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PacifiCorp Wyoming Low Income Weatherization

Program Evaluation for Program Years 2018–2019

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1. Executive Summary

The Rocky Mountain Power Low Income Weatherization Program (the "Program") was offered in the State of Wyoming in 2018 and 2019. Opinion Dynamics performed both an impact and process evaluation of this Program on behalf of Rocky Mountain Power; we present the results from these evaluations in the following report.

Two Wyoming-based sub-grantee agencies known for serving low-income communities have historically implemented the Program: Council of Community Services (CCS) and Wyoming Weatherization Services (WWS). These agencies subcontract with the Wyoming Department of Family Services (WFS) to deliver weatherization services through the funding WFS receives from federal and state government sources. CCS and WWS target income-eligible single-family, multi-family, and manufactured homes across all Rocky Mountain Power service territory in Wyoming. The agencies leverage grants from WFS with funds from Rocky Mountain Power to provide these customers with energy efficiency measures at no cost to them. WFS determines the "Low Income" eligibility guidelines.

Opinion Dynamics conducted this program evaluation with the following objectives in mind: (1) document and measure effects of the Program and (2) identify areas of potential improvement. To quantify energy savings, we conducted a deemed savings review of current ex-ante savings assumptions. This included reviewing existing program assumptions as available and researching other algorithms and savings assumptions based on Technical Reference Manuals (TRMs), studies, and other secondary sources as applicable. We also conducted a process evaluation based on a program materials review, an in-depth interview with WWS agency staff, and participant responses to a telephone survey. The telephone survey asked about participant satisfaction with the Program, Program barriers and bottlenecks, best practices, and any opportunities for improvement. This report includes the cost-effectiveness analysis conducted by a third-party consultant, AEG.

1.1 Impact Results

For the impact evaluation, we verified Program participation through participant telephone surveys and completed surveys with eight of the 55 Rocky Mountain Power customers participating in 2018 and 2019. All surveyed participants (n=8) verified they participated in the Program and received measures.

Given the small number of program participants, we conducted a deemed savings review to estimate the energy savings from the Program. The results show that the average annual net energy savings per participant for the program years is 1,206 kWh. Table 1 presents the ex-post net savings for each program year and in total. Overall, the Program achieved 46% of its ex-ante gross savings for the evaluation period.

Table 1. Ex-Ante Gross and Ex-Post Net Energy Savings (kWh)

Program Year	Participation	Ex-Ante Gross Energy Savings (kWh)	Ex-Post Net Energy Savings (kWh)	Realization Rate
2018	36	107,081	43,156	40%
2019	19	35,964	23,163	64%
Total	**55**	**143,045**	**66,319**	**46%**

Note: For this low-income program, the net-to-gross ratio is assumed to equal 1 and, therefore, gross savings are equal to net savings.

Approximately 80% of the ex-post savings come from refrigerator replacement, LED lighting, and insulation measures. We describe the impact evaluation in more detail in the sections below and document all ex-post algorithms and assumptions in Appendix A.

1.2 Process Results

The process evaluation examined Program operations from multiple perspectives. Rocky Mountain Power, WWS, and CCS have worked together for several years to deliver the Program, and over this time, WWS has developed expertise in implementing the Program using multiple funding mechanisms. Combining the funds from Rocky Mountain Power with those from government organizations has allowed the Program to reach more utility customers and demonstrates a best practice in low-income energy efficiency program delivery.[1] It is a common practice for utilities to work with community action agencies to bring their energy efficiency programs to low-income households since these organizations generally have well-established relationships with them already.

WWS receives Program applications directly from the Low Income Energy Assistance Program (LIEAP) and places customers on a waitlist. WWS uses a point-system to determine where customers are positioned on the waitlist; households with young, disabled, and elderly residents receive more points than other households. As WWS receives new applications, it reviews and adds them to the waitlist based on this priority point system. Some customers may wait years for service if they do not meet the criteria of a priority household.

Agency staff noted that once a customer reaches the top of the waitlist, the goal is to complete an energy audit within a week and complete weatherization services within the next 30 days. WWS reports it typically meets this goal. Although survey participants noted longer wait times for weatherization services, they were asked how long it took to receive these services from the time they submitted their application. Their responses, therefore, do not reflect when they reached the top of the waitlist. Half of those surveyed (4/8) reported receiving weatherization services within three months of submitting their application, one said between six months and a year, one said more than a year, and two customers did not recall when they received weatherization services after submitting their application. While agency staff reported that some customers could wait years to receive services (see Section 5.1), no customers noted year-long wait times during the survey; however, customers who have been waitlisted for years may not have responded to the survey.

Participants continue to be highly satisfied with the Program, as suggested by all surveyed participants noting they would recommend it to family and friends. Respondents were asked to rate the Program on a scale of 0 to 10, where 0 is "Extremely dissatisfied" and 10 is "Extremely satisfied." Over half of respondents (5/8) were extremely satisfied and rated the Program a “10.” One respondent gave a moderate satisfaction score of 5, and some (2/8) gave a moderately high rating of 8. One participant ascribed their moderate dissatisfaction score to how the home was treated (i.e. contractors left trash under the home after completing improvements). All surveyed participants reported they would recommend the Program to others, which is consistent with previous Program evaluation results.[2]

[1] Kushler, Martin, York, Dan and Witte, Patti, “Meeting Essential Needs: The Results of a National Search for Exemplary Utility-Funded Low-Income Energy Efficiency Programs,” ACEEE Report Number U053, September 2005.
[2] Smith & Lehmann Consulting and H. Gil Peach & Associates, *Wyoming Low-Income Weatherization Program Evaluation Report for Program Years 2011-2012*, Prepared for Rocky Mountain Power Company. August 17, 2015, page 30.

The Program helps educate participants on ways to save energy beyond the direct-install measures. While energy education is not a formal part of the Program, agency staff speak to Program participants about ways to save energy in the home. Coupling informal energy efficiency education with home audits and measure installation is one way implementation staff can take advantage of their visits to help induce behavioral changes that may further reduce energy costs. This is also considered a best practice of energy efficiency programs designed to serve low-income customers.[3] Six out of eight survey respondents recalled learning about ways to save energy from the agency staff and all found the energy education to be helpful. Most respondents (6/8) recalled the Program staff informing them of ways to save energy in their home, with four respondents noting they acted on the recommendations received. These actions included:

- Turning off lights when not in use;
- Installing new windows/doors;
- Turning off HVAC equipment/using an alternate source for heating/cooling;
- Caulking, weather-stripping, or sealing windows and doors; and
- Turning off appliances when not in use.

1.3 Cost-Effectiveness Results

AEG estimated the cost-effectiveness of PacifiCorp's evaluated savings for the Low Income Weatherization program in the state of Wyoming based on Program Year (PY) 2018-2019 costs and savings provided by PacifiCorp. The program passes the PacifiCorp Total Resource Cost Test (PTRC), Total Resource Cost Test (TRC), and Utility Cost Test (UCT).

Table 2: 2018-2019 Low Income Weatherization Benefit/Cost Ratios by Program

Program Year	PTRC	TRC	UCT	RIM	PCT
Low Income Weatherization	1.67	1.52	1.52	0.42	n/a

1.4 Recommendations

Based on the evaluation results, we recommend the following:

- **Continue using community-based agencies to implement the Program**. Rocky Mountain Power is adhering to best practices by delivering the Program through a community-based agency.[4] WWS and CCS have served as Program implementers on behalf of Rocky Mountain Power for years. It is a common practice for utilities to work with one or more community action agencies to bring their energy efficiency programs to low-income households since these organizations generally have well-established relationships with them already. Additionally, these agencies are knowledgeable about using funding from utilities in combination with government funding to expand the reach of programs. Leveraging these types of agencies is a best practice in low-income weatherization programs.

[3] Same as footnote 2.
[4] Two sub-grantee agencies are contracted with Rocky Mountain Power to deliver weatherization services on its behalf (CCS and WWS), but CCS completed no low-income weatherization projects for the utility.

- **Based on customer demand and need for Program services, Rocky Mountain Power should consider proactive ways to access the new infrastructure funding and layer those funds onto existing funding.** While Rocky Mountain Power relies on WWS and CCS to provide weatherization services, the backlog of customers on its waitlist tends to be long. Servicing these customers is a challenge since WWS knows there are several households that will not benefit from weatherization for some time. At the time of our interview with agency staff, WWS had 5,000 approved and eligible customers on its waitlist, of which 60% were Rocky Mountain Power customers. Some customers wait several years to receive services because households with children, disabled, or elderly residents take priority. As new customers with high-priority scores apply for services, customers with low-priority scores are pushed further down the waitlist. Additional funding for the Program may become available through the new bipartisan infrastructure law until 2027.
- **Establish protocols to ensure the cleanliness of homes and surrounding property after home improvements.** Participants continue to be highly satisfied with the Program, as suggested by all surveyed participants noting that they would recommend it to family and friends. Respondents were asked to rate the Program on a scale of 0 to 10, where 0 is "Extremely dissatisfied" and 10 is "Extremely satisfied." Over half of respondents (5/8) were extremely satisfied, rating the Program a "10." One respondent gave a moderate satisfaction score of 5 and some (2/8) gave a moderately high rating of 8. One participant attributed their moderate dissatisfaction score to how the home was treated, (i.e. contractors left trash under the home after completing improvements).
- **For ex-ante savings in Program tracking databases, apply the unit energy savings (UES) values for individual measures for the Program based on the deemed values provided in Appendix A moving forward.** Given the small number of participants, we conducted a deemed savings review to estimate the energy savings from the Program. The results show the average annual net energy savings per participant is 1,206 kWh. Overall, the Program achieved 46% of its ex-ante gross savings for the evaluation period. Ex-ante applied the average per household savings from the 2014–2015 program year instead of the deemed savings for each individual measure.
- **At minimum, the Program or implementers should start noting whether a home uses electric heat on the initial application and capture it as a field in the program tracking database to improve the accuracy of ex-post savings estimates.** The ex-post impact evaluation relied on many high-level engineering assumptions to estimate impacts because participant- or program-specific data was not available. For example, information on heating fuel type, square footages of insulation installed per home, R-values of pre- and post-insulation, and type of heating and cooling equipment in participant homes was not available; we relied on statewide averages and other sources to make estimates for these and other parameters. We understand this is a small program with a desire to minimize the burden on agencies in collecting these data, but collecting and providing this type of information can greatly improve the accuracy of ex-post savings estimates.

