# 2021 Virginia Residential Portfolio EM&V Report

Volume I of II

Prepared for:
Appalachian Power Company

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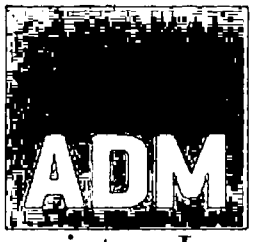
Prepared by:

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# 1 Introduction

Under contract with Appalachian Power Company (herein referred to as the "Company" or "APCo"), ADM Associates, Inc., (herein referred to as "the Evaluation Team") performed evaluation, measurement and verification (EM&V) activities to confirm the energy savings (kWh) and demand reduction (kW) realized through the energy efficiency and demand response programs that the Company implemented in Virginia during 2021. This report details the EM&V activities and findings relating to programs the Company offered in the residential sector.

This chapter provides a brief description of the residential programs offered by the Company, a summary of evaluation findings, and information regarding the organization of the report.

## 1.1 Program Year 2021 Residential Program Offerings

The Company offered residential customers four energy efficiency programs and one demand response program during program year 2021 (PY2021). A brief description of each program is provided below.

**Home Performance Program:** The Home Performance Program provides customers with a more comprehensive approach and enhances the ability to drive long-term participation and deeper savings. Homeowners can engage the program through:

- Registering through the online portal
- Working with a trade ally
- Calling a dedicated contact center to register over the phone;
- Completing an online Home Performance self-assessment; or
- Requesting an on-site or virtual home assessment.

The Home Performance Program utilizes a progressive residential technology platform to engage customers in energy conservation over time through the promotion of energy efficient homes. The Home Performance Program engages the customer at his or her own pace to reduce their energy use and improve the customer experience, enhancing the ability to drive long-term participation and deeper energy savings.

**Low-Income Single Family Program:** The LISF Program is designed to provide home energy services to APCo's Virginia customers with limited income to assist them in reducing their electric energy usage and to manage their utility costs. The LISF Program will help facilitate the implementation of electric energy-saving measures in residential low-income single family households.

The program reduces energy consumption by educating residential customers about the energy and money saving benefits associated with energy efficiency in the home. All customers participating in this program receive educational materials and an opportunity

to discuss ways that they can continue to conserve and maintain the energy efficiency of their home after the weatherization process has been completed.

The LISF Program targets measures which have been proven to save energy, reduce consumption, and protect the health and safety of occupants while helping to lower their electric bills. Eligible measures include, but are not limited to, those listed below.

- Energy efficient lighting
- Water saving devices (for homes with electric water heaters)
- Water heater pipe wrap insulation (for homes with electric water heaters)
- HVAC replacement and maintenance
- ENERGY STAR® appliance upgrades
- Insulation and air sealing measures
- Electrical system upgrades and maintenance
- Home ventilation measures
- Programmable thermostat upgrades
- General health and safety measures

Equipment and installation costs for all measures are provided at no cost to eligible customers and properties.

**Low-Income Multifamily Program:** The LIMF Program aims to reduce energy consumption by educating residential customers about the energy and money saving benefits associated with energy efficiency in the home. All customers participating in this program receive educational materials and an opportunity to discuss ways that they can continue to conserve and maintain the efficiency of their home after the services have been performed.

The LIMF Program targets measures which have been proven to save energy, reduce consumption, and protect the health and safety of occupants while helping to lower their electric bills. Eligible measures include, but are not limited to, those listed below.

- Electric Baseload Reduction
  - Energy efficient lighting
  - Electric water heating measures (aerators, pipe wrap, showerheads, etc.)
  - ENERGY STAR® appliance upgrades
- Electric Weatherization Measures
  - HVAC replacement and maintenance
  - Insulation and air sealing measures

- Duct system sealing and replacement

- Health and Safety
  - Electrical system upgrades and maintenance
  - Home ventilation

In general, equipment and installation costs for all measures will be provided at no cost to eligible customers and properties.

**Bring Your Own Thermostat Program:** The Bring Your Own Thermostat (BYOT) program is a demand response program that offers customers a one-time $50 incentive to enroll a qualifying smart thermostat and a $5 a month incentive, up to $25 per year, for allowing adjustments to their thermostat to reduce air conditioner usage during peak event periods. Nest, Honeywell, and Eco bee thermostats are eligible for the program.

The program sets a maximum of 15 load management events during the program year. The events typically last two to three hours. During an event, a signal is sent to the enrolled thermostat to either cycle the unit on and off or raise the thermostat set point to reduce consumption during the event period. Fifteen events were called during PY2021. The events were called during periods when forecasted electricity demand on the PJM regional transmission organization (RTO) was high.

**ENERGY STAR® Manufactured Housing Program:** The ENERGY STAR Manufactured Housing Program (ESMH) Program pays incentives in the form of rebates for electrically heated manufactured homes that qualify for the ENERGY STAR label as defined by the U.S. Environmental Protection Agency. ENERGY STAR compliance requires the use of a package of envelope and equipment measures that in combination result in performance that is more energy efficient than comparable homes built to the federal Manufactured Home Construction and Safety Standards, commonly referred to as the HUD code.

For each ENERGY STAR certified home sold to an APCo Virginia customer, incentives of the following amounts are paid:

- APCo customer (home buyer): $700
- HVAC contractor: $50 - $100
- Manufactured home retailer: $600 - $650

Program evaluation findings are summarized in the following sections. The evaluation findings refer to expected and realized as well as gross and net impacts. For the purposes of this report, these impacts are defined as:

**Expected Impacts:** Energy savings (kWh) and peak demand (kW) reduction estimates based on customer participation in PY2021, before program evaluation activities.

**Realized Impacts:** Energy savings (kWh) and peak demand (kW) reduction estimates for PY2021 developed through the Evaluation Team's evaluation, measurement and verification (EM&V) activities.

**Gross Impacts:** Changes in energy consumption/demand that result directly from program-promoted actions regardless of the extent or nature of program influence on these actions.

**Net Impacts:** The portion of gross impacts that is directly attributable to the actions of the Company's energy efficiency and/or demand response programs.

The evaluation of the Company's programs complies with the rules for evaluation, measurement, and verification (EM&V) set forth in Case No. PUR-2017-00047.

