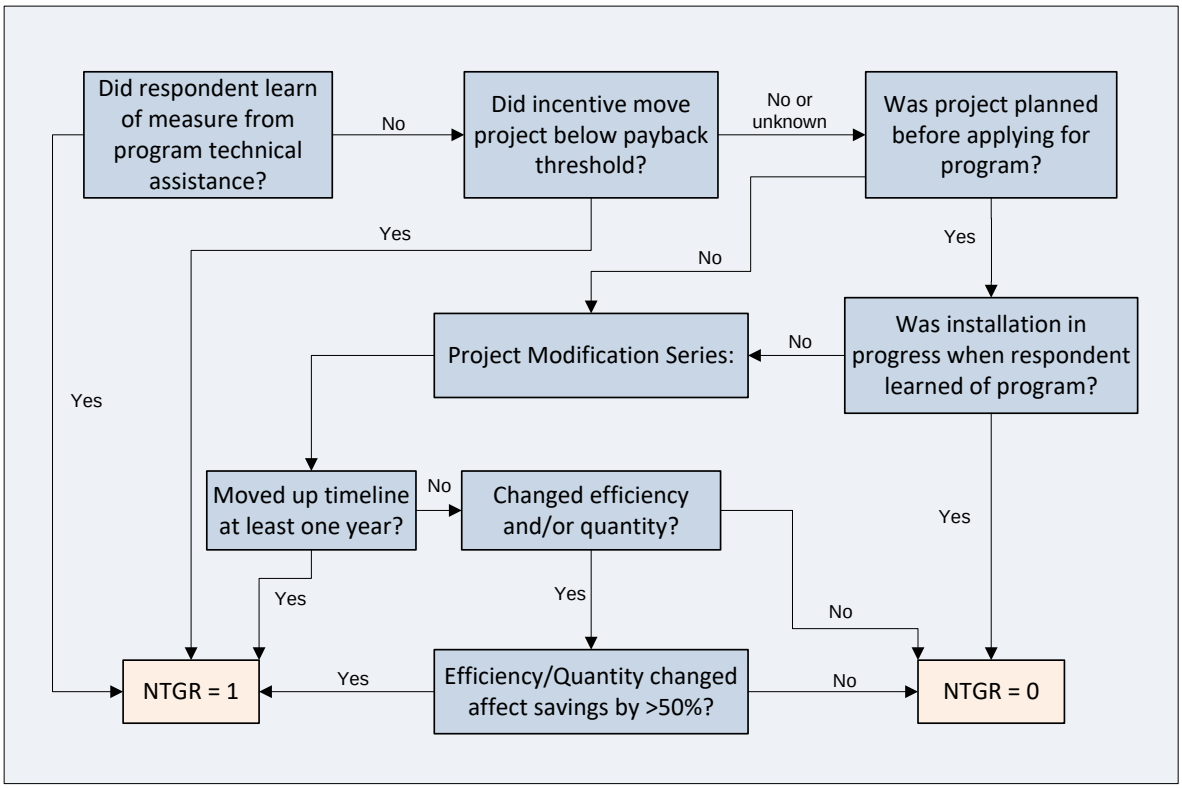


Figure 7-4: C&I Solutions Custom Project Free-Ridership Diagram

The projects reviewed by the evaluators had 100% NTGR. Projects were found to have been induced by-and-large by program-funded audits, and incentives were required bring projects within the participants' required payback period.

Given the small number of participants, the free rider assessments were a series of case studies as opposed to an extrapolated survey.

7.3.3.2 Participant Spillover

Participant spillover is defined as savings from program participants that was not incentivized by the SUA programs. During participant surveying, both DI and Custom participants are asked questions addressing whether their participation had led to the installation of equipment that was not rebated by SUA. The estimated savings from these projects are tallied and added to the program savings as Participant Spillover.

OS-3 Has your organization's participation in the C&I Solutions Program led you to buy any energy resulted in the installation of additional efficient equipment for which you did not apply for a financial incentive?

❑ Yes

- ❑ No
- ❑ Don't know

If Yes: OS-3a What type of equipment?

- ❑ [RECORD VERBATIM]
- ❑ Don't know

No participant spillover was identified.

7.3.3.3 Overall Program NTGR

The overall program NTGR for the C&I Solutions Program is defined as:

$$Program\ NTGR = \frac{Verefied\ Net\ Participant\ Savings + Particpant\ Spillover + PartialParticipant\ Spillover}{Gross\ DI\ Savings + Gross\ Steam\ Trap\ Savings + Gross\ Custom\ Savings}$$

7.3.4 Verified Savings

Table 7-9 presents the gross savings results of the evaluation of the PY2022 C&I Solutions Program. Total Gross Savings summarizes the savings calculations performed by TRM protocols and custom analyses.

Table 7-9 C&I Solutions Verified Therms Savings

Component	Measure	Expected Therms Savings	Verified Therms Savings	EUL	Lifetime Therms Savings
Direct Install	Faucet Aerators	438	438	10	4,377
	Showerheads	1,030	1,030	10	11,331
	Pre-Rinse Spray Valves	208	208	5	2,083
	Weather stripping	376,451	376,461	11	4,141,076
Custom	Varies	1,423,508	1,395,868	14.97	20,642,931
Total Gross Savings		**1,801,635**	**1,774,006**	**14.12**	**24,801,798**

Net savings for the C&I 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 7-10.

Table 7-10 C&I Solutions Net Savings Summary

Component	Free-Ridership Rate		Net Annual Savings		Net Realization Rate	Net Lifetime Therms Savings
	Ex Ante	Ex Post	Ex Ante	Ex Post		
Direct Install	0%	0%	378,127	378,138	99.9%	4,157,826
Custom	0%	0%	1,423,508	1,395,868	98.1%	20,642,931
Overall:	**0%**	**0%**	**1,801,635**	**1,774,006**	**98.5%**	**24,801,798**

Table 7-11: Commercial & Industrial Solutions Verified Net Water Savings

Component	Net Annual Water Saving (Gallons)	Lifetime Net Water Savings (Gallons)
Direct Install	425,619	4,530,349
Custom	1,431,485	18,141,247
Total	**1,857,104**	**22,711,596**

kWh and kW NEBs are summarized in Table 7-12.

Table 7-12: Commercial & Industrial Solutions Verified Net Electric Savings

Component	Net kWh	Net kW	Net Lifetime kWh
Direct Install	80	.06	876
Custom	0	0	0
Total	**80**	**.06**	**876**

7.4 Conclusions

The program met savings goals and was highly cost-effective.	The program met 111% of its savings goal with 1,774,006 net therms.
	Savings declined by 10.6% compared to PY2021, though PY2021 was the highest-saving year in the history of the program.

7.5 Recommendations

Develop Strategic Energy Management offerings.	Elsewhere in Arkansas, Strategic Energy Management (SEM) has played an increased role in custom programs for large commercial and industrial customers.

8 Commercial Food Service Program

The Commercial Food Service Program provides incentives for a range of food service measures. In PY2022, eligible high-efficiency measures include:

- Combi ovens;
- Convection ovens;
- Conveyor ovens;
- Rotating rack ovens;
- Fryers;
- Conveyor broilers;
- Griddles; and
- Steamers.

Incentives range from $300 to $2,400 for eligible equipment, with an additional dealer/installer incentive ranging from $45 to $225 depending upon equipment type. The program added Third Tier Fryer and Conveyor Broilers incentives for the 2020-2022 program cycle.

8.1 Program Overview

The Commercial Food Service Program is primarily a vendor-driven program, with the marketing targeted at food service equipment distributors. Table 8-1 summarizes the historical performance of the Commercial Food Service Program.

Table 8-1: Commercial Food Service Program Historical Performance against Goals

Program Year	Budget			Net Therms		
	Spent	Allocated	%	Achieved	Goal	%
2010	$121,129	$294,054	41%	354,702	264,327	134%
2011	$215,900	$275,129	78%	144,465	209,341	69%
2012	$164,704	$293,854	56%	54,162	259,752	21%
2013	$180,476	$331,595	54%	59,515	385,040	15%
2014	$182,608	$331,594	55%	77,619	385,050	20%
2015	$152,485	$231,595	66%	85,891	60,210	143%
2016	$163,893	$231,595	71%	66,534	60,210	111%
2017	$199,189	$222,987	89%	83,289	62,260	134%
2018	$164,026	$229,403	71%	71,653	68,196	105%
2019	$155,205	$232,120	67%	53,123	69,951	76%
2020	$120,124	$172,491	70%	21,693	63,195	34%
2021	$150,488	$178,216	84%	50,469	62,873	80%
2022	$179,946	$81,932	46%	21,283	64,641	33%

8.1.1 Participation Summary

In PY2022, the Commercial Food Service Program had 22 companies receive rebates for 51 pieces of kitchen equipment.

Figure 8-1 summarizes the Commercial Food Service Program participation by facility type.

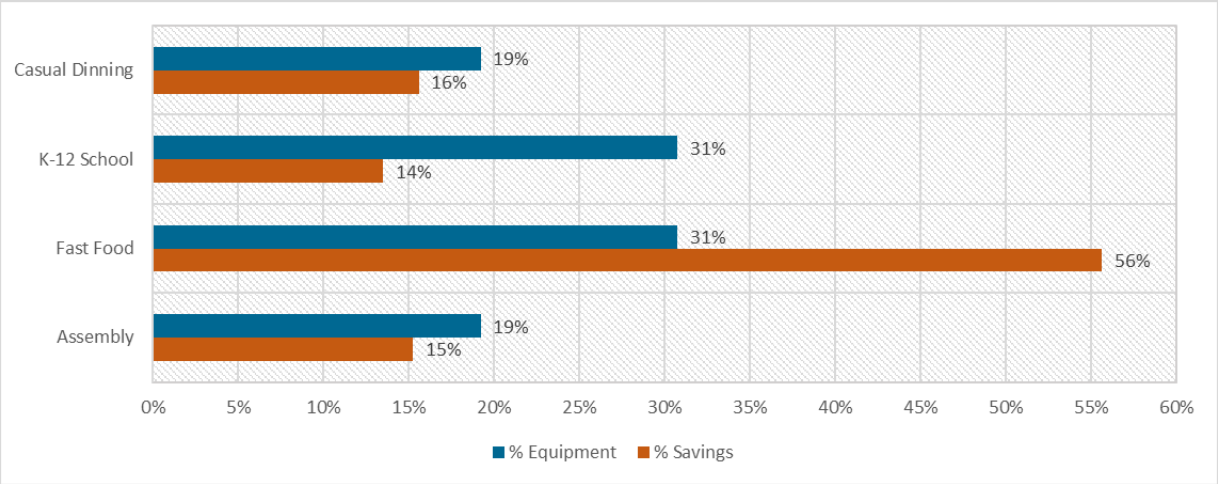


Figure 8-1: Commercial Food Service Program Participation by Facility Type

Figure 8-2 summarizes Commercial Food Service Program participation by measure category.

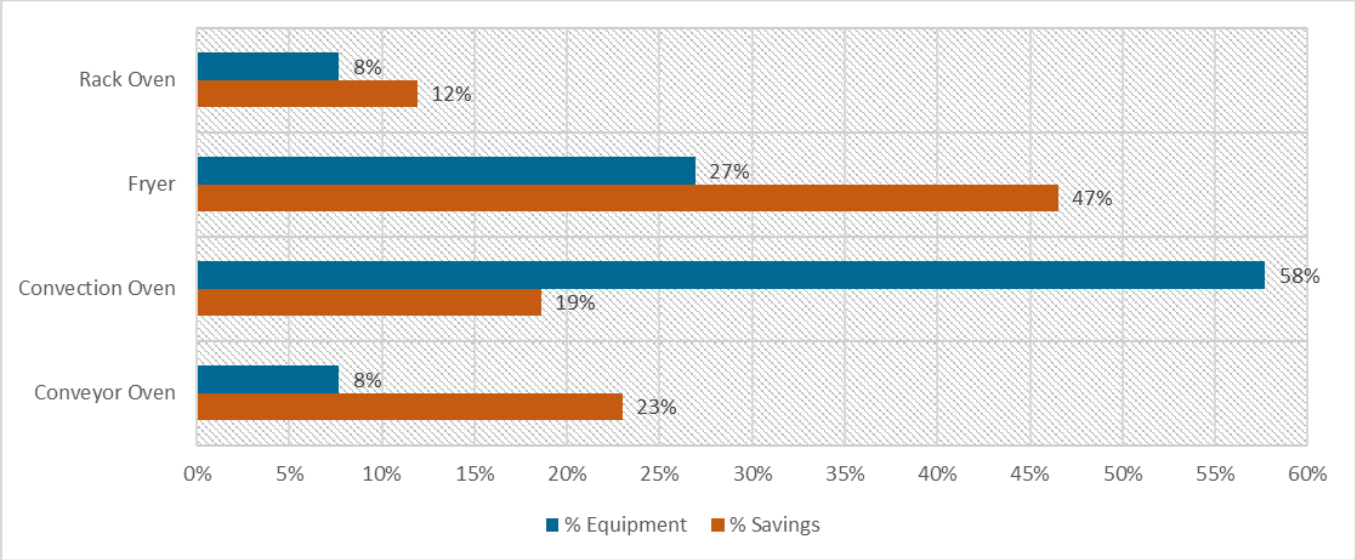


Figure 8-2: Participation by Measure Category

8.2 Commercial Food Service Program Process Evaluation

In following guidance from the TRM, Protocol C, we conducted limited process evaluation activities for PY2022, consisting of staff interviews and a review of program materials. The program has not recognized any major program changes from PY2020 to PY2022.

Table 8-2 and Table 8-3 summarize the Evaluators' review of the Commercial Food Service Program in comparison to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 8-2: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and Innovative Components	No. The program is designed in a manner consistent with similar programs elsewhere and applies deemed savings values from the TRM.
No Previous Process Evaluation	No. The program received a comprehensive process evaluation in 2017.
New Vendor or Contractor	Yes. CenterPoint AR was acquired by Summit in 2021. 2022 marked the first year the program was managed by Summit. Despite the acquisition, program staff remained largely the same from 2021.

Table 8-3: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	Yes. The program did not meet goal in PY2021, though it showed significant improvement compared to prior program years.
Are the educational or informational goals not meeting program goals?	No. The programs have had successful consumer and contractor outreach & education.
Are the participation rates lower or slower than expected?	Yes. The program did not meet its goal in PY2021, though it showed significant improvement compared to prior program years.
Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	No. Past process evaluations found that operational and management structure to be up to speed and efficient in administering the program.
Is the program's cost-effectiveness less than expected?	No, the program's cost-effectiveness was within expected range.
Do participants report problems with the programs or low rates of satisfaction?	No. Participant surveys in past evaluations found exceedingly high satisfaction levels.
Is the program producing the intended market effects?	Yes. Interviews with participating vendors found that the program has caused a shift in their sales

8.2.1 Data Collection Activities

The process evaluation of the Commercial Food Service Program included the following data collection activities:

- *Program Actor In-Depth Interviews*. The Evaluators conducted in-depth interviews with a series of program actors. These interviews covered a range of topics, including marketing efforts, feedback on program delivery, an assessment of barriers to program implementation and success, and recommendations for program improvement. Program Actors interviewed include Summit Program Staff and implementation contractor staff.

Table 8-4 summarizes the data collection for this process evaluation effort. This includes the titles, role, sample sizes, and timeframe of data collection.

Table 8-4: Summit Commercial Food Service Program Data Collection Summary

Target	Component	Activity	N	Precision	Role
Summit AR Program Staff	Portfolio Manager C&I Programs Program Manager Senior Engineer Consultant Energy Efficiency Analyst	Group interview	1	NA	Overall administration of Summit EE programs. The Portfolio manager is involved in the larger strategic decisions associated with the EE portfolio. The other staff are responsible for day-to-day operation of the program on the part of Summit, including assisting in outreach and marketing efforts of the program.

8.2.2 Process Results & Findings

This section will present the results and key findings from the data collection activities. These findings are based upon interviews with utility staff, implementation staff, and surveys with participants.

8.2.3 Response to Program Recommendations

Table 8-5 summarizes the status of issues and recommendations identified in the PY2021 process evaluation.

Table 8-5: Food Service Program Response to PY2021 Recommendations

Recommendation	Status of Issue
Set conditional formatting in the equipment specifications workbook with parameter boundaries that will flag unit of measurement errors. Entering the myriad equipment inputs for each individual product is a manual process and could be subject to copy-paste or typographical errors. This occurred with Combi Oven cooking efficiencies being entered as "37" instead of "37%". Establishing conditional formatting in the columns with boundaries set to align with the unit of measurement could flag erroneous entries.	Under consideration

8.2.4 Program Design Changes

No changes were made to the program in 2022. Summit staff indicated that the food service program continues to struggle to meet participation and savings goals. At the time of the interview at the end of the third quarter, savings were at 30% of the program goal, and not expected to meet goal for the year. Summit AR staff noted that the food service industry is focused on labor issues, and restaurants do not have the capacity to focus on other things. Moreover, trade allies have begun leaning heavily on refurbished rather than new equipment. Although Summit offered bonuses for food service equipment in the past, they chose not to offer those bonuses this year as they did not feel as though they were driving sales.

Summit staff also noted that the acquisition by Summit disrupted some of their previous food services related relationships. CenterPoint central office had relationships with large corporate chains that they were then connected to locally, but they lost those connections with the transition to Summit. Moreover, chains and franchises have experienced an increase in managerial turnover lately, making it difficult to build relationships and get in the door.

8.2.5 Adherence to Protocol A

Summit maintains an internal tracking system based on the SAP platform.

During PY2022, the Evaluators received quarterly tracking data updates as well as final tracking exports. The tracking system includes necessary inputs as per AR TRM 9.0. The Evaluators previously reviewed program tracking data in PY2018 to assess its compliance with Protocol A of the AR TRM 9.0 which specifies that tracking data should be checked for:

- Participating Customer Information;
- Measure Specific Information;
- Vendor Specific Information;
- Program Tracking Information;

- Program Costs; and
- Marketing & Outreach Activities.

8.2.5.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.0. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was complete for nearly all projects.
- Projects contained complete information on the contractor that completed the installation.
- All inputs needed to re-calculate savings according to AR TRM 9.0 protocols were present in the database.

8.2.5.2 Measure Specific Information

The content of tracking data was found to include enough information for all measures in PY2022.

8.2.6 Literature Review of Food Service Program Models

The Evaluators conducted a literature review of food service program models in an effort to identify means through which the program could increase participation. Although SUA staff attribute some of these struggles to changes in staffing and support structures following the transition from Center Point to Summit, the food service program lagged in participation prior to this transition. Moreover, previous interviews with trade allies have uncovered that the market for new food service equipment has waned, as many customers have decreasing budgets and additional expenses competing for limited funds.

Evaluators conducted a literature review of alternative versions of food service equipment programs in order to provide SUA with recommendations on how to pivot their programs to increase its savings potential. The Evaluators focused on midstream food service programs, as these programs have proven successful in other jurisdictions. Although the switch to a midstream program would involve an overhaul of the existing downstream food service program, the current program mode has for a significant time fallen short of expectations and the underlying program model warrants reconsideration.

8.2.6.1 Midstream Program Description

A “midstream” program provides incentives directly to the participating distributors for sales of qualifying energy efficient food service equipment. The distributor submits their purchase

orders for incentives on a regular basis (often monthly), and this removes the need for the end-use customer to submit incentive application forms.

8.2.6.2 Midstream Program Benefits

Midstream programs have the potential to provide several benefits over downstream programs.

- **Increased stocking of efficient equipment options.** Midstream programs can increase stocking of efficient equipment by participating distributors. Stocking can be increased either directly through the provision of stocking incentives or indirectly through reducing the cost of more expensive efficient equipment, and in that way, reduce the amount of capital the distributor has tied up in stock. Midstream program impacts on stocking practices make this incentive design particularly well suited for increasing installations of equipment types that would typically require a special order and for which customers would be less willing to wait for delivery of ordered equipment.
- **Reduced transaction costs borne by customers and program staff.** In a downstream program, each project requires submission and review of a program application in addition to processes of educating the purchaser on equipment qualifications and submission requirements. By working with a relatively small number of distributors, these costs can be reduced by leveraging the distributors to collect data on purchases and educate buyers.
- **Leverage distributors to educate end-users and purchasers.** Midstream programs can leverage distributors existing relationships with their clients to deliver education on the benefits of efficient equipment options.
- **Strengthen ties between program administrators and market actors.** Midstream programs provide an opportunity for program administrators to develop relationships with distributors providing equipment in their service territory.

8.2.6.3 Midstream Program Challenges

Challenges associated with midstream food service programs include:

- **Risk of incentives not generating additional sales of efficient equipment.** Midstream incentives can result in distributor incentive payments without impacting sales of efficient equipment if they are based on the number of units sold without payments contingent on increased sales above a baseline sales volume.
- **Time-intensive program launch.** The costs of setting up a midstream program can be high because of the investments in recruiting and building relationships with distributors, developing systems for capturing sales, training distributors on program requirements and data systems.

- **Less data is collected.** The streamlined processes necessary for a midstream program result in a reduction of data collected about the project. The reduction of data collection can create challenges in supporting claimed program impacts. Programs need to focus on limiting data to collection of critical data needs to reduce administrative burdens that could reduce the effectiveness of the program. Early engagement with third-party evaluators to get agreement on key data needs is recommended.
- **Reduced customer contact opportunities for the sponsoring utility.** Midstream programs reduce the opportunity for the program administrator to interface with the customer. This reduced contact limits opportunities for the administrator to affect customer satisfaction and demonstrate the benefit of using rate-payer dollars to fund investments in energy efficiency.

8.2.6.4 Key Considerations for Program Design & Implementation

Key considerations for program design and implementation include:

- **Incentive design.** Incentives for midstream programs can be structured in a variety of ways. Incentives can be provided with a requirement that all or a portion of the incentive is to be used to buy down the cost to the customer, provided to the distributor to use the incentives as they best seem fit to increase sales of the equipment, and/or designed to cover specific costs associated with administering the program or training of staff.

  Incentive design should be kept simple so that it is easy for the distributor to understand, be sufficient to drive sales while remaining reasonable relative to the level of energy savings that the equipment can provide.

  A good approach is to provide a flat per-unit incentive structure to make it easier for distributors to anticipate payments. Additional stipends to offset costs of administering the program, providing training, and marketing the measures can be used to increase distributor buy-in. Additionally, allowing distributors flexibility in how they utilize the incentives (e.g., for training, system upgrades, sales bonuses) is a recommended practice. Lastly, prompt payment to distributors will help to maintain their satisfaction and engagement.
- **Product selection.** Midstream programs are particularly well suited for types of equipment that are not well stocked, have high savings potential, but low downstream rebate volume, or have a relatively low per-unit cost and have low savings. Another characteristic of products well-suited for midstream programs are products that are easy substitutes for alternative less efficient products that do not require a lot of explanation to communicate the benefits to end-users. Products selected for midstream programs should not be offered through downstream incentive programs to prevent double counting of savings and incentive payments.

8.2.6.5 Example Programs

When deciding whether or not to transition its food service program from a downstream approach to a midstream approach, Summit AR can learn from other food service midstream programs. A review of other utilities' programs revealed at least nine natural gas focused food service equipment midstream programs exist across ten states. Table 8-6 provides more details regarding the current incentive levels offered by each program. All programs provide discounts to customers immediately at the point of purchase when customers purchase equipment from participating retailers.

Table 8-6: Midstream Food Service Program Examples

State	Utility	Program	Products	Incentives
NC, SC	Duke Energy	Smart $aver Program	Steam Cookers Commercial Combination Ovens Demand Control Ventilation for Kitchen Exhaust Hood	Up to 75% of the line-item equipment cost
NY	ConEdison	Midstream	Combination oven Convection oven Fryer Griddle Single-rack oven Double-rack oven Steamer Dishwasher Conveyor broiler	$1,200-2,500 $1,250 $1,000 $350 $2,000 $3,000 $2,500 $50-900 $1,000-2,750
CT	Energize CT	Commercial Food Service Equipment	Broilers Fryers Dishwashers	Up to $3,000 Up to $900 Up to $250
MA	National Grid	Point-of-Sale Food Service Initiative	Infrared Conveyor Broiler <22" Wide Infrared Conveyor Broiler 22-28" Wide Infrared Conveyor Broiler >28" Wide Combination oven Convection oven Conveyor oven Fryer (large) Fryer (standard) Griddle Pasta cooker Pre-rinse spray valve Single-rack oven Double-rack oven Steamer Underfired broiler	$2,000 $2,500 $3,000 $1,000 $1,500 $1,500 $1,500 $1,300 $500 $2,000 $25 $2,000 $2,500 $1,500 $650

CA	California EnergyWise (for IOUs)	California Foodservice Instant Rebates	Griddle Rack oven Conveyor oven Combination oven Convection oven Fryer Steamer Underfired broiler	$150/ft $1,000 $1,200 $1,500-3,000 $600 $900 $2,000 $600
NJ	PSEG	PSE&G Midstream	Combination oven Convection oven Steamer Griddle Rack oven Commercial conveyor oven Commercial Fryer Dishwasher Pre-rinse spray valve	$2,000 $750 $200 $500 $1,000 $1,500 $750 $50-$1000 $25
MI	DTE	DTE Commercial Midstream Food Service Program	Combination Oven Convection Oven Conveyor Broiler Conveyor Oven Demand Controlled Kitchen Ventilation Dishwasher Fryer Griddle Infrared Charbroiler Infrared Rotisserie Oven Infrared Salamander Broiler Infrared Upright Broiler Pasta Cooker Pre-Rinse Spray Valve Rack Oven Steamer	$1,500 $500 $2,000 - $3,000 $1,400 $0.50/CFM $45 – $850* $1,200 $400 $1,500 $400 $500 $1,200 $2,000 $7 $1,500 – $3,000 $900 – $3,000
WA	Puget Sound Energy	Commercial Food Service Equipment	Deep fat fryers Connectionless steamers Griddles Convection ovens Combination ovens Rack ovens Deck ovens Conveyor ovens	Up to $4,000 Up to $3,500 Up to $3,600 Up to $3,000 Up to $10,500 Up yo $6,000 Up to $4,800 Up to $3,300

8.2.6.6 Measure Cost-Effectiveness Review

The Evaluators screened the current measure offerings to determine whether measure could support larger incentive levels. At the outset, the Evaluators found that the program maintains

a UCT ratio greater than 1.0 if incentives are increased by 50% above current levels. As incentives are a transfer payment, this does not affect the program TRC score.

Table 8-7 summarizes the Evaluators' analysis of measure savings, UCT benefits, and establishment of a maximum incentive threshold where the measure still passes UCT screening with a score greater than 1.0, with an assumed 20% administration adder on top of the incentive amount.

Table 8-7: Food Service Equipment UCT Screening

Measure	Incremental Cost	Current SUA Incentive	Typical unit savings	Current Measure-level UCT	Maximum Incentive with a UCT > 1.0
Fryer - Tier 1	$882	$500	375	2.28	$1,140
Fryer - Tier 2	$1,488	$750	414	1.68	$1,250
Griddle	$449	$300	126	1.28	$375
Rack Oven	$4,128	$500	585	3.55	$1,775
Conveyor Broiler	$2,523	$750	1,933	7.83	$5,850
Conveyor Oven	$2,320	$750	422	1.71	$1,280
Convection Oven	$1,324	$500	356	2.16	$1,050
Combi Oven	$4,217	$1,450	1,121	2.35	$3,040
Steam Cooker	$1,811	$1,000	2,595	5.44	$7,850

SUA's most common measures historically are:

- Fryers
- Convection ovens
- Combi ovens
- Conveyor ovens

These measures have maximum incentive thresholds ranging from 1.67 to 2.28 of current incentive amounts. Rack ovens, conveyor broilers, and steamers are larger in per-unit savings but lower in participation volume, and have multipliers ranging from 3.55 to 7.80 of current amounts. For these measures, incentives would have to be capped at incremental cost, however.

Based on this analysis, the Evaluators conclude that incentives should be increased significantly across all measures, with the exception of griddles.

8.3 Commercial Food Service Program Impact Evaluation

The impact evaluation effort of the Commercial Food Service Program included the following:

- *Unit-Specific Savings Review.* The deemed parameters listed in the TRM V9.0 include assumptions of cooking efficiency, preheat BTU, and capacity. The Evaluators developed a lookup table for key parameters for units rebated through SUA's program, using specific unit characteristics in TRM V9.0 algorithms.

8.3.1 Savings Calculation Methodologies

The Evaluators applied deemed savings algorithms from TRM V9.0 in calculating savings for measures included in the Commercial Food Service Program.

The Evaluators conducted a review of the key parameters contributing to savings for equipment rebated in the Commercial Food Service Program. From this, a table was developed allowing SUA to update energy savings calculations using the characteristics of the equipment purchased. In the subsections to follow, the deemed savings tables will present:

- Baseline specifications from the TRM V9.0;
- Efficient specifications from the TRM V9.0; and
- Verified specifications from the Evaluators' review of units rebated in the program.

Most measures had 100% realization. The Evaluators note that the program had a rack oven with zero savings claimed. The SUA tracking system had not had rebates for this type of equipment before and did not have parameters established. The Evaluators calculated 3,286 therms savings for this project, though realization rate is incalculable as ex ante savings was 0 therms.

8.3.1.1 Free-Ridership

The PY2021 survey had too low of a response rate to update NTGRs. The Evaluators applied the NTGR developed in prior evaluations of 77.2%.

8.3.2 Verified Savings

Table 8-8 presents the gross savings results of the evaluation of the PY2022 Commercial Food Service Program. Total Gross Savings summarizes the savings calculations performed by TRM V9.0 protocols for food service equipment.

Table 8-8: Commercial Food Service Program Verified Therms Savings

Measure Category	Expected Therms Savings	Verified Therms Savings	Gross Realization	EUL	Lifetime Therms Savings
Convection Oven	5,126	5,126	100.0%	12	61,516
Conveyor Oven	6,334	6,334	100.0%	12	76,011
Rack Oven	0	3,286	N/A	12	39,427
Fryer	12,823	12,823	100.0%	12	153,871
Total	**24,283**	**27,569**	**113.5%**	**12**	**330,825**

The resulting net savings are presented in Table 8-9.

Table 8-9: Commercial Food Service Program Net Savings Summary

Free-Ridership Rate		Net Annual Savings		Net Realization Rate	Net Lifetime Therms Savings
Ex Ante	Ex Post	Ex Ante	Ex Post		
77.2%	77.2%	18,747	21,283	113.5%	255,397

8.4 Conclusions

SUA accurately calculates savings per TRM V9.0 protocols.	All projects other than rack ovens had 100% gross realization. Rack ovens did not have calculations automated in the tracking system as there had never been participation in this measure.
Savings have declined significantly.	Program net therms decreased from 50,469 to 21,283 from PY2021 to PY2022. SUA staff have noted a long struggle for this program to meet participation and savings goals.

8.5 Recommendations

Increase incentives across most measures.	The Evaluators found that most measures in the program could have increases in incentive levels while maintaining robust utility cost test benefit ratios.

9 Home Energy Reports

The Home Energy Reports Program is a behavioral energy efficiency program run by Oracle, a third-party implementer for Summit. The program is delivered on an opt-out basis and provides a sample of Summit's residential customers with personalized print and email reports that contain a normative comparison of their energy usage compared to similar households, tailored recommendations of ways to save energy, and promotions of other programs in Summit's portfolio. The Home Energy Reports program also includes a web portal that answers frequently asked questions and allows customers to view their current and historical energy usage, update their home profile information via a home energy analysis survey, or remove themselves from the program. The program is designed to deliver energy savings by motivating behavior change and program participation by the recipients of the Home Energy Reports.

9.1 Program Overview

The Home Energy Reports Program began in September 2011. The program is designed to generate quantifiable behavioral savings that cannot be feasibly attained through standard EE 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 homes in their neighborhood. The program theory asserts that the normative comparison is a motivating force that drives energy-saving 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 9-1 summarizes the attrition that has occurred in each wave.

Table 9-1: Home Energy Reports Recipient Attrition

	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Inception	50,071	52,199	24,330	21,702	46,668	11,827
Current	23,827	26,528	14,419	14,428	39,551	10,554
Attrition %	52.4%	49.2%	40.7%	33.5%	15.3%	10.8%

9.2 Savings Calculation Methodologies

Based on the opt-out program design, savings calculation can be conducted using a randomized controlled trial (RCT) in which the energy use of the program participants (treatment group) is compared to a statistically-equivalent control group. 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:

- α_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.
- ε_{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

9.2.1 Home Energy Report Net Savings

The HER program uses a randomized controlled 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.

Table 9-2 shows the pre-period interval for each wave, based on the billing data. For each wave, the same interval was found for both recipient and control groups, which allows for a proper comparison of pre-usage.

Table 9-2: Pre-Period Interval

Wave	Start Year/Month	End Year/Month
1	2010-10	2011-09
2	2011-11	2012-10
3	2013-12	2014-11
4	2018-10	2019-09
5	2019-10	2020-09
6	2021-03	2021-12

9.2.1.1 Wave 1

Table 9-3 provides the model coefficients for the regression of customer billing data in the analysis of Wave 1.