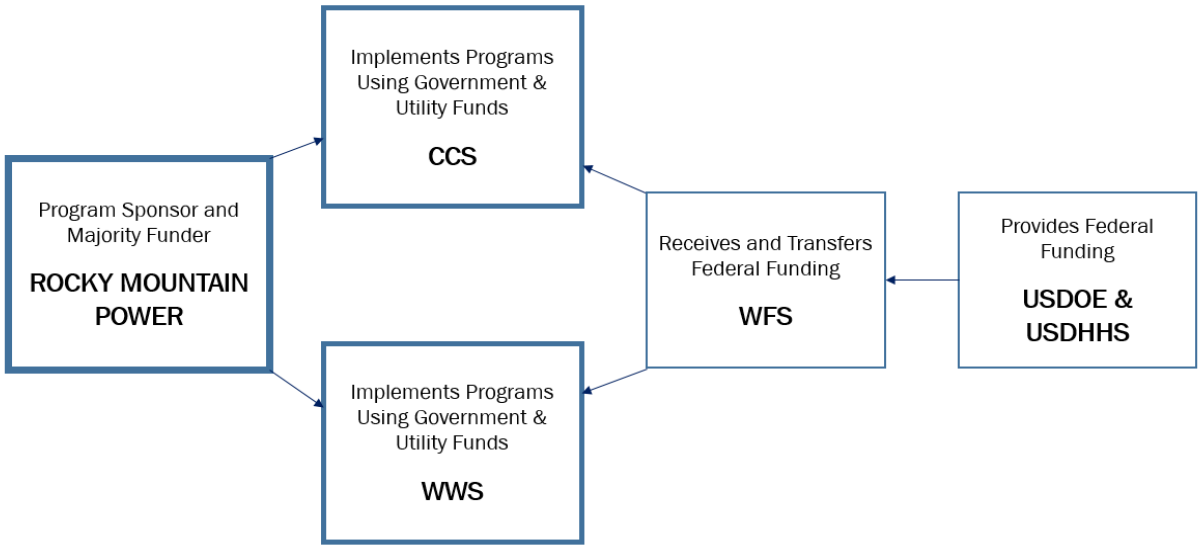
2. Introduction

Rocky Mountain Power's Low Income Weatherization Program provides energy efficiency measures to eligible residential customers through a partnership with two non-profit agencies in Wyoming: CCS and WWS. Partnering with agencies that have historically served low-income communities throughout Wyoming provides Rocky Mountain Power with streamlined access to the customers targeted by this Program.

The Program operates by reimbursing agencies for 50% of the installed cost of measures. Importantly, the Program calculates reimbursements after deducting property owner contributions. Agencies may also be reimbursed for administrative costs based on 10% of the rebate Rocky Mountain Power receives on installed measures. To cover any remaining Program costs, the implementing agencies leverage federal government funding from the United States Department of Energy (US DOE) and the United States Department of Health and Human Services (US DHHS). The WFS administers the federal government funds to the implementing agencies and monitors completed weatherization projects.

Leveraging utility, state, and federal funding sources allows the agencies to provide comprehensive weatherization services to more low-income households than they may have otherwise. Other exemplary utility-funded low-income energy efficiency programs also bring together multiple funding sources and implement programs through social service agencies. We show the sources of funding and roles of oversight and implementation of the Program in Figure 1.

Figure 1. Funding and Oversight for Rocky Mountain Power's Low Income Weatherization Program



2.1 Program Implementation

Program implementation involves the following steps, which are detailed in the 2019 Wyoming Annual Demand-Side Management Report:[5]

- income verification based on WFS guidelines to ensure participants qualify for program participation,[6]
- energy audit using a US DOE-approved tool to determine eligible measures (i.e., audit results must indicate a savings-to-investment ratio [SIR] of 1.0 or greater),
- installation of eligible measures,
- post-inspections of all projects, and
- billing notification to Rocky Mountain Power within 60 days of job completion, which must be accompanied by a homeowner agreement invoice form with installed measures and associated cost for each completed home.

The Program is available to income-eligible residential customers in existing single-family, multi-family, and manufactured homes served by Rocky Mountain Power in the State of Wyoming. Duplexes and fourplexes are eligible if low-income tenants occupy at least one-half of the units. Other multi-family properties are also eligible if low-income tenants occupy at least 66% of the units. Income eligibility is determined by WFS Guidelines.[7]

Energy conservation measures broadly fall into two categories: "major" and "supplemental." Major measures include floor, wall, and ceiling insulation. Electric heat supplemental measures include, but are not limited to, weather stripping, attic ventilation, and timed thermostat installation and are only available if an electric heating system heats at least 51% of the home. Examples of supplemental measures that do not require an electric heating system include LED light fixtures and pipe insulation.

2.2 Evaluation Objectives

The objectives of our evaluation of the Program, with the evaluation type included in parentheses, are listed below:

- Document and measure effects of the Program (impact and process)
- Verify measure installation and savings (impact)
- Review Program operations (process)
- Document other funding used by agencies to provide no-charge services to participants (process)
- Provide data to support Program cost-effectiveness assessments (impact)
- Identify areas of potential improvement (impact and process)
- Document compliance with regulatory requirements (process)

[5] Rocky Mountain Power, *Wyoming Annual Demand-Side Management Report*, July 1, 2020.
[6] Wyoming Department of Family Services, Accessed January 27, 2023, http://dfsweb.wyo.gov.
[7] Income eligibility depends on the number of individuals residing in the household. The most current guidelines can be found at Income Guidelines - Wyoming Low Income Energy Assistance Program (lieapwyo.org)

- Survey participants and agency staff (process)

In the remainder of this report, we include a description of the data collection and methodologies used to conduct the study, a presentation of the impact evaluation, the findings from the process evaluation, and cost effectiveness results.

3. Data Sources

In this section, we present the data sources used in this evaluation.

3.1 Program Tracking Data

We requested and received Program tracking data for the 2018 and 2019 program years to support both impact and process evaluations. These data are tracked at the measure level; therefore, Program participants who received more than one measure or treatment are listed multiple times.

We received the following key variables in the Program tracking data:

- Customer name, address, and phone number
- Project name (embedded within this is the implementing agency that provided services)
- Project ID
- Primary utility number (customer identifier)
- Bill account number
- Cost recovery date
- Project creation date
- Project last update date
- Measure category, type, sub-type, and name
- Measure level kWh/year savings for some measures
- Direct install costs
- Measure costs

The Program tracking data does not include kWh/year savings at the measure level. Instead, the tracking data include a single bundled deemed savings value (listed as "WY Weatherization") for each participant.

We used the Program tracking data to identify Program participants and the measures installed to develop the participant telephone survey sample. During the survey, we asked respondents to verify their participation.

3.2 Agency Interviews and Participant Survey Data

Primary data collection activities included an in-depth interview with staff members at WWS and a participant telephone survey. The agency interview helped inform our review of Program operations and compliance with regulatory requirements, as well as identify major accomplishments and challenges related to Program implementation. We used information gathered through the participant telephone survey to verify the installation of measures, estimate lighting in-service rates, and inform process-related Program findings.

3.3 Other Data Sources

We requested all sources for ex-ante assumptions and reviewed all received files. These included the Wyoming Technical Reference Library (TRL) file and previous Wyoming Low Income Weatherization Program studies. In addition, we submitted several measure-specific questions via email to the Wyoming program manager and received some clarifying answers.

The above documents were not entirely sufficient to document all ex-ante calculations. We therefore relied on several additional sources to perform our ex-post analysis. For the additional resources, we attempted to use Wyoming-specific values to the extent possible. We list these resources below at a high-level and provide additional details on each source in Appendix A:

- ASHRAE Fundamentals (2017)
- ENERGY STAR®[8]
- Lawrence Berkeley National Labs
- Michigan Evaluation Working Group Showerhead and Faucet Aerator Meter Study (June 2013)
- National Renewable Energy Labs
- Building Performance Institute
- Residential Energy Consumption Survey (RECS), 2015 data for Mountain North climate
- Technical Reference Manuals
  - Illinois TRM V10.0
  - Indiana TRM V2.2
  - Iowa TRM V5.0
- Wyoming Census Data (2017–2021)
- Wyoming Tax Assessor Public Records
- Wyoming participant survey conducted by Opinion Dynamics

[8] The ENERGY STAR® name and mark are registered trademarks owned by the US EPA.

4. Impact Evaluation

A total of 55 customers participated in the Program during the 2018 and 2019 program years. In the participant telephone survey, we asked respondents whether they recalled someone coming to their home to provide weatherization services and perform energy efficiency upgrades. All survey respondents (n=8) confirmed their participation. A list of the various measures installed from the most common (LED light bulbs) to the least common (wall insulation) is presented in Table 3 below. Other common measures include refrigerator replacements, weather-stripping, and water heater pipe insulation.