*Table 1-1 Compliance with Case No. PUR-2017-00047 EM&V Rules*

| *Subsection* | *Requirement* | *Response* |
|---|---|---|
| 20VAC5-318-40 (A) | In all filings required by 20VAC5-318-30, the sources of all data or estimates used as inputs for proposed DSM measures or programs, in descending order of preference, shall be:<br><br>1. Utility-specific data;<br>2. Virginia-specific data if utility-specific data is unavailable or impracticable. When Virginia-specific data is used, the utility shall provide an explanation as to why utility-specific data is unavailable or impracticable;<br>3. Data from non-Virginia jurisdictions or sources, if neither utility-specific data nor Virginia-specific data is available or practicable:<br>a. When data from non-Virginia jurisdictions or sources is used, the utility shall provide an explanation as to why utility-specific data is unavailable or impracticable.<br>b. When data from non-Virginia jurisdictions or sources is used, the utility shall provide an explanation as to why Virginia-specific data is unavailable or impracticable as well as the sources of all data, to include:<br>(1) Titles, version numbers, publication dates, and page numbers of all source documents, as appropriate; and<br>(2) An explanation as to why, in the utility's assessment, use of this data is appropriate. | The methods used to evaluate program impacts is provided in the methodology sections of each program chapter of this report. The methods comply with the order of preferred data inputs cited in code 20VAC5-318-40 (A). Primary data may be supplemented by secondary data to facilitate cost efficient allocation of EM&V resources. Titles, version numbers, publication dates, and page numbers of all source documents are cited, as appropriate. |
| 20VAC5-318-40 (B) | EM&V reports shall include relevant workpapers, support documents, assumptions, and equations used in developing the measurement and verification methodologies of measures or programs reported. | The program chapters describe the methodologies used to estimate savings for the program measures and include citations of relevant workpapers, support documents, assumptions, and equations used in developing the measurement and verification methodologies of measures or programs reported. |
| 20VAC5-318-40 (C) | EM&V reports shall include measure-level estimates of kilowatt, kilowatt-hour, dekatherm, and pipeline capacity savings as appropriate. An estimate that has been adjusted for free-ridership as well as an estimate that has not been adjusted for free-ridership should be included as appropriate. | The cost-effectiveness analysis file submitted with the EM&V report presents measure-level estimates of peak kW and kWh energy savings. |
| 20VAC5-318-50 (A) | EM&V of approved DSM measures or programs should be consistent with and contrasted to the preliminary EM&V plan set forth in the filings for approval of such measures or programs or as otherwise specified in a commission order approving such measures or programs. The commission recognizes that each utility has unique characteristics, and new or modified energy | The EM&V reports detail any deviations from the approach submitted in the EM&V plan set forth in the filings and the reasons for that deviation. |

| *Subsection* | *Requirement* | *Response* |
|---|---|---|
| | efficiency measures are constantly being developed. As such, alternative methodologies may be included in reporting provided that sufficient supporting documentation and explanation of appropriateness of alternative methodologies is provided. | |
| 20VAC5-318-50 (B) | EM&V reports of existing measures or programs shall utilize utility-specific data or other data in conformance with 20VAC5-318-40 A when updating the analysis of the cost effectiveness of each measure, program, or portfolio as appropriate and practicable. EM&V reports of existing measures or programs shall include the information required by 20VAC5-318-40 B and C. | The EM&V report includes this information. |
| 20VAC5-318-50 (C) | Any changes to or variances from originally approved measure-level inputs and assumptions shall be documented and explained, and the impact of such changes on original cost/benefit estimates for DSM programs or measures shall be quantified. | The EM&V report presents cost effectiveness analysis based on the expected savings estimates to characterize the discrepancy between the benefits resulting from the expected estimates and the ex post estimates. The presentation of savings results includes discussion of the reasons for differences between the expected savings and ex post savings estimates. |
| 20VAC5-318-50 (D) | EM&V reports shall describe the methodologies by which the measured data was collected, including at a minimum:<br><br>1. The sampling plan; and<br>2. Statistical calculations upon which the reported data is based when applicable. | The sampling approach is presented in the methodology section of the program chapters. |
| 20VAC5-318-50 (E) | EM&V reports for ongoing DSM measures or programs shall include an explanation of eligibility requirements for each rate schedule to which the measures or programs are being offered. | The program chapters provide a description of the program that includes information on the measure or program eligibility requirements as provide by the Company. |
| 20VAC5-318-50 (F) | EM&V reports for ongoing DSM measures or programs shall include a comparison of the measured annual measure or program savings estimates to the annual usage of the average rate schedule usage and eligible customer in each rate schedule to which the measures or programs is being offered. A comparison to originally approved estimated savings for the measures or programs that were approved by the commission shall also be provided. This will include a calculation of the expected savings as a percentage of the annual usage of the average rate schedule usage and eligible customer as appropriate and practicable. | The program chapters present a table for each program and rate class, based on data provided by the Company, that summarizes the following information: Program Name, Rate Class, Total kWh Savings, Number of Participating Customer Accounts, Average kWh Savings per Customer Account, and Average Consumption per Account for the Rate Schedule |

| *Subsection* | *Requirement* | *Response* |
|---|---|---|
| 20VAC5-318-50 (G) | EM&V reports for ongoing DSM measures or programs shall include a description of the controls undertaken by the utility to verify proper installation of the measures or programs, as appropriate. Additionally, utilities shall require the contractors and subcontractors that will be implementing the measures or programs, if applicable and practicable, to record details of serviced or replaced equipment, to include at a minimum:<br><br>1. Nameplate efficiency ratings;<br>2. Serial numbers; and<br>3. Model numbers.<br><br>This information will be made available to commission staff upon request. | The program chapters include the following information was provided by the Company or otherwise determined through the evaluation effort:<br>1) a description of program installation quality controls.<br>2) a description of equipment specification data recorded by the program. |
| 20VAC5-318-50 (H) | EM&V reports should include actual costs incurred by the utility and each EM&V contractor for (i) the development of the most recent EM&V plan and (ii) the administration of EM&V activities for the reporting period. | Unless otherwise noted, where applicable, costs presented in the cost effectiveness analysis chapter of the EM&V report are inclusive of actual costs incurred by the utility and each EM&V contractor for the development of the most recent EM&V plan and the administration of EM&V activities for the reporting period. |

## 1.2 Summary of Data Collection

Table 1-2 summarizes data collection activities that supported the PY2021 evaluation of the Company's residential programs.