Table 9-3: Regression Coefficients & Model Details – Wave 1

Variable Description	Regression Coefficient	Standard Error	T-Stat	PR > |T|
Intercept	0.49	0.02	21.92	<0.00001
Treatment	-0.04	0.00	-11.90	<0.00001
February	0.03	0.03	0.96	0.34
March	-0.11	0.03	-3.45	0.0006
April	-0.27	0.03	-8.44	<0.00001
May	-0.47	0.03	-14.78	<0.00001
June	-0.45	0.03	-14.41	<0.00001
July	-0.43	0.03	-13.77	<0.00001
August	-0.45	0.03	-14.12	<0.00001
September	-0.46	0.03	-14.55	<0.00001
October	-0.43	0.03	-13.55	<0.00001
November	-0.19	0.03	-6.03	<0.00001
December	0.05	0.03	1.46	0.14
Pre-usage	0.02	0.01	2.16	0.0304
Pre-summer	0.12	0.01	7.74	<0.00001
Pre-winter	0.79	0.01	64.51	<0.00001
Pre-usage: February	-0.05	0.01	-3.72	0.0002
Pre-usage: March	0.09	0.01	6.96	<0.00001
Pre-usage: April	0.33	0.02	21.31	<0.00001
Pre-usage: May	0.25	0.02	13.32	<0.00001
Pre-usage: June	0.15	0.05	3.20	0.00
Pre-usage: July	-0.18	0.06	-2.82	0.00
Pre-usage: August	0.16	0.05	3.18	0.00
Pre-usage: September	0.19	0.03	6.6	<0.00001
Pre-usage: October	0.2	0.02	12.76	<0.00001
Pre-usage: November	0.09	0.01	6.59	<0.00001
Pre-usage: December	0.03	0.01	2.36	0.02
Pre-summer: February	0.07	0.02	3.13	0.00
Pre-summer: March	0.06	0.02	2.84	0.00

Pre-summer: April	0.01	0.02	0.63	0.5271
Pre-summer: May	0.27	0.03	10.44	<0.00001
Pre-summer: June	0.33	0.05	6.16	<0.00001
Pre-summer: July	0.58	0.06	8.89	<0.00001
Pre-summer: August	0.27	0.05	5.23	<0.00001
Pre-summer: September	0.26	0.04	7.35	<0.00001
Pre-summer: October	0.21	0.02	9.23	<0.00001
Pre-summer: November	0.06	0.02	2.75	0.01
Pre-summer: December	0.07	0.02	3.16	0.00
Pre-winter: February	0.00	0.02	0.03	0.97
Pre-winter: March	-0.37	0.01	-28.19	<0.00001
Pre-winter: April	-0.66	0.01	-51.69	<0.00001
Pre-winter: May	-0.76	0.01	-59.65	<0.00001
Pre-winter: June	-0.77	0.01	-60.89	<0.00001
Pre-winter: July	-0.78	0.01	-61.25	<0.00001
Pre-winter: August	-0.78	0.01	-61.17	<0.00001
Pre-winter: September	-0.77	0.01	-60.11	<0.00001
Pre-winter: October	-0.67	0.01	-52.58	<0.00001
Pre-winter: November	-0.38	0.01	-28.77	<0.00001
Pre-winter: December	-0.16	0.02	-10.06	<0.00001
Adjusted R-Square: 0.789				

The resulting annual savings are:

- Annual Savings = ∑ (0.04402 * Number of recipients in month I * Number of days in month i) = 394,894 Therms
- 95% Confidence Interval: +/- 54,588 (13.8%)

9.2.1.2 Wave 2

Table 9-4 provides the model coefficients for the regression of customer billing data in the analysis of Wave 2.

Table 9-4: Regression Coefficients & Model Details – Wave 2

Variable Description	Regression Coefficient	Standard Error	T-Stat	PR > |T|
Intercept	1.08	0.01	85.17	<0.00001
Treatment	-0.03	0.00	-12.13	<0.00001
February	-0.04	0.02	-2.13	0.03
March	-0.46	0.02	-25.74	<0.00001
April	-0.81	0.02	-45.42	<0.00001
May	-0.95	0.02	-53.54	<0.00001
June	-0.97	0.02	-54.72	<0.00001
July	-0.97	0.02	-54.66	<0.00001
August	-0.98	0.02	-54.91	<0.00001
September	-0.99	0.02	-55.44	<0.00001
October	-0.93	0.02	-51.86	<0.00001
November	-0.55	0.02	-31.02	<0.00001
December	-0.18	0.02	-9.86	<0.00001
Pre-usage	-0.19	0.01	-13.06	<0.00001
Pre-summer	-0.28	0.02	-18.29	<0.00001
Pre-winter	1.1	0.02	66.56	<0.00001
Pre-usage: February	0.13	0.02	6.7	<0.00001
Pre-usage: March	0.34	0.02	16.49	<0.00001
Pre-usage: April	0.5	0.02	21.76	<0.00001
Pre-usage: May	0.42	0.03	14.08	<0.00001
Pre-usage: June	0.3	0.05	6.5	<0.00001
Pre-usage: July	0.22	0.06	3.63	0
Pre-usage: August	0.1	0.04	2.49	0.01
Pre-usage: September	0.46	0.03	14.79	<0.00001
Pre-usage: October	0.45	0.02	22.12	<0.00001
Pre-usage: November	0.3	0.02	17.25	<0.00001
Pre-usage: December	0.22	0.02	11.62	<0.00001
Pre-summer: February	0.09	0.02	4.22	0
Pre-summer: March	0.25	0.02	10.31	<0.00001
Pre-summer: April	0.36	0.03	13.22	<0.00001
Pre-summer: May	0.64	0.03	18.91	<0.00001
Pre-summer: June	0.76	0.05	15.29	<0.00001

Pre-summer: July	0.79	0.06	12.98	<0.00001
Pre-summer: August	0.92	0.04	20.79	<0.00001
Pre-summer: September	0.59	0.03	17.64	<0.00001
Pre-summer: October	0.46	0.02	18.62	<0.00001
Pre-summer: November	0.26	0.02	11.97	<0.00001
Pre-summer: December	0.11	0.02	4.8	<0.00001
Pre-winter: February	-0.2	0.02	-9.88	<0.00001
Pre-winter: March	-0.61	0.02	-35.02	<0.00001
Pre-winter: April	-0.9	0.02	-52.76	<0.00001
Pre-winter: May	-1.06	0.02	-62.24	<0.00001
Pre-winter: June	-1.09	0.02	-63.88	<0.00001
Pre-winter: July	-1.09	0.02	-64.18	<0.00001
Pre-winter: August	-1.09	0.02	-64.11	<0.00001
Pre-winter: September	-1.08	0.02	-63.56	<0.00001
Pre-winter: October	-0.96	0.02	-56.31	<0.00001
Pre-winter: November	-0.64	0.02	-35.36	<0.00001
Pre-winter: December	-0.36	0.02	-17.02	<0.00001
Adjusted R-square: .0760				

The resulting annual savings are:

- Annual Savings = ∑ (0.02553 * Number of recipients in month I * Number of days in month i) = 255,108 Therms
- 95% Confidence Interval: +/- 34,586 (13.56%)

9.2.1.3 Wave 3

Table 9-5 provides the model coefficients for the regression of customer billing data in the analysis of Wave 3.

Table 9-5: Regression Coefficients & Model Details – Wave 3

Variable Description	Regression Coefficient	Standard Error	T-Stat	PR > |T|
Intercept	0.74	0.02	35.92	<0.00001
Treatment	-0.04	0.00	-11.62	<0.00001
February	-0.01	0.03	-0.46	0.65
March	-0.31	0.03	-10.47	<0.00001
April	-0.5	0.03	-17.46	<0.00001
May	-0.7	0.03	-24.18	<0.00001
June	-0.65	0.03	-22.6	<0.00001
July	-0.59	0.03	-20.32	<0.00001
August	-0.62	0.03	-21.51	<0.00001
September	-0.64	0.03	-22.11	<0.00001
October	-0.6	0.03	-20.73	<0.00001
November	-0.31	0.03	-10.72	<0.00001
December	0.07	0.03	2.47	0.01
Pre-usage	0.11	0.01	9.62	<0.00001
Pre-summer	0.00	0.02	0.30	0.77
Pre-winter	0.55	0.01	41.32	<0.00001
Pre-usage: February	-0.07	0.02	-4.72	<0.00001
Pre-usage: March	0.06	0.01	4.23	0.00
Pre-usage: April	0.17	0.02	9.84	<0.00001
Pre-usage: May	0.11	0.02	4.96	<0.00001
Pre-usage: June	0.14	0.05	2.89	0.00
Pre-usage: July	-0.26	0.06	-4.08	0.00
Pre-usage: August	-0.16	0.05	-3.43	0.00
Pre-usage: September	-0.04	0.03	-1.35	0.18
Pre-usage: October	0.19	0.02	10.59	<0.00001
Pre-usage: November	-0.01	0.01	-0.64	0.52
Pre-usage: December	-0.18	0.02	-11.21	<0.00001
Pre-summer: February	0.05	0.02	2.28	0.02
Pre-summer: March	0.16	0.02	7.23	<0.00001
Pre-summer: April	0.27	0.02	11.31	<0.00001
Pre-summer: May	0.45	0.03	15.9	<0.00001
Pre-summer: June	0.28	0.05	5.27	<0.00001

Pre-summer: July	0.55	0.07	8.27	<0.00001
Pre-summer: August	0.50	0.05	9.95	<0.00001
Pre-summer: September	0.41	0.03	12.54	<0.00001
Pre-summer: October	0.12	0.02	5.05	<0.00001
Pre-summer: November	0.11	0.02	4.99	<0.00001
Pre-summer: December	0.02	0.02	0.81	0.42
Pre-winter: February	0.05	0.02	2.94	0.00
Pre-winter: March	-0.25	0.01	-17.61	<0.00001
Pre-winter: April	-0.45	0.01	-32.2	<0.00001
Pre-winter: May	-0.52	0.01	-37.76	<0.00001
Pre-winter: June	-0.53	0.01	-38.75	<0.00001
Pre-winter: July	-0.54	0.01	-39.43	<0.00001
Pre-winter: August	-0.54	0.01	-39.11	<0.00001
Pre-winter: September	-0.53	0.01	-38.18	<0.00001
Pre-winter: October	-0.46	0.01	-33.14	<0.00001
Pre-winter: November	-0.22	0.01	-15.61	<0.00001
Pre-winter: December	0.07	0.02	3.79	<0.00001
Adjusted R-Square: 0.796				

The resulting annual savings are:

- Annual Savings = ∑ (0.03917 * Number of recipients in month I * Number of days in month i) = 212,588 Therms
- 95% Confidence Interval: +/- 30,098 (14.16%)

9.2.1.4 Wave 4

Table 9-6 provides the model coefficients for the regression of customer billing data in the analysis of Wave 4.

Table 9-6: Regression Coefficients & Model Details – Wave 4

Variable Description	Regression Coefficient	Standard Error	T-Stat	PR > |T|
Intercept	0.49	0.02	26.11	<0.00001
Treatment	-0.04	0.00	-10.99	<0.00001
February	0.09	0.03	3.50	0.00
March	-0.15	0.03	-5.59	<0.00001
April	-0.37	0.03	-14.09	<0.00001
May	-0.50	0.03	-18.78	<0.00001
June	-0.45	0.03	-17.18	<0.00001
July	-0.41	0.03	-15.44	<0.00001
August	-0.45	0.03	-16.77	<0.00001
September	-0.49	0.03	-18.48	<0.00001
October	-0.43	0.03	-15.78	<0.00001
November	-0.26	0.03	-9.60	<0.00001
December	0.02	0.03	0.84	0.40
Pre-usage	0.37	0.02	17.92	<0.00001
Pre-summer	0.20	0.01	16.35	<0.00001
Pre-winter	0.52	0.02	24.39	<0.00001
Pre-usage: February	-0.34	0.02	-13.80	<0.00001
Pre-usage: March	-0.01	0.02	-0.40	0.69
Pre-usage: April	0.10	0.02	4.24	0.00
Pre-usage: May	0.05	0.03	1.94	0.05
Pre-usage: June	-0.30	0.04	-6.85	<0.00001
Pre-usage: July	-0.53	0.07	-7.92	<0.00001
Pre-usage: August	-0.05	0.05	-1.05	0.29
Pre-usage: September	-0.11	0.03	-4.07	0.00
Pre-usage: October	-0.08	0.02	-3.47	0.00
Pre-usage: November	-0.18	0.02	-8.17	<0.00001
Pre-usage: December	-0.50	0.03	-19.35	<0.00001
Pre-summer: February	0.07	0.02	4.04	0.00
Pre-summer: March	0.09	0.02	5.17	<0.00001
Pre-summer: April	0.07	0.02	3.86	0.00
Pre-summer: May	0.22	0.02	8.93	<0.00001
Pre-summer: June	0.50	0.05	10.89	<0.00001

Pre-summer: July	0.62	0.07	9.38	<0.00001
Pre-summer: August	0.19	0.04	4.39	0.00
Pre-summer: September	0.33	0.02	14.43	<0.00001
Pre-summer: October	0.27	0.02	14.70	<0.00001
Pre-summer: November	0.11	0.02	6.10	<0.00001
Pre-summer: December	0.06	0.02	3.13	0.00
Pre-winter: February	0.28	0.03	11.07	<0.00001
Pre-winter: March	-0.24	0.02	-10.7	<0.00001
Pre-winter: April	-0.41	0.02	-18.77	<0.00001
Pre-winter: May	-0.49	0.02	-22.39	<0.00001
Pre-winter: June	-0.51	0.02	-23.25	<0.00001
Pre-winter: July	-0.51	0.02	-23.67	<0.00001
Pre-winter: August	-0.51	0.02	-23.43	<0.00001
Pre-winter: September	-0.50	0.02	-23.00	<0.00001
Pre-winter: October	-0.45	0.02	-20.37	<0.00001
Pre-winter: November	-0.15	0.02	-6.67	<0.00001
Pre-winter: December	0.35	0.03	13.30	<0.00001
Adjusted R-Square: 0.847				

The resulting annual savings are:

- Annual Savings = ∑ (0.03906 * Number of recipients in month I * Number of days in month i) = 216,339 Therms
- 95% Confidence Interval: +/- 32,386 (14.97%)

9.2.1.5 Wave 5

Table 9-7 provides the model coefficients for the regression of customer billing data in the analysis of Wave 5. Savings were small and not statistically significant.

Table 9-7: Regression Coefficients & Model Details – Wave 5

Variable Description	Regression Coefficient	Standard Error	T-Stat	PR > |T|
Intercept	0.45	0.01	73.44	<0.00001
Treatment	-0.00	0.00	-0.13	0.90
February	0.02	0.01	2.13	0.03
March	-0.17	0.01	-20.34	<0.00001
April	-0.34	0.01	-39.15	<0.00001
May	-0.43	0.01	-49.79	<0.00001
June	-0.42	0.01	-48.97	<0.00001
July	-0.39	0.01	-45.60	<0.00001
August	-0.41	0.01	-47.28	<0.00001
September	-0.44	0.01	-51.17	<0.00001
October	-0.42	0.01	-49.09	<0.00001
November	-0.24	0.01	-27.72	<0.00001
December	-0.01	0.01	-1.30	0.20
Pre-usage	0.04	0.01	2.65	0.01
Pre-summer	0.13	0.01	19.20	<0.00001
Pre-winter	1.01	0.01	69.87	<0.00001
Pre-usage: February	0.25	0.02	15.38	<0.00001
Pre-usage: March	0.33	0.01	22.50	<0.00001
Pre-usage: April	0.31	0.01	21.18	<0.00001
Pre-usage: May	0.24	0.02	15.77	<0.00001
Pre-usage: June	-0.04	0.02	-1.78	0.08
Pre-usage: July	0.20	0.03	5.70	<0.00001
Pre-usage: August	0.21	0.03	8.25	<0.00001
Pre-usage: September	0.26	0.02	13.85	<0.00001
Pre-usage: October	0.3	0.01	20.46	<0.00001
Pre-usage: November	0.23	0.01	15.48	<0.00001
Pre-usage: December	-0.17	0.02	-10.51	<0.00001
Pre-summer: February	0.06	0.01	6.22	<0.00001
Pre-summer: March	0.05	0.01	4.92	<0.00001
Pre-summer: April	0.16	0.01	15.73	<0.00001
Pre-summer: May	0.42	0.01	36.44	<0.00001
Pre-summer: June	0.64	0.02	27.72	<0.00001

Pre-summer: July	0.27	0.03	8.48	<0.00001
Pre-summer: August	0.30	0.02	12.99	<0.00001
Pre-summer: September	0.30	0.02	18.81	<0.00001
Pre-summer: October	0.30	0.01	31.46	<0.00001
Pre-summer: November	0.10	0.01	10.42	<0.00001
Pre-summer: December	0.01	0.01	0.62	0.54
Pre-winter: February	-0.31	0.02	-18.35	<0.00001
Pre-winter: March	-0.60	0.01	-40.59	<0.00001
Pre-winter: April	-0.85	0.01	-57.96	<0.00001
Pre-winter: May	-0.98	0.01	-67.60	<0.00001
Pre-winter: June	-1.00	0.01	-68.57	<0.00001
Pre-winter: July	-1.00	0.01	-68.84	<0.00001
Pre-winter: August	-1.00	0.01	-68.82	<0.00001
Pre-winter: September	-0.98	0.01	-67.61	<0.00001
Pre-winter: October	-0.93	0.01	-63.46	<0.00001
Pre-winter: November	-0.63	0.02	-41.39	<0.00001
Pre-winter: December	0.01	0.02	0.52	0.61
Adjusted R-Square: 0.879				

The resulting annual savings are:

- Annual Savings = ∑ (0.00019 * Number of recipients in month I * Number of days in month i) = 2,873 Therms
- 95% Confidence Interval: +/- 36,023 (1254.1%)

9.2.1.6 Wave 6

Table 9-8 provides the model coefficients for the regression of customer billing data in the analysis of Wave 6. Savings were small and not statistically significant.

Table 9-8: Regression Coefficients & Model Details – Wave 6

Variable Description	Regression Coefficient	Standard Error	T-Stat	PR > |T|
Intercept	0.53	0.01	40.67	<0.00001
Treatment	-0.00	0.00	-1.66	0.10
April	-0.43	0.02	-24.05	<0.00001
May	-0.52	0.02	-28.78	<0.00001
June	-0.49	0.02	-27.29	<0.00001
July	-0.48	0.02	-26.81	<0.00001
August	-0.49	0.02	-27.29	<0.00001
September	-0.50	0.02	-27.7	<0.00001
October	-0.40	0.02	-22.29	<0.00001
November	0.15	0.02	8.11	<0.00001
December	0.57	0.02	30.99	<0.00001
Pre-usage	0.19	0.01	35.62	<0.00001
Pre-summer	0.01	0.01	1.28	0.20
Pre-winter	0.64	0.01	124.27	<0.00001
Pre-usage: April	0.11	0.01	12.16	<0.00001
Pre-usage: May	0.16	0.01	14.23	<0.00001
Pre-usage: June	-0.02	0.03	-0.84	0.40
Pre-usage: July	0.04	0.05	0.97	0.33
Pre-usage: August	-0.12	0.03	-3.65	0.00
Pre-usage: September	0.16	0.02	9.90	<0.00001
Pre-usage: October	0.07	0.01	6.13	<0.00001
Pre-usage: November	-0.06	0.01	-4.56	<0.00001
Pre-usage: December	-0.16	0.01	-11.81	<0.00001
Pre-summer: April	0.31	0.02	19.72	<0.00001
Pre-summer: May	0.44	0.02	23.5	<0.00001
Pre-summer: June	0.55	0.03	16.80	<0.00001
Pre-summer: July	0.39	0.05	8.42	<0.00001
Pre-summer: August	0.57	0.03	17.48	<0.00001
Pre-summer: September	0.34	0.02	15.77	<0.00001
Pre-summer: October	0.29	0.02	17.02	<0.00001
Pre-summer: November	-0.02	0.01	-1.58	0.11
Pre-summer: December	-0.13	0.01	-8.78	<0.00001

Pre-winter: April	-0.38	0.01	-54.99	<0.00001
Pre-winter: May	-0.60	0.01	-90.84	<0.00001
Pre-winter: June	-0.62	0.01	-94.10	<0.00001
Pre-winter: July	-0.62	0.01	-94.64	<0.00001
Pre-winter: August	-0.62	0.01	-94.61	<0.00001
Pre-winter: September	-0.61	0.01	-91.85	<0.00001
Pre-winter: October	-0.46	0.01	-63.27	<0.00001
Pre-winter: November	-0.01	0.01	-0.46	0.65
Pre-winter: December	0.44	0.01	31.10	<0.00001
Adjusted R-Square: 0.856				

The resulting annual savings are:

- Annual Savings = ∑ (0.00429 * Number of recipients in month I * Number of days in month i) = 17,491 Therms
- 95% Confidence Interval: +/- 17,286 (98.8%)

9.3 Group Comparison

Figure 9-1 presents the monthly differences in consumption between the treatment and control groups in Wave 1. Reports were first delivered in October of 2011, and at that point, the magnitude of difference in consumption increases. This difference remains relatively consistent from 2013 onwards, with winter months (December – February) showing the most pronounced difference in gas usage.

Similar representations for Waves 2-6 are presented in Figure 9-2, Figure 9-3, Figure 9-4, Figure 9-5, and Figure 9-6 respectively. The impact of the reports on Wave 2 and Wave 3 is lower than Wave 1; however, the difference between controls and recipients in Wave 3 seems to be increasing in recent years. Figure 9-4 suggests that from 2021 onwards a moderate difference in usage has developed. Waves 5 and 6 meanwhile, do not appear to have clear differences in usage. However, given that the RCT period for these waves began in October of 2020 and February of 2022, respectively, it is reasonable to assume that discernible differences will present themselves in the coming years.

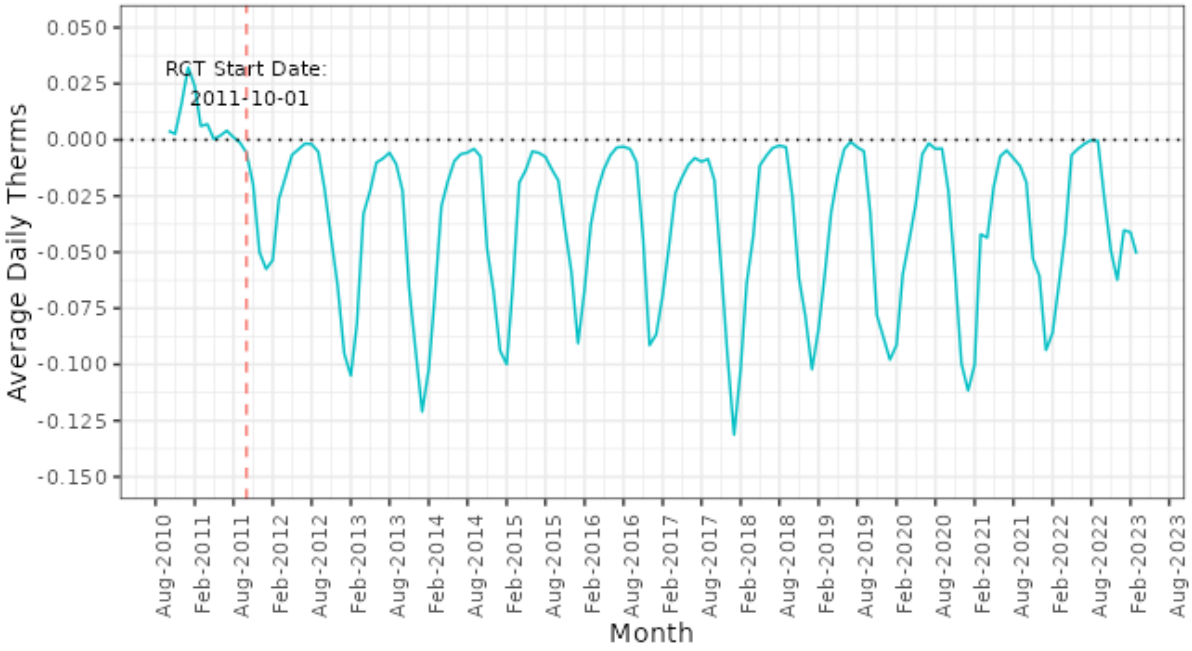


Figure 9-1: Difference in Daily Consumption between Treat. & Control Group – Wave 1

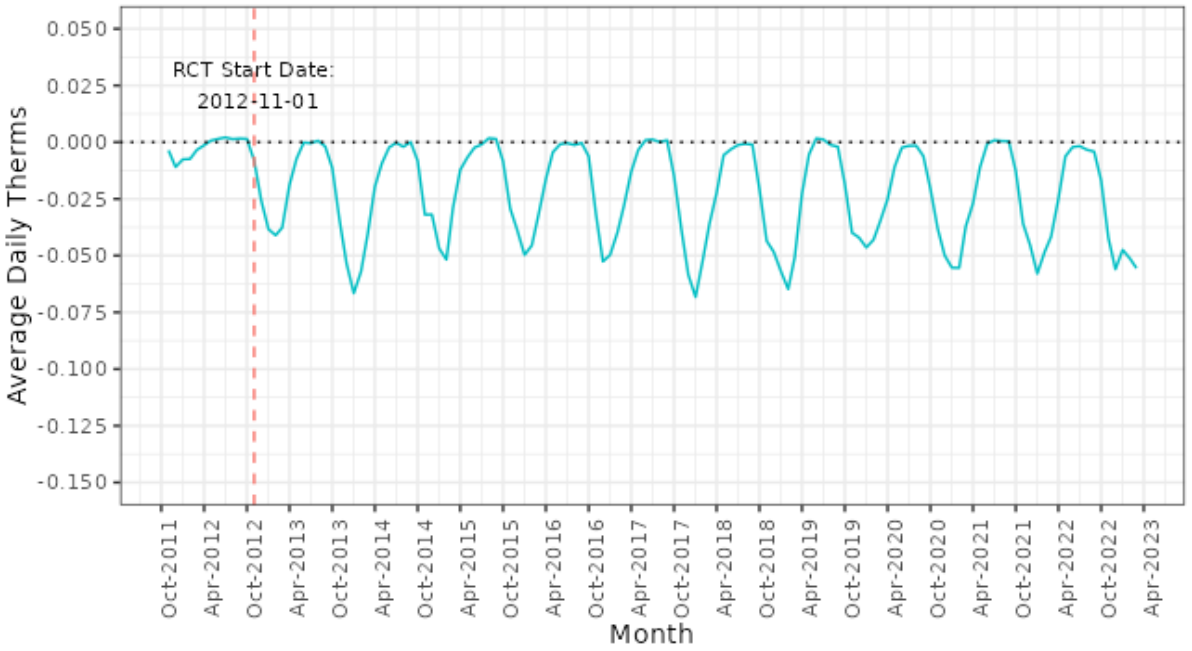


Figure 9-2: Difference in Daily Consumption between Treat. & Control Group – Wave 2

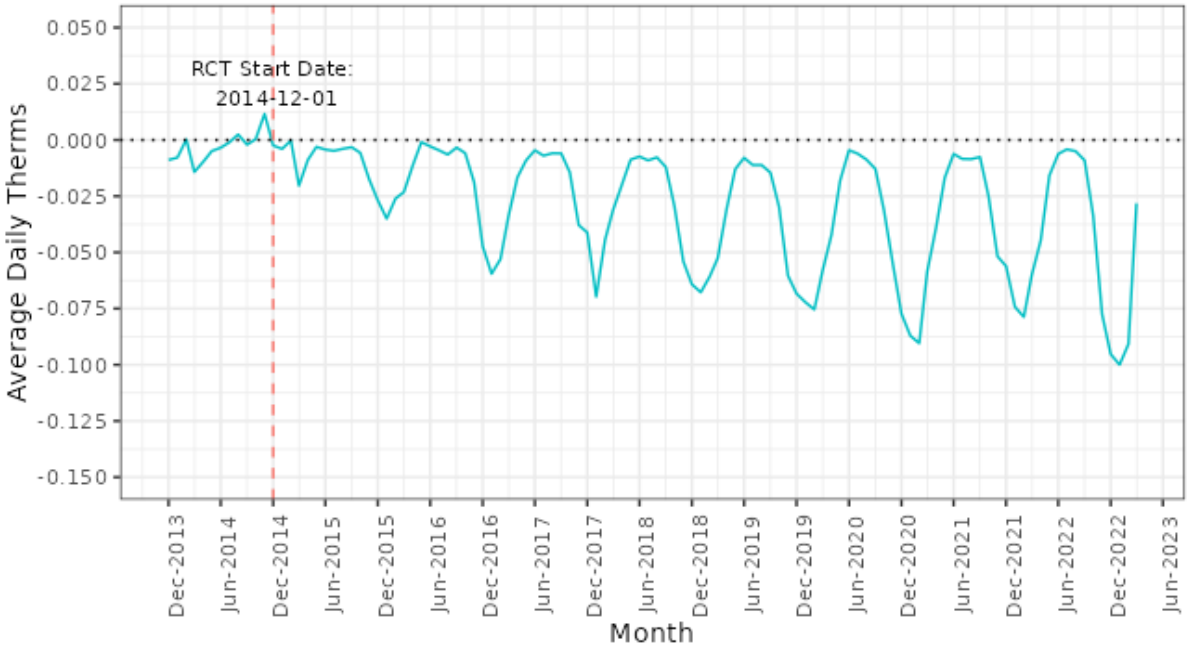


Figure 9-3: Difference in Daily Consumption between Treat. & Control Group – Wave 3

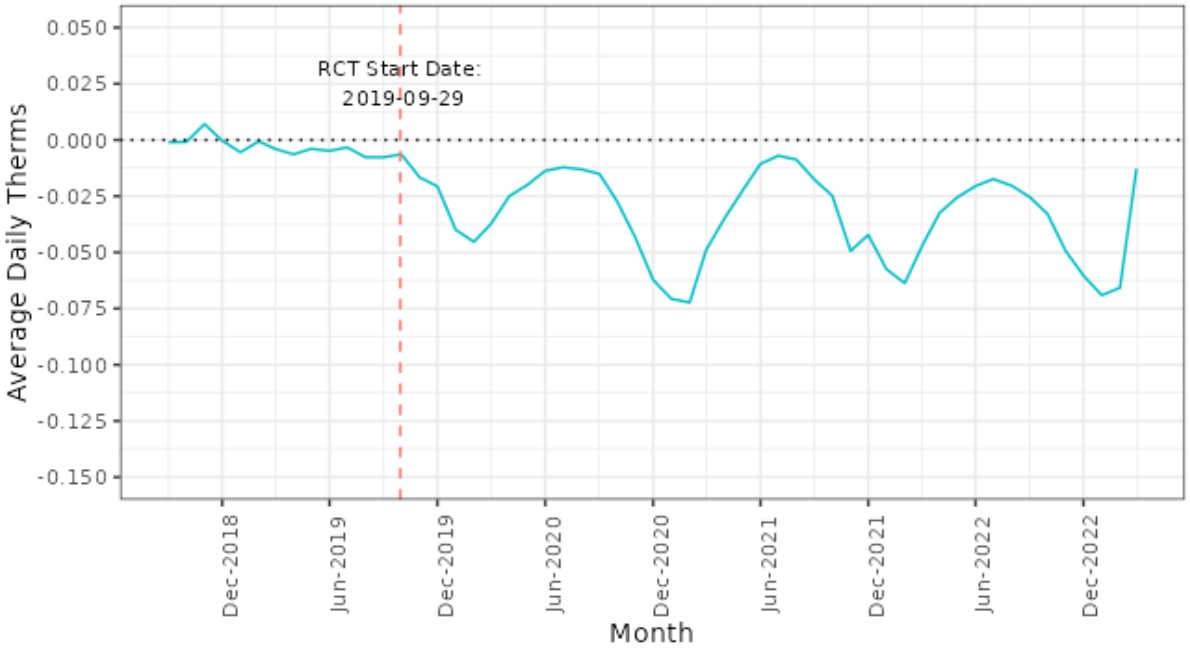


Figure 9-4: Difference in Daily Consumption between Treat. & Control Group – Wave 4

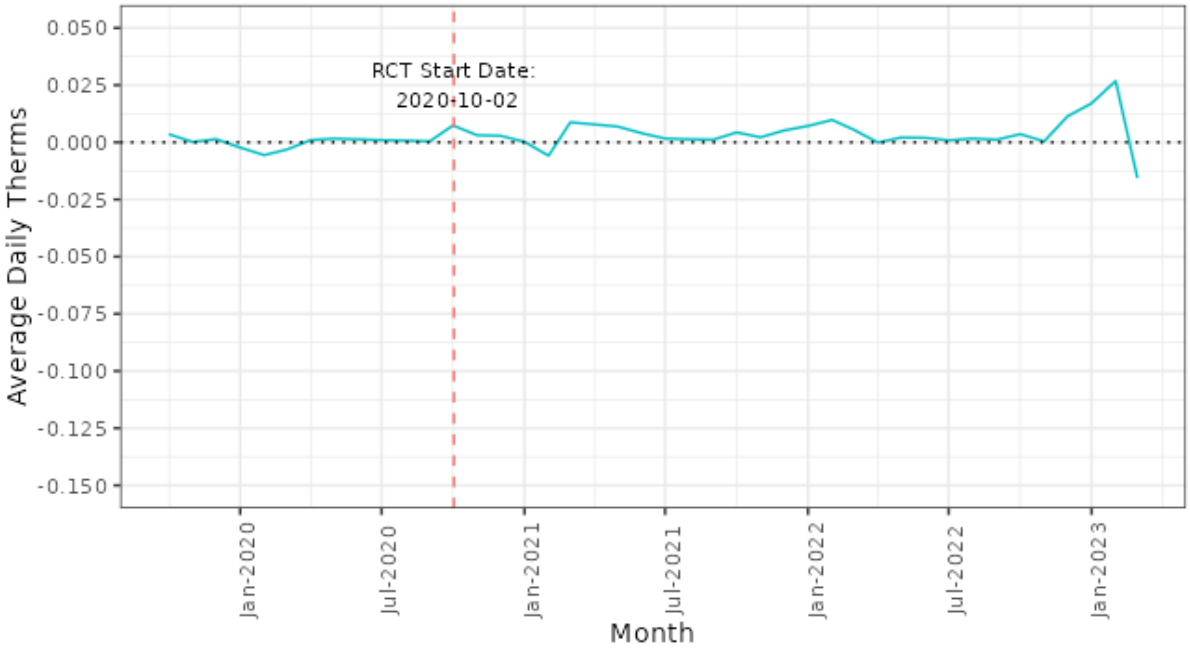


Figure 9-5: Difference in Daily Consumption between Treat. & Control Group – Wave 5

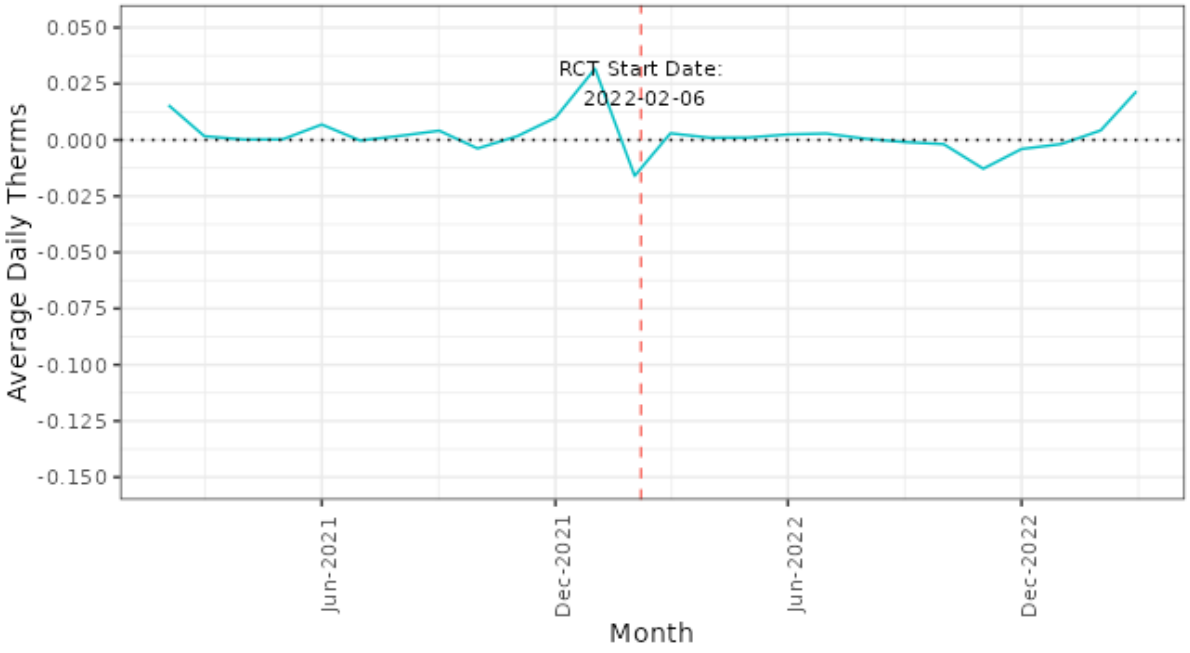


Figure 9-6: Difference in Daily Consumption between Treat. & Control Group – Wave 6

9.4 Per-Customer Performance

The change in annual savings per-recipient is summarized in Figure 9-7. Waves 1-4 all show an upward trend from PY2021 to PY2022. Meanwhile, waves 5 and 6 were not analyzed in PY2021, but are currently associated with minimal annual savings (0.1 and 1.3 therms per recipient, respectively). Additional data are likely necessary to draw meaningful conclusions regarding these two newer waves. As of PY2022, Wave 1 has the highest annual savings at 16.1 therms per customer. Waves 3 and 4 are tied for second with 14.3 therms each, while Wave 2 is associated with 9.3 therms per recipient. Broadly, waves 2-4 all seem to have maintained or increased annual savings from PY2020 onwards, reaching their peak this year.