Table 3. Wyoming Participation Counts and Measures for Program Years 2018–2019

Measures	2018	2019	Total	Percent
Total # of homes treated	36	19	55	100%
LED light bulbs	35	17	52	95%
Replacement refrigerators	27	13	40	73%
Weather-stripping	12	10	22	40%
Water heater pipe insulation	14	7	21	38%
Floor insulation	8	4	12	22%
Ceiling insulation	5	4	9	16%
Low-flow showerheads	7	2	9	16%
Thermal doors	6	1	7	13%
Replacement windows	2	3	5	9%
Duct sealing	2	3	5	9%
Air sealing	1	2	3	5%
Duct insulation and sealing	0	1	1	2%
Wall insulation	0	1	1	2%

4.1 Methodology

Given the small number of participants, we performed an engineering review of ex-ante documentation and developed revised assumptions for the ex-post analysis. We requested, but did not receive, home-specific information such as square footage of installed insulation, pre- and post-R-values, and the heating/cooling characteristics of each home. In the absence of these data, we developed average savings assumptions at the measure level (e.g., LED bulb, refrigerator, ceiling insulation, showerhead) based on other TRMs and similar programs in other jurisdictions. We customized the savings assumptions and inputs to Wyoming as much as possible. We used these average savings per measure to estimate program-level savings by multiplying the per-measure savings by the number of each measure unit installed from the Program tracking database. To minimize the potential overlap of interactive effects between measures,[9] we used conservative assumptions as much as possible in the per-measure savings estimates.

We leveraged data from the Wyoming participant survey to develop installation rates for lighting measures and applied this installation rate (100%) to the deemed ex-post lighting savings. For all non-lighting measures, we assumed an installation rate of 100% based on survey feedback and Program records.

[9] For example, savings from duct sealing may be somewhat offset by installing additional insulation in a home.

Appendix A documents all ex-post equations, assumptions, and sources in detail.

4.2 Results

In Table 4, we present the ex-ante and ex-post net energy savings for the Program. The overall net savings realization rate was 46%, and the average annual ex-post net savings per participant was 1,206 kWh. Major measures (e.g., insulation, duct sealing, windows, air sealing) were available to all participants regardless of heating fuel type; therefore, we weighted ex-post savings to account for the percentage of homes with electric heating, which impacted program-level realization rates. However, supplemental measures (e.g., weather stripping) were available to participants with at least 51% of electrically heated homes; ex-post savings assume 100% of electric heating in these cases. The realization rate varied between 2018 and 2019 because of a difference in measure mix between the two years (see Table 5). The change in measure mix resulted in adjustments to ex-post savings at the measure level, which, in turn, influences the overall realization rate for that year. Table 5 presents ex-post savings by measure type and the percent contribution to the overall program ex-post savings.

Table 4. Ex-Ante Gross and Ex-Post Net Energy Savings (kWh)

Program Year	Participation	Ex-Ante Gross Energy Savings (kWh)	Ex-Post Net Energy Savings (kWh)	Realization Rate
2018	36	107,081	43,156	40%
2019	19	35,964	23,163	64%
Total	**55**	**143,045**	**66,319**	**46%**

Note: For this low-income program, the net-to-gross ratio is assumed to equal 1 and, therefore, gross savings are equal to net savings.

Table 5. Ex-Post Net Savings by Measure

Measure	Quantity		Quantity Unit of Measure	Ex-Post Net Savings		Percent of Total Ex-Post Savings
	2018	2019		2018	2019	
Refrigerators	27	13	Refrigerators	15,276	7,355	34%
LED	333	142	Bulbs	13,069	5,573	28%
Floor insulation	8	4	Participants	6,938	3,469	16%
Water heater pipe insulation	14	7	Per six feet of insulation	3,681	1,841	8%
Weather stripping	12	10	Participants	1,219	1,016	3%
Duct sealing	2	3	Participants	757	1,136	3%
Showerhead	11	2	Showerheads	419	838	2%
Window	2	13	Windows	1,035	188	2%
Ceiling insulation	5	4	Participants	491	392	1%
Duct sealing and insulation	0	1	Participants	0	657	1%
Wall insulation	0	1	Participants	0	454	1%
Air sealing	1	2	Participants	238	40	0.4%
Thermal doors	6	1	Doors	31	203	0.4%
Total	**424**	**206**		**43,156**	**23,163**	**100%**

Note: Percentage of total savings may not sum to 100% due to rounding.

5. Process Evaluation

5.1 Agency Perspective

We interviewed staff from WWS in November 2022 and attempted to contact CCS for an interview but were not able to reach them. We spoke with a representative from WWS to gain a deeper understanding of Program operations and any key areas of improvement. We present the agency's perspective on various topics addressed during the interview in Table 6 below. Notably, 51 participants received WWS Program services and four received CCS services.

Table 6. Agency Feedback

Topic	Feedback
Balance of funding	WWS uses Rocky Mountain Power funds to supplement funding from government sources (i.e., US DOE, US DHHS) to help increase the number of homes they can weatherize per year.
Waitlist process	WWS receives Program applications directly from the LIEAP program and immediately places customers on the waitlist once their application is received. WWS receives new applications daily after customers apply for LIEAP. A customer's position on the waitlist for services is based on a priority point system, where points are awarded based on whether the customer or the customer's dependents are elderly or disabled, whether there are small children living with the customer, or the amount of fuel usage of the home. Customers with the most points appear at the top of the waitlist. The waitlist is revised and updated as new customers are approved through LIHEAP and given a priority score or as customers receive services and are removed from the list. Customers with low-priority points could wait years to be serviced. As WWS noted, "There are people who have been on the waitlist for years due to their low priority score. However, this score can change based on the information on their most current application." Customers at the top of the WWS waitlist are called first and, once reached, WWS will attempt to complete an energy audit and close the job within 30 days. This time goal, according to WWS, was usually met prior to 2020; however, with supply issues in recent years that time goal has often been missed. While WWS reports meeting its time goals, participant responses during the telephone survey report much longer wait times.
Current waitlist	At the time of the interview, WWS had roughly 5,000 applicants on its waitlist, 60% of whom were Rocky Mountain Power customers. The priority score of a customer on the waitlist is determined by their most recent application to the LIEAP program, which is valid for one calendar year before the customer must reapply.
Challenges and barriers	WWS has very few deferrals. The few cases of deferral, however, are often due to unsafe conditions in the home, pest infestations, and excessive clutter, among other reasons. In these instances, customers receive information about the issue along with recommended steps to resolving the issues and other programs that may help remediate the issues. WWS can continue working on the home if the remediation steps are completed, but staff report only about 5% of these homes complete these necessary steps. WWS identified their two biggest challenges: (1) meeting contract submission deadlines and (2) stretching a limited budget for projects. The state process for contracts is lengthy, while funding constraints limit the amount of work that can be done per customer and how many customers can be serviced per year. However, the new bipartisan infrastructure law will allow for a large increase in funding through 2027. WWS saw the largest barrier to participation in the Program as customer awareness of the Program and the benefits it can provide to the customer. WWS noted that Program outreach is

Topic	Feedback
	performed by the State of Wyoming, but agency staff often drop off literature at community-based organizations in between home assessments.

5.2 Participant Perspective

The evaluation team attempted to reach a census of customers who participated in the Program in 2018 and 2019 with a telephone survey. Of the 55 customers who participated, a total of 8 participants completed telephone interviews, yielding a response rate of 20% and cooperation rate of 67% (see Table 7).[10]

Table 7. Wyoming Participant Telephone Survey

Population Frame	Unique Telephone Numbers	Final Survey Responses	Survey Response Rate	Survey Cooperation Rate
40	39	8	20%	67%

The call center attempted to reach participants multiple times. Table 8 lists the survey disposition categories.

Table 8. Participant Survey Disposition

Survey Disposition	Sample
Complete	8
Answering machine	25
Disconnected	10
Initial refusal	3
No answer	3
Busy	2
Hard refusal – do not call	1
Call block	1
Language barrier	1
Terminate	1

We used this survey to collect data about participant household characteristics and Program experience. The eight completed surveys included a mix of customers with varying housing types: three customers lived in single-family homes, four in manufactured/mobile homes, and one in a townhome. Seven of the eight respondents reported owning their homes. Below we summarize participant feedback on their Program experience across an array of topic areas.

Table 9. Participant Feedback

Topic Area	Participant Feedback
Program awareness	Respondents generally heard about the Program by word of mouth from family, friends, and neighbors (5/8). Other respondents indicated they heard about the Program through their gas company or another income assistance program.

[10] Response rate is calculated using American Association for Public Opinion Research (AAPOR) Response Rate 3.