*Table 1-2 Summary of Survey and Interview Data Collection*

| *Survey* | *Mode* | *Fielding Period* | *Number of Contacts* | *Number of Survey/Interview Completions* |
|---|---|---|---|---|
| Home Performance Program Participant | Online | September 2021 | 618 | 84 |
| | Online | January 2022 | 352 | 52 |
| Low-Income Single Family Program Participant | Telephone | January 2022 | 81 | 10 |
| Low Income Multifamily Program Tenant Survey | Online | September 2021 | 91 | 4 |
| | Online | January 2022 | 180 | 13 |
| Low Income Multifamily Program Property Manager Survey | Online | January 2022 | 4 | 2 |
| Bring Your Own Thermostat Program Participant | Online | September 2021 | 800 | 122 |
| ENERGY STAR Manufactured Home Program Home Buyer Survey | Online | December 2021 | 62 | 5 |
| ESMH Retailer Interviews | Telephone | December 2021 | 14 | 6 |

## 1.3 Impact Evaluation Findings

The Evaluation Team performed EM&V activities for each of the five residential programs offered by the Company during PY2021. PY2021 was the first year that the Low-Income Multifamily Program was offered and the program completed projects at six properties. The program implementer noted that the program is continuing to increase the number of properties in the pipeline and the program savings may increase in the coming years. The ENERGY STAR Manufactured Home Program, which was last offered in 2018, was relaunched in 2021. Based on interviews completed in December of 2021, ADM concluded that the market for ENERGY STAR Manufactured homes had transformed and that the program did not achieve any net savings impacts. Consequently, ADM has recommended that the Company discontinue the program in its current form.

As shown in Table 1-3, the Company's residential programs achieved gross realized energy savings of 2,507,744 kWh, with a gross realization rate of 74%. The residential programs achieved net realized energy savings of 2,323,152 kWh, with an average residential program net-to-gross ratio of 93%.

As shown in Table 1-4, the Company's residential programs achieved gross realized peak demand reductions of 4,884.30 kW, with a gross realization rate of 90%. The residential programs achieved net realized peak demand reductions of 4,862.46 kW, with an average residential program net-to-gross ratio of 100%.

*Table 1-3 Summary of Residential Portfolio Energy Savings*

| *Program Name* | *Ex Ante kWh Savings* | *Ex Post Gross kWh Savings* | *Gross kWh Savings Realization Rate* | *Ex Post Net kWh Savings* | *Estimated Net-to-Gross Ratio* | *Lifetime Net Ex Post kWh Savings* |
|---|---|---|---|---|---|---|
| Home Performance Program | 1,312,658 | 917,268 | 70% | 671,749 | 73% | 9,195,069 |
| Low-Income Single Family Program | 678,953 | 477,853 | 70% | 477,853 | 100% | 5,978,841 |
| Low-Income Multifamily Program | 1,268,455 | 982,294 | 77% | 982,294 | 100% | 11,843,186 |
| ENERGYSTAR Manufactured Homes Program | - | 7,940 | N/A | - | 0% | - |
| Bring Your Own Thermostat Program | 122,389 | 122,389 | 100% | 191,256 | 156% | 191,256 |
| Residential Portfolio Totals | 3,382,455 | 2,507,744 | 74% | 2,323,152 | 93% | 27,208,353 |

*Table 1-4 Summary of Residential Portfolio Peak Demand Impacts*

| *Program Name* | *Ex Ante Gross kW Savings* | *Ex Post Gross kW Savings* | *Gross Realization Rate* | *Ex Post Net kW Savings* | *Net-to-Gross Ratio* |
|---|---|---|---|---|---|
| Home Performance Program | 220.54 | 101.40 | 46% | 74.77 | 74% |
| Low-Income Single Family Program | 249.86 | 95.09 | 38% | 95.09 | 100% |
| Low-Income Multifamily Program | 483.90 | 228.65 | 47% | 228.65 | 100% |
| ENERGYSTAR Manufactured Homes Program | - | (4.79) | N/A | - | 0% |
| Bring Your Own Thermostat Program | 4,463.95 | 4,463.95 | 100% | 4,463.95 | 100% |
| Residential Portfolio Totals | 5,418.25 | 4,884.30 | 90% | 4,862.46 | 100% |

## 1.4 Process Evaluation Findings

This section presents the high-level findings and recommendations developed through process evaluation activities for the PY2021 residential portfolio. Key process related findings and recommendations from the PY2021 evaluation are summarized below:

**Home Performance Program**

- **Program participation increased in 2021 compared 2020.** The number of customers participating in the program increased in comparison to 2020. Increases were seen across the various participation channels.
- **Participants continue to participate in a variety of ways in the program.** The most common ways in which customers participated in the Home Performance program were by receiving direct install measures and an assessment, an assessment without direct install measures, and completing a major measure project followed by receiving direct install measures and an assessment.
- **Most participants were satisfied with the program, although 14% reported dissatisfaction with it.** The most common reasons given for dissatisfaction were not receiving the assessment report and slow rebate payments. Additionally, some customers reported a lack of understanding of the next steps.
    - **Recommendation 1:** Review the process of delivering assessment reports to ensure that customers are receving the report.
    - **Recommendation 2:** Review the rebate payment process to identify opportunities for streamlining and expediting rebate payments.
    - **Recommendation 3:** Consider following up with customers who receive a rebate to provide additional information and clarify next steps for participants. Although a small number of participants reported that this was an issue, it suggests there may be additional opportunities to encourage customers to make efficiency improvements.

**Low-Income Single Family Program**

- **Participant satisfaction continues to be high.** All survey respondents were satisfied with the work performed and all but one was satisfied with the program overall.

**Low Income Multifamily Program**

- **Feedback from property managers was positive.** Participating property managers were satisfied with the program and likely to recommend it to colleagues. Both respondents provided a favorable assessment of the installation process and one noted that the implementer and its subcontractors were "great to work with through this process."
- **Most surveyed tenants were satisfied with the measures received and their experience with the program.** Overall, tenants provided positive feedback on the measures and 80% reported realizing multiple benefits.