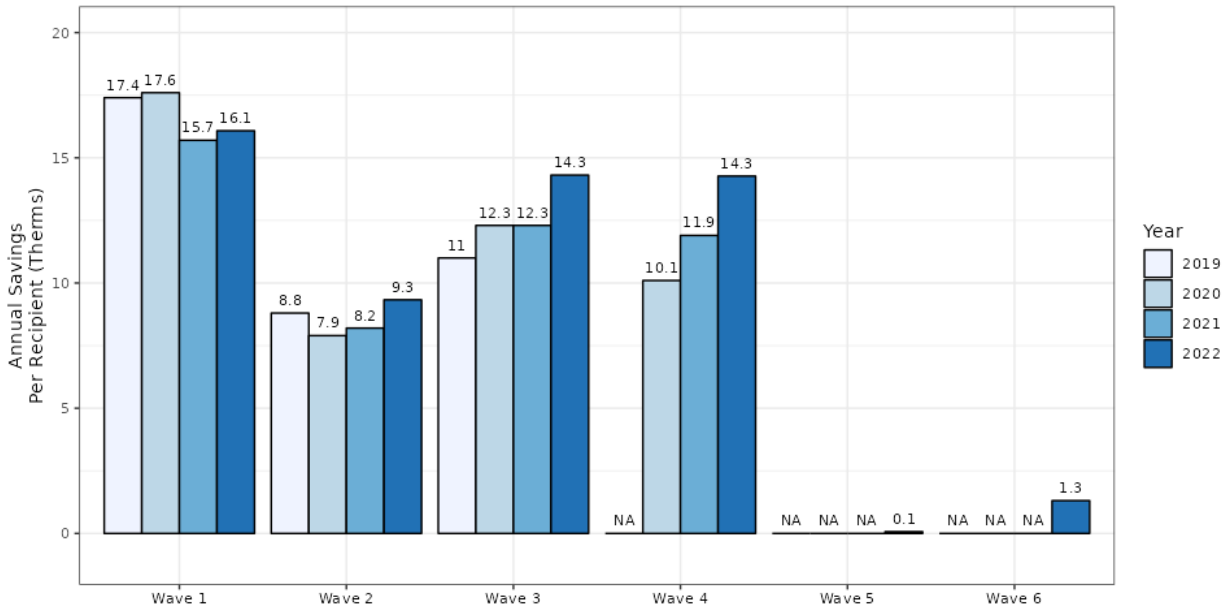


Figure 9-7: Savings per Recipient by Year

Table 9-9 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. Excluding waves 5 and 6, the savings for each wave were calculated in the 1.47 – 2.22% range, consistent with expected general program performance and program performances in previous years.

Table 9-9: 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	16.08	13.43	18.73	984.93	17.26%	1.63%
2	9.33	7.82	10.83	419.60	20.52%	2.22%
3	14.31	11.89	16.72	775.50	11.21%	1.84%
4	14.27	11.72	16.81	968.34	10.85%	1.47%
5	0.07	-0.98	1.12	703.86	30.82%	0.01%
6	1.31	-0.23	2.86	415.52	8.28%	0.32%
All	**8.14**	**6.35**	**9.93**	**709.39**	**-**	**1.15%**

9.5 Double Counting Analysis

Protocol J in TRM V9.0 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.

Table 9-10 shows the calculated PY2022 program savings after adjusting for double counting. Of note, ADM did not receive sufficient data to calculate PY2022 double counted savings based on customer-specific matching, as such double-counted savings are assumed to be 0.63% per previous program year data.

Table 9-10: PY2022 Program Savings Before and After Double Counting

PY	Ex-post Therms Before Double Counting	Percent Difference	Ex-post Therms After Double Counting
2022	1,096,289	-0.63%	1,089,383

9.6 Verified Savings

When accounting for double counted savings, the Home Energy Reports Program has 1,089,383 annual therms savings. Table 9-11 summarizes the results of the program analysis.

Table 9-11: Overall PY2022 HER Program Savings

Ex-ante Therms	Ex-post Therms After Double Counting	Ex-post Therms Before Double Counting	Realization Rate	95% Confidence	Precision
1,015,851	1,089,383	1,096,289	107.2%	202,001	±18.4%

The overall program realization rate for PY2022 is 107.2%.

Additionally, the overall program savings are shown on a per-wave basis in Table 9-12 where the lower and upper bounds at the 95% confidence interval are calculated.

Table 9-12: PY2022 HER Program Savings at 95% Confidence

Wave	Weighted Number of Participants	Ex-post Therms (Before Double Counting)	Double Counted Savings (Therms)	Ex-post Therms (After Double Counting)	Ex-post Therms After Double Counting (Lower 95% CI)	Ex-post Therms After Double Counting (Upper 95% CI)
1	24,576	394,894	-2,488	392,406	337,818	446,993
2	27,372	255,108	-1,607	253,501	218,915	288,087
3	14,870	212,588	-1,339	211,249	181,151	241,347
4	15,172	216,339	-1,363	214,976	182,590	247,362
5	40,890	2,873	-18.10	2,855	-33,158	38,878
6	11,049	14,488	-91.27	14,397	76.51	28,717
All	**133,929**	**1,089,383**	**-6,907**	**1,089,383**	**887,382**	**1,291,384**

Table 9-13 summarizes the annual gross and net savings by wave.

Table 9-13: Therms Savings Summary by Wave

Wave	Number of Total Participants	Annual Therms Usage	Ex-post Savings	Ex-post Savings after Double Counting	Savings as a Percent of Annual
1	25,306	20,715,285	394,894	392,406	1.89%
2	28,222	13,462,216	255,108	253,501	1.88%
3	15,325	8,994,935	212,588	211,249	2.35%
4	16,051	11,854,924	216,339	214,976	1.81%
5	42,292	27,950,896	2,873	2,855	0.01%
6	11,677	4,784,874	14,488	14,397	0.30%
All	**133,929**	**87,773,132**	**1,096,289**	**1,089,383**	**1.24%**

When aggregating the savings and confidence intervals, the Evaluators found that the overall 95% confidence interval was ± 18.43% of program savings. In addition, across all waves, savings were 1.24% of annual 2022 usage.

9.7 Conclusions

The program continues to provide reliable savings as a percent of billed use but faces ongoing issues with customer attrition.	Waves 1-4 are responsible for 36.2%, 23.4%, 19.5%, and 19.9% of program savings, respectively. However, as of the end of 2022, these same waves have 53.4%, 49.4%, 41.6%, and 34.3% attrition. Collecting data on reasons for attrition and conducting an analysis on those data may be worthwhile.
Savings per customer increased for Waves 2-4 compared to prior program years.	For waves 2-4, savings have either been maintained or have increased from PY2020 onwards. Moreover, for all 3 waves savings are at their highest level since PY2019, at 9.3, 14.3, and 14.3 therms per customer respectively. As a result, the Home Energy Reports program outperformed program plan savings.
Data from Waves 5 and 6 are yet to demonstrate significant savings.	Wave 5 and 6 have an RCT start date of 10/02/2020 and 02/06/2022, respectively. Statistically significant differences between the treatment and control groups in these waves are yet to develop. COVID-19 lockdowns extending into the RCT pre period and incomplete post period data for Wave 6 may have had a confounding impact on savings results.

9.8 Recommendations

The Evaluators' have no recommendations at this time.

10 Low Flow Showerhead & Faucet Aerator Program

The Low Flow Showerhead & Faucet Aerator Program provides no-cost mailer kits to SUA 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).

10.1 Program Background

The Low Flow Showerhead & Faucet Aerator Program began in 2010. The program is designed to provide no-cost kits containing low flow showerheads and faucet aerators to SUA residential customers. These kits are then self-installed. The program has been markedly popular among SUA customers and exceeded the participation goal most years from 2011 to 2017. Over the past five years there has been a declining participation trend.

The history of program performance and expenditures is presented in Table 10-1.

Table 10-1: Low Flow Showerhead & Faucet Aerator Program Historical Performance Against Goals

3	Budget			Net Therms		
	Spent	Allocated	%	Achieved	Goal	%
2010	$114,947	$181,404	63%	112,422	414,151	27%
2011	$212,460	$167,117	127%	124,042	120,904	103%
2012	$379,048	$379,048	100%	215,295	129,136	167%
2013	$401,061	$165,227	243%	148,589	169,920	87%
2014	$282,502	$415,227	68%	154,562	147,440	105%
2015	$286,121	$415,227	69%	163,181	147,440	111%
2016	$299,572	$415,227	72%	147,948	147,440	100%
2017	$344,483	$290,732	118%	168,409	165,900	102%
2018	$277,558	$290,487	95%	100,396	165,898	61%
2019	$231,713	$290,362	80%	108,933	165,898	66%
2020	$198,760	$288,292	69%	69,336	167,600	41%
2021	$157,244	$290,596	54%	25,098	161,622	16%
2022	$72,165	$299,712	24%	8,950	161,622	6%

10.1.1 Low Flow Showerhead & Faucet Aerator Program Participation Summary

In PY2022, SUA distributed 1,025 kits to their residential customers. Table 10-2 presents a summary of the composition of the kits installed. There were three types of kits given to participants categorized as a one, two, or three bathroom bundle.

Total equipment distributed in the program included:

- 2,150 1.5 GPM showerheads
- 813 1.5 GPM kitchen aerators
- 1,340 1.0 GPM bathroom aerators

Table 10-2: Low Flow Kit Composition

Quantity	Showerhead	Kitchen Aerator	Bathroom Aerator
0	54.5%	84.8%	85.5%
1	22.1%	12.4%	7.0%
2	13.1%	2.1%	5.5%
3	10.2%	.7%	2.0%

10.2 Low Flow Showerhead & Faucet Aerator Program Process Evaluation

The Evaluators conducted a limited process evaluation of the Low Flow Showerhead & Faucet Aerator Program PY2020 and found that the program was successful in meeting participation, savings, and satisfaction goal; a limited process evaluation was conducted in PY2022. Table 10-3 and Table 10-4 summarize the Evaluators' review of the Low Flow Showerhead & Faucet Aerator Program in comparison to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 10-3: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and Innovative Components	No. The program is designed in a manner consistent with similar programs elsewhere and applies deemed savings values from the TRM.
No Previous Process Evaluation	No. The program received a comprehensive process evaluation in PY2020.
New Vendor or Contractor	Yes. CenterPoint AR was acquired by Summit in 2021. 2022 marked the first year the program was managed by Summit. Despite the acquisition, program staff remained largely the same from 2021.

Table 10-4: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	Yes. The program fell short of goal in PY2021.
Are the educational or informational goals not meeting program goals?	No. The programs have had successful consumer outreach & education.
Are the participation rates lower or slower than expected?	Yes. The program has fallen short of participation goals in recent program years.
Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	No. Prior process evaluations found that operational and management structure to be up to speed and efficient in administering the program.
Is the program's cost-effectiveness less than expected?	No, the program's cost-effectiveness exceeded expectations.
Do participants report problems with the programs or low rates of satisfaction?	No. Prior participant surveys found exceedingly high satisfaction levels.
Is the program producing the intended market effects?	Yes. The program is generating transactions and installations that would not occur otherwise.

A limited process evaluation was conducted in PY2021 and PY2022.

10.2.1 Response to Recommendations

Table 10-5: Low Flow Program Response to PY2021 Recommendations

Recommendation	***Status of Issue***
Consider a reduction in program funding for the next cycle. CenterPoint should consider a reduction in funding for the next program cycle and redirect this budget to higher incentive levels in other programs or to new programs	Completed

10.2.2 Data Collection Activities

The process evaluation of the Low Flow Showerhead & Faucet Aerator Program included the following data collection activities:

- *Summit Program Staff Interviews*. The Evaluators interviewed staff at Summit involved in the administration of the Low Flow Showerhead & Faucet Aerator Program. This interview was used to validate that there were no program changes in PY2022 to warrant process evaluation activities.

- *Desk Review*. The Evaluators reviewed calculations provided by SUA to validate that they used prior-year M&V findings for in-service-rates (ISRs) and natural gas water heating rates.

10.2.3 Adherence to Protocol A

Summit maintains an internal tracking system based on the SAP platform.

During PY2022, the Evaluators received quarterly tracking data updates as well as final tracking exports. The tracking system includes necessary inputs as per AR TRM V9.0 Protocol A of the AR TRM V9.0 which specifies that tracking data should be checked for:

- Participating customer information;
- Measure specific information;
- Vendor specific information;
- Program tracking information; and
- Program costs

10.2.3.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.0. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was complete for nearly all participants.
- Weather zones were provided in the tracking data.
- All inputs needed to re-calculate savings according to TRM V9.0 protocol were present.

10.2.3.2 Measure Specific Information

The content of tracking data was found to include sufficient information for all measures in PY2022.

10.2.4 Declining Savings & Participation

The Low Flow Program has had declining participation in recent years. The program has struggled to fully expend its budget and meet participant goals, and at the same time the NTG for kit measures has declined. Summit staff have concerns related to market saturation as the program has reached the majority of their eligible customers. Though the service territory of course sees new entrants that are thus newly eligible, it is unlikely that the program will reach the scale it had in its earlier years of operation.

SUA had rescaled this program in the past; for the 2017-2019 program cycle, its budget was reduced from $415,000 to $290,000 per year due to lack of expenditure. This should be

examined for the next program cycle as remaining market potential for the program may warrant a lower funding level.

10.3 Low Flow Showerhead & Faucet Aerator Program Impact Evaluation

10.3.1 Energy Savings Calculations

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

- First, the Evaluators total the per-unit savings as determined by TRM V9.0 algorithms which incorporate weather-zone specific ground water temperatures.
- Further, based upon PY2021 survey results, these values are scaled down by the verified *in-service rate*. This is the percent of distributed equipment installed. This is determined separately for each item in the kit (showerheads, kitchen aerators, and bathroom aerators).
- The Evaluators then parse out the savings based on the percent 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 TRM V9.0.

10.3.2 Unit Energy Savings

Unit energy savings is summarized in Appendix C: Sample TRM Calculations.

10.3.3 Net-to-Gross

The Evaluators applied the NTG developed in PY2020 participant surveying. The resulting NTG is 50.33%.

10.4 Verified Savings

Table 10-6 summarizes the total gross savings for the Low Flow Showerhead & Faucet Aerator Program.

Table 10-6: Low Flow Showerhead & Faucet Aerator Program Verified Gross Savings

Measure Category	Annual Therms Savings		EUL	Lifetime Therms Savings		Gross Realization Rate
	Ex Ante	Ex Post		Ex Ante	Ex Post	
Faucet aerators	2,250	2,250	10	22,498	22,498	100%
Showerheads	15,533	15,533	10	155,334	155,334	100%
Total gross savings	**17,783**	**17,783**	-	**177,832**	**177,832**	**100%**

Table 10-7: Low Flow Showerhead & Faucet Aerator Program Verified Net Savings

Measure Category	Free Ridership Rate		Annual Therms Savings		EUL	Lifetime Therms Savings	
	Ex Ante	Ex Post	Ex Ante	Ex Post		Ex Ante	Ex Post
Kit savings	49.67%	49.67%	8,950	8,950	10	89,503	89,503
Total Net Savings			**8,950**	**8,950**	**10**	**89,503**	**89,503**

Table 10-8 summarizes the net non-energy benefits from the PY2022 Low Flow Showerhead & Faucet Aerator Program.

Table 10-8: Low Flow Showerhead & Faucet Aerator Net Non-Energy Benefits Summary

Non-Energy Benefit	Annual	Lifetime
kWh	31,965	319,649
kW	3.32	-
Water savings (gallons)	2,503,730	25,037,299

10.5 Conclusions

The program is cost-effective but has had continuously declining participation and savings.	The program expended only %2 of its budget and met 6% of its savings goal. Much of this decline in savings is due to revised NTG findings, but at the prior (higher) NTG, the program still significantly over-expended relative to participation volume.

10.6 Recommendations

Consider a reduction in program funding for the next cycle.	SUA should consider a reduction in funding for the next program cycle and redirect this budget to higher incentive levels in other programs or to new programs.
Send kits as part of a "welcome package" for new service connections.	The program has faced declining participation due to saturation. The program could consider increasing participation by targeting new movers into SUA territory with a "welcome kit".

11 Saving Homes Program

The Saving Homes Program is a weatherization program launched by Summit in PY2016. The program is designed to train contractors and home energy consultants to analyze the energy use for single and multifamily homes and identify specific energy efficiency improvements which may be undertaken by the customer.

The program corresponds to the Consistent Weatherization Approach and provides two tiers of energy assessments, along with direct installation of low-cost measures and pre-qualification for building envelope improvements.

Direct install measures include:

- Faucet aerators;
- Low flow showerheads;
- Water heater pipe insulation; and
- Water heater wrap.

Weatherization measures include:

- Air sealing;
- Duct sealing; and
- Ceiling insulation.

The program is implemented by CLEAResult.

11.1 Program Background

The Saving Homes Program (SHP) is intended to be primarily vendor-driven program, with the marketing targeted at contractors in the Summit service territory. Table 11-1 summarizes the historical performance of the Saving Homes Program.

Table 11-1: SHP Historical Performance against Goals

Program Year	Budget			Net Therms		
	Spent	Allocated	%	Achieved	Goal	%
2016	$598,379	$503,910	119%	142,741	87,820	163%
2017	$1,754,790	$1,652,646	106%	386,648	432,000	90%
2018	$1,820,720	$1,733,415	105%	438,656	466,200	94%
2019	$1,849,180	$1,803,822	103%	339,781	495,000	69%
2020	$1,717,720	$1,612,521	107%	410,663	428,074	99%
2021	$1,671,364	$1,692,627	101%	436,278	425,180	103%
2022	$1,857,362	$1,736,281	107%	398,991	437,939	91%

11.2 Participation Summary

The SHP had 1,287 distinct participants in PY2022. Ninety-seven percent of participants installed at least one measure. Thirty-seven participants had an assessment completed but did not complete subsequent projects.

Figure 11-1 summarizes the share of program savings contributed by each measure. Most savings came from duct sealing, air sealing, and ceiling insulation.

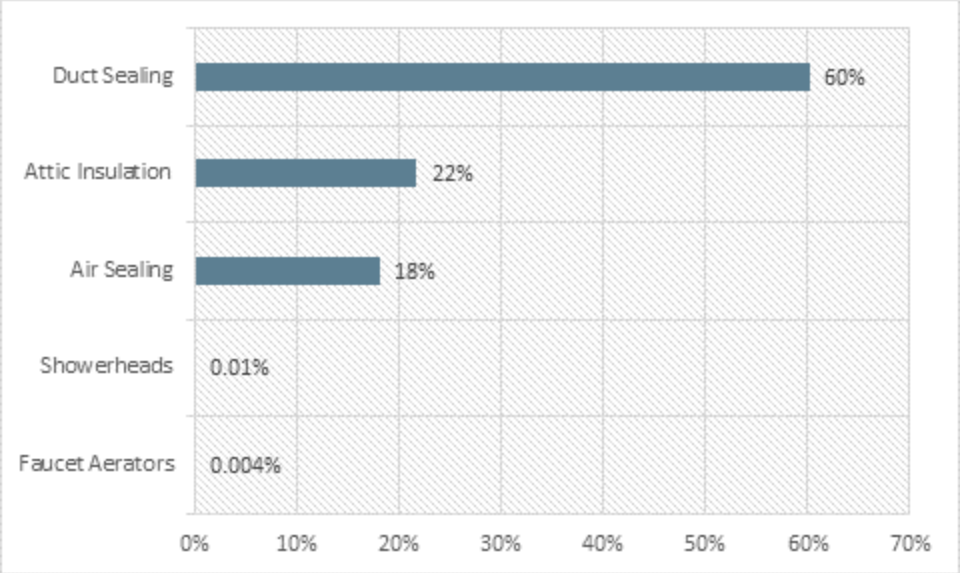


Figure 11-1: SHP Net Savings Share by Measure

In addition, incentives were provided for 1,072 Assessments.

11.2.1 Contractor Participation

In PY2022, the SHP had eight registered trade allies. This trade ally list was published on the program website, along with a summary of services provided and regions served. All trade allies were active in the program in PY2022. Project volume by trade ally ranged from 14% to 29% of program savings.

11.3 SHP Process Evaluation

The Evaluators conducted a limited process evaluation of the SHP in PY2022. Table 11-2 and

Table 11-3 summarize the Evaluators' review of the Saving Homes Program in comparison to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 11-2: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and Innovative Components	No. The program is designed in a manner consistent with similar programs elsewhere and applies deemed savings values from the TRM.
No Previous Process Evaluation	No. The program received a comprehensive process evaluation in 2021.
New Vendor or Contractor	No. CLEAResult has implemented the program since program inception.

Table 11-3: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	No. The program met goal in PY2021.
Are the educational or informational goals not meeting program goals?	No. The programs have had successful consumer and contractor outreach & education.
Are the participation rates lower or slower than expected?	No. The program met participant goals in PY2021.
Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	No. The prior process evaluations found that operational and management structure to be up to speed and efficient in administering the program.
Is the program's cost-effectiveness less than expected?	No, the program's cost-effectiveness was within expected boundaries.
Do participants report problems with the programs or low rates of satisfaction?	No. 2021 participant surveys found high satisfaction levels.
Is the program producing the intended market effects?	Yes. The program has engaged contractors in completing weatherization projects that would not otherwise occur.

The program received a full process evaluation in PY2020 and limited process evaluation in PY2021. The Evaluators conducted a limited process evaluation for PY2022 to address response to recommendations.

11.3.1 Recommendation Tracking

The status of PY2021 recommendations is provided in the table below.

Table 11-4: SHP Response to PY2021 Recommendations

Recommendation	*Summit Response*	*Status of Issue*
Address declines in project comprehensiveness Program implementation staff should review the causes of declining comprehensiveness and address if homes should be revisited to install weatherization measures that were not completed in PY2021.	The contractors revisited insulation eligible customers in early 2022 due to supply chain delays in 2021.	Completed

11.3.2 Data Collection Activities

The process evaluation of Saving Homes Program included the following activities:

- *Program Actor In-Depth Interviews*. The Evaluators conducted in-depth interviews with a series of program actors. These interviews covered a range of topics, including marketing efforts, feedback on program delivery, an assessment of barriers to program implementation and success, and recommendations for program improvement. Program Actors interviewed include:
  - *Summit program staff*. The Evaluators interviewed staff at Summit involved in the administration of the Saving Homes Program.
  - *Third party implementation staff interviews.* The Evaluators conducted interviews with CLEAResult involved with the Saving Homes Program.
  - *Participant surveying.* The Evaluators surveyed 22 participants in the SHP, collecting feedback on their experiences with the program.

Table 11-5 summarizes the data collection for this process evaluation effort. This includes the titles, role, and sample sizes for data collection.

Table 11-5: Summit SHP Data Collection Summary

Target	Respondents	Activity	n	Precision	Role
Summit AR Program Staff	Portfolio Manager for Summit AR and OK Program Manager of Residential Programs Senior Engineer Consultant Energy Efficiency Analyst Rebate Program Coordinator	Group interview	1	NA	Overall administration of Summit EE programs. The Portfolio manager is involved in the larger strategic decisions associated with the EE portfolio. The other staff are responsible for day-to-day operation of the program on the part of Summit, including assisting in outreach and marketing efforts of the program.
CLEAResult Staff	Program Portfolio Manager	Interview	1	N/A	Handles day-to-day operations, including mass market outreach, application review, billing, and logistics
Program Participants	Single Family Owner-Occupants	Survey	22	±17.5%	This survey was conducted on a sample of single-family owner-occupants who participated in the program.
		Field Data Collection	40	±12.8%	The Evaluators conducted duct blaster and blower door testing as well as measurement of ceiling insulation at a sample of program participant homes.

11.3.3 Adherence to Protocol A

During PY2022, the Evaluators received quarterly tracking data updates as well as final tracking exports. The tracking system includes necessary inputs as per AR TRM V9.0. The Evaluators

reviewed program to assess its compliance with Protocol A of the AR TRM V9.0 which specifies that tracking data should be checked for:

- Participating customer information;
- Measure specific information;
- Vendor specific information;
- Program tracking information;
- Program costs; and
- Marketing & outreach activities.

The Evaluators conducted a review of each of the above factors within PY2022 tracking data except for marketing and outreach activities as these are outside the scope of the tracking system's reporting.

11.3.3.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.0. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was complete for most participants.
- Weather zones were provided in the tracking data.

11.3.3.2 Model Specific Information

Measure-specific information in SHP tracking was sufficient to calculate savings per AR TRM V9.0 protocols.

11.3.4 Program Administration

The SHP was overseen by the Program Manager at Summit. This Manager's responsibilities primarily include interfacing with CLEAResult, who directly implements the program. Other activities by this Manager include providing updated customer lists to CLEAResult to better facilitate their implementation, participation in outreach events, and at times assisting CLEAResult in customer interactions.

11.3.5 Program Implementation & Delivery

There are two program channels for the SHP, *assessment* and *install-only*.

- **Assessment.** The *assessment* is a comprehensive audit which includes conducting duct blast and blower door testing. This testing is needed to pre-qualify a home for duct sealing and air sealing improvements. Before a home may receive an *assessment*, program trade allies are required to calculate the gas intensity of the residence. In this,

the contractor must take the customer's highest winter natural gas bill and divide it by the heated square feet of the home. Figure 11-2 summarizes the calculation process.

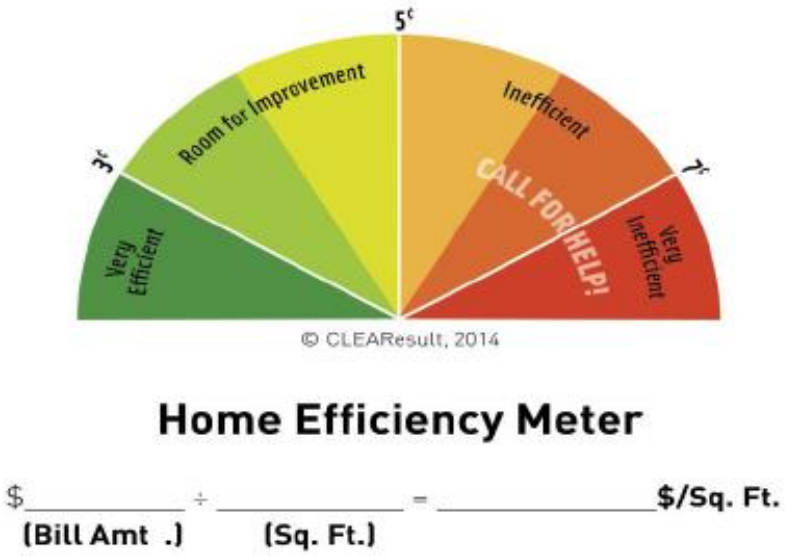


Figure 11-2 Home Efficiency Meter Graphic

A home must have use above $0.05 per square foot during a winter season month to qualify for an *assessment*.

- **Install-only.** Further, residential customers may opt to do directly through a contractor to install eligible measures without receiving an *assessment*. This is allowed if the contractor is a registered trade ally with the program.

The criteria of $0.05/square foot of use on a customer's highest bill is used to ensure that program funds go towards project which will produce enough savings to be cost-effective. Further, all participating residences are required to have central natural gas space heating to receive an assessment and rebates for building envelope measures and natural gas water heating to be eligible for direct install measures.

Residential customers may enter the program either by contacting the Energy Efficiency Solutions Center (EESC) to request an assessment or by working through a participating contractor who initiates the assessment and coupon process.

11.3.6 CWA Metrics Summary

They key CWA metrics are presented in Table 11-6.

Table 11-6: CWA Program Metrics Summary

Metric	Value
Program name	Saving Homes Weatherization Program
CWA implementation	The CWA is implemented using a third-party contractor (CLEAResult) with a network of pre-approved trade allies that market the program. The program coordinates with SWEPCO and Entergy
Total audits completed	1,072
Total submitted projects	1,180 (145 projects completed without assessment)
Conversion rate	96.5% (1,035 of 1,072 assessments yielded projects) Adjusted to account for 2021 assessments: 98.6%
Measures installed per-project	Including projects with no measures: 1.69 Excluding projects with no measures: 1.74 Adjusted to account for 2021-2022 split year projects: 1.78
Cost per participant	No customer co-pay. SUA paid $869/home
Percent of contractors promoting program	100%

Table 11-7: Alignment with CWA Requirements

Requirement	Alignment with Requirement	Percent of Participants Receiving
Includes Applicable DI Measures	Yes	.6%
Aerators	Yes	.5%
Showerheads	Yes	0.3%
Efficient lighting	Yes	N/A
Smart strips	Yes	N/A
Prequalifies homes based on year of construction or energy costs	Yes, the customer must have had a bill in the last twelve months that exceeded ten cents per square foot or the home's age is 10 years or greater.	Not in tracking data
TRC is used to assess program cost-effectiveness	Yes	N/A
Measures screened using SIR or comparable metric	Program uses TRC	N/A
Includes Core No Cost Measures	Yes	100.0%
Audit (walk through)	Yes	88.1%
Audit (virtual)		N/A
Ceiling insulation	Yes	48.7%
Duct sealing	Yes	70.3%
Air infiltration reduction	Yes	54.2%
Safety testing and/or measures	Yes	Not in tracking data
Offers other utility measures	Yes	N/A
Contractors are certified BPI Building Analyst or RESNET HERS Rater	Yes, for duct sealing, air infiltration, and assessments. Insulation requires Arkansas Home Improvement Specialty License.	N/A

The Evaluators developed adjusted versions of some key measures due to circumstances surrounding timing of assessments or measure installations occurring over multiple program years:

- **Lower measures per home:** Program implementation staff noted that some homes receive installation of different weatherization measures across calendar years based on 1) timing of assessment, 2) availability of required materials, and 3) availability of contractors. The Evaluators identified 22 homes that received ceiling insulation in PY2022 that had received their assessment and other weatherization measures in PY2021. Materials shortages in insulation in PY2021 caused the subsequent delay of installation of this measure. Accounting for these customers, the average energy-saving measures per-home increases to 1.78.
- **Lower conversion rate:** There were assessments that were completed in PY2021 that resulted in measure installations in PY2022. Further, there are assessments in PY2022 that result in measure installations in PY2023. The Evaluators lack sufficient data to make adjustments for PY2022 assessments that result in PY2023 projects, but there were 22 projects identified where an assessment occurred in PY2021 and an installation occurred in PY2022. After accounting for these customers, the adjusted conversion rate for assessments is 98.6%.

11.3.7 Marketing

Recognizing that trade allies are the face of the program, Summit staff rely heavily on their trade allies to get the word about the residential programs to the public. Staff provide trade allies with the materials needed to promote the programs and then trade allies go out and make the connections with customers. Although Summit does not focus on co-branding, as they do not want to appear as though they favor one trade ally over another, they do provide trade allies with flyers, brochures, and other informational materials. Summit also does some of its own marketing including email blasts, mailers, radio ads, etc., but they are more expensive and not as fruitful as word of mouth. To improve its marketing strategies, Summit tracks marketing materials and online behavior to better understand what methods are most effective; they have also recruited an advertisement agency to help with this endeavor.

11.3.8 Quality Assurance

Summit staff did not express any issues with quality control and assurance. Staff at CLEAResult conducts post inspections at 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 rebate amount.
- *Minor violations* may be resolved without chargeback.

The definition of *major* and *minor* violations by measure are summarized in Table 11-8.