Topic Area	Participant Feedback
	Historically, Rocky Mountain Power customers have had difficulty identifying Rocky Mountain Power as a funding source of the Program. This is still a challenge, as none of the respondents identified Rocky Mountain Power as a funding source. Half of the respondents believed LIEAP was the sole source of funding. Half of respondents (4/8) reported receiving weatherization services within three months of submitting their applications. Other responses included between three to six months (1/8), between six months and a year (1/8), more than a year (1/8), and don't know (2/8). WWS aims to complete an energy audit within a week of an application coming up on the waitlist and close the job within 30 days; however, customers are called in order of priority points and those without priority points can spend a significant amount of time on the waitlist before moving to the top.
Energy education	The Program does not offer energy education formally; however, most respondents (6/8) recalled that Program staff informed them of ways to save energy in their home. Four of the six respondents who recalled receiving energy education noted they acted on the recommendations received, including: ▪ Turning off lights when not in use ▪ Installing new windows/doors ▪ Turning off HVAC equipment/using an alternate source for heating/cooling ▪ Caulking, weather-stripping or sealing windows and doors ▪ Turning off appliances when not in use Customers valued the additional education. Of the participants who recalled receiving energy education (6/8), half rated the education extremely helpful (3/6), while the other half rated it as moderately helpful (3/6). Fewer respondents said Program staff informed them of ways to improve the health and safety in their home (4/8); however, health and safety recommendations may be customized to each participant's home. A few respondents recalled that the Program staff checked their home for needed repairs outside the scope of Program measures during the home visit (3/8).
Program delivery satisfaction	All respondents (8/8) would recommend the Program to family and friends. After receiving the weatherization services, most surveyed participants noticed a decrease in their electric bill (5/8). Five respondents had no suggestions for Program improvement. The three respondents who suggested improvements each cited a different issue: the need for follow-up after the Program, availability of replacement appliance options, and the amount of repairs provided to each household. We list some verbatim quotes on this topic below: ▪ "Check on the elderly and lower income families that do need the assistance. Contact clients for follow ups a year later to find out if services were helpful or not." ▪ "For the crew to look more thorough and ask the homeowner what repairs need to be looked at or completed. Give options on new appliances that are being replaced." ▪ "I wish they could afford more money to each account or household for repairs." Respondents were asked to rate the Program on a scale of 0 to 10, where 0 is "Extremely dissatisfied" and 10 is "Extremely satisfied." Over half of respondents (5/8) were extremely satisfied and rated the Program a "10." One respondent (1/8) gave a moderate satisfaction score of 5 and the remaining respondents (2/8) gave a moderately high rating of 8. A sample of verbatim quotes from respondents included the following: ▪ "When they went underneath my other house, they left a bunch of trash underneath it." ▪ "Because the work they did do and the difference it has made."
LED verification and satisfaction	Almost all respondents who received LEDs recalled receiving the bulbs (7/8). Of those who recalled receiving the bulbs, four were more satisfied with the lighting in their homes after installing LEDs, one was neutral about their lighting, and one was less satisfied with the lighting in their home after installing LEDs. Since receiving LEDs through the Program, three customers purchased additional lighting for their homes; two of those three reported buying LEDs.

6. Cost-Effectiveness

AEG estimated the cost-effectiveness of PacifiCorp's evaluated savings for the Low Income Weatherization program in the state of Wyoming based on Program Year (PY) 2018-2019 costs and savings provided by PacifiCorp. The program passes the PacifiCorp Total Resource Cost Test (PTRC), Total Resource Cost Test (TRC), and Utility Cost Test (UCT).

The following assumptions were utilized in the analysis:

- Avoided Costs: Hourly values provided by PacifiCorp based on the 2017 Integrated Resource Plan (IRP) Preferred Portfolio, converted into annual values using Wyoming load shapes from the same IRP.
- Modeling Inputs: evaluated measure savings, costs, measure lives, incentive levels, and portfolio costs were based on estimates provided by PacifiCorp.
- Other Economic Assumptions: Discount rate, line loss, retail rate, and inflation rate values were provided by PacifiCorp and are presented in the table below.

Tables below summarize cost-effectiveness assumptions for the Low Income Weatherization program. All costs and impacts are presented at the program level.

Table 10: Cost-Effectiveness Analysis Inputs

Parameter	Value
Discount Rate	6.57%
Residential Line Loss	9.51%
Residential Energy Rate ($/kWh)	$0.1088
Inflation Rate[1]	2.20%

Table 11: Low Income Weatherization Annual Program Costs, Nominal - PY2018-2019[11]

Program Year	Program Delivery	Utility Admin	Program Development	Incentives	Total Utility Budget	Gross Customer Costs
Low Income Weatherization	$3,450	$7,429	$207	$34,504	$45,590	$0
Total Program	$3,450	$7,429	$207	$34,504	$45,590	$0

Tables below present the savings and cost-effectiveness results at the program level.

[11] To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.

Table 12: 2018-2019 Low Income Weatherization kWh Savings by Program

Program Year	Gross kWh Savings at Site	Realization Rate	Adjusted Gross kWh Savings at Site	Net to Gross Ratio	Net kWh Savings at Site	Measure Life
Low Income Weatherization	143,045	46%	66,319	100%	66,319	27
Total Program	143,045	46%	66,319	100%	66,319	27

Table 13: 2018-2019 Low Income Weatherization Benefit/Cost Ratios by Program

Program Year	PTRC	TRC	UCT	RIM	PCT
Low Income Weatherization	1.67	1.52	1.52	0.42	n/a

Table 14: 2018-2019 Low Income Weatherization Program Cost-Effectiveness Results (without NEBs) - (Load Shape - WY_Single_Family_Cooling)

Cost-Effectiveness Test	Levelized $/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	$0.05	$44,602	$74,680	$30,077	1.67
Total Resource Cost Test (TRC) No Adder	$0.05	$44,602	$67,890	$23,288	1.52
Utility Cost Test (UCT)	$0.05	$44,602	$67,890	$23,288	1.52
Participant Cost Test (PCT)		$0	$151,194	$151,194	n/a
Rate Impact Test (RIM)		$162,045	$67,890	($94,155)	0.42
Lifecycle Revenue Impacts ($/kWh)					0.00000

AEG estimated the cost-effectiveness of PacifiCorp's evaluated savings for the Low Income Weatherization program in the state of Wyoming based on Program Year (PY) 2018 costs and savings provided by PacifiCorp. The program passes the PacifiCorp Total Resource Cost Test (PTRC), Total Resource Cost Test (TRC), and Utility Cost Test (UCT).

The following assumptions were utilized in the analysis:

- Avoided Costs: Hourly values provided by PacifiCorp based on the 2017 Integrated Resource Plan (IRP) Preferred Portfolio, converted into annual values using Wyoming load shapes from the same IRP.
- Modeling Inputs: evaluated measure savings, costs, measure lives, incentive levels, and portfolio costs were based on estimates provided by PacifiCorp.
- Other Economic Assumptions: Discount rate, line loss, retail rate, and inflation rate values were provided by PacifiCorp and are presented in the table below.

Tables below summarize cost-effectiveness assumptions for the Low Income Weatherization program. All costs and impacts are presented at the program level.

Table 15: Cost-Effectiveness Analysis Inputs

Parameter	Value
Discount Rate	6.57%
Residential Line Loss	9.51%
Residential Energy Rate ($/kWh)	$0.1088
Inflation Rate[1]	2.20%

Table 16: Low Income Weatherization Annual Program Costs, Nominal - PY2018[12]

Program Year	Program Delivery	Utility Admin	Program Development	Incentives	Total Utility Budget	Gross Customer Costs
Low Income Weatherization	$2,228	$4,923	$131	$22,285	$29,567	$0
Total Program	$2,228	$4,923	$131	$22,285	$29,567	$0

Tables below present the savings and cost-effectiveness results at the program level.

Table 17: 2018 Low Income Weatherization kWh Savings by Program

Program Year	Gross kWh Savings at Site	Realization Rate	Adjusted Gross kWh Savings at Site	Net to Gross Ratio	Net kWh Savings at Site	Measure Life
Low Income Weatherization	107,081	40%	43,156	100%	43,156	27
Total Program	107,081	40%	43,156	100%	43,156	27

Table 18: 2018 Low Income Weatherization Benefit/Cost Ratios by Program

Program Year	PTRC	TRC	UCT	RIM	PCT
Low Income Weatherization	1.66	1.51	1.51	0.42	n/a

[12] To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.

Table 19: 2018 Low Income Weatherization Program Cost-Effectiveness Results (without NEBs) - (Load Shape - WY_Single_Family_Cooling)

Cost-Effectiveness Test	Levelized $/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	$0.05	$29,567	$49,064	$19,497	1.66
Total Resource Cost Test (TRC) No Adder	$0.05	$29,567	$44,603	$15,036	1.51
Utility Cost Test (UCT)	$0.05	$29,567	$44,603	$15,036	1.51
Participant Cost Test (PCT)		$0	$99,820	$99,820	n/a
Rate Impact Test (RIM)		$107,102	$44,603	($62,498)	0.42
Lifecycle Revenue Impacts ($/kWh)					0.00000

AEG estimated the cost-effectiveness of PacifiCorp's evaluated savings for the Low Income Weatherization program in the state of Wyoming based on Program Year (PY) 2019 costs and savings provided by PacifiCorp. The program passes the PacifiCorp Total Resource Cost Test (PTRC), Total Resource Cost Test (TRC), and Utility Cost Test (UCT).

The following assumptions were utilized in the analysis:

- Avoided Costs: Hourly values provided by PacifiCorp based on the 2017 Integrated Resource Plan (IRP) Preferred Portfolio, converted into annual values using Wyoming load shapes from the same IRP.
- Modeling Inputs: evaluated measure savings, costs, measure lives, incentive levels, and portfolio costs were based on estimates provided by PacifiCorp.
- Other Economic Assumptions: Discount rate, line loss, retail rate, and inflation rate values were provided by PacifiCorp and are presented in the table below.

Tables below summarize cost-effectiveness assumptions for the Low Income Weatherization program. All costs and impacts are presented at the program level.

Table 20: Cost-Effectiveness Analysis Inputs

Parameter	Value
Discount Rate	6.57%
Residential Line Loss	9.51%
Residential Energy Rate ($/kWh)	$0.1069
Inflation Rate[1]	2.20%

Table 21: Low Income Weatherization Annual Program Costs, Nominal - PY201913

Program Year	Program Delivery	Utility Admin	Program Development	Incentives	Total Utility Budget	Gross Customer Costs
Low Income Weatherization	$1,222	$2,506	$76	$12,219	$16,023	$0
Total Program	$1,222	$2,506	$76	$12,219	$16,023	$0

Tables below present the savings and cost-effectiveness results at the program level.