- **The program has quality control and assurance processes in place.** The program has multiple levels of quality control and assurance in place. These processes cover the quality of the installations, review of data collected during audits and results of diagnostic testing. Additionally, the program is documenting installed and replaced measure specifications and photographing the items. Future inclusion of BPI certification of individuals performing diagnostic testing will add an additional measure of quality assurance to the process. One aspect, that additional attention should be placed on is the installation of advanced power strips. These devices have the potential to cause dissatisfaction among tenants who do not understand them and the risk of being used improperly.
  - **Recommendation 1: ADM recommends providing guidance to installers on the installation of the advanced power strips.** Installers should be informed that they should use customer input in determining what components should be plugged into control and switched locations of the device. Generally devices with hard drives should not be installed in the switched locations.
  - **Recommendation 2: ADM recommends recording information on the use of the advanced power strips.** An enhancement to the program data is to record whether the device is controlling entertainment or computer/office equipment. The estimating savings for these two types of equipment vary.

- **In-person outreach has been the primary recruitment tactic.** Staff reported that in-person outreach in the form of cold calling on individual properties has been the primary means of recruiting participant. This is a best practice for these types of programs, but there may be opportunities to engage in other forms of outreach.
  - **Recommendation 3: ADM recommends in other forms of best-practice outreach for multifamily programs.**[1] Other best practices include outreach to housing associations and identifying property management firms that manage multiple properties.

**Bring Your Own Thermostat Program**

- **Program information continues to explain the program well.** Nearly all survey respondents indicated that the program information addressed their questions about it. A majority of customers got information on the program from the Company website.

[1] For example, see ACEEE (2014). Effective Marketing and Outreach Strategies for Multifamily Energy Efficiency Programs.

- **Most participants thought that it was easy to enroll their thermostat.** Eighty-four percent of respondents rated the enrollment process as a four or a five on a five-point scale where five represented very easy.
- **Overall satisfaction with the program was high.** Approximately 84% of participants reported that they were very satisfied or somewhat satisfied with the program. Additionally, 86% indicated a high likelihood of participating in the program in the following year.

**ENERGY STAR Manufactured Home Program**

- **Overall, the findings of the research into the effect of the ESMH program on sales of higher efficiency homes does not support a conclusion that the program is impacting manufactured home efficiency.** There are two pathways by which the program may influence sales of more efficient homes. First, the program works with retailers to educate them on how to market ENERGY STAR homes and provides financial incentives to the retailer for selling ENERGY STAR homes. This pathway does not appear to be functioning as intended for two reasons. First, retailers either believe all the homes they sell are ENERGY STAR homes or that they do not think there is a difference between ENERGY STAR homes and the Clayton EnergySmart homes that comprise the non-ENERGY STAR homes they sell. This suggest that retailers would not promote one home over the other because they believe that all EnergySmart homes are or will be ENERGY STAR certified. Second, in the interviews performed with the six retailers in December, all said that the program was not at all influential in their decision to sell ENERGY STAR homes. Consequently, it appears the program is not having any impact on retailer behavior and their promotion of the ENERGY STAR homes.

  The other pathway by which the program may impact sales of ENERGY STAR homes is through the influence of the purchaser rebate on their purchase decision. However, very few purchasers applied for that rebate in 2021 and as such most sales happened even without the rebate.

  The Evaluation Team acknowledges that the difference between SBRA reported sales of ENERGY STAR homes and the larger number of total homes sold by Clayton suggests some non-ENERGY STAR home sales are occurring in the APCo service area and this seems to contradict retailer reports. However, the preponderous of evidence we have suggests that the program is not influencing retailer behavior, nor purchaser behavior. Furthermore, the construction standards for the ENERGY STAR and the EnergySmart Homes may be equivalent as suggested by the available data on the EnergySmart construction standards.

  - **Recommendation 1: The Evaluation Team believes that future research on energy savings attribution should focus on the impact of the purchaser rebate on the decision to buy the home and specifically the choice to install a heat pump system.** We note however, that there is significant evaluation risk in that additional research may not support program attribution.

- **Other jurisdictions, such as Oregon, have focused their manufactured homes program services to upgrading the existing stock of manufactured homes.** They have done this to assist low-income households and generate energy savings.
    - **Recommendation 2: Investigate shifting the focus of the APCo program to assisting people, especially low-income households, living in existing manufactured housing by offering rebates and services aimed at upgrading and replacing the existing manufactured housing stock.**
- **Nearly all heat pumps installed in homes met the minimum ENERGY STAR requirements for the heat pump compliance pathway.** Review of the tracking data indicated that most program homes met the minimum requirements of 8.2 HSPF and 14 SEER equipment. There may be the potential to accrue net energy impacts by offering buyers an incentive for heat pumps with a minimum efficiency of 9 HSPF and 16 SEER. The limited number of higher efficiency units suggests that there is the potential to influence the installation of higher efficiency heat pumps.
    - **Recommendation 3: Investigate offering buyer incentives for heat pumps that exceed the ENERGY STAR requirement.**

## 1.5 Cost Effectiveness Evaluation Findings

Company cost effectiveness models were updated to account for ex post savings determined by the evaluation team. The following cost effectiveness tests were updated for the programs: Total Resource Cost (TRC) test, Program Administrator Cost Test (PACT), Participant Cost Test (PCT), and Ratepayer Impact Measure (RIM) test. A test score above one signifies that, from the perspective of the test, the program benefits were greater than the program costs. The test results for each program and the overall residential portfolio are presented in Table 1-5. For reference, for the Bring Your Own Thermostat Program and the Home Performance Program, supplemental test results are presented that are inclusive of PY2021 costs and benefits as well as costs of benefits of the program during PY2022 – PY2026, discounted to PY2021 net present value (NPV).