Table 11-8: QA Violation Definitions by Measure

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

11.3.9 Impact of Home Assessments

The Evaluators reviewed the measure installations energy savings for participants in the SHP. The Evaluators key findings from this review were as follows:

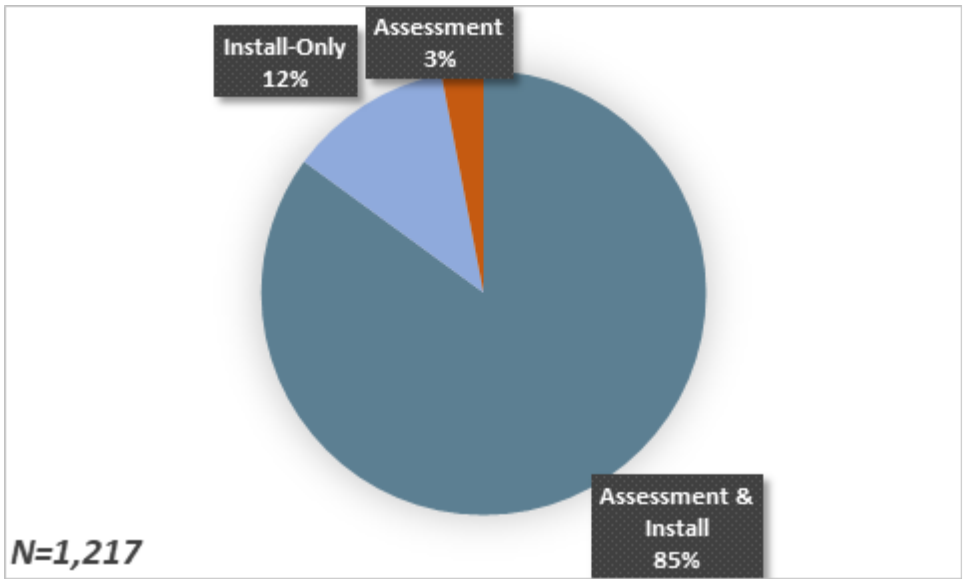


Figure 11-3: Measure Installation

The differences in measure installation by participant class are presented in Figure 11-4. There is a statistically significant difference in quantity and net savings of measures installed between the *assessment* & *install* and the *install-only* groups.

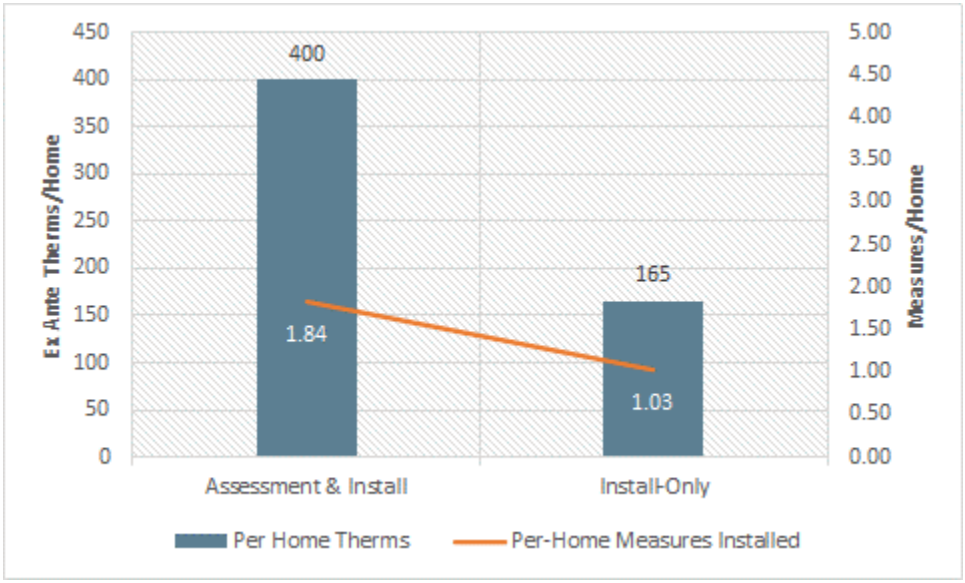


Figure 11-4: Per-Home Measure Installation

11.3.10 Trade Ally Outreach

In PY2022, the SHP had eight trade allies. The Home Energy Consultant (HEC) trade allies can provide *assessments* through the program, which receive rebates of $100[29] from Summit (split evenly in instances of joint implementation with an overlapping electric IOU). When the home overlaps with a participating electric utility and has equipment that qualifies for both programs, the incentive cost is split equally. HECs must attend program training sessions held by CLEAResult in a classroom setting as well as in the field before being certified and allowed to perform Surveys and *assessments*. Other requirements for HECs include:

- Must have at least one employee with certification as either a Building Performance Institute Building Analyst (BPI-BA) or a RESNET Home Energy Rater (this rater is required to be present on all jobs in progress);
- If the staff member with the appropriate certification leaves the company, the trade ally must hire a replacement or obtain a certification for another employee within 30 days (though this is extended if the needed courses are not available in that time frame).
- Must own and maintain a Blower Door, Duct Blaster, combustion safety testing tools, energy modeling software (provided by the program), and all appropriate hand tools.

Most trade allies procure leads themselves, but CLEAResult will assign trade allies new projects as they come in if the customer does not have a trade ally in mind.

11.3.11 Participant Survey Response

Residential participants were contacted via phone to complete an online survey regarding their experience with Summit Arkansas's Energy Savings Home program. Twenty-two participants responded to the survey.

11.3.11.1 Respondent Profile

All but one respondent owned their home (95.0%, n=19), and half of respondents lived with one to two other people (50.0%, n=11). The majority of respondents were at least 35 years old (81.8%, n=18), and just over three-quarters worked or attended school (77.3%, n=17).

[29] The incentive is reduced to $150 if the home is 700 ft.^{2} or less.

11.3.11.2 Program Awareness

The most popular program awareness avenue was through word of mouth (45.5%, n=10) (Figure 11-5).

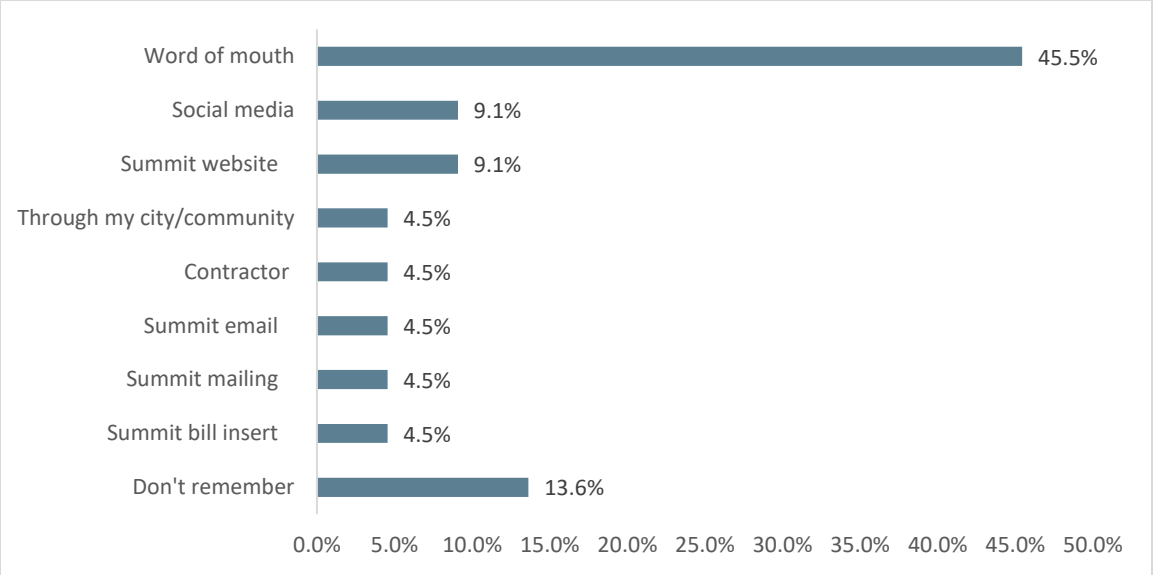


Figure 11-5: Program Awareness (n=22)

Two-thirds of respondents (68.2%, n=15) were interested in participating in the program to save money on utility bills (), and just under three-quarters of respondents wanted to make improvements to their home to increase the efficiency of their equipment in order to save energy (72.7%, n=16) (Figure 11-6).

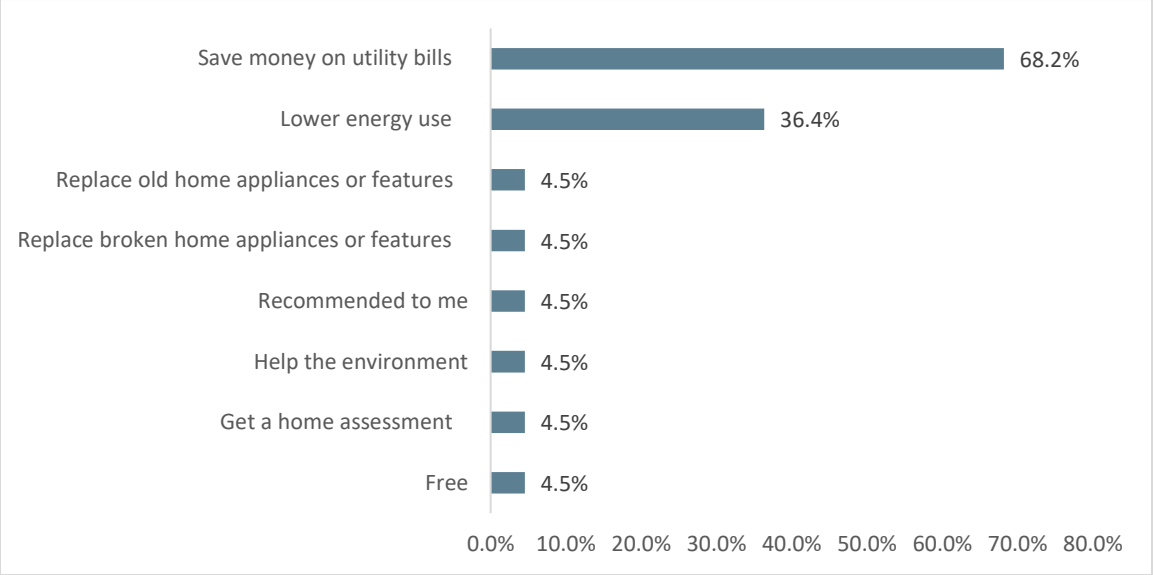


Figure 11-6: Participation Motivation (n=22)

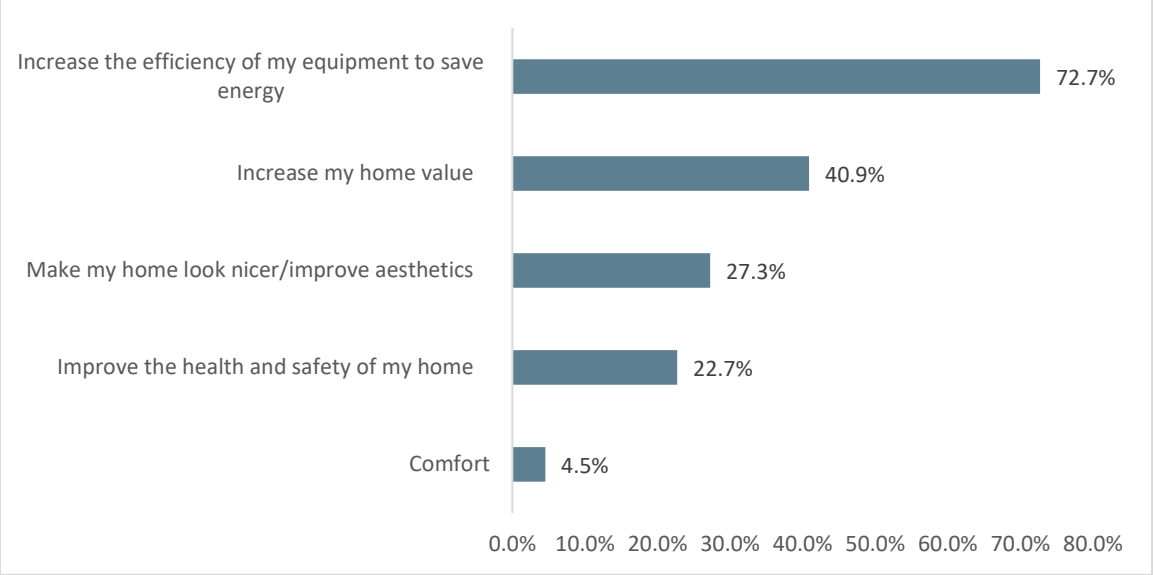


Figure 11-7: Home Improvement Motivations (n=22)

11.3.11.3 Home Energy Assessment

Fifteen respondents remember receiving a home energy assessment as part of their participation in the program. Three (20.0%) of those respondents had plans to have an energy assessment prior to their participation in the program. Among the 15 respondents who

remember receiving a home energy assessment, just over half were interested in the assessment to learn ways they could save energy and money (53.5%, n=8) (Figure 12-9).

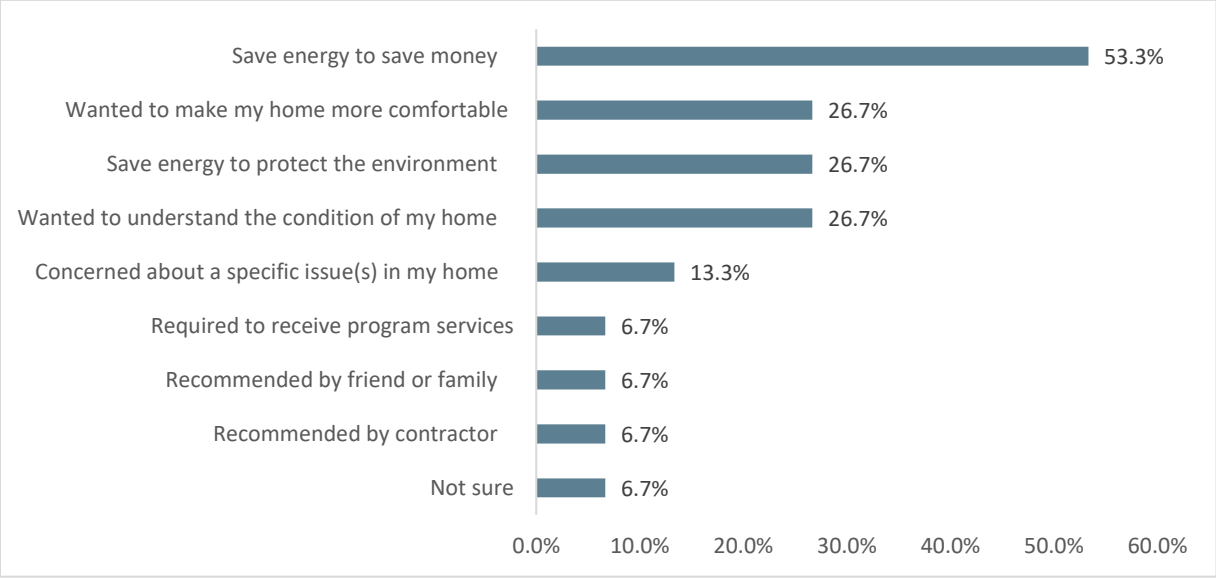
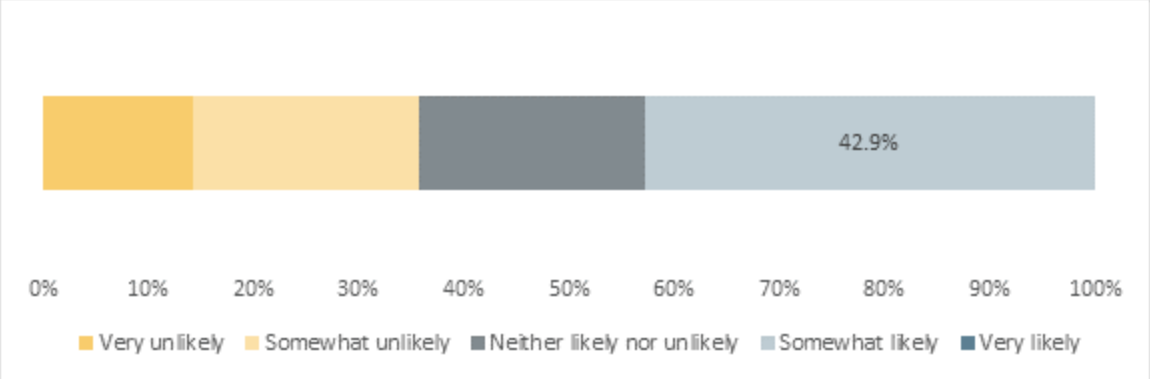


Figure 11-8: Home Energy Assessment Motivation (n=22)

Most respondents were home for the energy assessment (73.3%, n=11) and all of them indicated the assessment occurred in-person. Most of them noted that the assessor discussed the assessment findings with them (81.8%, n=9).

Respondents were pleased with the home energy assessment (Figure 11-9) and found the information provided in to be useful (Figure 11-9). Forty percent of respondents who remember receiving the assessment would have made the improvements to their home even if they were not recommended in the assessment (42.9%, n=6) (Figure 11-11



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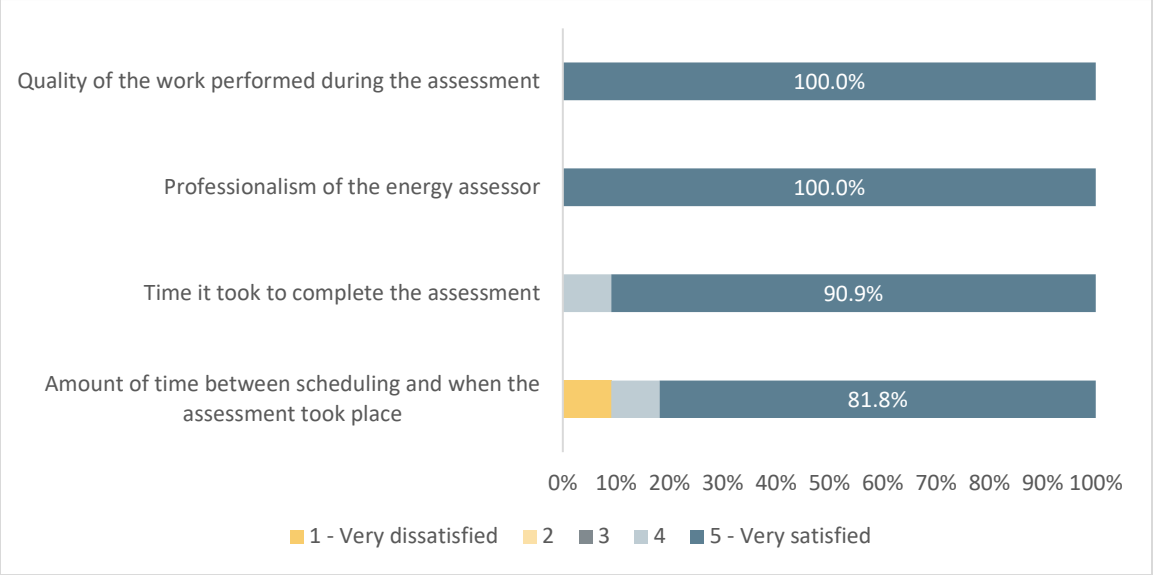

Figure 11-9: Home Energy Assessment Satisfaction (n=15)

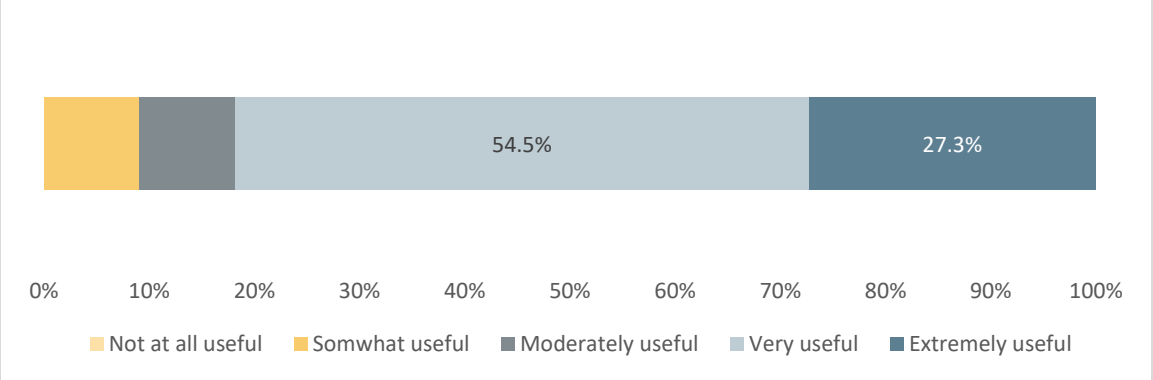

Figure 11-10: Home Energy Assessment Usefulness (n=15)

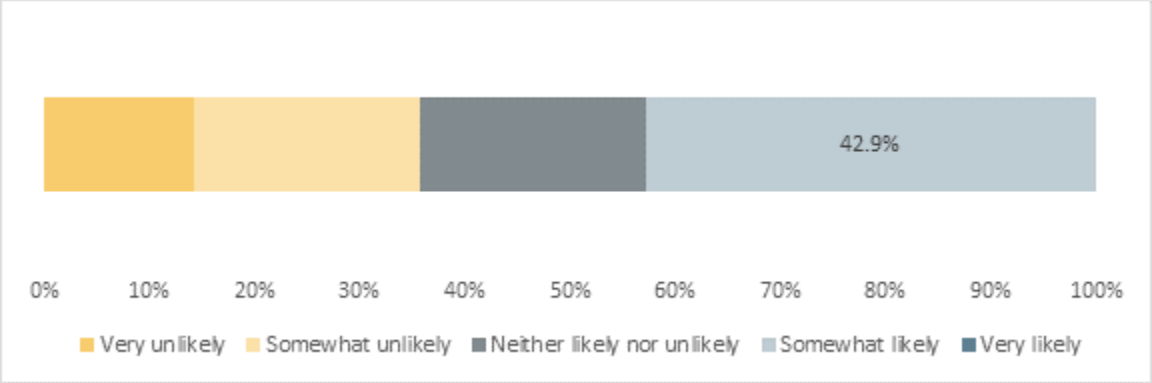

Figure 11-11: Likelihood of Installing Equipment (n=14)

11.3.11.4 Program Participation

Less than half of respondents (40.9%, n=9) had plans to complete similar work prior to their participation in the program and few respondents (13.6%, n=3) indicated they would have been able to complete these improvements without the financial assistance provided through the program. Forty-one percent respondents indicated they would have taken longer to complete these home improvements if the assistance from the program had not been available (40.9%, n=9); about three-quarters of these respondents (77.8%, n=7) indicated it would have taken at least another year before they made those improvements.

Almost two-thirds of respondents completed the program application themselves (63.6%, n=14) and all of these respondents found the application easy to complete. One third of respondents have noticed a decrease in their energy bill since their participation in the program (31.8%, n=7) (Figure 12-12). Few respondents (n=3) reached out to Summit AR staff for assistance or questions while participating in the program.

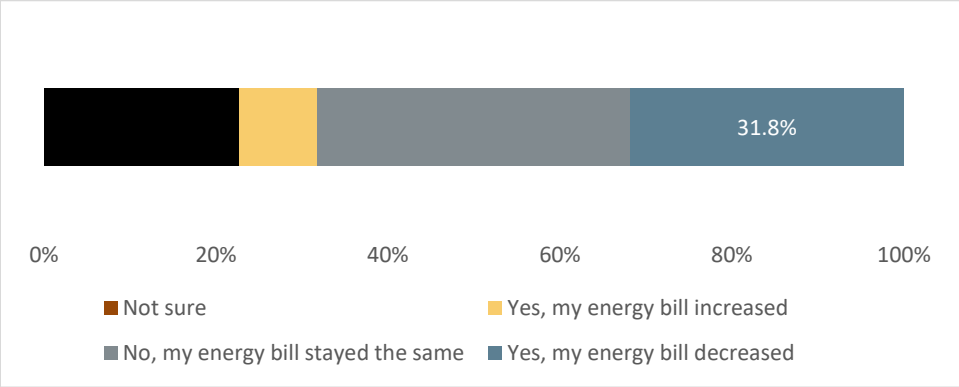

Figure 11-12: Changes in Energy Bill (n=22)

11.3.11.5 Program Satisfaction

Respondents were generally satisfied with the energy savings home program (Figure 11-13) and 86.4% of respondents have recommended the program to other people (n=19). 59.1% of respondents indicated that participating in the program increased their satisfaction with Summit AR as their energy provider (n=13).

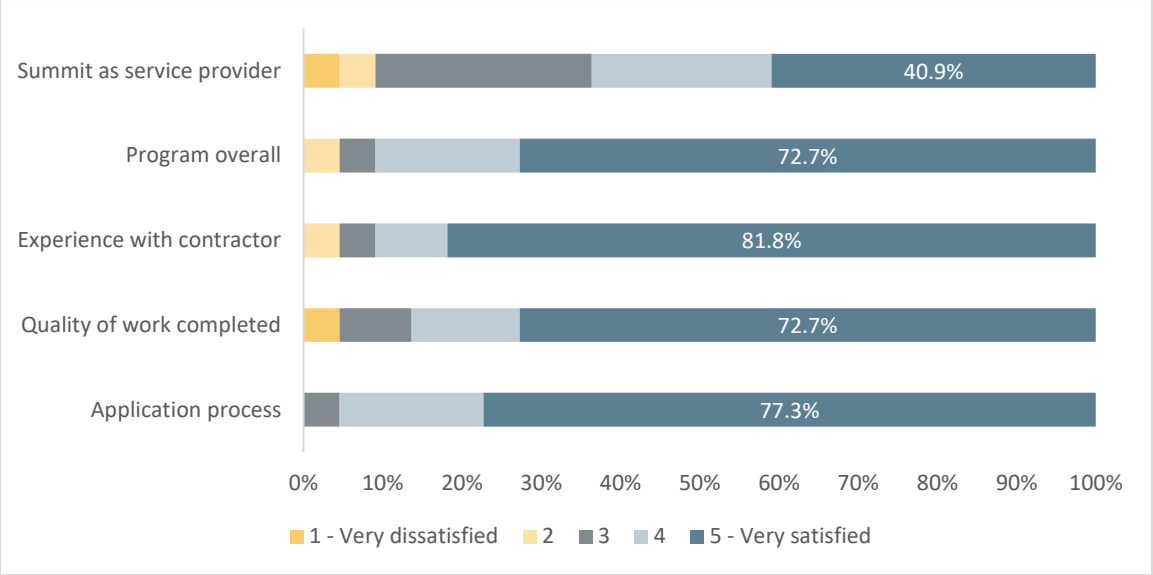

Figure 11-13: Program Satisfaction (n=22)

11.4 SHP Impact Evaluation

The evaluation effort of the SHP included the following:

- *Desk Review of Residential Calculations.* The Evaluators utilized TRM V9.0 values in assessing savings from measures included in the program.
- *Field Verification.* The Evaluators conducted field verification at 40 homes representing 42 measures in PY2022.

11.4.1 Tracking 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 11-9 summarizes ex ante savings by measure for the SHP.

Table 11-9 SHP Ex Ante Summary

Measure	Ex Ante Therms
Duct Sealing	266,044
Air Infiltration	75,990
Ceiling Insulation	95,847
Showerhead	40
Aerators	17
Total	**437,938**

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.

11.4.2 Field Verification Procedures

The Evaluators conducted field verification at 40 homes in the SHP. Measures included in this sample were as follows:

- Air Infiltration: 15 homes
- Ceiling Insulation: 7 homes
- Duct Sealing: 20 homes

The Evaluators conducted duct blast and blower door tests at all homes that received duct sealing and air sealing (respectively).

- **Air infiltration:** The Evaluators lower infiltration than shown in ex ante estimates. This resulted in an overall in-service rate (ISR) of 105.24%.
- **Duct sealing:** Field results for duct sealing very closely aligned with expected results, and there was an overall ISR of 100.21%.
- **Ceiling insulation:** Ceiling insulation projects had no discrepancies, and final FVR was 100.0%.

11.4.3 Net Savings Estimates

The overall free ridership score for participants with the financial ability to install the measures was based on the average of the prior plans and the likelihood scores. The free ridership scoring is summarized in Figure 11-14.

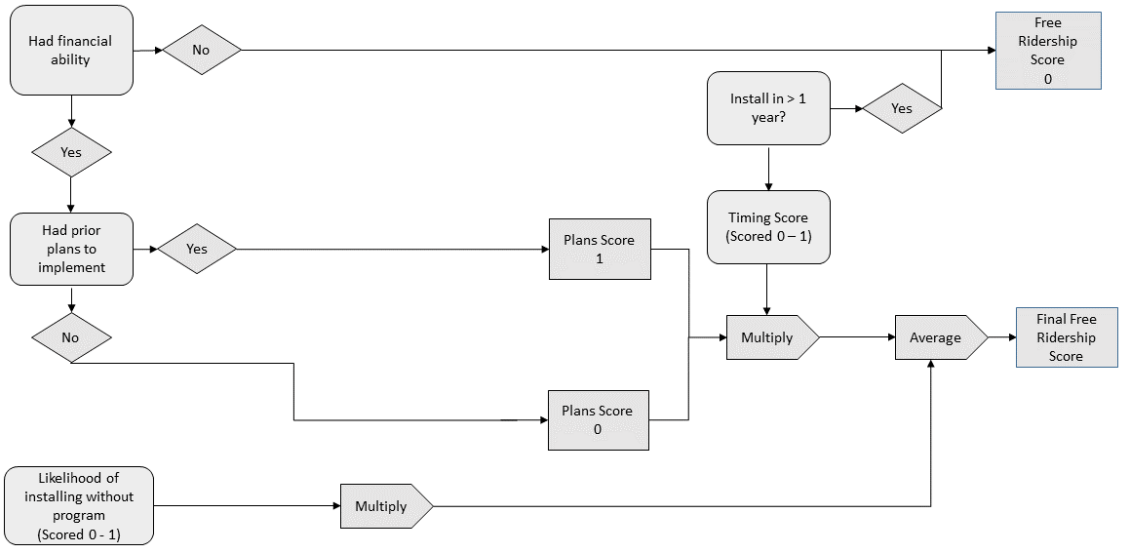

Figure 11-14: Major Measure Free ridership

To assess the program's influence on major measures (i.e., duct sealing, air sealing, and insulation), program participants were asked questions regarding:

- If they could afford to install the equipment if it had not been provided for free through the program;
- If they had plans to complete the project;
- The likelihood of installing the equipment if it had not been provided for free; AND
- The timing of the project in the absence of the program.

In this methodology, financial ability 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. Respondents that reported they could have afforded to implement the improvements were assigned an overall free ridership score based on a prior plan score, a likelihood of installing the measure in the absence of the program, and a timing score.

11.4.3.1 Prior Plans and Deferred Free ridership

The prior plans score was based on a response to a question regarding the presence of plans. Specifically, respondents were considered to have had prior plans if they answered "Yes" to the following question:

- Prior to learning about the program, did you have plans to implement the [Measure]?

The program influence on the timing of the project was incorporated into the estimation of free ridership in one of two ways. First, consistent with the Arkansas TRM definition of free ridership, respondents who indicated that the project would have been completed in more than one year if the program were not available were assigned a free ridership score of 0. For all other respondents, the plans score was factored by the program impact on timing. Specifically,

- If the respondent stated that they would have installed the measure in 6 months to one year, then the prior plans score was reduced by one-half.
- If the respondent stated that they would have installed the measure at the same time or within 6 months of when it was installed, the prior plans score was not adjusted.

11.4.3.2 Likelihood of Implementing Measure without Program

A likelihood of installing the measure in the absence of the program was developed based on respondents stated likelihood of installing a measure if the financial support was not provided or if the measure had not been recommended through the energy assessment. Specifically, responses to this question were scored as follows:

- Very likely: 1
- Somewhat likely: .75
- Neither particularly likely nor unlikely: .5
- Somewhat unlikely: .25
- Very unlikely: 0

The likelihood score was based on the lower value of the likelihood of installing the measure if the program financial support was not available or if the measure was not recommended through the energy assessment.

The resulting NTGR was 90.0%. This was applied to all measures in the program.

11.4.3.3 Direct Install Measures Free Ridership Methodology

Due to the low volume of direct install measures (which accounted for less than .01% of verified savings) the Evaluators did not develop a separate NTGR. DI measures received the 90% NTGR developed for the weatherization measures.

11.4.4 Verified Savings

Table 11-10 presents the gross savings results of the evaluation of the PY2022 Saving Homes Program. Total Gross Savings summarizes the savings calculations performed by TRM protocols for program measures.

Table 11-10: SHP Verified Savings Summary

Measure	Ex Ante Therms	Ex Post Therms	Gross Realization	EUL	Lifetime Therms
Duct Sealing	266,044	266,614			
Air Infiltration	75,990	80,323	105.7%	11	883,551
Ceiling Insulation	95,847	96,319	100.5%	20	1,926,383
Showerhead	40	51	127.5%	10	507
Aerators	17	17	100.0%	10	167
Total	**437,938**	**443,323**	**101.2%**	17.2	**7,609,656**

Table 11-11: SHP 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			
2.67%	10.00%	426,245	398,991	93.6%	17.16	6,848,691

11.4.5 Water & Electric NEBs

Table 11-12: SHP Verified Net Water Savings

Measure	Net Annual Water Saving (Gallons)	Lifetime Net Water Savings (Gallons)
Aerators	3,877	38,772
Showerhead	10,991	109,908
Total	**14,868**	**148,680**

Table 11-13: SHP Verified Net Electric Savings

Measure	Net Annual kWh	Net Peak kW	Lifetime Net kWh
Duct Sealing	669,852	356	12,057,337
Air Infiltration	117,470	146	1,292,170
Ceiling Insulation	302,701	368	6,054,022
Total	**1,090,023**	**869**	**19,403,529**

11.5 Conclusions

Realization rates were high overall.	The overall realization rate was 101.2%.
The program is highly cost-effective.	With a significant contribution from NEBs, the program's TRC is 6.61.
NEBs have increased as SUA has expanded participation in areas served by municipal utilities and rural co-ops.	This has been most notable with expanded participation in North Little Rock.
Project comprehensiveness has declined.	The average measures per-project has remained consistent : PY2020: 2.95 PY2021: 1.78 PY2022: 1.78

11.6 Recommendations

Focus on completion of comprehensive projects.	33% of PY2022 projects were single-measure. 48% received two measures. With a TRC of 6.61, the program could fund more comprehensive retrofits per-home, achieving savings goals while treating fewer homes annually.