Table 22: 2019 Low Income Weatherization kWh Savings by Program

Program Year	Gross kWh Savings at Site	Realization Rate	Adjusted Gross kWh Savings at Site	Net to Gross Ratio	Net kWh Savings at Site	Measure Life
Low Income Weatherization	35,964	64%	23,163	100%	23,163	27
Total Program	35,964	64%	23,163	100%	23,163	27

Table 23: 2019 Low Income Weatherization Benefit/Cost Ratios by Program

Program Year	PTRC	TRC	UCT	RIM	PCT
Low Income Weatherization	1.70	1.55	1.55	0.42	n/a

Table 24: 2019 Low Income Weatherization Program Cost-Effectiveness Results (without NEBs) - (Load Shape - WY_Single_Family_Cooling)

Cost-Effectiveness Test	Levelized $/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	$0.05	$16,023	$27,299	$11,276	1.70
Total Resource Cost Test (TRC) No Adder	$0.05	$16,023	$24,817	$8,794	1.55
Utility Cost Test (UCT)	$0.05	$16,023	$24,817	$8,794	1.55
Participant Cost Test (PCT)		$0	$53,107	$53,107	n/a
Rate Impact Test (RIM)		$56,911	$24,817	($32,094)	0.44
Lifecycle Revenue Impacts ($/kWh)					0.00000

[13] To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.

7. Conclusions and Recommendations

Rocky Mountain Power is adhering to best practices by delivering the Program through a community-based agency.[14] WWS and CCS have served as Program implementers on behalf of Rocky Mountain Power for years. It is a common practice for utilities to work with one or more community action agencies to bring their energy efficiency programs to low-income households since these organizations generally have well-established relationships with them already. Additionally, these agencies are knowledgeable about using funding from utilities in combination with government funding to expand the reach of programs. The implementing agency demonstrates its understanding of Program processes, requirements, and funding mechanisms. Leveraging these types of agencies is a best practice in low-income weatherization programs. **Rocky Mountain Power should continue to use the same Program implementers moving forward.**

While Rocky Mountain Power relies on WWS and CCS to provide weatherization services, the backlog of customers on its waitlist tends to be long. Servicing these customers is a challenge because WWS knows there are several households that will not benefit from weatherization for some time. At the time of our interview with agency staff, it had 5,000 approved and eligible customers on its waitlist, of which 60% were Rocky Mountain Power customers. Some customers wait several years to receive services because households with children, disabled, or elderly residents are prioritized. As a result, other households get pushed down on the waitlist as new customers who are prioritized send in applications for services. Additional funding for this program may become available through the new bipartisan infrastructure law through to 2027. **Based on customer demand and need for this program's services, Rocky Mountain Power should consider proactive ways by which it can access the new infrastructure funding and layer those funds onto existing funding.**

Participants continue to be highly satisfied with the Program, as suggested by all surveyed participants noting they would recommend it to family and friends. Respondents were asked to rate the Program on a scale of 0 to 10 where 0 is "Extremely dissatisfied" and 10 is "Extremely satisfied." Over half of respondents (5/8) were extremely satisfied and rated the Program a "10." One respondent gave a moderate satisfaction score of 5 and the remaining respondents (2/8) gave a moderately high rating of 8. One respondent attributed their moderate dissatisfaction score to how the home was treated (i.e., contractors left trash under the home after completing improvements). **The Program should establish protocols with contractors to ensure "no mess is left behind" after home improvements.**

Given the small number of program participants, we conducted a deemed savings review to estimate the energy savings from the Program. The results showed the average annual net energy savings per participant was 1,206 kWh during the 2018 and 2019 program years. Overall, the Program achieved 46% of its ex-ante gross savings for the evaluation period. Ex-ante calculations applied the average per household savings from the 2014–2015 program year instead of the deemed savings for each individual measure. **We recommend using the unit energy savings (UES) values for individual measures for the Program based on the deemed values provided in Appendix A moving forward.**

The ex-post impact evaluation relied on many high-level engineering assumptions to estimate impacts because participant- or program-specific data was not available. For example, information on heating fuel type, square footages of insulation installed per home, R-values of pre- and post-insulation, and type of heating and cooling equipment in participant homes was not available. We relied on statewide averages and other sources to make estimates for these and other parameters. We understand this is a small program

[14] Two sub-grantee agencies are contracted with Rocky Mountain Power to deliver weatherization services on its behalf (CCS and WWS), but CCS completed no low-income weatherization projects for the utility.

with a desire to minimize the burden on agencies in collecting these data, but collecting and providing this type of information can greatly improve the accuracy of ex-post savings estimates. **At minimum, we recommend the Program implementers note whether a home is using electric heat or not on the initial application and capture this input as a field in the Program tracking database, as providing this data to the evaluator moving forward will improve the accuracy of ex-post savings estimates.**

Appendix A. Impact Analysis Details

A.1 Refrigerator Replacement

Table 25 documents the inputs and methodology for estimating refrigerator replacement savings.

Table 25. Algorithms and Inputs for Refrigerator Replacement

Algorithms Used		
$kWh_{existing}$	= [83.32 + (Age * 3.68) + (Pre-1990 * 485.04) + (Size * 27.15) + (Side-by-side * 406.78) + (Primary * 161.86) + (CDD/365.25 * unconditioned * 15.37) + (HDD/365.25 * unconditioned * -11.07)] * Part Use Factor	
$kWh_{ENERGYSTAR}$	= 0.90 * kWh_{code}	
kWh savings	= ($kWh_{existing}$ – $kWh_{ENERGYSTAR}$) * ISR	
Source of Algorithm(s): Illinois TRM V10.0 Section 5.1.6, Federal Code, ENERGY STAR		
Parameter	**Value**	**Source/Notes**
Age of Existing Refrigerator (Age)	17.00	Average Age of Refrigerator from a Refrigerator Recycling Program from a confidential client (n=3,497). This aligns with the Measure Life from IL TRM V10.0.
Percentage refrigerators manufactured pre1990 (Pre1990)	0.00	Based on Age assumption, assuming 2019 is age of replacement
Capacity of Existing Refrigerator (Size)	22.44	Weighted capacity of refrigerators from 2015 RECS for Mountain North Division
Percentage of Refrigerators Side by Side (SidebySide)	0.33	Percentage of side-by-side refrigerators from 2015 RECS for Mountain North Division
Percentage of Refrigerators Primary Unit (Primary)	1.00	All refrigerators replace primary units.
Cooling Degree Day (CDD)	412	ASHRAE Fundamentals 2017 for Wyoming
Heating degree day (HDD)	7,182	
Percentage of Refrigerators Operating in Unconditioned Space (Unconditioned)	0.00	Assumed 100% of refrigerators operate in conditioned space as Program targets the replacement of primary units
Part-time use adjustment factor (part use factor)	1.00	Replaced refrigerator is the primary refrigerator and operates continuously.
Energy consumption of code compliant refrigerators (kWh_{code})	540.85	Federal standard for refrigerators manufactured between 2001 and 2014 based on weighted capacity from RECS data for Mountain North Division
In-Service Rate (ISR)	100%	Assumed 100% of refrigerators remain installed as it is not likely to be removed by the participant

Table 26 provides the deemed savings for refrigerator replacements, using the assumptions from Table 25.

Table 26. Refrigerator Replacement Deemed Savings

Metric	Deemed Savings Per Measure
Annual kWh per refrigerator	565.80

A.2 LED Light Bulbs

Table 27 documents the inputs and methodology for estimating LED savings.

Table 27. Algorithms and Inputs for LED Light Bulbs

Algorithms Used		
kWh Savings	= ((Baseline Watts – LED Watts) / 1,000) * (1 - Leakage) * Hours * WHFe * ISR	
Source of Algorithm: Illinois TRM V10.0 Section 5.5.8		
Parameter	**Value**	**Source/Notes**
Baseline Watts	43.0	IL TRM V10.0 halogen equivalent wattage for a standard 9W LED
LED Watts	9.0	LED wattage distributed within the Program
Percentage of bulbs outside utility jurisdiction (Leakage)	0%	Measures are directly installed and, therefore, 100% remain in utility jurisdiction.
Annual hours of use (Hours)	1,089	IL TRM V10.0. Average Annual Average of Use for Residential LEDs. This aligns with program guidelines, which state that lights must be on for at least two hours a day to qualify.
Energy waste heat factor (WHFe)	1.06	IL TRM V10.0 for single-family housing type (participants predominantly live in single-family or mobile homes)
In-service rate (ISR)	100%	Based on results from 2018-2019 Wyoming Participant Survey

Table 28 provides the deemed savings for LED light bulbs using the assumptions from Table 27.

Table 28. LED Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per LED	39.25

A.3 Floor Insulation

Table 29 documents the inputs and methodology for estimating floor insulation savings.