*Table 1-5 Summary of Benefit-Cost Ratios – PY2021*

| *Program* | *Program Administrator Cost Test* | *Total Resource Cost Test* | *Ratepayer Impact Measure* | *Participant Cost Test* |
|---|---|---|---|---|
| Low-Income Single Family Program | 0.14 | 0.38 | 0.11 | N/A |
| Low-Income Multifamily Program | 0.11 | 0.36 | 0.09 | N/A |
| ENERGYSTAR Manufactured Homes Program | - | - | - | N/A |
| Bring Your Own Thermostat Program | 0.21 | 0.31 | 0.21 | N/A |
| Home Performance Program | 0.33 | 0.33 | 0.20 | 4.09 |
| Bring Your Own Thermostat Program (PY2021 + NPV Projected PY2022 - PY2026) | 0.71 | 1.13 | 0.25 | 1.76 |
| Home Performance Program (PY2021 + NPV Projected PY2022 - PY2026) | 1.33 | 1.34 | 0.87 | 1.36 |

## 1.6 Organization of Report

This report is divided into two volumes providing information on the impact, process, and cost effectiveness evaluation of the Company's portfolio of residential programs implemented in Virginia during the 2021 program year. Volume I is organized as follows:

- Chapter 2: Home Performance Program
- Chapter 3: Low-Income Single Family Program
- Chapter 4: Low-Income Multifamily Family Program
- Chapter 5: Bring Your Own Thermostat Program
- Chapter 6: ENERGY STAR Manufactured Homes Program
- Chapter 7: Cost Effectiveness Evaluation

See report Volume II for chapters presenting data collection instruments and survey results.

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# 2 Home Performance Program

## 2.1 Program Description

The Home Performance Program provides customers with a more comprehensive energy conservation approach and creates the pathway for an energy efficient home. Residents can engage the program through:

- Registering through the online portal
- Working with a trade ally
- Calling a dedicated contact center to register over the phone;
- Completing an online Home Performance self-assessment; or
- Requesting an on-site or virtual home assessment.

The Home Performance Program utilizes a progressive residential technology platform to engage customers in energy conservation over time through the promotion of energy efficient homes. The Home Performance Program engages the customer at their own pace to reduce the implementation cost of saving energy and to improve the customer experience, enhancing the ability to drive long-term participation and deeper energy savings.

### 2.1.1 Program Eligibility Requirements

Eligible Home Performance participants include active residential customers served by the Company in existing single family residential detached homes, townhomes, and duplexes. Eligible homes include owner occupied and non-owner occupied (renters) with electrical service in the occupant's name and with written consent of owner.

Measures must be purchased, installed, and for HVAC equipment, operable prior to submitting a rebate application. The measure eligibility requirements are as follows:

- **Attic insulation**: Attic flat or sloped roof insulated to R-30 for homes with electric heat.
- **Air sealing**: Blower door test-in and test-out required, unless there is suspected mold or asbestos present. Contractors' target the highest sources of air leakage first, such as major penetrations in the attic, basement, or crawlspace. Measured leakage reduction must be 30% or greater to qualify.
- **Duct sealing**: Accessible joints, seams, connections, and penetrations sealed with approved mastics.
- **Air source heat pump SEER 17**: Replace an existing electric resistance heat. Fuel switches are not eligible. Equipment must be new, ENERGY STAR rated, and meet the minimum efficiency requirement.
- **Mini split ductless SEER 19:** Replace an existing air source heat pump or electric resistance heating. Equipment must be new, ENERGY STAR rated, and meet the minimum efficiency requirement.

- **Smart thermostat.** Installed on an air source heat pump that provides heating and cooling or on an electric resistance heating system with central air conditioning. Must replace a non-programmable thermostat.
- **ECM retrofit**: Replace an existing PSC motor. Upgrade should not be installed if existing equipment is near end of its service life or very low efficiency, in which case full equipment replacement is the recommendation.

### 2.1.2 Summary of Savings by Eligible Rate Schedule

Table 2-1 compares average participant ex post net energy savings with the average energy usage of accounts for the applicable eligible rate schedule.

*Table 2-1 Summary of Savings by Eligible Rate Schedule*

| *Rate Schedule* | *Total Net Ex Post kWh Savings* | *Number of Participating Accounts* | *Average Participant Account-Level Net Ex Post kWh Savings* | *Average Rate Schedule Account-Level kWh Usage* | *Average Participant Account-Level Net Ex Post kWh Savings as Percentage of Average Rate Schedule Account-Level kWh Usage* |
|---|---|---|---|---|---|
| RS | 671,749 | 1177 | 571 | 15,417 | 3.70% |

## 2.2 Data Collection

### 2.2.1 Participant Survey

Data collection from a participant survey was used to:

- Verify measures to estimate gross savings impacts;
- Collect data on participant decision making to estimate net impacts; and
- Collect data on participants experience with the program to inform the process evaluation.

To estimate the sufficiency of the sample size, the Evaluation Team calculated the sample size needed to meet the 90/10 precision and confidence level. The sample size to meet 90/10 requirements is calculated using the coefficient of variation defined as:

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

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 by the following equation:

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

Where,

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

CV = Coefficient of Variation

RP = Required Precision, 10% in this evaluation

A sample of 68 is sufficient to achieve at least 10% precision at the 90% level of confidence. The Evaluation Team met this target through 136 completed surveys.

The survey was administered online and by telephone to Home Performance participants. Participants were contacted by email in September 2021 and by telephone in January 2022 to complete the survey. The Evaluation Team contacted all participants with valid email addresses and two reminder emails were sent in addition to the initial email contact. The Evaluation Team contact all customers with a valid telephone number and placed up to three calls with the customers to request that they complete the survey. Table 2-2 summarizes the number of customers contacted and the number of survey completions received.

*Table 2-2 Survey Response Summary*

| *Survey* | *Mode* | *Fielding Period* | *Number of Contacts* | *Number of Survey/Interview Completions* |
|---|---|---|---|---|
| Home Performance Program Participant | Online | September 2021 | 618 | 84 |
| | Online | January 2022 | 352 | 52 |
| Total | | | 970 | 136 |

## 2.3 Impact Evaluation

This chapter addresses the kWh savings and peak kW reductions resulting from measures installed in homes of customers that received measures through the Home Performance Program during the period January 2021 through December 2021.

### 2.3.1 Methodology for Estimating Gross Savings

The methodology used for estimating gross savings is described in this section. The methodology used to estimate savings deviated from the preliminary EM&V plan set forth in the program filing. The preliminary EM&V plan stated that the Evaluation Team would perform on-site visits to verify measure installations. Instead, the Evaluation Team utilized online surveys to verify measures as a safety precaution in response to COVID-19.