12 Low-Income Savings Home Program

The Low-Income Saving Homes Program (LISHP) began in PY2020 and was designed to comply with Act 1102. LISHP is an extension of the Consistent Weatherization Approach (CWA) targeted to customers who meet the income eligibility requirements of the Low-Income Home Energy Assistance Program (LIHEAP). The program is designed to train contractors and home energy consultants to analyze the energy use for single and multifamily homes and identify specific energy efficiency improvements which may be undertaken by the customer.

The program provides energy assessments, along with direct installation of low-cost measures and pre-qualification for building envelope improvements.

Direct install measures include:

- Faucet aerators;
- Low flow showerheads;
- Pipe wrap;
- Tank wrap; and
- Smart thermostats.

Weatherization measures include:

- Air sealing;
- Duct sealing; and
- Ceiling insulation.

The program is implemented by CLEAResult.

12.1 Program Background

Table 11-1 summarizes the historical performance of the Low-Income Saving Homes Program.

Table 12-1: LISHP Historical Performance against Goals

Program Year	Budget			Net Therms		
	Spent	Allocated	%	Achieved	Goal	%
2020	$299,846	$292,567	102%	45,902	45,871	100%
2021	$301,038	$304,168	99%	47,516	47,243	101%
2022	$357,919	$316,273	113%	49,170	48,660	101$

12.2 Participation Summary

The LISHP had 167 participants in PY2022. Eight-nine percent of participants installed at least one measure, and a total of 266 energy efficiency improvements were installed overall.

Figure 12-1 summarizes the share of program savings contributed by each measure. All savings came from duct sealing, ceiling insulation, and air sealing.

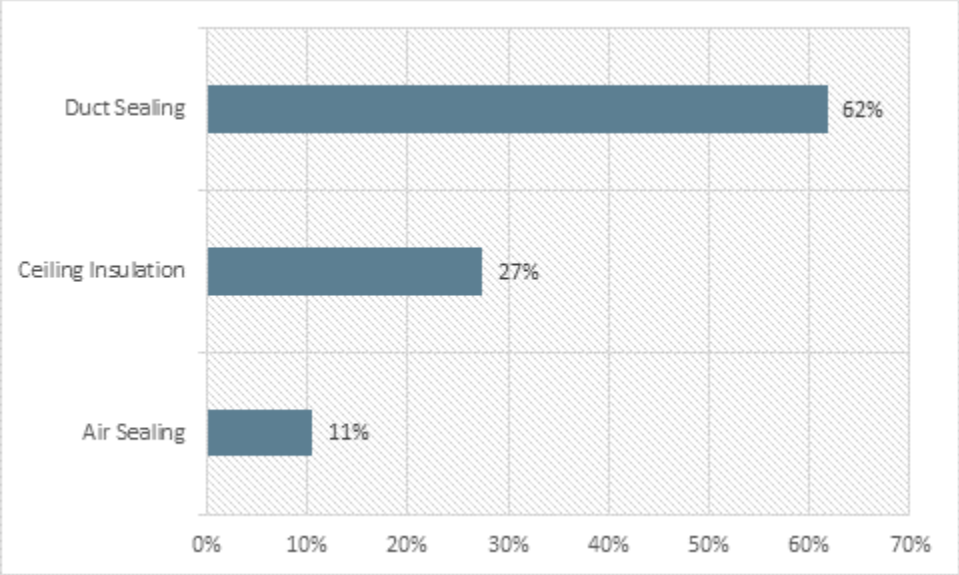

Figure 12-1: Program Expected Savings Share by Measure

In addition, incentives were provided for 140 assessments.

12.2.1 Contractor Participation

In PY2022, the LISHP had six registered trade allies. All trade allies were active in the program in PY2022. The top three performing trade allies were responsible for 86% of program net savings.

12.3 LISHP Process Evaluation

and summarize the Evaluators' review of the Low-Income Saving Homes Program in comparison to TRM V9.0 Protocol C for timing and conditions of conducting a process evaluation.

Table 12-2: Determining Appropriate Timing to Conduct a Process Evaluation

Component	Determination
New and innovative components	No. Program design is unchanged from PY2021
No previous process evaluation	No. The program received a process evaluation in PY2021
New vendor or contractor	No. CLEAResult implements this program and uses contractors from the Savings Home Program.

Table 12-3: Determining Appropriate Conditions to Conduct a Process Evaluation

Component	Determination
Are program impacts lower or slower than expected?	No. The program met PY2021 savings goals.
Are the educational or informational goals not meeting program goals?	Yes. The program failed to install adequate health & safety measures in PY2021.
Are the participation rates lower or slower than expected?	No. The program met PY2021 participant goals.
Are the program's operational or management structure slow to get up and running or not meeting program administrative needs?	Partial. The program's operations were found to be adequate to ensure savings but did not address all Act 1102 requirements.
Is the program's cost-effectiveness less than expected?	No. The program was cost-effective in PY2021.
Do participants report problems with the programs or low rates of satisfaction?	No satisfaction issues found.
Is the program producing the intended market effects?	No. The program did not adequately address health and safety measures in in PY2021.

The Evaluators conducted a limited process evaluation for LIPP due to small program size and budget. This evaluation focused on issues pertaining to health and safety measures identified in the PY2021 evaluation.

12.3.1 Recommendation Tracking

The status of PY2021 recommendations is provided in the table below.

Table 12-4: LI-SHP Response to PY2021 Recommendations

Recommendation	***Summit Response***	***Status of Issue***
Expand H&S measure offerings. Additional offerings can include bathroom ventilation fans, air cyclers, furnace filter, air purifiers, re-flue water heaters, and gutter downspout repairs.		Completed
Increase budget to fund H&S measures. The Evaluators estimate that a $50,000 budget increase is required to fund H&S up to regional benchmarks while maintaining success in meeting the filed savings goal. If done, this budget should be earmarked as not usable for energy-saving measures. The most likely candidate for this reallocation is the Low Flow Program, which had $133,353 in unused budget in PY2021	Taking $50k from the low flow budget, would account for 17% of its total. We can move 10% of budget without approval ($29,971), which leaves around $20k more to be sourced from other programs. Can take from NG program.	In progress
Impose H&S performance targets as part of trade ally agreements. Trade allies need to have further H&S requirements placed upon them. Program staff could impose a framework where a trade ally must meet H&S benchmarks to maintain their program budget allocation.	Plan to implement in 2023	In progress
Delineate between H&S measures in program tracking Current tracking denotes “Health & Safety” without indicating what work is performed. The H&S framework used in BHE’s Act 1102 program should be applied for CenterPoint’s program, in which common individual H&S measures are noted in tracking		Complete

12.3.2 CWA Metrics Summary

They key CWA metrics are presented in Table 12-5.

Table 12-5: CWA Program Metrics Summary

Metric	Value
Program name	Low Income Saving Homes Weatherization Program
CWA implementation	The LISHP is implemented using a third-party contractor (CLEAResult) with a network of pre-approved trade allies. The program coordinates with SWEPCO and Entergy
Total audits completed	140
Total submitted projects	149 (27 projects completed without assessment)
Conversion rate	87.9% (131 out of 140 assessments yielded projects)
Measures installed per-project	Projects with no assessment: 1.84 Projects with assessment: 1.11
Cost per participant	No customer co-pay. SUA paid $982/home
Percent of contractors promoting program	100%

12.3.3 Data Collection Activities

The process evaluation of Low-Income Saving Homes Program included:

- *Program actor in-depth interviews*. The Evaluators conducted in-depth interviews with a series of program actors. These interviews covered a range of topics, including marketing efforts, feedback on program delivery, an assessment of barriers to program implementation and success, and recommendations for program improvement. Program actors interviewed include:
  - *SUA Energy program staff*. The Evaluators interviewed staff at SUA involved in the administration of the Saving Homes Program.
  - *Third party implementation staff interviews.* The Evaluators conducted interviews with CLEAResult involved with the Saving Homes Program.
- *Program participant surveys.* The Evaluators administered surveys with program participants. These surveys sought to collect data on participant experience with the program including sources of program awareness, motivations for participating, and satisfaction with the program. Due to low responses rates across three AR gas utility low-income programs, Evaluators combined and summarized responses from all three programs together.

Table 12-6 summarizes the data collection for this process evaluation effort. This includes the titles, role, and sample sizes for data collection.

Table 12-6: SUA LISHP Data Collection Summary

Target	Component	Activity	n	Precision	Role
Summit AR Program Staff	Portfolio Manager, Residential Programs Program Manager, Senior Engineer Consultant, Energy Efficiency Analyst, Rebate Program Coordinator	Interview	1	NA	NA
CLEAResult Staff	Program Portfolio Manager	Interview	1	N/A	Handles day-to-day operations, including mass market outreach, application review, billing, and logistics
Program Participants	Single Family Owner-Occupants	Survey	20	±8.8%	This survey was conducted on a sample of single-family owner-occupants who participated in low-income weatherization program across three AR based utilities (Summit, Black Hills Energy, Arkansas-Oklahoma Gas)

12.3.4 Adherence to Protocol A

During PY2022, the Evaluators received quarterly tracking data updates as well as final tracking exports. The tracking system includes necessary inputs as per AR TRM V9.0, which specifies that tracking data should be checked for:

- Participating customer information;

- Measure specific information;
- Vendor specific information;
- Program tracking information;
- Program costs; and
- Marketing & outreach Activities.

The Evaluators conducted a review of each of the above factors within PY2022 tracking data except for marketing and outreach activities as these are outside the scope of the tracking system's reporting.

12.3.4.1 Customer, Premise, Cost, and Vendor Information

Each of these factors was assessed individually based on the guidelines stated in AR TRM V9.0. Overall, the Evaluators conclude the following regarding tracking data completeness:

- Participating customer information was complete for nearly all participants.
- Weather zones were provided in the tracking data.
- All inputs for energy savings calculations were present.

12.3.4.2 Model Specific Information

Health & safety measures were not fully documented. They were identified as "Health & Safety" with no further description.

12.3.5 Program Administration

The LISHP is overseen by the Program Manager at Summit. This Manager's responsibilities primarily include interfacing with CLEAResult, who directly implements the program. Other activities by this Manager include providing updated customer lists to CLEAResult to better facilitate their implementation, participation in outreach events, and at times assisting CLEAResult in customer interactions.

12.3.6 Program Implementation & Delivery

The program is driven by home assessments. The assessment is a comprehensive audit which includes conducting duct blast and blower door testing. This testing is needed to pre-qualify a home for duct sealing and air sealing improvements. Before a home may receive an assessment, program trade allies are required to calculate the gas intensity of the residence. In this, the contractor must take the customer's highest winter natural gas bill and divide it by the heated square feet of the home. Figure 12-2 summarizes the calculation process.

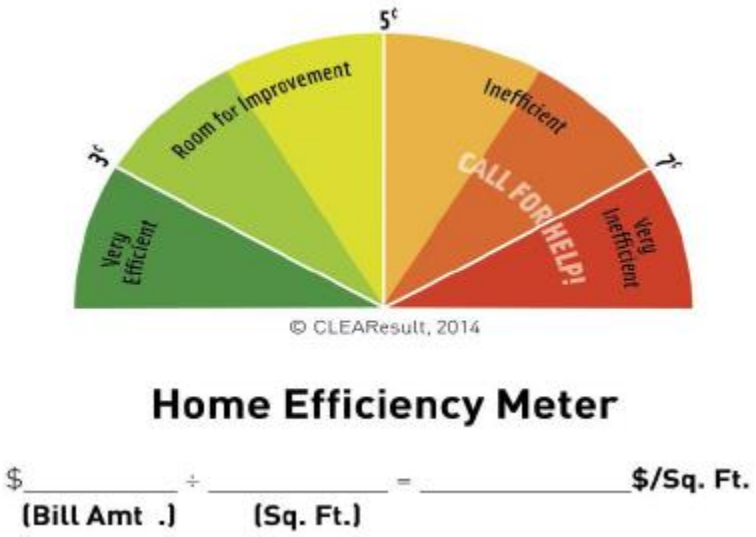

Figure 12-2: Home Efficiency Meter Graphic

A home must have use above $0.05 per square foot during a winter season month to qualify for an assessment.

The criteria of $0.05/square foot of use on a customer's highest bill is used to ensure that program funds go towards project which will produce enough savings to be cost-effective. Further, all participating residences are required to have central natural gas space heating to receive an assessment and rebates for building envelope measures and natural gas water heating to be eligible for direct install measures.

Summit AR staff did note challenges within the low-income program, as they strive to spend the full $500 on participating homes. Staff are working towards better educating their trade allies to understand the types of homes that are eligible and measures that are covered by the low-income program and teaching them how they can best assist those customers. Because the low-income program has a small budget, CLEAResult staff encourage trade allies not to classify homes as low-income (even if they qualify) unless the homes need health and safety measure upgrades; this system allows the program to maximize the number of low-income customers it can assist.

12.3.7 Program Changes

Based on recommendations from the Evaluators in PY2021, CLEAResult staff made changes to the low-income program in PY2022. Strengthening their focus on the health and safety measures aspect of the program. Staff encouraged trade allies to thoroughly vet homes for potential upgrades and opened up eligibility for what could be considered a health and safety

measure, allowing trade allies to better serve customers. Health and safety measures expanded past carbon monoxide and smoke detectors to include other potential hazards like gas leaks, wall gaskets, and night lights. Staff are also working on developing a health and safety leave behind kit that includes night lights and wall gaskets.

12.3.8 Marketing

The LISHP is marketed alongside the SHP. Eligible customers are referred from the SHP to the LISHIP when identified.

12.3.9 Quality Assurance

Quality assurance procedures align with those established for the SHP.

12.3.10 Impact of Home Assessments

The Evaluators reviewed the measure installations energy savings for participants in the LISHP. The Evaluators key findings from this review were as follows:

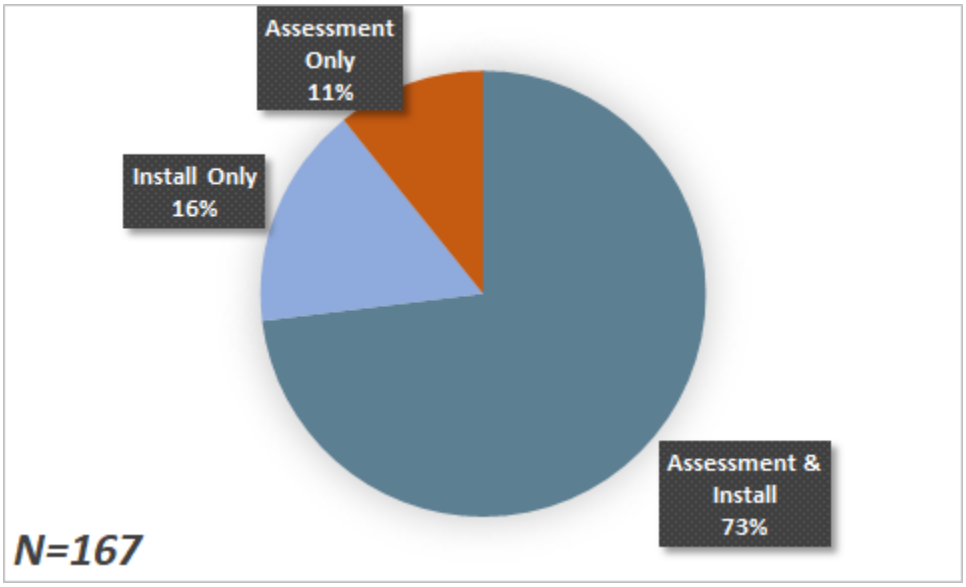

Figure 12-3: Measure Installation

The differences in measure installation by participant class are presented in Figure 12-3. There is a statistically significant difference in quantity and gross savings of measures installed between the *assessment & install* and the *install-only* groups. *Install-only* participants displayed lower savings than *assessment & install* participants, as shown in Figure 12-4.

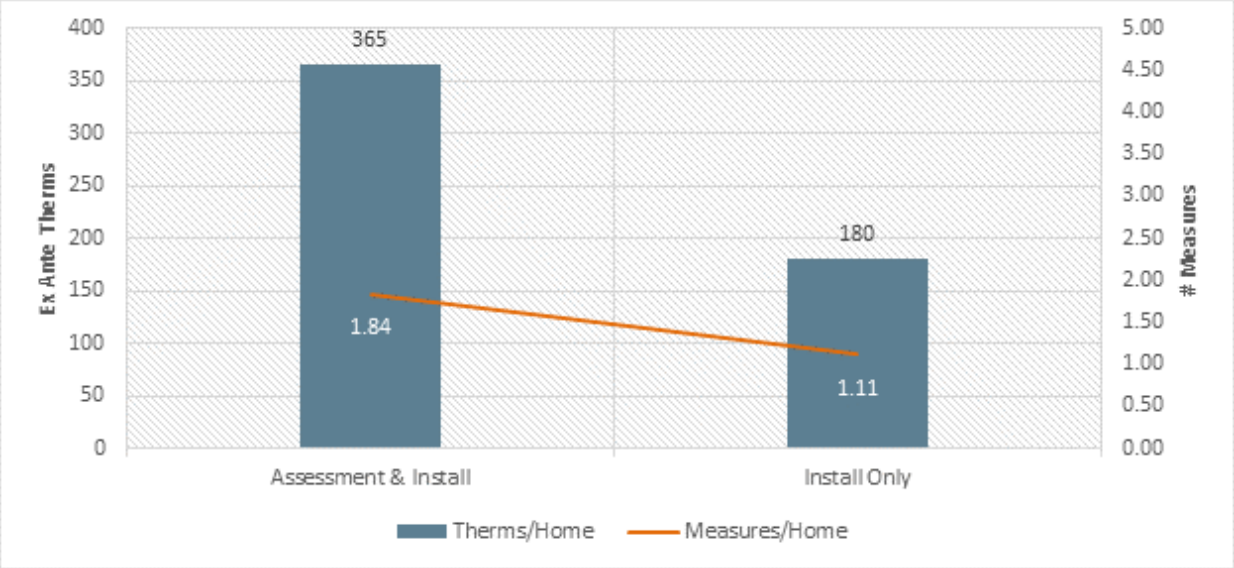

Figure 12-4: Per-Home Measures & Savings

Figure 12-5 presents the percent of homes receiving each measure in PY2021 and PY2022. The percent of homes receiving each energy saving measure declined n PY2021 to PY2022, though the Evaluators found a significant increase in homes receiving H&S spending (increasing from 29% to 43% of homes).

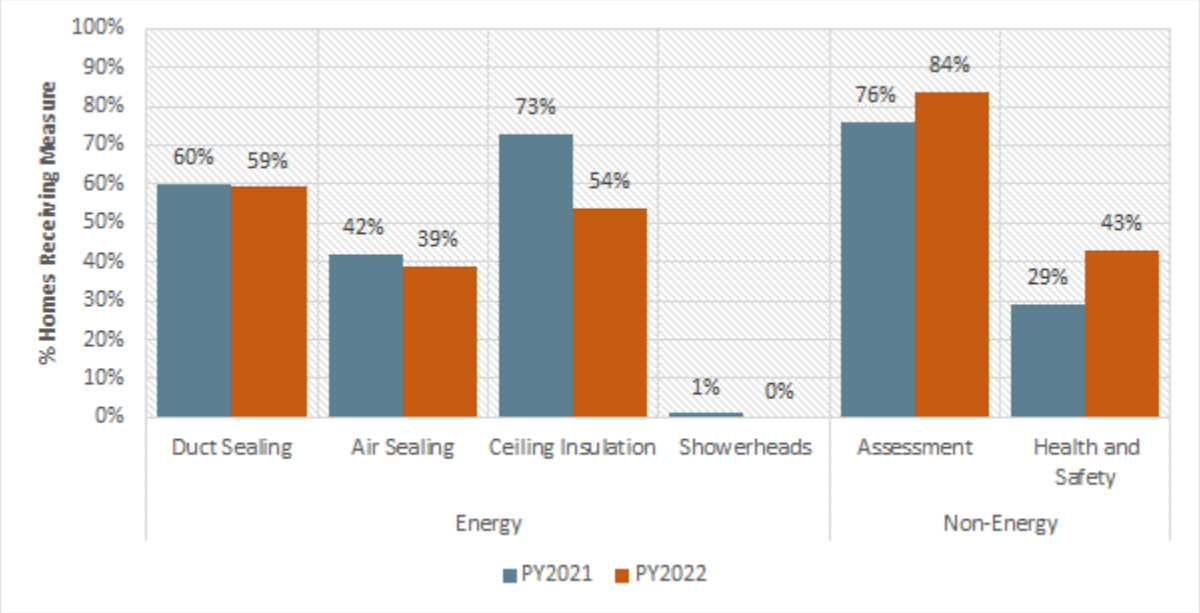

Figure 12-5: Percent of Participant Homes with Each Measure

12.3.11 Trade Ally Outreach

In PY2022, the LISHP had six registered trade allies. The registered trade allies have all been active in the SHP for several years and refer customers to the LISHP when eligible.

12.3.12 Trade Ally Performance

The Evaluators compared trade ally performance on the following *key performance indicators* (KPIs):

- Total projects completed;
- Average measures per home;
- Average net therms per project;
- Percent of projects with positive savings that began with an audit;
- Audit conversion rate; and
- Percent of homes with health and safety measures.

These KPIs are summarized in Table 12-7.

Table 12-7: SUA LISHP Trade Ally Summary

ID	# Projects	Therms / Project	Measures / Project	% Energy-saving Projects with Audit	Audit Conversion Rate	% Homes with Health & Safety Measures
TA#1	79	225.57	1.49	98%	83%	70%
TA#2	23	527.91	1.65	74%	100%	35%
TA#3	46	259.58	1.33	51%	81%	15%
TA#4	4	542.2	1.75	100%	100%	0%
TA#5	13	306.79	2.15	100%	100%	15%
TA#6	1	772.27	1.00	100%	100%	0%

Health and safety spending is higher than in PY2021, with four of six trade allies engaging in some level of H&S installation.

12.3.13 Health & Safety

The program plan for the LISHP specifies up to $500 per home in health and safety spending. SUA has made some progress, increasing spending to $87.07 per participant (increased from $60.54 in PY2921 and $3.43 in PY2020). This is reasonable progress but is not yet up to the level of effort expected out of Act 1102 programs.

CLEAResult has improved the documentation associated with H&S spending, more clearly delineating the activities undertaken. The program's TRC has increased from 2.97 in PY2021 to 3.95 in PY2022. If CLEAResult and SUA met H&S spending goals of $500 per home, the TRC would have been 3.14, leaving ample room to support H&S goals associated with Act 1102.

12.3.14 Participant Survey Response

The Evaluators surveyed 20 participants across three Arkansas gas utility low-income weatherization programs (Table 12-8). These surveys sought to collect data on participant experience with the program including sources of program awareness, motivations for participating, and satisfaction with the program. Furthermore, the evaluators collected demographic information on the respondents during the survey.

Table 12-8: Respondents by Utility (n=20)

	Respondents
Arkansas Oklahoma Gas	2
Black Hills Energy	7
Summit Arkansas	11

Respondents were more limited than observed in prior years. Due to the small number of responses, evaluators have combined all three utilities' respondents into one summary.

12.3.14.1 Respondent Profile

The majority of respondents owned their home (90.0%, n=18), and over half of respondents lived with one to two other people (55.0%, n=11). Eighty percent of respondents were at least 35 years old (n=16), and just over half worked or attended school (55.5%, n=11).

12.3.14.2 Program Awareness

Respondents learned about the program through indirect outreach avenues (60.0%, n=12) and direct outreach avenues (35.0%, n=7) (Figure 12-6).

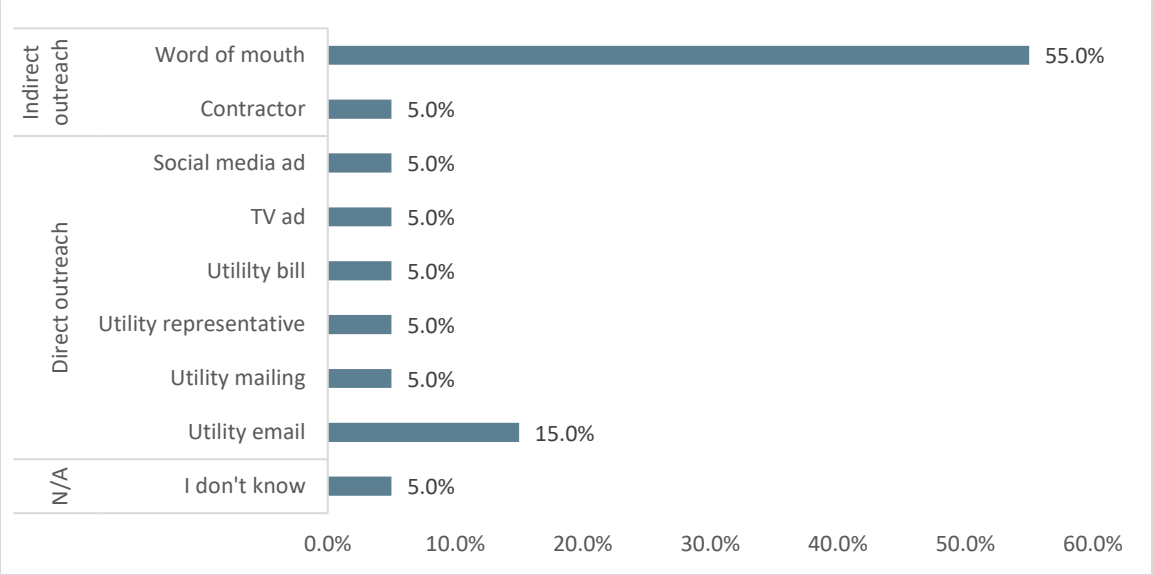

Figure 12-6: Program Awareness (n=20)

Three-quarters of respondents (n=15) were interested in participating in the program to save money on utility bills (

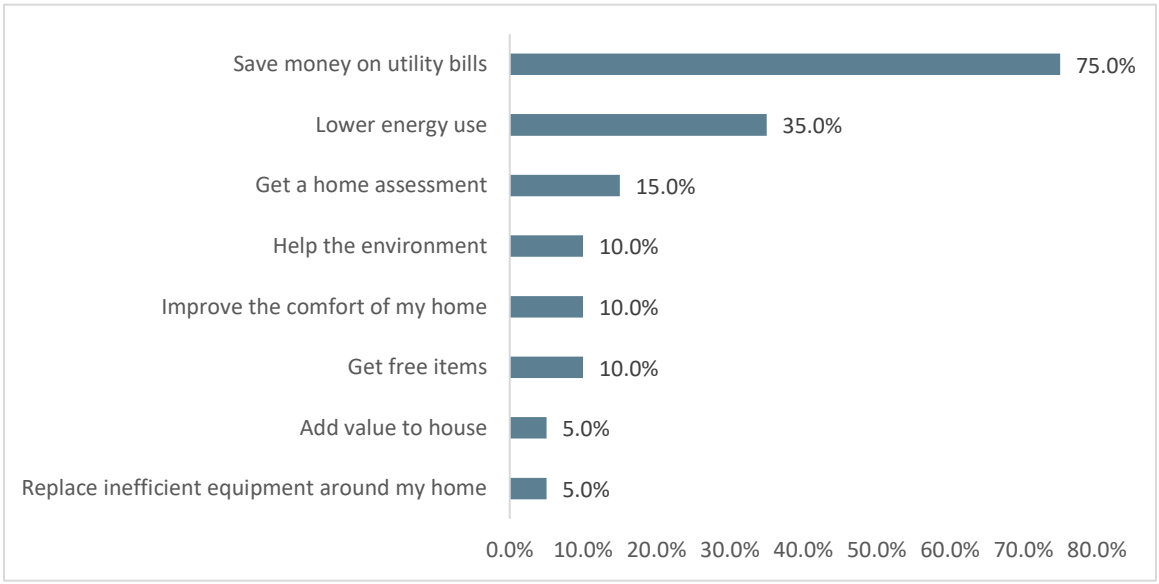

Figure 12-7) and just under two-thirds of respondents wanted make improvements to their home to increase the efficiency of their equipment in order to save energy (65.0%, n=13) (Figure 12-8).

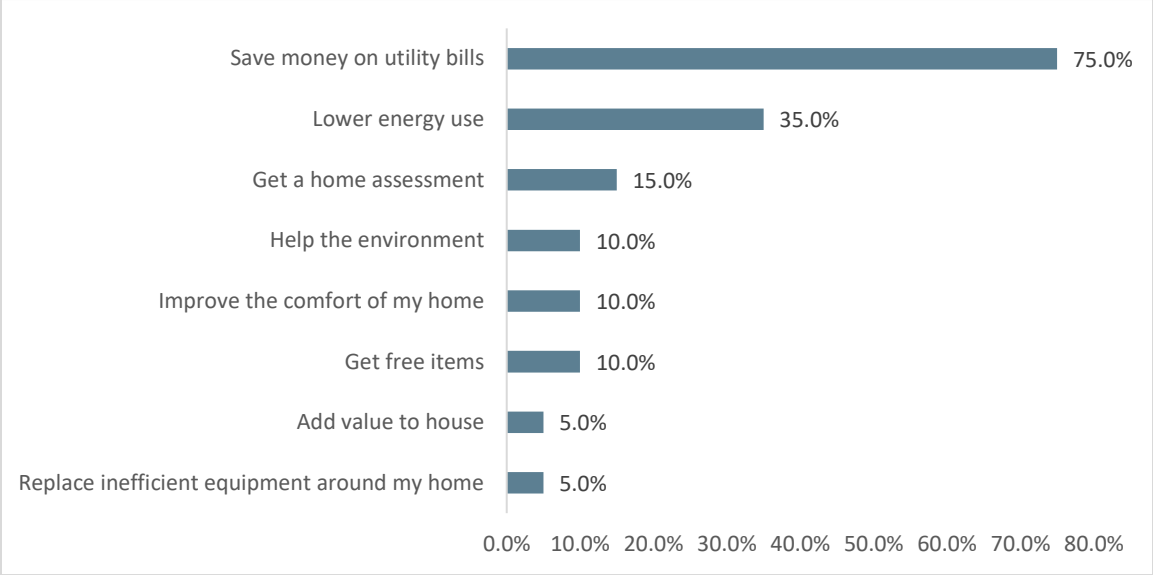

Figure 12-7: Participation Motivation (n=20)

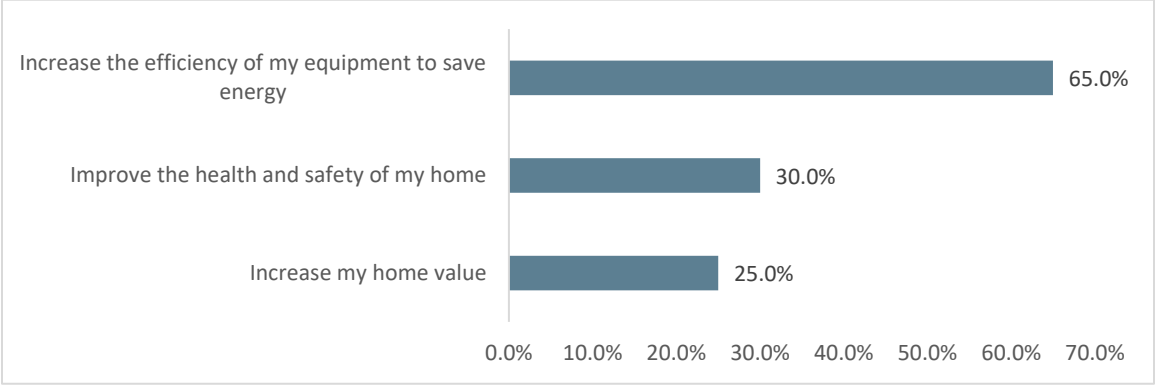

Figure 12-8: Home Improvement Motivations (n=20)

12.3.14.3 Home Energy Assessment

The majority of respondents remember receiving a home energy assessment as part of their participation in the program (80.0%, n=16). Among the respondents who remember receiving a home energy assessment, just under two-thirds were interested in the assessment to save energy to save money (64.3%, n=9) (Figure 12-9).

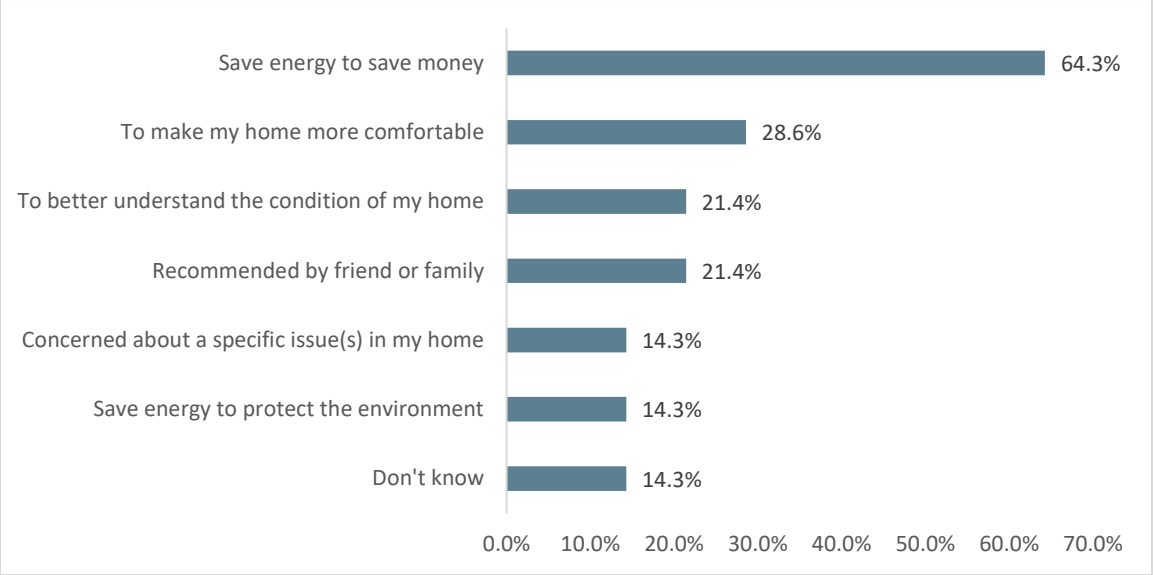

Figure 12-9: Home Energy Assessment Motivation (n=14)

All but one of the respondents who were home for the energy assessment indicated the assessment occurred in-person (n=14) and almost all of them noted that the assessor discussed the assessment findings with them (86.7%, n=14). Just under three-quarters of respondents who were home for the assessment noted they received an energy report with recommendations following the assessment (73.3%, n=11). Two respondents (13.3%) indicated there were recommendations in their assessment report that they did not act on; both of them indicated they did not replace the shower head.