Table 29. Algorithms and Inputs for Floor Insulation

Algorithms Used		
kWh Savings (cooling)	= ((((1/Rexisting - 1/(Radded+Rexisting)) * Area * (1 – Framing Factor)) * 24 * CDD * DUA) / (1,000 * ηCool))) * ADJcool * %Cool * ISR	
kWh Savings (heating)	= (((1/Rexisting - 1/(_added + Rexisting)) * Area * (1 – Framing Factor) * 24 * HDD) / (3,412 * ηHeat)) * ADJheat * %ElecHeat * ISR	
kWh Savings	= Cooling kWh Savings + Heating kWh Savings	
Source of Algorithm: Illinois TRM V10.0 Section 5.6.3		
Parameter	**Value**	**Source/Notes**
Existing Insulation R-value (Rexisting)	3.53	IL TRM V10.0, assuming 3/4” plywood subfloor and carpet with pad. "LIW TRL" does not specify a program specific baseline description for this measure.
Added Insulation R-value (Radded)	15.47	“LIW TRL” sheet in Program database specifies an efficiency requirement “Up to R-30”. In absence of a statewide energy code, the IECC energy code for Wyoming’s climate zone (zone 6), requires R-30

Algorithms Used		
		or insulation sufficient to fill the framing cavity, R-19 minimum. Assume total R-value of R-19 as a conservative estimate. (Radded = Rtotal – Rexisting)
Area of installed insulation (area)	1,238	Calculated foundation footprint square footage by dividing total conditioned floor area (1,666 sf) by the number of stories (1.34) from RECS 2015 data for Wyoming (Mountain North)
Framing factor	12%	IL TRM V10.0.
Cooling Degree Day (CDD)	412	ASHRAE Fundamentals 2017 for Wyoming
Heating Degree Day (HDD)	7,182	
Discretionary Use Adjustment (DUA)	0.75	Discretionary Use Adjustment for cooling. Common to most TRMs Accounts for fact that all cooling systems will not operate 100% of time requiring cooling
Cooling Efficiency (nCool)	11.88 SEER	Weighted average by equipment type and age from the IL TRM V10.0 and 2015 RECS data for Mountain North Division
Heating Efficiency (nHeat)	1.56 COP	
Cooling Savings Adjustment (ADJcool)	80%	IL TRM V10.0. Adjustment for cooling savings to account for inaccuracies in prescriptive engineering algorithms
Heating Savings Adjustment (ADJheat)	60%	IL TRM V10.0. Adjustment for heating savings to account for inaccuracies in prescriptive engineering algorithms
Percent of Homes with Central Cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of Homes with Electric Heating (%ElecHeat)	16%	Wyoming County Assessor public records. Address lookup for participants who received major measures
In-Service Rate (ISR)	100%	Assumed 100% of installed floor insulation remain installed as it is a major measure and not likely to be removed by the participant.

Table 30 provides the deemed savings for floor insulation, using the assumptions from Table 29.

Table 30. Floor Insulation Deemed Savings

Metric	Deemed Saving Per Measure
Annual kWh per home	867.25

A.4 Water Heater Pipe Insulation

Table 31 documents the inputs and methodology for estimating water heater pipe insulation savings.

Table 31. Algorithms and Inputs for Water Heater Pipe Insulation

Algorithms Used		
kWh Savings	= ((1/Rexist – 1/Rnew) * Cinside * L * ΔT * 8,766)/ ηDHW / 3412) * %ElecWH * ISR	
Source of Algorithm: Illinois TRM V10.0 Section 5.4.1.		
Parameter	**Value**	**Source/Notes**
R-value of uninsulated water heater pipe (Rexist)	0.42	IL TRM V10.0. Average values for 1/2" and 3/4" diameter for both copper and PEX types
R-value of added water heater pipe insulation (Radded)	2.00	Calculated. Radded = Insulation thickness (inches) / Conductivity at 100°F. Assumed ½" insulation thickness base on standard pipe insulation thickness. Conductivity of 0.25 based on 100°F fluid temperature with an outer radius <1.0

Algorithms Used		
		inches from ASHRAE Fundamentals Chapter 23 (Table 2)
Total R-value of water heater pipe insulation (Rnew)	2.42	Calculated. Rnew = Radded +Rexist
Inside circumference of the pipe (Cinside)	0.16	IL TRM V10.0. Average values for 1/2" and 3/4" diameter for both copper and PEX types
Effective linear feet of pipe length (L)	5.17	Calculated using equation from IL TRM V10.0. L = Lhorizontal + αLvertical, Assume 6 feet of insulation (consistent with 2014-2015 evaluation). Per IL TRM V10.0, assume 3 feet for vertical and remaining length for horizontal. IL TRM V10.0 average value for 1/2-inch and 3/4-inch diameter for both copper and PEX type α = 0.72
Supplied water and outside air temperature differential (ΔT)	60°F	IL TRM V10.0. Assumes 125°F water leaving the hot water tank and average temperature of basement of 65°F
Annual hours per year	8,766	Conversion
Recovery efficiency of water heater (nDHW)	0.98	Typical recovery efficiency for electric resistance heaters (IL TRM, IN TRM, ARK TRM)
BTU to kWh Conversion	3,412	Standard conversion
Percent of homes with electric water heating (%ElecWH)	100%	Program targets homes with electric hot water heaters. Confirmed by the 2018-2019 Wyoming Participant Survey even though sample size was small (n=8)
In-Service Rate (ISR)	100%	From the Low Income Weatherization Program Summary in the Wyoming Demand Side Management Report (issued July 2020). Post-Installation Inspections completed to verify installation of measures

Table 32 provides the deemed savings for water heater pipe insulation, using the assumptions from Table 31.

Table 32. Water Heater Pipe Insulation Deemed Savings

Metric	Deemed Savings Per Measure
Annual kWh per 6 feet	262.96

A.5 Weather Stripping

Table 33 documents the inputs and methodology for estimating weather stripping savings.

Table 33. Algorithms and Inputs for Weather Stripping

Algorithms Used	
kWh Savings (cooling)	= [(((CFM50existing - CFM50new)/Nfactor * 60 * 24 * CDD * DUA * 0.018) / (1,000 * ηCool) * LM] * %Cool * ISR
kWh Savings (heating)	= [(((CFM50existing - CFM50new)/Nfactor) * 60 * 24 * HDD * 0.018) / (ηHeat * 3,412)] * %ElecHeat * ISR
kWh Savings	= Cooling kWh Savings + Heating kWh Savings
Source of Algorithm: Illinois TRM V10.0 Section 5.6.1	

Algorithms Used		
Parameter	**Value**	**Source/Notes**
Existing infiltration rate (ACH50existing)	17.40	ENERGY STAR savings analysis assumptions for Wyoming (Use Climate Zone 6 as it covers the majority of the state). Assume air sealing for "Windows, Doors, and Walls," but assume half the reduction since this measure is only weather stripping and it is not known how much it covers per home. https://www.energystar.gov/ia/home_improvement/home_sealing/Measure_Upgrade_Assumptions.pdf?945a-eddc
Improved infiltration rate (ACH50new)	17.20	
Existing infiltration rate (CFM50existing)	3,864	Converts ACH50 to CFM50 (=ACH50*Volume/60 minutes), where volume is the total conditioned floor area (1,666 sf) from RECS 2015 data for Wyoming (Mountain North) multiplied by an assumed ceiling height of 8 feet. http://www.pureenergyaudits.com/docs/Blower_Door_Handout_ACI_Baltimore.pdf
Improved infiltration rate (CFM50new)	3,820	
Nfactor	15.79	BPI Technical Standards for the Building Analyst Professional. Approximately half of Wyoming is located in Zone 1 and the other half is in Zone 2, so the median N Factor from both zones was applied across 1, and 1.5 stories as the average number of stories per 2015 RECs is 1.34 stories multiplied by the average Height Correction Factor (0.95)
Conversion	1,440	Converts ft3/min to ft3/day by multiplying 60 (mins/hour) by 24 (hours/day)
Cooling degree day (CDD)	412	ASHRAE Fundamentals 2017 for Wyoming
Heating degree day (HDD)	7,182	
Discretionary use adjustment (DUA)	0.75	Discretionary Use Adjustment for cooling. Common to most TRMs. Accounts for fact that all cooling systems will not operate 100% of time, requiring cooling
Heat capacity of air	0.018	Volumetric heat capacity of air
Cooling Efficiency (nCool)	12.39 SEER	Weighted average by equipment type and age from the ILTRM V10.0 and 2015 RECS data for Mountain North Division
Heating Efficiency (nHeat)	1.56 COP	
Latent Multiplier (LM)	3.20	IL TRM V10.0 for Chicago, IL, most representable climate to Wyoming.
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of homes with electric heating (%ElecHeat)	100%	Program requires 51% of conditioned floor area be electrically heated
In-service rate (ISR)	100%	From the Low Income Weatherization Program Summary in the Wyoming Demand Side Management Report (issued July 2020). Post-Installation Inspections completed to verify installation of measures

Table 34 provides the deemed savings for weather stripping, using the assumptions from Table 33.

Table 34. Weather Stripping Deemed Savings

Metric	kWh Savings per Measure
Annual kWh per home	101.46

A.6 Duct Sealing

Table 35 documents the inputs and methodology for estimating duct sealing savings.

Table 35. Algorithms and Inputs for Duct Sealing

Algorithms Used		
kWh Savings (cooling)	= ((((DEafter – DEbefore) / DEafter) * FLHcool * CapacityCool * TRFcool / 1,000 / ηCool) * %Cool * ISR	
kWh Savings (heating)	= ((((DEafter – DEbefore) / DEafter) * FLHheat * CapacityHeat * TRFheat / ηHeat / 3,412) * %ElecHeat * ISR	
kWh Savings	= Cooling kWh Savings + Heating kWh Savings	
Source of Algorithm: Illinois TRM V10.0 Section 5.3.4		
Parameter	**Value**	**Source/Notes**
DEafter (cooling)	93%	From BPI "Guidance on Estimating Distribution Efficiency." Assume average for tightly sealed ducts for all duct locations and insulation R-values
DEafter (heating)	90%	
DEbefore (cooling)	86%	From BPI "Guidance on Estimating Distribution Efficiency." Assume average for duct leakage that is both average and leaky for all duct locations and insulation R-values
DEbefore (heating)	83%	
Full load cooling hours (FLHcool)	409	EPA Calculator. Assume average between cities in Wyoming
Full load heating hours (FLHheat)	2,588	
Capacity of central cooling equipment (CapacityCool)	36,000	Approximately 0.0016 tons of cooling is needed per square foot. Rounded to the nearest nominal tonnage. Total conditioned floor area (1,666 square feet) from RECS 2015 data for Wyoming (Mountain North)
Output capacity of heating equipment (CapacityHeat)	58,293	Average between 20 and 50 BTUh of heating required per square foot from National Renewable Energy Laboratory (NREL) and South Carolina State University studies
Thermal regain factor for cooling (TRFcool)	1.00	IL TRM V10.0. Assumed ducts located in unconditioned space
Thermal regain factor for cooling (TRFheat)	1.00	
Cooling Efficiency (nCool)	11.88 SEER	Weighted average by equipment type and age from the IL TRM V10.0 and 2015 RECS data for Mountain North Division
Heating Efficiency (nHeat)	1.56 COP	
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of homes with electric heating (%ElecHeat)	16%	Wyoming County Assessor public records. Address lookup for participants who received major measures
In-service rate (ISR)	100%	Assumed 100% of duct sealing remain installed as it is a major measure and not likely to be removed by the participant

Table 36 provides the deemed savings for duct sealing, based on the assumptions from Table 35.