The M&V approach for the 2021 Home Performance Program is aimed at the following:

- Determining the number of measures reported as being installed through the program;
- Verifying the number of measures that are currently installed;
- Estimating annual gross and net kWh savings for measures implemented; and
- Estimating annual gross and net kW reduction for measures implemented.

Table 2-3 below summarizes the inputs needed for gross savings calculations and the source of each input.

*Table 2-3 Data Sources for Gross Impact Parameters – Home Performance Program*

| *Parameter* | *Source* |
|---|---|
| Number of Participants | Program Tracking Data |
| Measures Installed | Program Tracking Data/ Participant Surveys |
| Measures Still in Use | Participant Survey |
| Measure Characteristics | Program Tracking Data/ Mid-Atlantic TRM/ Virginia Weather Data |
| Home Characteristics | Program Tracking Data |

#### 2.3.1.1 Measure Attributes Tracked

For homes that received direct install measures under this program, home characteristics were documented including heating and cooling system type and water heating type. Program staff also maintained a catalog of measure attributes of direct installation measures including, where applicable, manufacturer model, and ENERGY STAR model identifier.

Table 2-4 presents information on the equipment specification data tracked by the program.

*Table 2-4 Gross Impact Attributes Tracked by Program – Home Performance Program*

| *Measure* | *Attributes Tracked* |
|---|---|
| HVAC Measures | Heating and Cooling System Types and Efficiency Levels |
| Lighting Measures | Wattage, Lumens |
| | HVAC equipment |
| | Installation Location (Room) |
| Water Heating Measures | Water Heating Type, Installation Location (Room) for Aerators |
| Envelope Measures | Existing and New Insulation Levels, Heating and Cooling System Types |

#### 2.3.1.2 Verification of Measure Installation

The Evaluation Team took several steps in verifying the number of measures installed, which consists of the following:

- Validating program tracking data by checking for duplicate or erroneous entries;
- Verifying that participants were part of the program according to the agreed-upon process between CLEAResult and the Company; and
- Conducting verification surveys with a statistically valid sample of program participants (the focus of these verification surveys is to confirm that customers listed in the program tracking database did indeed participate and that the number of measures installed was accurate).

Table 2-5 summarizes the in-service and verification rates used in savings estimations for the Home Performance Program. Most measures were verified as installed as reported in the program data, but some customers reported removing measures after installation.

*Table 2-5 Installation Rates by Measure Type – Home Performance Program*

| *Measure* | *In-Service/ Verification Rate* |
|---|---|
| Insulation | 100% |
| Duct Insulation/Sealing | 100% |
| Heat Pump | 100% |
| Smart thermostat | 100% |
| Water Heater Pipe Wrap | 100% |
| Water Heater Tank Wrap | 100% |
| LEDs | 97% |
| Faucet Aerators | 89% |
| Showerheads | 89% |

#### 2.3.1.3 Weather Dependent Inputs

Many measures utilize common weather dependent factors, such as effective full load heating hours and cooling hours (EFLH), cooling degree hours (CDH), heating degree days (HDD) and cooling degree days (CDD).

The method utilized by the Mid-Atlantic TRM to estimate full load hours (EFLH) from the EmPower metering study multiplied by the ratio of the Energy Star full load hours of the analyzed city to the study city, was developed for the eight Virginia and West Virginia cities referenced in the Energy Star full load data.

The heating degree days were developed for 932 zip codes in Virginia from TMY3 weather data and the Mid-Atlantic TRM method with the referenced base balance point outdoor air temperature. The data from 11 weather stations with TMY3 data were obtained along with the TRM heating balance point of 60F and a TRM cooling balance point of 65F to develop CDD and HDD. From these 11 weather stations, the HDD and CDD values were assigned by the nearest radial distance to 932 zip codes. The CDH was determined for each zip code by a similar Mid-Atlantic TRM method, with the referenced balance point of 75F.

#### 2.3.1.4 Measure Specific Calculations

Table 2-6 summarizes the equations and inputs used to estimate the savings of the program measures. The savings calculated using the approaches outlined in the table were adjusted by the verification and in-service rates developed from the survey of program participants to estimate the gross program savings.