Respondents were pleased with the home energy assessment (Figure 12-10) and found the information provided in to be useful (Figure 12-11).

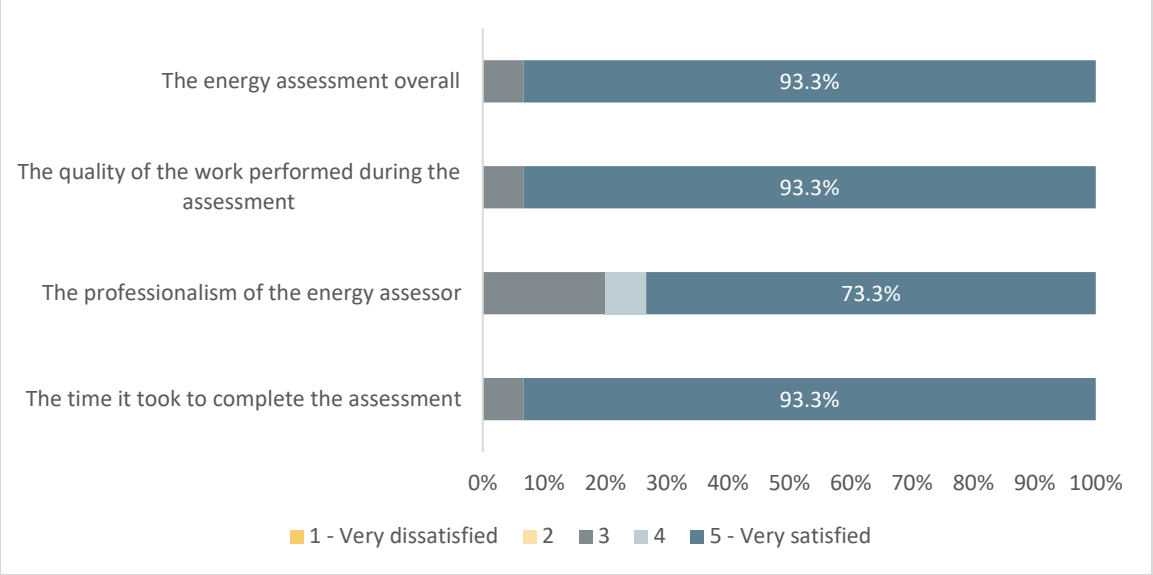

Figure 12-10: Home Energy Assessment Satisfaction (n=15)

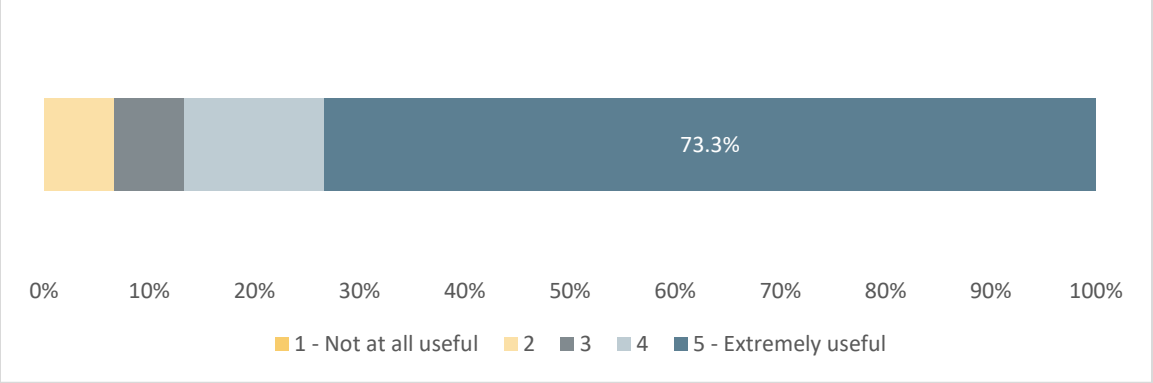

Figure 12-11: Home Energy Assessment Usefulness (n=15)

12.3.14.4 Program Participation

One-third of respondents completed the program application themselves (35.3%, n=6); some of these respondents found the application difficult to complete (66.6%, n=4). Respondents found their contractor through past experience (n=4), utility recommendation (n=3), and word of mouth (n=2).

Just under two-thirds of respondents have noticed a decrease in their energy bill since their participation in the program (Figure 12-12). Twenty percent of respondents have noticed

benefits of the energy efficient equipment installed (n=4). Some respondents (n=4) reached out to the utility staff for assistance or questions while participating in the program.

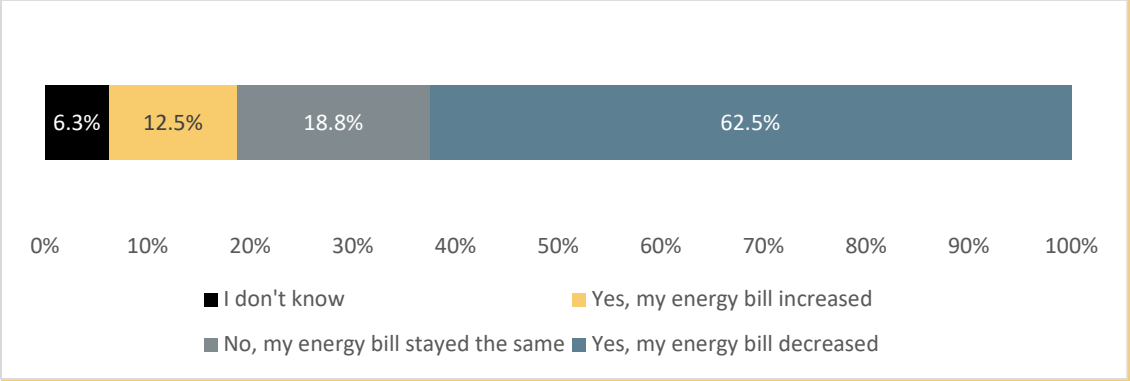

Figure 12-12: Changes in Energy Bill (n=16)

Since participating in the program, one respondent indicated they have installed additional energy efficient items in their home.

12.3.14.5 Program Satisfaction

Respondents were generally satisfied with the program (Figure 12-13) and 80.0% of respondents have recommended the program to other people (n=16). One-quarter of respondents indicated that participating in the program increased their satisfaction with the utility as their energy provider (n=41).

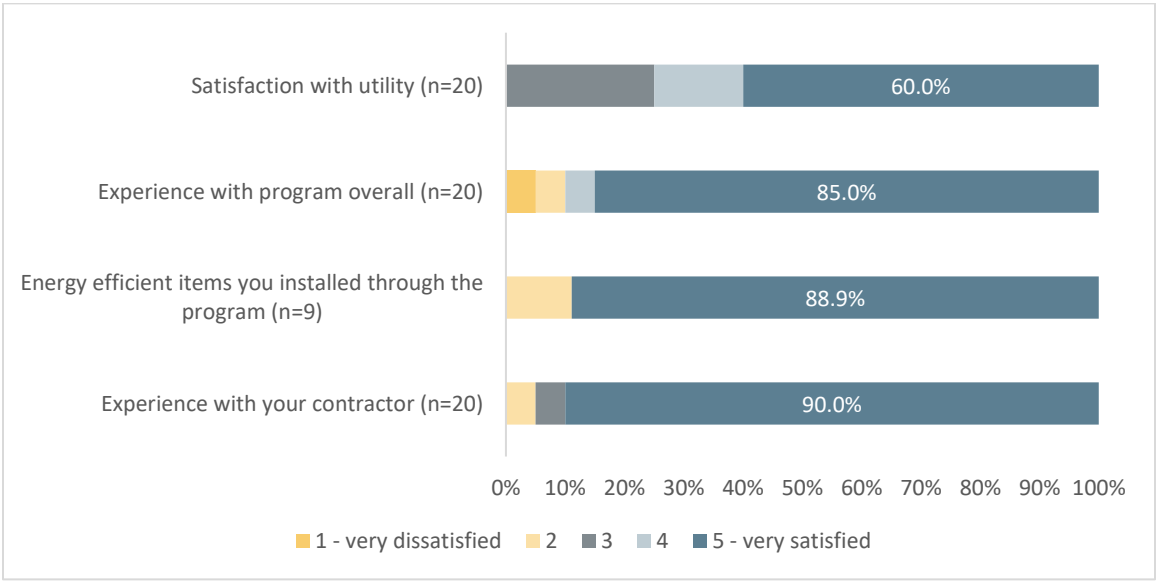

Figure 12-13: Program Satisfaction (n varies)

12.4 LISHP Impact Evaluation

The evaluation effort of the LISHP included:

- *Desk review of residential calculations.* The Evaluators utilized TRM V9.0 values in assessing savings from measures included in the program.

12.4.1 Tracking 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 12-9 summarizes ex ante savings by measure for the LISHP.

Table 12-9: LISHP Ex Ante Summary

Measure	Ex Ante Therms
Duct sealing	30,160
Ceiling insulation	13,416
Air infiltration	5,256
Total	48,831

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 insulation.

12.4.2 Field Verification Procedures

The Evaluators applied FVRs developed for the SHP (see Section 11.4).

12.4.3 Net Savings Estimates

The Evaluators assigned a NTG of 100% to the LISHP, keeping with industry best practices for low-income weatherization programs as-specified in the Department of Energy Uniform Methods Project[30].

12.4.4 Verified Savings

Table 12-10 presents the gross savings results of the evaluation of the PY2022 LISHP.

[30] https://www.energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf

Table 12-10: LISHP Verified Savings Summary

Measure	Ex Ante Therms	Ex Post Therms	Gross Realization	EUL	Lifetime Therms
Duct sealing	30,160	30,223	100.2%	18	544,020
Ceiling insulation	13,416	13,416	100.0%	20	268,311
Air infiltration	5,256	5,531	105.2%	11	60,843
Total	**48,331**	**49,170**	**100.7%**	**17.8**	**873,175**

Table 12-11 SHP 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			
0.0%	0.0%	**48,331**	**49,170**	**100.7%**	**17.8**	**873,175**

12.4.5 Water & Electric NEBs

Table 12-12 LISHP Verified Net Water Savings

Measure	Net Annual Water Saving (Gallons)	Lifetime Net Water Savings (Gallons)
Showerheads	0	0
Total	**0**	**0**

Table 12-13 LISHP Verified Net Electric Savings

Net Annual kWh	Net Peak kW	Lifetime Net kWh
211,712	**160**	**3,874,992**

12.5 Conclusions

The program met savings goals and was highly cost-effective.	The program met 101% of its net savings goal and had a 3.95 TRC.
Progress was made on H&S measures, but the program is not yet meeting Act 1102 requirements.	H&S spending increased from $60.54 to $87.07 per participant, and the percent of homes with any H&S spending increased from 29% to 43%. The program could significantly increase H&S spending and maintain a robust TRC score.

12.6 Recommendations

Establish a payment structure for Trade Allies tied to H&S spending.	Trade Allies are paid per-therm saved for the SHP and LIHSP. For the LISHP, this runs in conflict to H&S goals. Though the program reimburses for H&S costs, it is possible that that Trade Allies could overlook H&S opportunities if engaging with them presents an opportunity cost, i.e., forgone time spent on energy-saving projects at other homes. Without a financial incentive for H&S that is equally attractive, or without a hard program requirement introducing punitive measures in response to H&S shortfalls, the incentive structure for the program is misaligned with Act 1102 goals.

Recommendations made in the PY2021 evaluation related to H&S efforts (both in budget allocation and in per-home outcomes) are at present time incomplete. They remain valid and will be assessed in upcoming program year evaluations.

13 Recommendations for TRM Updates

The Evaluators have the following recommendations for updates to the TRM.

13.1 New Measure: Residential Drain Water Heat Recovery

Drain Water Heat Recovery (DWHR) is a heat recovery device for residential showers that captures heat from draining during a shower and uses it to heat incoming cold water. This measure is included in the Illinois TRM, with the following key inputs:

- Savings: 25.4 therms
- Measure life: 30 years

The measure is most viable in new construction applications, and could be potentially paired with rebates for tankless water heaters in this market segment.

14 Appendix A: Site Reports

Program	C&I Solutions
Project ID	EA-0000365928
Facility SIC Code	2951 - Asphalt Paving Mixtures and Blocks
Measures	Pipe Insulation
Annual Consumption	385,740 therms

Project Background

The participant is an asphalt manufacturing company that received incentives from Summit Utilities 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 include the following assumptions:

- Annual operating hours of the hot oil system is assumed to be 2,390 hours/year, based on utility data analysis.
- Heating System Efficiency will be assumed to be 87%, based on the spec sheet for the hot oil heater.
- The average annual ambient air temperature is 61.8°F. This is based on the average temperature from the TMY3 data for Little Rock, AR.
- The average windspeed for measure outdoors is 7.09 MPH. This is based on average TMY3 data for Little Rock, AR.
- Removable insulation jackets (where applicable) will be made from a non-woven glass fiber material.

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 include the following assumptions:

- Insulation thickness: 1 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14, 850F MF Blanket, Type IV, C553-13
- Process temperature is 400°F
- The average annual ambient air temperature is 61.8°F

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 1" 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } \mathbf{100,000} \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	6" pipe	Pipe	1		6
2	4" pipe	Pipe	1		4
3	2" pipe	Pipe	1		2
4	1" pipe	Pipe	1		1
5	2" fittings	Valve or Fitting	1	2.8	
6	4" fittings	Valve or Fitting	1	3.4	
7	3" flange	Valve or Fitting	1	3.2	
8	2" flange	Valve or Fitting	1	2.8	
9	3" valve	Valve or Fitting	1	3.2	
10	4" valve	Valve or Fitting	1	3.4	
11	2" valve	Valve or Fitting	1	2.8	
12	1" valve	Valve or Fitting	1	2.3	
13	1" flex hose	Pipe	1		1
14	2" flex hose	Pipe	1		2
15	4" pump	Valve or Fitting	1	3.4	

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	6" pipe	Pipe	400	2,789	251	662
2	4" pipe	Pipe	400	2,092	170	627
3	2" pipe	Pipe	400	1,334	105	2,247
4	1" pipe	Pipe	400	900	69	651
5	2" fittings	Valve or Fitting	400	1,334	105	1,002
6	4" fittings	Valve or Fitting	400	2,092	170	85
7	3" flange	Valve or Fitting	400	1,747	143	530
8	2" flange	Valve or Fitting	400	1,334	105	3,962
9	3" valve	Valve or Fitting	400	1,747	139	464
10	4" valve	Valve or Fitting	400	2,092	166	85
11	2" valve	Valve or Fitting	400	1,334	102	913
12	1" valve	Valve or Fitting	400	900	66	149
13	1" flex hose	Pipe	400	757	291	152
14	2" flex hose	Pipe	400	1,078	476	534
15	4" pump	Valve or Fitting	400	2,092	166	341
					Total:	**12,405**

Overall project savings are as follows:

Table 14. Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe and Tank Insulation	12,809	12,405	97%	248,091
TOTAL	**12,809**	**12,405**	**97%**	**248,091**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $62,531 Measure payback is summarized in the table below.

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
12,405	$0.601	$7,455	$62,531	$8,967	$8,683	3.9	8.4

Program	C&I Solutions
Project ID	EA-0000669400
Facility SIC Code	3812 - Search, Detection, Navigation, Guidance, Aeronautical, and Nautical Systems and Instruments
Measures	Boiler Blowdown Boiler Replacement
Annual Consumption	345,510 therms

Project Background

The participant is a manufacturing plant that received incentives from Summit Utilities for:

- ECM #1 – Boiler Blowdown
- ECM #2 – Boiler Replacement

The boiler blowdown measure optimized surface blowdown by regulating water volume discharge. The boiler replacement measure saved energy by integrating controls and has a higher efficiency, 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 include the following assumptions:

- The post combustion efficiency of the new boiler was updated from the assumed 85% to the average measured 84.5%. All other boiler combustion efficiencies stayed the same.
- The Load Analysis was updated to use the latest 12 months of usage.

Boiler Blowdown

The annual energy savings boiler blowdown is calculated with the following equation:

Boiler Blowdown Annual Energy Savings

$$Annual\ Energy\ Savings\left(\frac{CCF}{yr}\right)_i = \frac{Thermal\ Energy\ Savings\left(\frac{BTU}{lb}\right) \times Makeup\ Water\ Savings\left(\frac{lb}{hr}\right) \times AOH\left(\frac{hrs}{yr}\right) \times Load\ Factor(\%)}{100{,}000\left(\frac{BTU}{CCF}\right) \times Thermal\ Efficiency\ (\%)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Table 15. Boiler Blowdown Parameters

Entry #	Description	Operating Hours	Boiler Pressure	Makeup Water Temperature
1	A-25-6 NORTH BOILER	8,760	50	70.1
2	A-25-6 SOUTH BOILER	8,760	50	70.1
3	M-25-B6 EAST BOILER	8,760	50	70.1
4	M-25-B6 WEST BOILER	8,760	50	70.1
5	M-75-B4 BOILER	8,760	50	70.1
6	M-75-H1 EAST BOILER	8,760	15	70.1
7	M-75-H1 WEST BOILER	8,760	15	70.1

Measure Life

Table 16. Estimated Useful Life by Measure

Measure	EUL
Boiler Blowdown	15 years

Calculated Savings:

Boiler Blowdown

Table 17. Boiler Blowdown Annual Energy Savings

Entry #	Description	Capacity (BTU/hr)	AOH	Boiler Combustion Efficiency (%)	Boiler Thermal Efficiency (%)	Makeup Water Savings (lb/hr)	Thermal Energy Savings (BTU/lb)	Therms Savings
1	A-25-6 NORTH BOILER	1,640,000	8,760	82.75%	82.38%	-172	229	-165
2	A-25-6 SOUTH BOILER	1,640,000	8,760	82.75%	82.38%	-172	229	-165
3	M-25-B6 EAST BOILER	1,639,986	8,760	84.50%	84.24%	181	229	4,040
4	M-25-B6 WEST BOILER	1,639,986	8,760	82.75%	82.38%	181	229	4,131
5	M-75-B4 BOILER	1,506,555	8,760	82.75%	82.38%	272	229	420
6	M-75-H1 EAST BOILER	672,000	8,760	82.75%	82.38%	368	180	0
7	M-75-H1 WEST BOILER	672,000	8,760	82.75%	82.38%	368	180	0
							Total:	**8,260**

Boiler Replacement

The annual energy savings from replacing a boiler is calculated with the following equation:

Equation 2: Boiler Replacement Annual Energy Savings

$$Annual\ Energy\ Savings\left(\frac{CCF}{yr}\right) = 134{,}440\left(\frac{CCF}{yr}\right) \times \left(1 - \frac{79.58\%}{84.50\%}\right)$$

$$= 7{,}828\left(\frac{CCF}{yr}\right)$$

Where:

$$\text{Boiler Annual Usage}\left(\frac{\text{CCF}}{\text{yr}}\right) = 134{,}440\,\frac{\text{CCF}}{\text{yr}}$$

$$\text{Efficiency}_{\text{Pre}} = \text{CE} = 79.58\%$$

$$\text{Efficiency}_{\text{Post}} = 84.50\%$$

Boiler Replacement Parameters

Entry #	Boiler	Load Type
1	M-25-B6 EAST BOILER	Base

Calculated Savings:

Boiler Replacement

Boiler Replacement Annual Energy Savings

Boiler	Load Type	% of selected load on boiler	Capacity (BTU/hr)	Pre Boiler Efficiency (%)	Efficiency (%)	Usage (CCF/yr)	Therms Savings
M-25-B6 EAST BOILER	Base	47%	1,639,986	79.58%	84.50%	134,440	**7,828**
						Total:	**7,828**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Boiler Blowdown	8,246	8,260	100%	206,500
Boiler Replacement	7,828	7,828	100%	156,560
TOTAL	**16,074**	**16,088**	**100%**	**363,060**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $25,167.64. Measure payback is summarized in the table below.

Table 7. 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
16,088	$0.834	$13,417	$25,167	$11,251	$11,270	1.02	1.53

Program	C&I Solutions
Project ID	EA-0000365930
Facility SIC Code	2951 - Asphalt Paving Mixtures and Blocks
Measures	Pipe Insulation
Annual Consumption	340,090 therms

Project Background

The participant is an asphalt manufacturer that received incentives from Summit Utilities 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 include the following assumptions:

- Annual operating hours for the site are 2,390 hours
- Combustion efficiency is 85.21% (for both pre-retrofit and post-retrofit condition)
- The average annual ambient air temperature is 61.8°F. This is based on the average temperature from the TMY3 data for Little Rock, AR.
- The average windspeed for measure outdoors is 7.09 MPH. This is based on average TMY3 data for Little Rock, AR.

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 include the following assumptions:

- Insulation thickness: 1 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14, 850 MF Blanket, Type IV, C553-13

- Process temperature is 410°F
- The average annual ambient air temperature is 61.8°F
- The average wind speed is 7.09 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } 100,000 \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	6" pipe	Pipe	1		6
2	4" pipe	Pipe	1		4
3	3" pipe	Pipe	1		3
4	2" pipe	Pipe	1		2
5	1" pipe	Pipe	1		1
6	3" fitting	Valve or Fitting	1	3.2	
7	2" fitting	Valve or Fitting	1	2.8	
8	3" flange	Valve or Fitting	1	3.2	
9	2" flange	Valve or Fitting	1	2.8	
10	3" valve	Valve or Fitting	1	3.2	
11	2" valve	Valve or Fitting	1	2.8	
12	1" valve	Valve or Fitting	1	2.3	
13	1" flex hose	Pipe	1		1
14	3" flex hose	Pipe	1		2
15	2" flex hose	Pipe	1		3
16	3" pump	Valve or Fitting	1	3.2	
17	3" filter pot	Valve or Fitting	1	3.2	

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	6" pipe	Pipe	410	2,897	261	889
2	4" pipe	Pipe	410	2,172	177	1,122
3	3" pipe	Pipe	410	1,812	149	468
4	2" pipe	Pipe	410	1,382	109	4,296
5	1" pipe	Pipe	410	932	71	4,354
6	3" fitting	Valve or Fitting	410	1,812	149	444
7	2" fitting	Valve or Fitting	410	1,382	109	1,524
8	3" flange	Valve or Fitting	410	1,812	149	4,437
9	2" flange	Valve or Fitting	410	1,382	109	4,063
10	3" valve	Valve or Fitting	410	1,812	145	445
11	2" valve	Valve or Fitting	410	1,382	106	1,120
12	1" valve	Valve or Fitting	410	932	69	1,106
13	1" flex hose	Pipe	410	781	310	795
14	3" flex hose	Pipe	410	1,414	701	802
15	2" flex hose	Pipe	410	1,113	505	2,990
16	3" pump	Valve or Fitting	410	1,812	145	148
17	3" filter pot	Valve or Fitting	410	1,812	145	148
					Total:	**29,152**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe and Tank Insulation	29,779	29,151	98%	538,032
TOTAL	**29,779**	**29,151**	**98%**	**538,032**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $74,432. Measure payback is summarized in the table below.

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
29,151	$0.613	$17,870	$74,432	$20,846	$20,406	1.9	4.2

Program	C&I Solutions
Project ID	EA-0000365932
Facility SIC Code	2951 - Asphalt Paving Mixtures and Blocks
Measures	Pipe Insulation
Annual Consumption	426,510 therms

Project Background

The participant is an asphalt manufacturer that received incentives from Summit Utilities 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 include the following assumptions:

- Annual operating hours for the site are 1,266 hours
- Combustion efficiency is 85.21% (for both pre-retrofit and post-retrofit condition)
- The average annual ambient air temperature is 61.8°F. This is based on the average temperature from the TMY3 data for Little Rock, AR.
- The average windspeed for measure outdoors is 7.09 MPH. This is based on average TMY3 data for Little Rock, AR.

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 include the following assumptions:

- Insulation thickness: 1"
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14, 850 MF Blanket, Type IV, C553-13
- Process temperature is 490°F

- The average annual ambient air temperature is 61.8°F
- The average wind speed is 7.09 mph

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 1" 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } 100,000 \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	6" pipe	Pipe	1		6
2	4" pipe	pipe	1		4
3	2" pipe	Pipe	1		2
4	1" pipe	Pipe	1		1
5	3" fitting	Valve or Fitting	1	3.2	
6	2" fitting	Valve or Fitting	1	2.8	
7	3" flange	Valve or Fitting	1	3.2	
8	2" flange	Valve or Fitting	1	2.8	
9	3" valve	Valve or Fitting	1	3.2	
10	2" valve	Valve or Fitting	1	2.8	
11	1.5" valve	Valve or Fitting	1	2.6	
12	1" flex hose	Pipe	1		1
13	2" flex hose	Pipe	1		2
14	3" pump	Valve or Fitting	1	3.2	

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	6" pipe	Pipe	490	3,841	352	7,276
2	4" pipe	pipe	490	2,860	238	1,562
3	2" pipe	Pipe	490	1,799	147	4,429
4	1" pipe	Pipe	490	1,200	96	986
5	3" fitting	Valve or Fitting	490	2,374	200	410
6	2" fitting	Valve or Fitting	490	1,799	147	1,257
7	3" flange	Valve or Fitting	490	2,374	200	2,048
8	2" flange	Valve or Fitting	490	1,799	147	4,538
9	3" valve	Valve or Fitting	490	2,374	200	410
10	2" valve	Valve or Fitting	490	1,799	146	1,048
11	1.5" valve	Valve or Fitting	490	1,540	125	824
12	1" flex hose	Pipe	490	978	414	840
13	2" flex hose	Pipe	490	1,401	678	1,185
14	3" pump	Valve or Fitting	490	1,401	678	136
					Total:	**26,948**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe and Tank Insulation	26,980	26,948	100%	538,953
Total	**26,980**	**26,948**	**100%**	**538,953**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $80,733. Measure payback is summarized in the table below.

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
26,948	$0.587	$15,818	$80,733	$18,886	$18,864	2.3	5.1

Program	C&I Solutions
Project ID	EA-0000376553
Facility SIC Code	2051 – Bread and other Bakery Products, except Cookies and Crackers
Measures	Pipe Insulation
Annual Consumption	555,330 therms

Project Background

The participant is an industrial bakery that received incentives from Summit Utilities 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 include the following assumptions:

- Annual operating hours for the site are 8,592 hours
- Combustion efficiency is 82% (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 include the following assumptions:

- Insulation thickness: 2 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14
- Process temperature is 87°F
- The average annual ambient air temperature is 75°F

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 2 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } 100,000 \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	2 Pipe	Pipe	1	70	2

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss(btu/hr)	Post Heat Loss (btu/hr)	Therms Savings
1	2" Pipe	Pipe	87	18	1	3,120
					Total:	**3,120**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe and Tank Insulation	3,120	3,120	100%	62,399
TOTAL	**3,120**	**3,120**	**100%**	**62,399**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $36,806, Measure payback is summarized in the table below.

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
3,120	$0.599	$1,869	$36,806	$2,184	$2,184	9.1	19.7

Program	C&I Solutions
Project ID	EA-0000363860
Facility SIC Code	2951 – Asphalt & Asphalt Products (Manufacturers)
Measures	Pipe Insulation
Annual Consumption	256,380 therms

Project Background

The participant is an asphalt manufacturer that received incentives from Summit Utilities for:

- ECM #1 – Pipe Insulation

The Pipe insulation measure saved energy by reducing the heat loss from piping, flanges, pumps, flex hoses, filter pots, and fittings/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 include the following assumptions:

- Annual operating hours for the site are 1,188 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 include the following assumptions:

- Insulation thickness for pipes, flanges, fittings, valves, pumps, and filter pots: 1 in
- Insulation thickness for flex hoses: 1/8 in
- Insulation material type for pipes, flanges, fittings: 850F MF Pipe and Tank, Type IIIB, C1393-14
- Insulation material type for valves, pumps, and filter pots: 850 MF Blanket, Type IV, C553-13

- Insulation material type for flex hoses: Cellular Glass, Type II, Pipe and Tube, C552-16
- Process temperature is 410°F
- The average annual ambient air temperature is 68°F
- The average wind speed is 7.09 mph

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 1 in and 1/8 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } 100,000 \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Fitting Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	4" pipe	Pipe	1	220	4
2	2" pipe	Pipe	1	320	2
3	3" fittings	Valve or Fitting	6	3	3
4	2" fittings	Valve or Fitting	18	3	2
5	2" flange	Valve or Fitting	50	3	2
6	3" valves	Valve or Fitting	10	3	3
7	2" valves	Valve or Fitting	7	3	2
8	1" flex hose	Pipe	1	80	1
9	2" flex hose	Pipe	1	120	2
10	3" pump	Valve or Fitting	2	3	3
11	3" filter pot	Valve or Fitting	2	3	3

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	4" pipe	Pipe	410	2,140	175	6,041
2	2" pipe	Pipe	410	1,362	108	5,608
3	3" fittings	Valve or Fitting	410	1,785	147	434
4	2" fittings	Valve or Fitting	410	1,362	108	895
5	2" flange	Valve or Fitting	410	1,362	108	2,486
6	3" valves	Valve or Fitting	410	1,785	144	725
7	2" valves	Valve or Fitting	410	1,362	105	349
8	1" flex hose	Pipe	410	917	344	640
9	2" flex hose	Pipe	410	1,362	557	1,350
10	3" pump	Valve or Fitting	410	1,785	144	145
11	3" filter pot	Valve or Fitting	410	1,785	144	145
					Total:	**18,819**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe Insulation	19,359	18,819	97%	376,371
TOTAL	**19,359**	**18,819**	**97%**	**376,371**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $101,246 Measure payback is summarized in the table below.

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
18,819	$1.237	$23,279	$101,246	$13,553	$13,174	2.8	4.3

Program	C&I Solutions
Project ID	EA-0000363860
Facility SIC Code	2013 – Prepared Meats Products
Measures	Steam Leak Repairs Pipe Insulation
Annual Consumption	99,010

Project Background

The participant is a food processing plant that received incentives from Summit Utilities for:

- ECM #1 - Steam leak repairs
- ECM #2 – Pipe Insulation

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.

Measurement and verification activities include the following assumptions:

- Supply water temperature is 65.10°F based on the AR TRM 9.0
- Annual operating hours for the site are 8,760 hours
- Combustion efficiency is 86% (for both pre-retrofit and post-retrofit condition)

Steam Leak Repairs

An alternative method was used to calculate the steam loss before steam leak repairs. The more traditional method equates the orifice diameter flow rate, using the orifice diameter of the leak and the system's absolute pressure. Due to the difficulty in determining the exact diameter of an orifice leak, the alternate method was used.

Calculations follow the methods established by G.G. Rajan for a steam leak rate as a function of the length of an active steam plume.

Equating Steam Plume Length to Flow Rate

$$Leak\ Rate\ \left(\frac{kg}{hr}\right) = 2.5678\ x\ \exp[1.845\ x\ Plume\ Length\ (m)]$$

$$Leak\ Rate\ \left(\frac{lb}{hr}\right) = 5.661\ x\ \exp\ [0.562\ x\ Plume\ Length\ (ft)]$$

Calculation for Heat Loss

$$Heat\ Loss\ \left(\frac{Btu}{hr}\right) = Leak\ Rate\ \left(\frac{lb}{hr}\right) x\ \left[Steam\ Enthalpy\ \left(\frac{Btu}{lb}\right) - MW\ Enthalpy\ \left(\frac{Btu}{lb}\right)\right]$$

Where:

Leak Rate = calculated value using the equation above

Steam Enthalpy = saturated steam region based on system steam pressure

MV Enthalpy = steam look up table based on makeup water temperature,

derived from average temperature of water main in each zone (38.18 BTU/lb)

The following table shows relevant steam leak parameters required for annual energy savings calculations.

Steam Leak Parameters

Steam Leak #	Description	Quantity of Leaks	Plume Length (ft)	Steam Pressure (psig)	Leak Rate (lbs/hr)	Boiler Efficiency
1	Valve Leak	2	0.1	40	5.9	86%

Energy Savings

The annual energy savings from repairing a steam leak is calculated with the following equation:

$$Annual\ Energy\ Savings\ (therms) = \frac{Heat\ Loss\ \left(\frac{Btu}{hr}\right) x\ Annual\ Operating\ Hours\ \left(\frac{hrs}{yr}\right)}{Boiler\ Efficiency(\%)\ x\ 100{,}000\ \frac{Btu}{therm}}$$

Where:

Annual Operating Hours = number of hours facility operates annually = 8,760 hours

Boiler Efficiency = 86%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

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 include the following assumptions:

- Insulation thickness: 2 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14
- Varying process temperatures of 286.7°F, 274°F, and 190°F
- The average annual ambient air temperature is 75°F

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 0.75-4 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x 100,000 } \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency = 86%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Area (ft^2)	Length (ft)	Diameter (in)
1	4inch pipe 10ft - Steam - 40psi	Pipe		10	4
2	3/4inch - pipe 35ft - Steam - 30psi	Pipe		35	0.8
3	3/4inch - pipe 15ft - Condensate - 190F	Pipe		15	0.8
4	2inch - pipe 100ft - Steam - 30PSI	Pipe		100	2
5	Feedwater Cylinder Horizontal Tank 36in x 6ft - 190F	Cylindrical Tank	71	6	3

Water Savings

In addition to energy savings, water savings were calculated for each of the ECMs. These savings are considered as Non-Energy Benefits (NEBs).