Table 36. Duct Sealing Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per home	378.72

A.7 Low-Flow Showerheads

Table 37 documents the inputs and methodology for estimating low-flow showerhead savings.

Table 37. Algorithms and Inputs for Low-Flow Showerheads

Algorithms Used		
kWh Savings	= (Baseline GPM – Efficient GPM) * (Minutes/Shower) * SPCD * Household * 365.25 /SPH) * (8.33 * (Tmix – Tinlet)) / 3,412 / nDHW) * %ElecWH * ISR	
Source of Algorithm: Illinois TRM V10.0 Section 5.4.5.		
Parameter	**Value**	**Source/Notes**
Baseline GPM	2.24	IL TRM V10.0.
Efficient GPM	2.00	Based on email exchange with program manager for previous evaluation; shower head wands are rated at 2.0 GPM. This assumption aligns with multiple TRMs.
Shower length in minutes (minutes/shower)	7.80	IL TRM V10.0.
Showers per Capita per Day (SPCD)	0.60	IL TRM V10.0.
People per Household (Household)	2.44	Wyoming Census Data 2017-2021 https://www.census.gov/quickfacts/fact/table/WY/HSD310221#HSD310221
Shower Fixtures per Household (SPH)	1.30	IL TRM V10.0. Deemed showerheads per household for multi-family and mobile homes. Addresses listed in the Program data that received showerheads were spot-checked and 100% were mobile or multi-family residences.
Days per Year	365.25	Conversion
Shower Water Temperature (Tmix)	101.00°F	IL TRM V10.0.
Inlet Water Temperature (Tinlet)	51.94°F	NREL Domestic Hot Water Event Generator for Wyoming
Specific Heat of Water	8.33	Standard conversion
BTU to kWh Conversion	3,412	Standard conversion
Recovery Efficiency of water heater (nDHW)	0.98	Typical recovery efficiency for electric resistance heaters (IL TRM, IN TRM, ARK TRM)
Percent of homes with electric water heating (%ElecWH)	100%	Program targets homes with electric hot water heaters
In-Service Rate (ISR)	100%	From 2018–2019 Wyoming Participant Survey

Table 38 provides the deemed savings for low-flow showerheads, using the assumptions from Table 37.

Table 38. Low-Flow Showerhead Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per showerhead	94.11

A.8 Windows

Table 39 documents the inputs and methodology for estimating window savings.

Table 39. Algorithms and Inputs for Windows

Algorithms Used		
Source of Algorithm: Used RESFEN6 (LBNL Software) to model a home with new windows. We estimate savings per window, and then apply to the total number of windows replaced.		
Parameter	**Value**	**Source/Notes**
Location	Lander, WY	Input for RESFEN6. The closest city in the RESFEN6 database to the majority of homes (60%) that received window replacement.
House Type	1 Story Existing Masonry	Input for RESFEN6. The majority of homes (80%) that received window replacements were mobile homes.
HVAC System	Electric Heat Pump	Input for RESFEN6. Program targets electrically heated homes for this measure. electric heat pump is the only electric heating option in the RESFEN6 Modelling Software.
Window area	9 ft^2	Input for RESFEN6. Standard window size for window savings modeling
U-factor base	0.88	Input for RESFEN6. RESFEN6 preset value for single clear, non-metal frame window
U-factor new	0.29	Input for RESFEN6. RESFEN6 preset value for double low-E, medium solar gain, non-metal thermally improved frame window
SHGC Base	0.64	Input for RESFEN6. RESFEN6 Preset Value for single clear, non-metal frame window
SHGC New	0.31	Input for RESFEN6. RESFEN6 preset value for double low-e, medium solar gain, non-metal thermally improved frame window
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of homes with electric heating (%ElecHeat)	16%	Wyoming County Assessor public records. Address lookup for participants who received major measures.
In-Service Rate (ISR)	100%	Assumed 100% of windows remain installed as it is a major measure and not likely to be removed by the participant.

Table 40 provides the deemed savings for windows, using the assumptions from Table 39

Table 40. Window Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per window	15.59

A.9 Ceiling Insulation

Table 41 documents the inputs and methodology for estimating ceiling insulation savings.

Table 41. Algorithms and Inputs for Ceiling Insulation

Algorithms Used		
kWh Savings (cooling)	= (((1/Rexisting - 1/Rattic) * Area * (1 - Framing Factor)) * 24 * CDD * DUA) / (1,000 * ηCool)) * ADJcool * %Cool * ISR	
kWh Savings (heating)	= (((1/Rexisting - 1/Rattic) * Area * (1 – Framing Factor)) * 24 * HDD) / (ηHeat * 3,412)) * ADJheat * %ElecHeat * ISR	
kWh Savings	= Cooling kWh Savings + Heating kWh Savings	
Source of Algorithm: Illinois TRM V10.0 Section 5.6.5		
Parameter	**Value**	**Source/Notes**
Existing Insulation R-value (Rexisting)	20.0	"LIW TRL" sheet in Program database indicates the baseline description is "less than R-30 in place." We assume some ceilings will already have some insulation in place and, therefore, assume an existing R-value of R-20 for the average.
R-value after installing attic insulation (Rattic)	38.0	"LIW TRL" sheet in Program database specifies an efficiency requirement "Up to R-48." In absence of a statewide energy code, the IECC energy code for Wyoming's climate zone (Zone 6), requires R-48. Assume R-38 as a conservative estimate.
Area of Installed Insulation (Area)	1,238	Calculated attic footprint square footage by dividing total conditioned floor area (1,666 square feet) by the number of stories (1.34) from RECS 2015 data for Wyoming (Mountain North)
Framing factor	7%	IL TRM V10.0.
Cooling Degree Day (CDD)	412	ASHRAE Fundamentals 2017 for Wyoming
Heating Degree Day (HDD)	7,182	
Discretionary Use Adjustment (DUA)	0.75	Discretionary use adjustment for cooling. Common to most TRMs. Accounts for fact that all cooling systems will not operate 100% of time requiring cooling
Cooling Efficiency (nCool)	11.88 SEER	Weighted average by equipment type and age from the IL TRM V10.0 and 2015 RECS data for Mountain North Division
Heating Efficiency (nHeat)	1.56 COP	
Cooling savings adjustment (ADJcool)	121%	IL TRM V10.0. Adjustment for cooling savings to account for inaccuracies in prescriptive engineering algorithms
Heating savings adjustment (ADJheat)	60%	IL TRM V10.0. Adjustment for heating savings to account for inaccuracies in prescriptive engineering algorithms
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of homes with electric heating (%ElecHeat)	16%	Wyoming County Assessor public records. Address lookup for participants who received major measures
In-service rate (ISR)	100%	Assumed 100% of ceiling insulation remain installed as it is a major measure and not likely to be removed by the participant

Table 42 provides the deemed savings for ceiling insulation, using the assumptions from Table 41.

Table 42. Ceiling Insulation Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per home	98.10

A.10 Duct Sealing & Insulation

Table 43 documents the inputs and methodology for estimating duct sealing and insulation savings.

Table 43. Algorithms and Inputs for Duct Sealing and Insulation

Algorithms Used		
kWh Savings (cooling)	= ((((DEafter – DEbefore) / DEafter) * FLHcool * CapacityCool * TRFcool / 1,000 / ηCool) * %Cool * ISR	
kWh Savings (heating)	= ((((DEafter – DEbefore) / DEafter) * FLHheat * CapacityHeat * TRFheat / ηHeat / 3,412) * %ElecHeat * ISR	
kWh Savings	= Cooling kWh Savings + Heating kWh Savings	
Source of Algorithm: Illinois TRM V10.0 Section 5.3.4		
Parameter	**Value**	**Source/Notes**
DEafter (cooling)	95%	From BPI "Guidance on Estimating Distribution Efficiency." Assume average for tightly sealed ducts for all duct locations insulated to R-8
DEafter (heating)	94%	
DEbefore (cooling)	85%	From BPI "Guidance on Estimating Distribution Efficiency." Average for duct leakage that is both average and leaky for all duct locations for uninsulated and insulated to R-2 or R-4
DEbefore (heating)	82%	
Full Load Cooling Hours (FLHcool)	409	EPA Calculator. Assume average between cities in Wyoming
Full Load Heating Hours (FLHheat)	2,588	
Capacity of central cooling equipment (CapacityCool)	36,000	Approximately 0.0016 tons of cooling is needed per square foot. Rounded to the nearest nominal tonnage. Total conditioned floor area (1,666 sf) from RECS 2015 data for Wyoming (Mountain North)
Output capacity of heating equipment (CapacityHeat)	58,293	Average between 20 and 50 BTUh of heating required per square foot from National Renewable Energy Laboratory (NREL) and South Carolina State University studies
Thermal regain factor for cooling (TRFcool)	1.00	IL TRM V10.0. Assumed ducts located in unconditioned space
Thermal regain factor for cooling (TRFheat)	1.00	
Cooling Efficiency (nCool)	11.88 SEER	Weighted average by equipment type and age from the IL TRM V10.0 and 2015 RECS data for Mountain North Division
Heating Efficiency (nHeat)	1.56 COP	
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of homes with electric heating (%ElecHeat)	16%	Wyoming County Assessor public records. Address lookup for participants who received major measures
In-service rate (ISR)	100%	Assumed 100% of duct sealing and insulation remain installed as it is a major measure and not likely to be removed by the participant

Table 44 provides the deemed savings for duct sealing and insulation, using the assumptions from Table 43.