*Table 2-6 Measure Calculations and Inputs*

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| ***Measure Name: Low Flow Faucet Aerators*** | | | |
| Savings | *ΔkWh* | | *(((GPM_base * Throttle_base) - (GPM_low * Throttle_low)) * Time_faucet * #people * 365 * DR) * 8.3 * (TEMP_faucet - TEMP_in) / DHW_RE / 3412* |
| Savings | *ΔkW* | | *E8 / Hours * CF* |
| Input | *#people* | 2.39 | Mid-Atlantic TRM V10.0, p. 133. |
| Input | *GPM_base* | 2.2 | Mid-Atlantic TRM V10.0, p. 133. |
| Input | *Throttle_base* | 0.83 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *GPM_low* | Varies | Tracking data. Varies by aerator type. |
| Input | *Throttle_low* | 0.95 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *Time_faucet* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *TEMP_faucet* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *TEMP_in* | 60.9 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *DHW_RE* | 0.98 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *DR* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *Hours* | Calculation | Calculation: #people * Time_faucet / 60 * 365. |
| Input | *CF* | 0.00262 | Mid-Atlantic TRM V10.0, p. 135. |
| EUL | | 10 | Mid-Atlantic TRM V10, p. 136. |
| Inc Cost | | Varies | Total measure cost. |
| ***Measure Name: Low Flow Showerhead*** | | | |
| Savings | *ΔkWh* | | *((GPMbase - GPMlow) * Time_shower * #people * Showers_per_person * 365 / ShowerHeads_per_home) * 8.3 * 1 * (TEMP_sh - TEMP_in) / DHW_RE / 3412* |
| Savings | *ΔkW* | | *(((GPMbase - GPMlow) * Time_shower * #people * Showers_per_person * 365 / ShowerHeads_per_home) * 8.3 * 1 * (TEMP_sh - TEMP_in) / DHW_RE / 3412) / Hours * CF* |
| Input | *#people* | 2.39 | Mid-Atlantic TRM V10.0, p. 137. |
| Input | *GPMbase* | 2.5 | Mid-Atlantic TRM V10.0, p. 137. |
| Input | *GPMlow* | 1.5 | Tracking data. |
| Input | *Time_shower* | 7.8 | Mid-Atlantic TRM V10.0, p. 137. |
| Input | *TEMP_sh* | 105 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *TEMP_in* | 60.9 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *Showers_per_person* | 0.6 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *ShowerHeads_per_home* | 1.6 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *DHW_RE* | 0.98 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *Hours* | Calculation | Calculation: (TimeShower * #people * Showers_per_person) / (ShowerHeads_per_home * 60) * 365. |
| Input | *CF* | 0.00371 | Mid-Atlantic TRM V10.0, p. 139. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| EUL | | 10 | Mid-Atlantic TRM V10, p. 140. |
| Inc Cost | | Varies | Total measure cost. |
| ***Measure Name: Water Heater Tank Wrap*** | | | |
| Savings | *ΔkWh* | | *(((U_base * A_base) - (U_insul * A_insul)) * ΔT * Hours) / (3412 * ηDHW)* |
| Savings | *ΔkW* | | *((((U_base * A_base) - (U_insul * A_insul)) * ΔT * Hours) / (3412 * ηDHW)) / 8760* |
| Input | *U_base* | Varies | Mid-Atlantic TRM V10.0, p. 141, based on tank Wrap efficient R-Value. |
| Input | *A_base* | Varies | Mid-Atlantic TRM V10.0, p. 141, based on WH capacity. |
| Input | *U_insul* | Varies | Mid-Atlantic TRM V10.0, p. 142, based on new insulation R-value. |
| Input | *A_insul* | Varies | Mid-Atlantic TRM V10.0, p. 142, based on WH capacity. |
| Input | *ΔT* | 60 | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *Hours* | 8760 | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *ηDHW* | 0.98 | Mid-Atlantic TRM V10.0, p. 143. |
| EUL | | 5 | Mid-Atlantic TRM V10.0, p. 144. |
| Inc Cost | | Varies | Total measure cost. |
| ***Measure Name: Water Heater Pipe Insulation*** | | | |
| Savings | *ΔkWh* | | *(((1 / Rexist) - (1 / Rnew)) * L * C * ΔT * 8760) / n_DHW / 3413* |
| Savings | *ΔkW* | | *((((1 / Rexist) - (1 / Rnew)) * L * C * ΔT * 8760) / n_DHW / 3413) / 8760* |
| Input | *Rexist* | 1 | Mid-Atlantic TRM V9.0, p. 186. |
| Input | *Rnew* | Varies | Tracking data. |
| Input | *L* | Varies | Tracking data. |
| Input | *C* | Varies | Tracking data. |
| Input | *ΔT* | 65 | Mid-Atlantic TRM V9.0, p. 187. |
| Input | *n_DHW* | 0.98 | Mid-Atlantic TRM V9.0, p. 187. |
| EUL | | 15 | Mid-Atlantic TRM V9.0, p. 188. |
| Inc Cost | | Varies | Total measure cost. |
| ***Measure Name: Water Heater Temperature Setback*** | | | |
| Savings | *ΔkWh* | | *U * A * (Tpre - Tpost) * Hours / (3412 * RE)* |
| Savings | *ΔkW* | | *(U * A * (Tpre - Tpost) * Hours / (3412 * RE)) / 8760* |
| Input | *U* | 0.083 | Mid-Atlantic TRM V9.0, p. 208. |
| Input | *A* | Varies | Mid-Atlantic TRM V9.0, p. 208. Varies based on tank capacity. |
| Input | *Tpre* | 135 | Mid-Atlantic TRM V9.0, p. 208. |
| Input | *Tpost* | 120 | Mid-Atlantic TRM V9.0, p. 208. |
| Input | *RE* | 0.98 | Mid-Atlantic TRM V9.0, p. 208. |
| Input | *Hours* | 8760 | Mid-Atlantic TRM V9.0, p. 208. |
| EUL | | 2 | Mid-Atlantic TRM V9.0, p. 210. |
| Inc Cost | | $ 5.00 | Mid-Atlantic TRM V9.0, p. 210. |
| ***Measure Name: Direct Install Lighting*** | | | |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Savings | *ΔkWh* | | *(WattsBase - WattsEE) / 1000 * Hours * HCIF_kWh* |
| Savings | *ΔkW* | | *(WattsBase - WattsEE) / 1000 * HCIF_kW * CF* |
| Input | *WattsEE* | Varies | Tracking data. |
| Input | *WattsBase* | Varies | Mid-Atlantic TRM V10.0, p.27. |
| Input | *Hours* | Varies | Mid-Atlantic TRM V9.0, p.34. Varies by installation location. |
| Input | *HCIF_kWh* | Varies | ADM Protypical Builiding Model. |
| Input | *HCIF_kW* | Varies | ADM Protypical Builiding Model. |
| Input | *CF* | 0.059 | Mid-Atlantic TRM V9.0, p. 37. |
| EUL | | 16.3 | Mid-Atlantic TRM V10.0, p. 34. |
| Inc Cost | | Varies | Mid-Atlantic TRM V9.0, p. 38. |
| ***Measure Name: Air Source Heat Pump*** | | | |
| Savings | *ΔkWh* | | *(((Capacity_heat_ee / HSPF_base) - (Capacity_heat_ee / HSPF_ee)) / 1000 * EFLH_heat * HLAF) + (((Capacity_cool_ee / SEER_base) - (Capacity_cool_ee / SEER_ee)) / 1000 * EFLH_cool * CLAF) + (((Capacity_heat_ee / HSPF_exist) - (Capacity_heat_exist / HSPF_base)) / 1000 * Heating_ER_Factor * EFLH_heat * HLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / SEER_exist) - (Capacity_cool_ee / SEER_base)) / 1000 * Cooling_ER_Factor * EFLH_cool * CLAF),0)* |