Annual Energy Savings Unit Conversion (therms/year to BTU/year)

$$Annual\ Energy\ Savings\ \left(\frac{Btu}{yr}\right) = Annual\ Energy\ Savings\ \left(\frac{therm}{yr}\right) \times 100{,}000\ \frac{Btu}{therm}$$

Equation 6. Calculation for Pounds of Steam Produced per Year

$$Steam_{Trap}\ \left(\frac{lb}{yr}\right) = \left(\frac{Annual\ Energy\ Savings\ (Btu)}{Steam\ Enthalpy\ \left(\frac{Btu}{lb}\right) - FW\ Enthalpy\ \left(\frac{Btu}{lb}\right)}\right) \times Eff_{Boiler}\ (\%)$$

$$Steam_{Leak}\ \left(\frac{lb}{yr}\right) = \left(\frac{Annual\ Energy\ Savings\ (Btu)}{Steam\ Enthalpy\ \left(\frac{Btu}{lb}\right) - MW\ Enthalpy\ \left(\frac{Btu}{lb}\right)}\right) \times Eff_{Boiler}\ (\%)$$

Equation 7. Annual Water Savings Calculation

$$Annual\ Water\ Savings\ \left(\frac{gal}{yr}\right) = \frac{Steam\ \left(\frac{lb}{yr}\right)}{8.33\ \left(\frac{lb}{gal}\right)}$$

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Steam Leak Repairs	10 years
Pipe Insulation	20 years

Calculated Savings:

Steam Leak Repairs

Steam Leak Repairs Savings

Steam Leak #	Description	Quantity of Leaks	Plume Length (ft)	Steam Enthalpy (BTU/lb)	System Enthalpy (BTU/lb)	Therms Savings
1	Valve Leak	2	0.1	1,177	1,142	1,381
					Total:	**1,381**

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	4inch pipe 10ft - Steam - 40psi	Pipe	287	671	53	630
2	3/4inch - pipe 35ft - Steam - 30psi	Pipe	274	162	21	501
3	3/4inch - pipe 15ft - Condensate - 190F	Pipe	190	79	11	104
4	2inch - pipe 100ft - Steam - 30PSI	Pipe	274	339	32	3,130
5	Feedwater Cylinder Horizontal Tank 36in x 6ft - 190F	Cylindrical Tank	190	235	15	1,583
					Total:	**5,949**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings	Annual Water Gallons Savings	Lifetime Water Gallons Savings
Steam Leak Repair	1,384	1,381	100%	13,806	6,239	62,387
Pipe Insulation	5,964	5,949	100%	118,983	N/A	N/A
TOTAL	**7,348**	**7,330**	**100%**	**132,789**	**6,239**	**62,387**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $20,158 Measure payback is summarized in the table below.

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
7,330	$0.788	$5,776	$20,158	$6,614	$6,597	1.6	3.5

Program	C&I Solutions
Project ID	EA-0000386133
Facility SIC Code	3519 – Internal Combustion Engines, Not Elsewhere Classified
Measures	Carburizer Burner Tune-Ups
Annual Consumption	531,640 therms

Project Background

The participant is a manufacturing plant that received incentives from Summit Utilities for:

- ECM #1 – Carburizer Burner Tune-Ups

The participant uses natural gas at their facility to run carburizers that heat treat metal parts in the presence of carbon to harden the surfaces. The existing equipment affected by the tune-up were the single ended radiant tube burners on all the carburizers. These burners range in make and size. The burners ranging in size from 615 MBH to 3,360 MBH. No new equipment was installed.

This ECM saved energy by tuning up the burners so optimal burner combustion was maintained, very similar to boiler tune-ups. In this case there were no boilers, but carburizers that act as furnaces. The key variables that affected the realization of energy savings were gas usage per carburizer cycle hour and the total cycle time.

M&V Methodology

The M&V effort for this project follows the guidelines of the 2022 International Performance Measurement and Verification Protocol (IPMVP) Option C – Whole Facility. ADM evaluated the savings associated with this site during a desk review. The implementers provided the following data for the desk review process: a year of pre monthly billed gas use and daily production, two months of pre and post daily billed gas, and two months of post daily production.

During the desk review, it was found that there was no correlation between gas consumption and heating degree days (HDD).

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. The latest 12 months of usage data were added up to get the baseline annual usage. The utility data was in MBU, so it was converted to CCF at the end.

Annual MBU_{Pre}

$$Annual\ MBU_{Pre} = \sum_{i=1}^{12} Monthly\ MBU_{Pre,i} = 53{,}164 \frac{MBU}{yr}$$

Annual CCF_{Pre}

$$Annual\ CCF_{Pre} = Annual\ MBU_{Pre} \times 10 = 531{,}640 \frac{CCF}{yr}$$

The daily pre usage data was compiled with the corresponding daily pre total cycle time. The total gas usage over the baseline period was calculated.

Period CCF_{Pre}

$$Period\ CCF_{Pre} = \sum Daily\ CCF_{Pre,i} = 84{,}462\ CCF$$

The total cycle time over the baseline period was calculated.

Period Total $Cycle_{Pre}$

$$Period\ Total\ Cylce_{Pre} = \sum Daily\ Total\ Cycle_{Pre,i} = 7{,}350\ hours$$

The baseline energy intensity was calculated.

: Energy $Intensity_{Pre}$

$$Energy\ Intensity_{Pre} = \frac{Period\ CCF_{Pre}}{Period\ Total\ Cylce_{Pre}} = \frac{84{,}462\ CCF}{7{,}350\ hours} = 11.49 \frac{CCF}{hr}$$

The daily post usage data was compiled with the corresponding daily post total cycle time. The total gas usage over the post period was calculated.

Period CCF_{Post}

$$Period\ CCF_{Post} = \sum Daily\ CCF_{Post,i} = 101{,}110\ CCF$$

The total cycle time over the post period was calculated.

Period Total Cycle$_{Post}$

$$Period\ Total\ Cylce_{Post} = \sum Daily\ Total\ Cycle_{Post,i} = 9{,}909\ hours$$

The post energy intensity was calculated.

Energy Intensity$_{Post}$

$$Energy\ Intensity_{Post} = \frac{Period\ CCF_{Post}}{Period\ Total\ Cylce_{Post}} = \frac{101{,}110\ CCF}{9{,}909\ hours} = 10.20\frac{CCF}{hr}$$

The percent savings were calculated using the energy intensities.

%Savings

$$\%\ Savings = \frac{Energy\ Intensity_{Pre} - Energy\ Intensity_{Post}}{Energy\ Intensity_{Pre}} = \frac{11.49 - 10.20}{11.49} = 11.20\%$$

The post annual usage was calculated using the percent savings and the baseline annual usage.

Annual CCF$_{Post}$

$$Annual\ CCF_{Post} = Annual\ CCF_{Pre} - (Annual\ CCF_{Pre} \times \%\ Savings)$$
$$= 531{,}640 - (531{,}640\ X\ .112)$$
$$= 59{,}567\frac{CCF}{yr}$$

The annual savings were calculated using the baseline and post annual usage.

Annual CCF$_{Savings}$

$$Annual\ CCF_{Savings} = Annual\ CCF_{Pre} - Annual\ CCF_{Post}$$

$$= 531{,}640 - 472{,}073$$

$$= 59{,}567 \frac{CCF}{yr}$$

Measure Life

Table 18. Estimated Useful Life by Measure

Measure	EUL
Boiler Tune-Up	2 years

Calculated Savings:

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Carburizer Burner Tune-Ups	62,328	59,567	96%	119,133
TOTAL	**62,328**	**59,567**	**96%**	**119,133**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $5,110. Measure payback is summarized in the table below.

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
59,567	$0.80	$48,644	$5,110	$5,110	$5,110	0	0.1

Program	C&I Solutions
Project ID	EA-0000492934
Facility SIC Code	2899 - Chemicals and Chemical Preparations
Measures	Steam Leak Repairs
Annual Consumption	781,630 therms

Project Background

The participant is a chemical manufacturer that received incentives from Summit Utilities for:

- ECM #1 - Steam leak repairs

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.

Measurement and verification activities include the following assumptions:

- Supply water temperature is 67.80°F based on the AR TRM 9.0
- Annual operating hours for the site are 8,620 hours
- Combustion efficiency is 81% (for both pre-retrofit and post-retrofit condition)

Steam Leak Repairs

An alternative method was used to calculate the steam loss before steam leak repairs. The more traditional method equates the orifice diameter flow rate, using the orifice diameter of the leak and the system's absolute pressure. Due to the difficulty in determining the exact diameter of an orifice leak, the alternate method was used.

Calculations follow the methods established by G.G. Rajan for a steam leak rate as a function of the length of an active steam plume.

Equating Steam Plume Length to Flow Rate

$$Leak\ Rate\ \left(\frac{kg}{hr}\right) = 2.5678\ x\ \exp[1.845\ x\ Plume\ Length\ (m)]$$

$$Leak\ Rate\ \left(\frac{lb}{hr}\right) = 5.661\ x\ \exp\ [0.562\ x\ Plume\ Length\ (ft)]$$

Calculation for Heat Loss

$$Heat\ Loss\ \left(\frac{Btu}{hr}\right) = Leak\ Rate\ \left(\frac{lb}{hr}\right) x\ \left[Steam\ Enthalpy\ \left(\frac{Btu}{lb}\right) - MW\ Enthalpy\ \left(\frac{Btu}{lb}\right)\right]$$

Where:

Leak Rate = calculated value using the equation above

Steam Enthalpy = saturated steam region based on system steam pressure

MV Enthalpy = steam look up table based on makeup water temperature,

derived from average temperature of water main in each zone (35.88 BTU/lb)

The following table shows relevant steam leak parameters required for annual energy savings calculations.

Steam Leak #	Description	Quantity of Leaks	Plume Length (ft)	Steam Pressure (psig)	Leak Rate (lbs/hr)	Boiler Efficiency
1	Outside Driveway	1	0.5	114	8	81%

Energy Savings

The annual energy savings from repairing a steam leak is calculated with the following equation:

Steam Leak Repair Annual Energy Savings

$$Annual\ Energy\ Savings\ (therms) = \frac{Heat\ Loss\ \left(\frac{Btu}{hr}\right) x\ Annual\ Operating\ Hours\ \left(\frac{hrs}{yr}\right)}{Boiler\ Efficiency(\%)\ x\ 100{,}000\ \frac{Btu}{therm}}$$

Where:

Annual Operating Hours = number of hours facility operates annually = 8,620 hours

Boiler Efficiency = 81%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Steam Leak Repairs	10 years

Calculated Savings:

Steam Leak Repairs

Steam Leak Repairs Savings

Steam Leak #	Description	Quantity of Leaks	Plume Length (ft)	Steam Enthalpy (BTU/lb)	System Enthalpy (BTU/lb)	Therms Savings
1	Outside Driveway	1	0.5	1,193	1,157	923
					Total:	**923**

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings	Annual Water Gallons Savings	Lifetime Water Gallons Savings
Steam Leak Repair	923	923	100%	9,230	N/A	N/A
TOTAL	**923**	**923**	**100%**	**9,230**	**N/A**	**N/A**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $646. Measure payback is summarized in the table below.

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
923	$0.469	$433	$646	$646	$433	0.6	1.6

Program	C&I Solutions
Project ID	EA-0000625288
Facility SIC Code	0131 – Cotton
Measures	Condensate Return Steam Leak Repairs Pipe Insulation
Annual Consumption	1,417,580 Therms

Project Background

The participant is a cotton seed manufacture that received incentives from Summit Utilities for:

- ECM #1 - Steam leak repairs
- ECM #2 – Condensate Return
- ECM #3 – Pipe Insulation

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.

Measurement and verification activities include the following assumptions:

- Supply water temperature is 65.10°F based on the AR TRM 9.0
- Annual operating hours for the site are 8,592 hours
- Combustion efficiency is 82.59% (for both pre-retrofit and post-retrofit condition)

Steam Leak Repairs

An alternative method was used to calculate the steam loss before steam leak repairs. The more traditional method equates the orifice diameter flow rate, using the orifice diameter of the leak and the system's absolute pressure. Due to the difficulty in determining the exact diameter of an orifice leak, the alternate method was used.

Calculations follow the methods established by G.G. Rajan for a steam leak rate as a function of the length of an active steam plume.

Equating Steam Plume Length to Flow Rate

$$Leak\ Rate\ \left(\frac{kg}{hr}\right) = 2.5678\ x\ \exp[1.845\ x\ Plume\ Length\ (m)]$$

$$Leak\ Rate\ \left(\frac{lb}{hr}\right) = 5.661\ x\ \exp\ [0.562\ x\ Plume\ Length\ (ft)]$$

Calculation for Heat Loss

$$Heat\ Loss\ \left(\frac{Btu}{hr}\right) = Leak\ Rate\ \left(\frac{lb}{hr}\right) x\ \left[Steam\ Enthalpy\ \left(\frac{Btu}{lb}\right) - MW\ Enthalpy\ \left(\frac{Btu}{lb}\right)\right]$$

Where:

Leak Rate = calculated value using .

Steam Enthalpy = saturated steam region based on system steam pressure

MV Enthalpy = steam look up table based on makeup water temperature,

derived from average temperature of water main in each zone (38.18 BTU/lb)

The following table shows relevant steam leak parameters required for annual energy savings calculations.

Steam Leak #	Description	Quantity of Leaks	Plume Length (ft)	Steam Pressure (psig)	Leak Rate (lbs/hr)	Boiler Efficiency
1	Solvent Plant-DT Bottom Deck steam headerq	1	1.0	125	10	83%
2	Packing Leak at system by DT in front of stairs	1	0.8	125	9	83%
3	Packing Leak at system by DT in front of stairs	1	0.3	125	7	83%
4	DC heather at Y strainer	1	0.2	125	6	83%

Energy Savings

The annual energy savings from repairing a steam leak is calculated with the following equation:

Steam Leak Repair Annual Energy Savings

$$Annual\ Energy\ Savings\ (therms) = \frac{Heat\ Loss\ \left(\frac{Btu}{hr}\right) x\ Annual\ Operating\ Hours\ \left(\frac{hrs}{yr}\right)}{Boiler\ Efficiency(\%)\ x\ 100{,}000\ \frac{Btu}{therm}}$$

Where:

Annual Operating Hours = number of hours facility operates annually = 8,592 hours

Boiler Efficiency = 82.59%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Condensate Return

Measurement and verification activities include the following assumptions:

- Spot condensate flow reading representative of annual loss rate
- Condensate return temperature in CRU averaged 65°F
- The pumps that feed the condensate water into the CRU are activated 2.54% of the time throughout the day – based on logging data
- Average condensate flow in system is 1.5 GPM
- Boiler efficiency rate is 82.59%
- Facility operates 50 weeks per year
- Annual hours of operation are 8,592 hours/year

The following table shows the parameters that were used for the energy savings calculations.

Condensate Return Parameters

Boiler Efficiency	Condensate Flow Rate (GPM)	Condensate Temperature (°F)	Makeup Water Temperature (°F)	Percentage of time Pumps Activate	Pump Annual Hours of Operation
82.59%	1.5	65	346	2.54%	8,592

The heat loss from the condensate is estimated with the formula:

Calculation for Condensate Heat Loss

$$\frac{Btu}{hr} = \frac{1\ Btu}{lb\ x\ F} \times \frac{8.34\ lb}{gal} \times \frac{60\ min}{hr} \times \frac{gal}{min} \times (T_{makeup\ water} - T_{condensate})$$

Energy Savings

Condensate Return

The heat loss determined by the flow and temperature difference of the makeup water and condensate temperature is an input to the following equation to determine the boiler gas savings.

Annual Condensate Return Savings Calculation

$$\frac{CCF}{year} = \frac{Heat\ Loss\ \left(\frac{BTU}{hr}\right) x\ AOH}{Boiler\ efficiency\ (\%) x\ 100{,}000\ \frac{BTU}{CCF}}$$

Where:

$Heat\ Loss$ = 48,750 BTU/hr

AOH = Annual Operation Hours (8,592 hours)

Eff_{post} = Efficiency of the steam boiler = 82.59%

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 include the following assumptions:

- Insulation thickness: 0.75-4 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14
- Process temperature is 335°F
- The average annual ambient air temperature is 75°F

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 0.75-4 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } \mathbf{100,000} \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	DT header	Pipe			4
2	DTUpper Deck Trays Steam Lines	Pipe			1
3	DT Upper Deck Trays check valve	Valve or Fitting	3	2.3	
4	DC heater	Pipe			1
5	Steam line for DC and DT heaters	Pipe			2
6	Steam line for DC and DT heaters	Pipe			3
7	Steam line for DC Heaters	Pipe			2
8	Steam line for DC Heaters	Pipe			3
9	Main steam line for centrifuge	Pipe			3
10	Press room condensate return	Pipe			2
11	Steam line behind cookers	Pipe			2

12	Steam Lines for cooker #2	Pipe			2
13	Steam lines for Cooker #1	Pipe			2
14	Boiler #1	Pipe			2
15	Pellet Mill	Pipe			2
16	DT header	Pipe			2

Water Savings

In addition to energy savings, water savings were calculated for each of the ECMs. These savings are considered as Non-Energy Benefits (NEBs).

Annual Energy Savings Unit Conversion (therms/year to BTU/year)

$$Annual\ Energy\ Savings\ \left(\frac{Btu}{yr}\right) = Annual\ Energy\ Savings\ \left(\frac{therm}{yr}\right) \times 100{,}000\ \frac{Btu}{therm}$$

Calculation for Pounds of Steam Produced per Year

$$Steam_{Trap}\ \left(\frac{lb}{yr}\right) = \left(\frac{Annual\ Energy\ Savings\ (Btu)}{Steam\ Enthalpy\ \left(\frac{Btu}{lb}\right) - FW\ Enthalpy\ \left(\frac{Btu}{lb}\right)}\right) \times Eff_{Boiler}\ (\%)$$

$$Steam_{Leak}\ \left(\frac{lb}{yr}\right) = \left(\frac{Annual\ Energy\ Savings\ (Btu)}{Steam\ Enthalpy\ \left(\frac{Btu}{lb}\right) - MW\ Enthalpy\ \left(\frac{Btu}{lb}\right)}\right) \times Eff_{Boiler}\ (\%)$$

Annual Water Savings Calculation

$$Annual\ Water\ Savings\ \left(\frac{gal}{yr}\right) = \frac{Steam\ \left(\frac{lb}{yr}\right)}{8.33\ \left(\frac{lb}{gal}\right)}$$

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Steam Leak Repairs	10 years
Condensate Return	15 years
Pipe Insulation	20 years

Calculated Savings:

Steam Leak Repairs

Steam Leak Repairs Savings

Steam Leak #	Description	Quantity of Leaks	Plume Length (ft)	Steam Enthalpy (BTU/lb)	System Enthalpy (BTU/lb)	Therms Savings
1	Solvent Plant-DT Bottom Deck steam headerq	1	1.0	1,176	1,138	1,175
2	Packing Leak at system by DT in front of stairs	1	0.8	1,176	1,138	1,021
3	Packing Leak at system by DT in front of stairs	1	0.3	1,176	1,138	771
4	DC heather at Y strainer	1	0.2	1,176	1,138	736
					Total:	**3,703**

Condensate Return

Condensate Return Savings

Condensate Return	Annual operating hours	Make up water Temp(°F)	Condensate Temp(°F)	Heat Loss (Btu/hr)	Therms Savings
CRU	8,592	346	65	48,750	5,072
				Total:	**5,072**

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	DT header	Pipe	335	899	73	1495
2	DTUpper Deck Trays Steam Lines	Pipe	335	287	33	898
3	DT Upper Deck Trays check valve	Valve or Fitting	335	234	31	145
4	DC heater	Pipe	335	287	33	1021
5	Steam line for DC and DT heaters	Pipe	335	493	47	248
6	Steam line for DC and DT heaters	Pipe	335	709	61	898
7	Steam line for DC Heaters	Pipe	335	493	43	552
8	Steam line for DC Heaters	Pipe	335	709	61	48
9	Main steam line for centrifuge	Pipe	335	709	61	98
10	Press room condensate return	Pipe	335	493	43	651
11	Steam line behind cookers	Pipe	335	493	43	1189
12	Steam Lines for cooker #2	Pipe	335	493	43	304
13	Steam lines for Cooker #1	Pipe	335	493	43	304
14	Boiler #1	Pipe	335	401	38	425
15	Pellet Mill	Pipe	335	493	43	1404
16	DT header	Pipe	335	899	73	1495
					Total:	**9,679**

Overall project savings are as follows:

. Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings	Annual Water Gallons Savings
Steam Leak Repair	3,790	3,703	98.0%	37,034	32,276
Condensate Return	5,106	5,072	99.0%	76,073	N/A
Pipe Insulation	9,539	9,679	101.0%	193,572	N/A
Total	**18,435**	**18,454**	**99.0%**	**306,690**	**32,276**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $22,600. Measure payback is summarized in the table below.

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
18,454	$0.513	$9,467	$22,600	$15,246	$12,918	1	2.4

Program	C&I Solutions
Project ID	EA-0000589964
Facility SIC Code	8062 – General Medical Hospital
Measures	Steam Trap Replacement
Annual Consumption	906,980 therms

Project Background

The participant is a hospital that received incentives from Summit Utilities for implementing the following:

- ECM #1: Steam trap replacement

The site uses steam throughout the facility primarily for three process needs: space heating, domestic water heating, and other process heating loads such as sterilization. Savings will come from repairing the failed steam traps throughout the site's steam system.

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.

Measurement and verification activities include the following assumptions:

- Feedwater temperature is 230°F
- Annual operating hours for the on-site steam system are 8,760 and 3,600 hours
- Combustion efficiency is 85% (for both pre-retrofit and post-retrofit condition)

Steam Trap Replacement

The following table shows relevant failed steam traps parameters required for annual energy savings.

Steam Trap Parameters

Steam Trap #	Orifice Size (in.)	Inlet Pressure (psig)	Outlet Pressure (psig)	Service (Drip/Process)	Feedwater Temperature (°F)	Boiler Efficiency	Operating Hours
1	7/64	80	0	Drip	230	85%	8,760
2	7/64	30	0	Drip	230	85%	8,760
3	3/16	30	0	Drip	230	85%	8,760
4	1/6	30	0	Drip	230	85%	8,760
5	1/6	30	0	Drip	230	85%	3,600
6	7/64	30	0	Drip	230	85%	8,760
7	1/6	30	0	Drip	230	85%	8,760
8	7/64	30	0	Drip	230	85%	8,760
9	7/64	30	0	Drip	230	85%	8,760
10	1/6	30	0	Drip	230	85%	3,600

Calculations for the annual therms savings use the following equation:

Steam Trap Replacement Annual Energy Savings

$$Annual\ \ therms\ Savings = \frac{Steam\ Trap\ Discharge\ Rate \times OpHrs \times h_{fg}}{EC_{Base} \times Therm\ Conversion\ Factor}$$

Where:

Steam Trap Discharge Rate = steam loss from the system (lb/hr)

OpHrs = annual hours system is pressurized (hrs/yr) = 8,760 & 3,600 annual hours

H_{fg} = latent heat of evaporation (BTU/lb)

EC_{Base} = combustion efficiency of boiler (%), 82%

Therm Conversion Factor = 100,000 (BTU/therm)

The discharge rate (lb/hr) was calculated using Armstrong's "Steam Loss Through Failed Trap Calculator" (found here: https://www.armstronginternational.com/knowledge/resources-library/calculators/steam-loss)

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Steam Trap Replacement	5 years

Calculated Savings:

Steam Trap Replacement

Steam Trap Replacement Savings

Steam Trap #	Discharge Rate (lbs/hr)	Percent Failed	Steam Enthalpy (BTU/lb)	Feedwater Enthalpy (BTU/lb)	Therms Savings
1	30	100%	1187	198	3,560
2	42	100%	1173	198	4,921
3	42	100%	1173	198	4,921
4	36	100%	1173	198	4,159
5	36	100%	1173	198	1,709
6	14	100%	1173	198	1,640
7	36	100%	1173	198	4,159
8	14	100%	1173	198	1,640
9	14	100%	1173	198	1,640
10	36	100%	1173	198	1,709
				Total:	**30,059**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Steam Trap Replacement	29,949	30,059	100%	150,293
TOTAL	**29,949**	**30,059**	**100%**	**150,293**

Expected Savings differed from Realized Savings as the Ex-ante values used incorrect input values for inlet steam pressure when calculating the enthalpy of certain steam traps.

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with the project and verified a cost of $34,000. Measure payback is summarized in the table below.

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
30,059	$0.49	$14,728	$34,000	$20,964	$21,041	1.5	0.43

Program	C&I Solutions
Project ID	EA-0000589963
Facility SIC Code	8062 – General Medical Hospital
Measures	Steam Trap Replacement
Annual Consumption	1,141,880 therms

Project Background

The participant is a hospital that received incentives from Summit Utilities for implementing the following:

- ECM #1: Steam Trap Replacement

The site uses steam throughout the facility primarily for three process needs: space heating, domestic water heating, and other process heating loads such as sterilization. Savings will come from repairing the failed steam traps throughout the site's steam system.

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.

Measurement and verification activities include the following assumptions:

- Feedwater temperature is 220°F
- Annual operating hours for the on-site steam system are 8,760 and 3,600 hours
- Combustion efficiency is 85% (for both pre-retrofit and post-retrofit condition)

Steam Trap Replacement

The following table shows relevant failed steam traps parameters required for annual energy savings.

Steam Trap Parameters

Steam Trap #	Orifice Size (in.)	Inlet Pressure (psig)	Outlet Pressure (psig)	Service (Drip/Process)	Feedwater Temperature (°F)	Boiler Efficiency	Operating Hours
1	5/64	12	0	Drip	220	85%	8,760
2	8/73	12	0	Process	220	85%	3,600
3	7/64	12	0	Drip	220	85%	8,760
4	7/64	80	0	Drip	220	85%	8,760
5	5/64	80	0	Drip	220	85%	8,760
6	7/64	30	0	Process	220	85%	3,600
7	2/11	10	0	Drip	220	85%	8,760
8	7/64	20	0	Drip	220	85%	8,760
9	5/64	30	0	Drip	220	85%	3,600
10	1/3	30	0	Process	220	85%	3,600
11	1/3	30	0	Process	220	85%	3,600
12	1/8	30	0	Drip	220	85%	8,760
13	2/11	20	0	Drip	220	85%	8,760
14	5/64	30	0	Drip	220	85%	8,760
15	1/9	100	0	Drip	220	85%	3,600
16	7/64	12	0	Drip	220	85%	8,760

Calculations for the annual therms savings use the following equation:

Steam Trap Replacement Annual Energy Savings

$$Annual\ \ therms\ Savings = \frac{Steam\ Trap\ Discharge\ Rate \times OpHrs \times h_{fg}}{EC_{Base} \times Therm\ Conversion\ Factor}$$

Where:

Steam Trap Discharge Rate = steam loss from the system (lb/hr)

OpHrs = annual hours system is pressurized (hrs/yr) = 8,760 & 3600 annual hours

H_{fg} = latent heat of evaporation (BTU/lb)

EC_{Base} = combustion efficiency of boiler (%), 82%

Therm Conversion Factor = 100,000 (BTU/therm)

The discharge rate (lb/hr) was calculated using Armstrong's "Steam Loss Through Failed Trap Calculator" (found here: https://www.armstronginternational.com/knowledge/resources-library/calculators/steam-loss)

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Steam Trap Replacement	5 years

Calculated Savings:

Steam Trap Replacement

Steam Trap Replacement Savings

Steam Trap #	Discharge Rate (lbs/hr)	Percent Failed	Steam Enthalpy (BTU/lb)	Feedwater Enthalpy (BTU/lb)	Therms Savings
1	4	100%	1162	188	402
2	9	100%	1162	188	371
3	12	100%	1162	188	1,205
4	30	100%	1187	188	3,088
5	15	100%	1187	188	1,544
6	9	100%	1173	188	375
7	15	100%	1161	188	1,503
8	11	100%	1168	188	1,110
9	7	100%	1173	188	292
10	140	100%	1173	188	5,837
11	140	100%	1173	188	5,837
12	18	100%	1173	188	1,826
13	27	100%	1168	188	2,725
14	7	100%	1173	188	710
15	37	100%	1191	188	1,571
16	12	100%	1162	188	1,205
				Total:	**29,601**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings	Annual Water Gallons Savings	Lifetime Water Gallons Savings
Steam Trap Replacement	29,601	29,601	100%	148,007	111,890	N/A
TOTAL	**29,601**	**29,601**	**100%**	**148,007**	**111,890**	**N/A**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $13,500. Measure payback is summarized in the table below.

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
29,601	$0.47	$13,912	$13,500	$13,500	$20,721	2.6	1.03

Program	C&I Solutions
Project ID	EA-0000589963
Facility SIC Code	8062 – General Medical and Surgical Hospitals
Measures	Pipe Insulation Steam Leaks
Annual Consumption	1,141,880 therms

Project Background

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

- ECM #1 – Pipe and Tank Insulation
- ECM #2 – Steam Leak Repair

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 include the following assumptions:

- Annual operating hours for the site are 5,800 hours
- Combustion efficiency is 82.9% (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 include the following assumptions:

- Insulation thickness: 2 in
- Insulation material type: Foam Glass and 850F MF BLANKET, Type IV, C553-13
- Process temperature is 200°F and 350°F
- The average annual ambient air temperature is 67.8°F

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 2 in insulation (post-retrofit). The software required these inputs: process temperature, ambient temperature, pipe size, base metal, insulation, and jacket material. Annual therms savings was calculated using the following equation:

Equation 1. Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } 100,000 \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = number of hours facility operates annually

Boiler Efficiency

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	Steam Vault	Pipe		15	2
2	Steam Vault	Valve or Fitting	4	3	
3	Steam Vault	Pipe		64	3
4	Steam Vault	Valve or Fitting	13	3	
5	Steam Vault	Pipe		35	6
6	Steam Vault	Valve or Fitting	4	4	
7	Steam Vault	Pipe		22	8
8	Steam Vault	Valve or Fitting	8	4	
9	Steam Vault	Pipe		3	10
10	Steam Vault	Valve or Fitting	1	4	
11	Steam Vault	Pipe		17	1
12	Steam Vault	Valve or Fitting	5	2	
13	Steam Vault	Pipe		7	1
14	Steam Vault	Valve or Fitting	3	2	
15	Steam Vault	Pipe		24	2
16	Steam Vault	Valve or Fitting	4	3	

Steam Leak Repairs

An alternative method was used to calculate the steam loss before steam leak repairs. The more traditional method equates the orifice diameter flow rate, using the orifice diameter of the leak and the system's absolute pressure. Due to the difficulty in determining the exact diameter of an orifice leak, the alternate method was used.

Calculations follow the methods established by G.G. Rajan for a steam leak rate as a function of the length of an active steam plume.

The annual energy savings from repairing a steam leak is calculated with the following equation:

Steam Leak Repair Annual Energy Savings

$$Annual\ Energy\ Savings\ (therms) = \frac{Heat\ Loss\ \left(\frac{Btu}{hr}\right) x\ Annual\ Operating\ Hours\ \left(\frac{hrs}{yr}\right)}{Boiler\ Efficiency(\%)\ x\ 100{,}000\ \frac{Btu}{therm}}$$

Where:

Annual Operating Hours = number of hours facility operates annually = 8,760 hours

Boiler Efficiency = 81.0%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

The following table shows relevant steam leak parameters required for annual energy savings calculations.

Steam Leak Parameters

Steam Leak #	Description	Mass Flow Rate (well rounder orifice)	Mass Flow Rate (sharp edged orifice)	Boiler Efficiency
1	Leak 1	1,356	813	83%
2	Leak 2	54	32	83%
3	Leak 3	54	32	83%
4	Leak 4	54	32	83%

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years
Steam Leaks	10 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	Steam Vault	Pipe	350	140	17	119
2	Steam Vault	Valve or Fitting	350	93	14	58
3	Steam Vault	Pipe	350	231	22	862
4	Steam Vault	Valve or Fitting	350	2,297	158	5,653
5	Steam Vault	Pipe	350	1,858	136	3,874
6	Steam Vault	Valve or Fitting	350	1,442	111	1,273
7	Steam Vault	Pipe	350	786	69	1,014
8	Steam Vault	Valve or Fitting	350	547	53	1,003
9	Steam Vault	Pipe	350	140	16	24
10	Steam Vault	Valve or Fitting	350	93	12	21
11	Steam Vault	Pipe	200	231	20	232
12	Steam Vault	Valve or Fitting	200	547	49	394
13	Steam Vault	Pipe	200	786	64	325
14	Steam Vault	Valve or Fitting	200	1,442	103	529
15	Steam Vault	Pipe	200	1,588	128	2,253
16	Steam Vault	Valve or Fitting	200	2,297	148	1,667
					Total:	**19,301**

Steam Leak Repairs

Steam Leak Repairs Savings

Steam Leak #	Description	Mass Flow Rate (well rounder orifice)	Mass Flow Rate (sharp edged orifice)	Boiler Efficiency	Therms Savings
1	Leak 1	1,356	813	83%	50,625
2	Leak 2	54	32	83%	2,025
3	Leak 3	54	32	83%	2,025
4	Leak 4	54	32	83%	2,025
				Total:	**56,701**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe and Tank Insulation	19,381	19,301	100%	386,020
Steam Leaks	56,700	56,700	100%	567,000
TOTAL	**76,081**	**76,001**	**100%**	**953,020**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $195,000. Measure payback is summarized in the table below.

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
76,001	$0.470	$35,720	$195,000	$53,257	$53,201	2.2	5.5

Program **C&I Solutions**

Project ID	EA-0000392669
Facility SIC Code	2000-3999 Manufacturing
Measures	HVAC Controls – Schedule Optimization

Project Background

The participant is a manufacturing facility that received incentives from Summit Utilities 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 27 heaters. The initial heaters would supply heat to the facility any time the ambient air temperature dropped below 70°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 70°F, the heaters would then supply heat to the facility when it was unoccupied whenever the ambient air temperature fell below 55°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:

Unoccupied Supply Air Temperature

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

Mixed Air Temperature

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

Occupied BTUs

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

Unoccupied BTUs

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

Therms Savings

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

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

Measure Life

Estimated Useful Life by Measure

Measure	EUL
HVAC Controls	11 years

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
HVAC Controls	6,747	5,226	77%	57,486
Total	**6,747**	**5,226**	**77%**	**57,486**

Program	C&I Solutions
Project ID	EA-0000362789
Facility SIC Code	3355 – Aluminum Rolling and Drawing
Measures	Burner Upgrade
Annual Consumption	408,101 therms

Project Background

The participant is a manufacturing facility that received incentives from Summit Utilities for implementing the following:

- ECM #1: Annealing oven burner upgrade

M&V Methodology

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

The analysis used three weeks of production data and natural gas consumption from the pre-retrofit period and the post retrofit period to calculate the annual natural gas usage for the pre-retrofit period and post retrofit period.