Table 44. Duct Sealing and Insulation Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per home	656.99

A.11 Wall Insulation

Table 45 documents the inputs and methodology for estimating wall insulation savings.

Table 45. Algorithms and Inputs for Wall Insulation

Algorithms Used		
	= (((1/Rexisting - 1/Rwall) * Area * (1 – Framing Factor) * 24 * CDD * DUA) / (1,000 * ηCool)) * ADJcool * %Cool * ISR	
kWh Savings (heating)	= (((1/Rexisting - 1/Rwall) * Area * (1 - Framing Factor) * 24 * HDD) / (ηHeat * 3,412)) * ADJHeat * %ElecHeat * ISR	
kWh Savings	= Cooling kWh Savings + Heating kWh Savings	
Source of Algorithm: Illinois TRM V10.0 Section 5.6.4		
Parameter	**Value**	**Source/Notes**
Existing Insulation R-value (Rexisting)	5.0	IL TRM V10.0. Minimum of R-5 for uninsulated assemblies. "LIW TRL" sheet in program database indicates that the baseline description is no insulation for this measure
R-value after installing wall insulation (Rwall)	15.0	"LIW TRL" sheet in Program database specifies an efficiency requirement "Up to R-26". In absence of a statewide energy code, the IECC energy code for Wyoming's climate zone (Zone 6), requires R-20, R-13 cavity insulation + R-5 insulated sheathing (if <25% exterior structural sheathing), or R-13 cavity insulation + R-2 insulated sheathing (if >25% exterior structural sheathing). Assume R-15 as a conservative estimate
Area of Installed Insulation (Area)	1,317	Calculated wall area by multiplying wall height (assuming 8-foot ceilings * number of stories) by wall length (√conditioned floor area * 4 walls), where number of stories (1.34) and conditioned floor area (1,666 square feet) from RECS 2015 data for Wyoming (Mountain North) Reduced by 25% as a conservative estimate provided limited Program-specific data
Framing factor	25%	IL TRM V10.0.
Cooling degree day (CDD)	412	ASHRAE Fundamentals 2017 for Wyoming
Heating degree day (HDD)	7,182	
Discretionary use adjustment (DUA)	0.75	Discretionary use adjustment for cooling. Common to most TRMs. Accounts for fact that all cooling systems will not operate 100% of time, requiring cooling
Cooling Efficiency (nCool)	11.88 SEER	Weighted average by equipment type and age from the IL TRM V10.0 and 2015 RECS data for Mountain North Division.
Heating Efficiency (nHeat)	1.56 COP	
Cooling savings adjustment (ADJcool)	80%	IL TRM V10.0. Adjustment for cooling savings to account for inaccuracies in prescriptive engineering algorithms
Heating savings adjustment (ADJheat)	60%	IL TRM V10.0. Adjustment for heating savings to account for inaccuracies in prescriptive engineering algorithms

Algorithms Used		
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
percent of homes with electric heating (%ElecHeat)	16%	Wyoming County Assessor public records. Address lookup for participants who received major measures
In-service rate (ISR)	100%	Assumed 100% of wall insulation remain installed as it is a major measure and not likely to be removed by the participant

Table 46 provides the deemed savings for wall insulation, using the assumptions from Table 45.

Table 46. Wall Insulation Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per home	454.43

A.12 Air Sealing

Table 47 documents the inputs and methodology for estimating air sealing savings.

Table 47. Algorithms and Inputs for Air Sealing

Algorithms Used		
kWh Savings (cooling)	= ((((CFM50existing - CFM50new)/Nfactor) * 60 * 24 * CDD * DUA * 0.018) / (1,000 * ηCool) * LM) * %Cool * ISR	
kWh Savings (heating)	= ((((CFM50existing - CFM50new)/Nfactor) * 60 * 24 * HDD * 0.018) / (nHeat * 3,412)) * %ElecHeat * ISR	
kWh Savings	= Cooling kWh Savings + Heating kWh Savings	
Source of Algorithm: Illinois TRM V10.0 Section 5.6.1		
Parameter	**Value**	**Source/Notes**
Existing Infiltration Rate (ACH50existing)	17.40	ENERGY STAR savings analysis assumptions for Wyoming (Use Climate Zone 6 as it covers the majority of the State). Assume "Whole House Air Sealing." https://www.energystar.gov/ia/home_improvement/home_sealing/Measure_Upgrade_Assumptions.pdf?945a-eddc
Improved Infiltration Rate (ACH50new)	13.10	
Existing Infiltration Rate (CFM50existing)	3,864	Converts ACH50 to CFM50 (=ACH50*Volume/60 minutes), where volume is the total conditioned floor area (1,666 sf) from RECS 2015 data for Wyoming (Mountain North) multiplied by an assumed ceiling height of 8 feet http://www.pureenergyaudits.com/docs/Blower_Door_Handout_ACI_Baltimore.pdf
Improved Infiltration Rate (CFM50new)	2,909	
Nfactor	15.79	BPI Technical Standards for the Building Analyst Professional. Approximately half of Wyoming is located in Zone 1 and the other half is in Zone 2, so the median N Factor from both zones was applied across 1, and 1.5 stories as the average number of stories per 2015 RECs is 1.34 stories multiplied by the average Height Correction Factor (0.95)
Conversion	1,440	Converts ft3/min to ft3/day by multiplying 60 (mins/hour) by 24 (hours/day)
Cooling degree day (CDD)	412	ASHRAE Fundamentals 2017 for Wyoming
Heating degree day (HDD)	7182	
Discretionary use adjustment (DUA)	0.75	Discretionary use adjustment for cooling. Common to most TRMs. Accounts for fact that all cooling systems will not operate 100% of time requiring cooling

Algorithms Used		
Heat capacity of air	0.018	Volumetric heat capacity of air
Cooling Efficiency (nCool)	11.88 SEER	Weighted average by equipment type and age from IL TRM V10.0 and 2015 RECS data for Mountain North Division
Heating Efficiency (nHeat)	1.56 COP	
Latent multiplier (LM)	3.20	IL TRM V10.0 for Chicago, IL, most representable climate to Wyoming
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of Homes with electric heating (%ElecHeat)	16%	Wyoming County Assessor public records. Address lookup for participants who received major measures
In-service rate (ISR)	100%	From the Low Income Weatherization Program Summary in the Wyoming Demand Side Management Report (issued July 2020). Post-Installation Inspections completed to verify installation of measures

Table 48 provides the deemed savings for Air Sealing, using the assumptions from Table 47.

Table 48. Air Sealing Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per home	419.07

A.13 Thermal Doors

Table 49 documents the inputs and methodology for estimating thermal door savings.

Table 49. Algorithms and Inputs for Thermal Doors

Algorithms Used		
kWh Savings (cooling)	= (((1/Rexisting - 1/Rnew) * Area * 24 * CDD * DUA) / (1,000 * ηCool)) * %Cool * ISR	
kWh Savings (heating)	= (((1/Rexisting - 1/Rnew) * Area * 24 * HDD) / (3,412 * ηHeat)) * %ElecHeat * ISR	
kWh Savings	= Cooling kWh Savings + Heating kWh Savings	
Source of Algorithm: Iowa TRM V5.0 Section 2.6.5		
Parameter	**Value**	**Source/Notes**
Existing Insulation R-value (Rexisting)	3.13	Iowa TRM V5.0
R-value after Installing Thermal Door (Rnew)	3.85	ASHRAE 2017 Fundamentals Section 15, Table 6. Assume double glazing with 1/2 inch air space insulated steel slab with wood edge in wood frame, 25% glazing
Area of door in square feet (area)	20	Standard entry door: 6.75 feet by 3 feet
Cooling degree day (CDD)	412	ASHRAE Fundamentals 2017 for Wyoming
Heating degree day (HDD)	7,182	
Discretionary Use Adjustment (DUA)	0.75	Discretionary Use Adjustment for cooling. Common to most TRMs. Accounts for fact that all cooling systems will not operate 100% of time, requiring cooling
Cooling Efficiency (nCool)	11.88 SEER	Weighted average by equipment type and age from the ILTRM V10.0 and 2015 RECS data for Mountain North Division
Heating Efficiency (nHeat)	1.56 COP	

Algorithms Used		
Percent of homes with central cooling (%Cool)	57%	RECS Survey 2015 for Mountain North Division
Percent of homes with electric heating (%ElecHeat)	100%	Program requires 51% of conditioned floor area be electrically heated
In-service rate (ISR)	100%	Assumed 100% of installed thermal doors remain installed as they are a major measure and not likely to be removed by the participant

Table 50 provides the deemed savings for thermal door, using the assumptions from Table 49.

Table 50. Thermal Door Deemed Savings

Metric	Deemed Savings per Measure
Annual kWh per door	39.68

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