Savings Calculations

The following formulas were used to calculate the annual therm savings associated with the annealing oven burner upgrade.

$$Average\ SMCFH = AVERAGEIFS(Average\ Range, Criteria\ Range, Criteria) \quad (1)$$

Where:

Average Range: Rb10 Meter 1, 2 at interval

Criteria Range: same as Average Range

Criteria: >0

$$Convert\ SCCFH = Average\ SMCFH\ x\ 10\left(\frac{CCF}{MCF}\right) \quad (2)$$

$$CCF = Convert\ SCCFH\ x\ Period\ Length\ \left(\frac{hrs}{day}\right) \quad (3)$$

Where:

Pre-Period Length: 12hrs/day, interval between data points

Post Period Length: 1-hour intervals

$$Daily\ CCF\ \left(\frac{CCF}{day}\right) = SUMIFS(Sum\ Range, Criteria\ Range, Criteria) \quad (4)$$

Where:

Sum Range: CCF Range (Corrected Data Tab #1)

Criteria Range: Date Range

Criteria: >= Date

$$Avg.\frac{CCF}{Day} = AVERAGEIFS(Average\ Range,\ Criteria\ Range_{1-2}, Criteria_{1-2}) \quad (5)$$

Where:

Average Range: Daily CCF Range

Criteria Range1-2: Date Range

Criteria1: >= Date Start (Avg. Range)

Criteria2: <= Date End

$$Annual\frac{CCF}{yr} = Avg.\frac{CCF}{day}x\ AOD\ \left(\frac{Days}{yr}\right) \quad (6)$$

Where:

AOD: 350 days/yr

Savings Calculations

$$Annual\ Savings = Pre\ Annual\ Energy\ Use\ \left(\frac{CCF}{yr}\right) - Post\ Annual\ Energy\ Use\ \left(\frac{CCF}{yr}\right) \quad (7)$$

Where:

Pre-Annual Energy Usage: Pre-Annual CCF/yr

Post-Annual Energy Usage: Post-Annual CCF/yr

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Oven burner upgrade	15 years

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Oven burner upgrade	137,884	137,884	100%	2,068,267
TOTAL	**137,884**	**137,884**	**100%**	**2,068,267**

Expected Savings differed from Realized Savings as the Ex-ante values used incorrect input values for inlet steam pressure when calculating the enthalpy of certain steam traps.

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with the project and verified a cost of $96,519. Measure payback is summarized in the table below.

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
137,884	$0.56	$77,215	$96,519	$96,519	$96,519	0.5	1

Program	C&I Solutions
Project ID	EA-0000362919
Facility SIC Code	2951 - Asphalt Paving Mixtures and Blocks
Measures	Pipe Insulation
Annual Consumption	303,875 therms

Project Background

The participant is an asphalt manufacturer that received incentives from Summit Utilities for:

- ECM #1 – Pipe, Valve and Fitting Insulation

The pipe insulation measure saved energy by reducing the heat loss from 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 include the following assumptions:

- Annual operating hours for the site are 1,500 hours
- Combustion efficiency is 85.21% (for both pre-retrofit and post-retrofit condition)
- The average annual ambient air temperature is 61.8°F. This is based on the average temperature from the TMY3 data for Little Rock, AR.
- The average windspeed for measure outdoors is 7.09 MPH. This is based on average TMY3 data for Little Rock, AR.

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 include the following assumptions:

- Insulation thickness: 1 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14, 850 MF Blanket, Type IV, C553-13

- Insulation thickness: 1/8 in
- Insulation material type: Cellular Glass, Type II, PIPE and TUBE, C552-16
- Process temperature is 350°F
- The average annual ambient air temperature is 61.8°F
- The average wind speed is 7.09 mph

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 1 in and 1/8 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } \mathbf{100,000} \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = 1,500 hours

Boiler Efficiency = 85.21%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	6" pipe	Pipe	1		6
2	3" pipe	Pipe	1		3
3	2" pipe	Pipe	1		2
4	1" pipe	Pipe	1		1
5	3" fitting	Valve or Fitting	1	3.2	
6	2" flange	Valve or Fitting	1	2.8	
7	6" flange	Valve or Fitting	1	3.7	
8	4" flange	Valve or Fitting	1	3.4	
9	3" filter pot	Valve or Fitting	1	3.2	
10	1" flex hose	Pipe	1		1
11	2" flex hose	Pipe	1		2
12	3" pump	Valve or Fitting	1	3.2	

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	6" pipe	Pipe	350	2,275	202	7,298
2	3" pipe	Pipe	350	1,435	115	2,789
3	2" pipe	Pipe	350	1,101	84	1,789
4	1" pipe	Pipe	350	747	55	2,193
5	3" fitting	Valve or Fitting	350	1,435	115	441
6	2" flange	Valve or Fitting	350	1,101	84	762
7	6" flange	Valve or Fitting	350	2,275	202	271
8	4" flange	Valve or Fitting	350	1,715	137	2,450
9	3" filter pot	Valve or Fitting	350	1,435	111	74
10	1" flex hose	Pipe	350	747	273	668
11	2" flex hose	Pipe	350	1,101	442	116
12	3" pump	Valve or Fitting	350	1,435	111	221
					Total:	**19,072**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe and Tank Insulation	19,534	19,072	98%	381,435
TOTAL	**19,534**	**19,072**	**98%**	**381,435**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $74,432. Measure payback is summarized in the table below.

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
19,072	$0.745	$14,553	$94,322	$13,673	$13,350	3.3	6.5

Program	C&I Solutions
Project ID	EA-0000362784
Facility SIC Code	2096 – Potato Chips, Corn Chips, and Similar Snacks
Measures	Process Line Upgrade
Annual Consumption	447,028 therms

Project Background

The participant is a food manufacturer that received incentives from Summit Utilities for:

- ECM #1 – Process Line Upgrade

The custom upgrade measure saved energy by reducing the overall size of the cooking and frying equipment and by utilizing waste heat from the oxidizer to heat cooking oil.

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 include the following assumptions:

- The facility operates 320 days/yr
- Totalizer readings on the main gas lines were correctly set up and accurate
- Facility energy consumption does not correlate to weather.
- The customer used adjusted baseline and post totalizer readings, trimmed to 28 days. Final analysis used all totalizer reading data points provided.

Process Line Upgrade Energy Savings

Energy Intensity, based on system energy usage and production of product, was calculated to determine the total energy savings produced by the measure installation. Annual therms savings was calculated using the following equations:

Baseline

$$EI_{pre}\left(\frac{CCF}{yr}\right) = EI_{pre}\left(\frac{CCF}{yr}\right)_{production} + EI_{pre}\left(\frac{CCF}{yr}\right)_{NPD}$$

$$EI_{pre}\left(\frac{CCF}{yr}\right)_{production} = \frac{\sum Usage\left(\frac{CCF}{day}\right)}{\sum Production\ (lbs) \times Daily\ Production\ (lbs) \times Prod.days\left(\frac{Days}{yr}\right)}$$

$$EI_{pre}\left(\frac{CCF}{yr}\right)_{NPD} = \sum Usage\left(\frac{CCF}{day}\right) \times Days_{NPD}$$

Where:

$EI_{pre\text{-}production}$ = Production Day Energy Intensity during baseline period

$EI_{pre\text{-}NPD}$ = Non-Production Day Energy Intensity during baseline period

Post

$$EI_{post}\left(\frac{CCF}{yr}\right) = EI_{Post}\left(\frac{CCF}{yr}\right)_{production} + EI_{post}\left(\frac{CCF}{yr}\right)_{NPD}$$

$$EI_{post}\left(\frac{CCF}{yr}\right)_{production} = \frac{\sum Usage\left(\frac{CCF}{day}\right)}{\sum Production\ (lbs) \times Daily\ Production\ (lbs) \times Prod.days\left(\frac{Days}{yr}\right)}$$

$$EI_{post}\left(\frac{CCF}{yr}\right)_{NPD} = \sum Usage\left(\frac{CCF}{day}\right) \times Days_{NPD}$$

Where:

$EI_{post\text{-}production}$ = Production Day Energy Intensity during post period

$EI_{post\text{-}NPD}$ = Non-Production Day Energy Intensity during post period

Total

$$\boldsymbol{Annual\ Therms\ Savings}\left(\frac{\boldsymbol{CCF}}{\boldsymbol{yr}}\right) = \boldsymbol{EI_{pre}}\left(\frac{\boldsymbol{CCF}}{\boldsymbol{yr}}\right) - \boldsymbol{EI_{post}}\left(\frac{\boldsymbol{CCF}}{\boldsymbol{yr}}\right)$$

Where:

EI_{pre} = Energy Intensity during baseline period

EI_{post} = Energy Intensity during post period

Process Line Savings

Reporting Period	Energy Intensity (CCF/yr)		NDP (days)	Production (Days)	Daily Production	Total (CCF/yr)
	Production	NPD				
Baseline	446,749	278	39	326	88,000	447,028
Post	175,286	2,387	24	341	88,000	177,673

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Process Line Upgrade	15 years

Calculated Savings:

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual Therms Savings	Realized Annual Therms Savings	Realization Rate	Lifetime Therms Savings
Process Line Upgrade	286,325	269,354	94%	4,040,315
Total	**286,325**	**269,354**	**94%**	**4,040,315**

The realization rate of this project is 94%. This lower realization rate is due to the total day difference of data points used in the savings calculations. The customer used an adjusted baseline and post totalizer readings, trimmed to 28 days. Final analysis used all totalizer reading data points provided.

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $200,427. Measure payback is summarized in the table below.

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
269,354	$0.58	$156,225	$200,427	$200,427	$188,549	0.6	1.3

Program	C&I Solutions
Project ID	EA-0000403527
Facility SIC Code	2043 - Cereal Breakfast Foods
Measures	Process Line Upgrade
Annual Consumption	1,058,148 therms

Project Background

The participant is a food manufacturer that received incentives from Summit Utilities for:

- ECM #1 – Boiler Burner Controls

The custom, upgrade measure saved energy by ensuring the appropriate air to fuel ratio is being maintained, improving the boiler's efficiency.

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 include the following assumptions:

- The facility operates 24 hours a day, 7 days a week
- There are 2 boilers in the facility that produce 120 psig and 75 psig to the systems high and low pressure lines
- Pre and Post efficiencies were measured accurately

Energy Savings

Energy Intensity was calculated to determine the total energy savings produced by the measure installation. This was done by finding the CCF usage per day through compiled usage data supplied by the customer. Annual therms savings was calculated using the following equation:

$$Total\ Annual\ Savings\ \left(\frac{CCF}{yr}\right) = EI\left(\frac{CCF}{day} \times 365\ days\right) \times \left(\frac{1}{\eta_{pre}} - \frac{1}{\eta_{post}}\right)$$

Where:

EI = Energy Intensity of the system based off daily logged data

η_{pre} = boiler efficiency baseline conditions

η_{post} = boiler efficiency post conditions

Burner Controls Savings

Daily Usage (CCF/day)	Energy Intensity (CCF/year)	Boiler Eff. (Pre)	Boiler Eff. (Post)	Total (CCF/yr)
2,939	1,058,148	77.6%	80.9%	55,622

Measure Life

Estimated Useful Life by Measure

Measure	EUL
Boiler Burner Controls	20 years

Calculated Savings:

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual Therms Savings	Realized Annual Therms Savings	Realization Rate	Lifetime Therms Savings
Boiler Burner Controls	55,622	55,622	100%	1,112,449
TOTAL	**55,622**	**55,622**	**100%**	**1,112,449**

Program	C&I Solutions
Project ID	EA-0000625288
Facility SIC Code	2951 - Asphalt Paving Mixtures and Blocks
Measures	Pipe Insulation
Annual Consumption	1,417,580 therms

Project Background

The participant is an asphalt manufacturer that received incentives from Summit Utilities for:

- ECM #1 – Pipe Insulation

The pipe insulation measure saved energy by reducing the heat loss from 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 include the following assumptions:

- Annual operating hours for the site are 8,592 hours
- Combustion efficiency is 82% (for both pre-retrofit and post-retrofit condition)
- The average annual ambient air temperature is 75°F. This is based on the average temperature from the TMY3 data for Little Rock, AR.
- The average windspeed for measure outdoors is 7.09 MPH. This is based on average TMY3 data for Little Rock, AR.

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 include the following assumptions:

- Insulation thickness: 2 in
- Insulation material type: 850F MF Pipe and Tank, Type IIIB, C1393-14
- Process temperature is 240°F, 290°F, 300°F, 330°F, and 340°F

- The average annual ambient air temperature is 75°F
- The average wind speed is 7.09 mph

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 2 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:

Pipe Insulation Installation Annual Energy Savings

$$\textbf{Annual Therms Savings} = \frac{\textbf{Heat Loss } \left(\frac{\textbf{Btu}}{\textbf{hr}}\right) \textbf{ x Annual Operating Hours } \left(\frac{\textbf{hrs}}{\textbf{yr}}\right)}{\textbf{Boiler Efficiency x } 100,000 \left(\frac{\textbf{BTU}}{\textbf{CCF}}\right)}$$

Where:

Annual Operating Hours = 8,592 hours

Boiler Efficiency = 82%

100,000 Btu/CCF = conversion factor (BTU/yr to CCF/yr)

Pipe/Valve/Tank Insulation Parameters

Entry #	Description	Pipe or Valve	Quantity	Pipe Length / Valve Equivalent Length (ft)	Diameter (in)
1	Steam Return Line	Pipe	1	9	1
2	Oil Line	Pipe	1	1	2
3	DT Fan Steam	Pipe	1	7	1
4	DT Steam Tray	Pipe	1	19	1
5	DT Main Steam Line	Pipe	1	14	4
6	Refinery Main Steam Line	Pipe	1	3	3
7	Refinery Main Steam Line	Pipe	1	3	2
8	DT Main Steam Line	Pipe	1	3	8
9	DT Main Steam Line	Pipe	1	12	4

Measure Life

Table 19. Estimated Useful Life by Measure

Measure	EUL
Pipe and Tank Insulation	20 years

Calculated Savings:

Pipe Insulation

Pipe Insulation Annual Energy Savings

Entry #	Description	Pipe or Valve	Temperature (°F)	Pre Heat Loss	Post Heat Loss	Therms Savings
1	Steam Return Line	Pipe	240	154	19	120
2	Oil Line	Pipe	240	263	27	12
3	DT Fan Steam	Pipe	300	234	28	151
4	DT Steam Tray	Pipe	330	279	33	490
5	DT Main Steam Line	Pipe	340	924	75	1,245
6	Refinery Main Steam Line	Pipe	290	541	48	155
7	Refinery Main Steam Line	Pipe	290	377	37	107
8	DT Main Steam Line	Pipe	340	1720	125	501
9	DT Main Steam Line	Pipe	340	924	75	1,067
					Total:	**3,849**

Overall project savings are as follows:

Overall Project Savings

Measure	Expected Annual therms Savings	Realized Annual therms Savings	Realization Rate	Lifetime therms Savings
Pipe and Tank Insulation	3,848	3,849	100%	76,982
TOTAL	**3,848**	**3,849**	**100%**	**76,982**

Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of $74,432. Measure payback is summarized in the table below.

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
3,849	$0.513	$1,975	$11,823	$2,694	$2,694	2.5	6.0

15 Appendix B: Deferred Replacement Cost Calculations

This appendix presents the calculations of deferred replacement costs for residential and commercial tankless water heaters.

The two calculations are based off of a full-install cost of $614 for a baseline storage tank unit and an incremental cost of $605 for a tankless unit. These values cite the Illinois TRM.

	Inputs		
Measure Type=	Res Tankless (ROB + NC)		
Nominal Discount Rate=	5.66%		
Inflation Rate=	1.9%		
Real Discount Rate=	3.7%		
	Program	**Baseline**	
Equipment Type=	Tankless WH	Storage WH	
Effective UsefulLife=	20	11	
Remaining Useful Life=			
PW(EUL)=	13.97	8.91	
PW(RUL)=			
Installed Cost=	$1,219	$614	
Deferred Replacement Cost=		$ 348.90	
PWF Formula=		$ 348.90	
Incremental Cost=	$ 256.10		

Assumptions:	Tech Cost	Labor	Total Cost
Tankless Year 1 Full Cost	$1,219		$1,219
Storage Tank 2018 Cost	$614		$614
Source: Illinois TRM			

Figure 15-1 Residential Tankless WH Deferred Replacement Cost Calculation

	Inputs	
Measure Type=	C&I Tankless (ROB + NC)	
Nominal Discount Rate=	5.66%	
Inflation Rate=	1.9%	
Real Discount Rate=	3.7%	
	Program	**Baseline**
Equipment Type=	Tankless WH	Storage WH
Effective UsefulLife=	20	15
Remaining Useful Life=		
PW(EUL)=	13.97	11.36
PW(RUL)=		
Installed Cost=	$1,219	$614
Deferred Replacement Cost=		$ 140.91
PWF Formula=		$ 140.91
Incremental Cost=	$ 464.09	

Assumptions:	**Tech Cost**	**Labor**	**Total Cost**
Tankless Year 1 Full Cost	$1,219		$1,219
Storage Tank 2018 Cost	$614		$614
Source: Illinois TRM			

Figure 15-2 C&I Tankless WH Deferred Replacement Cost Calculation

	Inputs	
Measure Type=	Furnace Early Replacement	
Nominal Discount Rate=	5.66%	
Inflation Rate=	1.9%	
Real Discount Rate=	3.7%	
	Program	**Baseline**
Equipment Type=	HE Furnace	SE Furnace
Effective UsefulLife=	20	20
Remaining Useful Life=		5
PW(EUL)=	20.00	20.00
PW(RUL)=		$4.49
Installed Cost=	$ 2,548	$ 2,011
Deferred Replacement Cost=		$ 1,364.59
PWF Formula=		$ 1,559
	$ 1,183.41	

Figure 15-3 C&I Furnace early Retirement Deferred Replacement Cost Calculation

16 Appendix C: Sample TRM Calculations

16.1.1 Residential Furnaces (TRM V9.0 Section 2.1.3)

According to Arkansas TRM V9.0, savings for residential furnaces are calculated as follows:[31]

$$Annual\ Therm\ Savings\ =\ Heat\ load\ \times \left({}^{1}/_{AFUE_{base}}\ -\ {}^{1}/_{AFUE_{eff}}\right)$$

$$Heat\ load\ =\ {}^{therms}/_{site\ area}/year \times site\ area$$

Site area = ft.^{2} of the project site. If unknown, use installed capacity (BTUh)/30 (BTUh/ft^2).

$AFUE_{base}$ = baseline efficiency of the furnace, 80% AFUE.

$AFUE_{eff}$ = efficiency of the new furnace installed, in AFUE.

Table 16-1 summarizes the heating load multipliers per square foot from the TRM V9.0.

Table 16-1: TRM V9.0 Annual Furnace Heating Load

Vintage	Heating Load (Therms/Ft.2/Year			
	Zone 9 – Fayetteville	Zone 8 – Fort Smith	Zone 7 – Little Rock	Zone 6 – El Dorado
1979 & Earlier	.404	.360	.336	.296
1980-1989	.303	.270	.252	.222
1990-1999	.202	.180	.168	.148
2000 & Later	.152	.135	.126	.111

Example savings calculations for a home in Zone 8 are as follows:

- Retrofit – 90,000 Input BTU furnace, 95% AFUE
- Output BTU = 90,000 x .95 = 85,500
- Square Feet = 85,500 / 30 = 2,450
- Year built: 1986

$$Retrofit\ Therms\ Savings = 2{,}450 ft.^2 \times .270 \frac{Therms}{ft.^2} \times \left(\frac{1}{.80} - \frac{1}{.95}\right) = 130.56\ Therms$$

The same furnace in a new construction project would save:

$$NC\ Therms\ Savings = 2{,}850 ft.^2 \times .135 \frac{Therms}{ft.^2} \times \left(\frac{1}{.80} - \frac{1}{.95}\right) = 75.94\ Therms$$

[31] Arkansas TRM V9.0 Volume 2, Page 44

16.1.2 Residential Water Heater Replacement (TRM V9.0 Section 2.3.1)

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.

In TRM V9.0 Savings are calculated as:[32]

$$therm_{Savings} = \frac{\rho \times C_p \times V \times (T_{SetPoint} - T_{Supply}) \times \left(\frac{1}{EF_{pre}} - \frac{1}{EF_{post}}\right)}{Conversion\ Factor}$$

ρ = Water density, 8.33 lbs./gal.
C_p = Specific heat of water, 1 BTU/lb·°F
V = Estimated annual hot water use (gal per year)
$T_{SetPoint}$ = Water heater set point, if unavailable, use 120°F
T_{Supply} = Average supply water temperature
EF_{pre} = Baseline value
EF_{post} = Energy Factor of new water heater
$Conversion\ Factor$ = 100,000 BTU = 1 therm

Baseline energy factors are summarized in Table 16-2.

Table 16-2: Residential Water Heating Baseline Uniform Energy Factors

Draw Pattern	Equivalent Gallons	Baseline UEF
Very Small	20	.3056
Low	30	.5412
Medium	40	.5803
High	50	.6270

Volume estimates are provided in Table 16-3.

Table 16-3: TRM V9.0 Estimated Annual Hot Water Use

Weather Zone	40 Gal.	50 Gal.	65 Gal.	80 Gal.
9	18,401	20,911	25,093	30,111
8	18,331	20,831	24,997	29,996
7	18,267	20,758	24,910	29,892
6	17,815	20,245	24,293	29,152

[32] Arkansas TRM V9.0, Volume 2. Pg. 122-135

Supply water temperatures are presented in Table 16-4

Table 16-4: Residential Water Supply Inlet Temperatures

Weather Zone		Supply Water Temp
9	Fayetteville	65.6
8	Fort Smith	66.1
7	Little Rock	67.8
6	El Dorado	70.1

Example savings calculations are as follows:

- Retrofit – 199,000 Input BTU Tankless Water Heater, 96% UEF
- High Draw Pattern
- Location: Fort Smith, Zone 8.

$$Therms\ Savings = \frac{1 \times 8.33 \times 20{,}831 \times (120 - 66.1) \times \left(\frac{1}{.627} - \frac{1}{.96}\right)}{100{,}000} = 51.74\ Therms$$

16.1.3 Smart Thermostats (TRM V9.0 Section 2.1.12)

The savings multipliers for smart thermostats are shown in Table 16-5[33].

Table 16-5: Smart Thermostat Deemed Savings Factors

Baseline	Therms/Ft.2	kWh/Ft.2
Manual	.037	.450
Programmable	.009	.113
Default	.033	.399

16.1.4 Commercial Furnaces (TRM V9.0 Section 3.1.9)

Therms savings calculations for commercial furnaces apply more facility-specific information than the residential methodology. Savings were calculated as follows:[34]

$$Therms\ Savings = \frac{BTU\ Capacity * EFLH_H * \left(\frac{1}{Effic_{pre}} - \frac{1}{Effic_{post}}\right)}{100{,}000\ Therms/BTU}$$

The TRM V9.0 EFLH values are summarized in Table 16-6.

[33] AR TRM V9.0 Vol 2.0 Pg. 83

[34] Arkansas TRM V9.0, Pg. 252

Table 16-6: EFLH Values[35]

Building Type	Zone 6	Zone 7	Zone 8	Zone 9
Assembly	615	854	915	1032
College/University	674	936	1002	1130
Fast Food Restaurant	287	439	472	549
Full Menu Restaurant	178	321	362	438
Grocery Store	692	941	1001	1129
Health Clinic	641	878	915	1045
Lodging	391	589	637	722
Large Office (>30k Ft^2)	816	1020	1060	1157
Small Office (<30k Ft^2)	351	534	564	644
Religious Worship	575	798	854	963
Retail	781	1043	1133	1287
School	777	1030	1094	1236

For example, if a Small Office in Fort Smith (Zone 8) installed a 70,000 BTU 96% AFUE Furnace, the resulting therms savings are calculated as:

$$Therms\ Savings = \frac{70{,}000\ BTU * 564\ EFLH * \left(\frac{1}{.80} - \frac{1}{.96}\right)}{100{,}000\ BTU/Therm} = 82.24\ Therms$$

16.1.5 Commercial Water Heaters (TRM V9.0 Section 3.3.1)

Therms savings for commercial water heaters are calculated as:[36]

$$therms\ Savings = \frac{\rho * C_P * V * \left(T_{SetPoint} - T_{Supply}\right) * \left(\frac{1}{EF_{pre}} - \frac{1}{EF_{post}}\right) * Days/Year}{Conversion\ Factor}$$

P = Water Density, 8.33 lbs./Gallon

C_P = Specific Heat of Water, 1 BTU/Lb. F

V = Average daily hot water use (gallons)

$T_{setpoint}$ = Water Heater setpoint, 140 deg. F

T_{supply} = Supply water temperature, 58 deg. F

EF_{pre} = Energy factor of existing water heater (.62 - .0019V)

[35] Arkansas TRM V9.0 Volume 2, Table 478. Pg. 526.

[36] Arkansas TRM V9.0, Volume 2. Pg. 357-368

EF_{post} = Energy factor of installed water heater

Days/Year = Days per year of operation

Conversion Factor = 100,000 BTU = 1 therm

Table 16-7 presents the volume and days of usage values for a facility by square footage.[37]

Table 16-7: Hot Water Requirements by Facility Size

Building Type	Gallons / Unit / Day	Unit	Units / 1,000 ft.2	Applicable Days / Year	Gallons / 1,000 ft.2 / Day
Small Office	1	Person	2.3	250	2.3
Large Office	1	Person	2.3	250	2.3
Fast Food Rest.	.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	.5	250	1.0
Elementary School	.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	342.0
Motel	20	Unit (Room)	5	365	100.0
Hotel	14	Unit (Room)	2.2	365	30.8
Other	1	Employee	.7	250	.7

Table 16-8 presents the volume and days of usage values by unit produced or person served.

Table 16-8: 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

[37] Ibid

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

16.1.6 Commercial Faucet Aerators (TRM V9.0 Section 3.3.2)

Savings are calculated as follows:[38]

$$Annual\ Therms\ = [(F_B * U_B) - (F_P * U_P) * Days * (T_H - T_C) * C_H * C_G / Eff_G]$$

The inputs for this equation are defined in Table 16-9.

Table 16-9: DI Aerator Savings Calculation Parameters

Parameter	Description	Value
F_B	Baseline Flow Rate (GPM)	2.2
F_P	Post Flow Rate (GPM)	≤ 1.5

[38] Arkansas TRM V9.0, Volume 2. Pg. 369-372

Days	Annual operating days for the facility[39]	
	Prison	365
	Hospital, Nursing Home	365
	Dormitory	274
	Multifamily	365
	Lodging	365
	Commercial	250
	School	200
T_C	Average supply (cold) water temperature (deg. F)	Zone 9: 65.6
		Zone 8: 66.1
		Zone 7: 67.8
		Zone 6: 70.1
T_H	Average mixed hot water temperature (deg. F)	105
U_B	Baseline water Usage Duration	
	Prison	30 min/day/unit
	Hospital, Nursing Home	3 min/day/unit
	Dormitory	30 min/day/unit
	Multifamily	3 min/day/unit
	Lodging	3 min/day/unit
	Commercial	30 min/day/unit
	School	30 min/day/unit
U_P	Post Water Usage Duration (assumed)	= U_B
C_H	Unit Conversion: 8.33 BTU/Gallons/deg. F	8.33
C_G	Unit Conversion: 1 Therm/100,000 BTU	1/100,000
Eff_G	Efficiency of Gas Water Heater	.8

These values translate into per-faucet savings values by facility type, detailed in Table 16-10 and Table 16-11 for 1.0 and 0.5 GPM aerators, respectively.[40]

Table 16-10: 1.0 GPM Commercial Aerator Savings

Facility Type	Fayetteville (Zone 9)	Fort Smith (Zone 8)	Little Rock (Zone 7)	El Dorado (Zone 6)
Prison	53.91	53.22	50.90	47.75
Hospital / Nursing Home	5.35	5.32	5.09	4.78
Dormitory	40.47	39.95	38.21	35.85

[39] For facilities that operate year-round: conservatively assume operating days of 360/year; for schools open weekdays except summer: 360 x (5/7) x (9/12) = 193; for dormitories with few occupants in the summer: 360 x (9/12) = 270; and for normal commercial buildings: 360 x (5/7) = 257

[40] Table values interpolated based on data in Arkansas TRM V9.0, Volume 2. Pg. 369-372

Multifamily	5.35	5.32	5.09	4.78
Lodging	5.35	5.32	5.09	4.78
Commercial	36.92	3645	34.86	32.71
School	29.54	29.16	27.89	26.16

Table 16-11: 0.5 GPM Commercial Aerator Savings

Facility Type	Fayetteville (Zone 9)	Fort Smith (Zone 8)	Little Rock (Zone 7)	El Dorado (Zone 6)
Prison	76.37	75.40	72.10	67.65
Hospital / Nursing Home	7.64	7.54	7.21	6.76
Dormitory	57.33	56.60	54.13	50.78
Multifamily	7.64	7.54	7.21	6.76
Lodging	7.64	7.54	7.21	6.76
Commercial	52.31	51.64	49.39	46.33
School	41.85	41.31	39.51	37.07

16.1.7 Pre-Rinse Spray Valves (TRM V9.0 Section 3.8.11)

Low-flow pre-rinse spray valves PRSVs were also direct-installed at a wide range of facility types with food service applications. The savings per unit for these were calculated as follows:[41]

$$Annual\ Therms = [(F_B * U_B) - (F_P * U_P)] * Days * (T_H - T_C) * C_H * C_G / Eff_G$$

$$Peak\ Therms = P * [(F_B * U_B) - (F_P * U_P)] * (T_H - T_C) * C_H * C_G / Eff_G$$

Table 16-12 presents the definition of these parameters.[42]

Table 16-12: Pre-Rinse Spray Valves Savings Calculation Parameters

Parameter	Description	Value
F_B	Baseline Flow Rate (GPM)	2.25
F_P	Post Flow Rate (GPM)	1.28

[41] Arkansas TRM V9.0, Volume 2. Pg. 514-517

[42] Ibid

Days	Annual operating days for the facility43	
	Fast Food Restaurant	365
	Casual Dining Restaurant	365
	Institutional	365
	Higher Education	274
	School / K-12	200
TC	Average supply (cold) water temperature (deg. F)	Zone 9: 65.6
		Zone 8: 66.1
		Zone 7: 67.8
		Zone 6: 70.1
TH	Average mixed hot water temperature (deg. F)	120
U_B	Baseline water Usage Duration	
	Fast Food Restaurant	45 min/day/unit
	Casual Dining Restaurant	105 min/day/unit
	Institutional	210 min/day/unit
	Higher Education	210 min/day/unit
	School / K-12	105 min/day/unit
U_P	Post Water Usage Duration (assumed)	= U_B
C_H	Unit Conversion: 8.33 BTU/Gallons/deg. F	8.33
C_G	Unit Conversion: 1 Therm/100,000 BTU	1/100,00
Eff_G	Efficiency of Gas Water Heater	.8

16.1.8 Commercial Low Flow Showerheads (TRM V9.0 Section 3.3.5)

Savings are calculated as follows:[44]

$$Annual\ therms\ = \frac{8.33 * C_p * \Delta V * \left(T_{HW} - T_{Suppy}\right) * \left(\frac{1}{E_t}\right)}{100{,}000\ BTU/therm} * \frac{days}{year}$$

In this formula, ΔV is calculated as follows:

[43] For facilities that operate year-round: conservatively assume operating days of 360/year; for schools open weekdays except summer: 360 x (5/7) x (9/12) = 193; for dormitories with few occupants in the summer: 360 x (9/12) = 270; and for normal commercial buildings: 360 x (5/7) = 257

[44] Arkansas TRM V9.0, Volume 2. Pg. 381-388

$$\Delta V = U * N * (Q_b - Q_p) * F_{HW}$$

U = average shower duration (7.8 minutes)

N = Number of showers per showerhead per day

Q_b = Baseline flow rate (2.5 GPM);

Q_p = Installed flow rate (in GPM); and

F_{HW} = Hot Water Fraction (share of water which is from the water heater)

The inputs for this equation are defined in Table 16-13

Table 16-13: DI Showerhead Savings Calculation Parameters

Parameter	Description	Value
F_B	Baseline Flow Rate (GPM)	2.2
F_P	Post Flow Rate (GPM)	≤ 1.5
Days	Annual operating days for the facility	
	Hospital, Nursing Home	365
	Lodging	365
	Commercial	250
	24 Hour Fitness Center	365
	School	200
T_C	Average supply (cold) water temperature (deg. F)	Zone 9: 65.6
		Zone 8: 66.1
		Zone 7: 67.8
		Zone 6: 70.1
T_H	Average mixed hot water temperature (deg. F)	120
U_P	Post Water Usage Duration (assumed)	= U_B
C_G	Unit Conversion: 1 Therm/100,000 BTU	1/100,00
E_T	Efficiency of Gas Water Heater	.8

Table 16-14: Daily Hot Water Reduction

Installed Flow Rate	Weather Zone	Hospital / Nursing	Lodging	Commercial Employee Shower	24 Fitness Center	Schools
2.0 GPM	9	2.5	3.5	1.9	56.3	2.0
	8	2.5	3.5	1.9	56.1	2.0

	7	2.5	3.5	1.8	55.4	2.0
	6	2.4	3.4	1.8	54.4	2.0
1.75 GPM	9	3.8	5.3	2.8	84.4	3.1
	8	3.8	5.3	2.8	84.1	3.1
	7	3.7	5.2	2.8	83.1	3.0
	6	3.6	5.1	2.7	81.5	3.0
1.5 GPM	9	5.0	7.1	3.8	112.6	4.1
	8	5.0	7.0	3.7	112.2	4.1
	7	4.9	6.9	3.7	110.8	4.0
	6	4.9	6.8	3.6	108.7	.9

16.1.9 Commercial Door Air Infiltration (TRM V9.0 Section 3.2.11)

Savings are calculated as follows[45]:

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

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

The inputs for this equation are defined in Table 16-15.

Table 16-15: DI Door Infiltration Savings Calculation Parameters

Parameter	Description	Value
CFM_{pre}	Calculated pre-retrofit air infiltration rate (ft^3/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

[45] Arkansas TRM V9.0, Volume 2. Pg. 350-356

$EFLH_H$	Equivalent full-load hours	See table below

Table 16-16: $EFLH_H$ 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 ft.^{2})	811	1,014	1,054	1,036
Small Office (≤30k ft.^{2})	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 the table below.

Table 16-17: Deemed Annual Therm 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

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