| Savings | *ΔkW* | | *(((Capacity_cool_ee / EER_base) - (Capacity_cool_ee / EER_ee)) / 1000 * CF * CLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / EER_exist) - (Capacity_cool_ee / EER_base)) / 1000 * Cooling_ER_Factor * CF * CLAF),0)* |
| Input | *Capacity_cool_exist* | Varies | Tracking data. |
| Input | *Capacity_cool_ee* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SEER_exist* | Varies | Tracking data. |
| Input | *SEER_base* | 14 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *SEER_ee* | Varies | Tracking data. |
| Input | *EER_exist* | Varies | Tracking data. |
| Input | *EER_base* | 11.8 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *EER_ee* | Varies | Tracking data. |
| Input | *Capacity_heat_exist* | Varies | Tracking data. |
| Input | *Capacity_heat_ee* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *HSPF_exist* | Varies | Tracking data. |
| Input | *HSPF_base* | 8.2 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *HSPF_ee* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 95. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *CLAF* | Varies | Cooling load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *HLAF* | Varies | Heating load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *Cooling_ER_Factor* | Varies | Assessment of pre-existing equipment. Equals 1 or 0. |
| Input | *Heating_ER_Factor* | Varies | Assessment of pre-existing equipment. Equals 1 or 0. |
| Input | *Baseline_Cooling* | Varies | Equals 1 if there was pre-project cooling, else 0. |
| EUL - 1 | | 6 | Mid-Atlantic TRM V10.0, p. 87. |
| EUL - 2 | | 12 | Mid-Atlantic TRM V10.0, p. 87. |
| Inc Cost | | Varies | Mid-Atlantic TRM V9.0, p. 96. |
| ***Measure Name: Mini Split Heat Pump*** | | | |
| Savings - 1 | *ΔkWh Baseline 1* | | *(((Capacity_heat_ee / HSPF_base) - (Capacity_heat_ee / HSPF_ee)) / 1000 * EFLH_heat * HLAF) + (((Capacity_cool_ee / SEER_base) - (Capacity_cool_ee / SEER_ee)) / 1000 * EFLH_cool * CLAF) + (((Capacity_heat_ee / HSPF_exist) - (Capacity_heat_exist / HSPF_base)) / 1000 * Heating_ER_Factor * EFLH_heat * HLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / SEER_exist) - (Capacity_cool_ee / SEER_base)) / 1000 * Cooling_ER_Factor * EFLH_cool * CLAF),0)* |
| Savings - 2 | *ΔkW Baseline 1* | | *(((Capacity_cool_ee / EER_base) - (Capacity_cool_ee / EER_ee)) / 1000 * CF * CLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / EER_exist) - (Capacity_cool_ee / EER_base)) / 1000 * Cooling_ER_Factor * CF * CLAF),0)* |
| Savings - 2 | *ΔkWh* (Baseline 2) | | *(((Capacity_heat_ee / HSPF_base) - (Capacity_heat_ee / HSPF_ee)) / 1000 * EFLH_heat * HLAF) + (((Capacity_cool_ee / SEER_base) - (Capacity_cool_ee / SEER_ee)) / 1000 * EFLH_cool * CLAF)* |
| Savings - 2 | *ΔkW* (Baseline 2) | | *((Capacity_cool_ee / EER_base) - (Capacity_cool_ee / EER_ee)) / 1000 * CF * CLAF* |
| Input | *Capacity_cool_exist* | Varies | Tracking data. |
| Input | *Capacity_cool_ee* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SEER_exist* | Varies | Tracking data. |
| Input | *SEER_base* | 14 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *SEER_ee* | Varies | Tracking data. |
| Input | *EER_exist* | Varies | Tracking data. |
| Input | *EER_base* | 11.8 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *EER_ee* | Varies | Tracking data. |
| Input | *Capacity_heat_exist* | Varies | Tracking data. |
| Input | *Capacity_heat_ee* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *HSPF_exist* | Varies | Tracking data. |
| Input | *HSPF_base* | 8.2 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *HSPF_ee* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 124. |
| Input | *CLAF* | Varies | Cooling load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *HLAF* | Varies | Heating load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *Cooling_ER_Factor* | Varies | Assessment of pre-existing equipment. Equals 1 or 0. |
| Input | *Heating_ER_Factor* | Varies | Assessment of pre-existing equipment. Equals 1 or 0. |
| Input | *Baseline_Cooling* | Varies | Equals 1 if there was pre-project cooling, else 0. |
| EUL - 1 | | 6 | Mid-Atlantic TRM V10.0, p. 94. |
| EUL - 2 | | 12 | Mid-Atlantic TRM V10.0, p. 94. |
| Inc Cost | | Varies | Mid-Atlantic TRM V9.0, p. 125. |
| ***Measure Name: Smart Thermostat*** | | | |
| Savings | *ΔkWh* | | *Capacity_cool / SEER * EFLH_cool * SF_cool / 1000 + Capacity_heat / HSPF * EFLH_heat * SF_heat / 1000* |
| Savings | *ΔkW* | | *0* |
| Input | *Capacity_cool* | Varies | Tracking data. |
| Input | *SEER* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *Capacity_heat* | Varies | Tracking data. |
| Input | *HSPF* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SF_cool* | 0.06 | Mid-Atlantic TRM V9.0, p. 104. |
| Input | *SF_heat* | 0.07 | Mid-Atlantic TRM V9.0, p. 104. |
| EUL | | 7.5 | Mid-Atlantic TRM V10.0, p. 106. |
| Inc Cost | | $ 154.00 | Mid-Atlantic TRM V9.0, p. 460. |
| ***Measure Name: Attic Insulation*** | | | |
| Savings | *ΔkWh* | | *((1 / Rexist - 1 / Rnew) * CDH * DUA * Area / 1000 / ηCool * ADJcool) + ((1 / Rexist - 1 / Rnew) * HDD * 24 * Area / 1000000 / ηHeat * 293.1 * ADJheat)* |
| Savings | *ΔkW* | | *((1 / Rexist - 1 / Rnew) * CDH * DUA * Area / 1000 / ηCool) / EFLH_cool * CF* |
| Input | *Rexist* | Varies | Tracking data. |
| Input | *Rnew* | Varies | Tracking data. |
| Input | *CDH* | Varies | Applicable weather data. |
| Input | *DUA* | 0.75 | Mid-Atlantic TRM V9.0, p. 261. |
| Input | *Area* | Varies | Tracking data. |
| Input | *ηCool* | Varies | Tracking data. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *ADJcool* | 0.8 | Mid-Atlantic TRM V9.0, p. 261. |
| Input | *HDD* | Varies | Applicable weather data. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *ADJheat* | 0.6 | Mid-Atlantic TRM V9.0, p. 263. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 263. |
| EUL | | 25 | Mid-Atlantic TRM V9.0, p. 265. |
| Inc Cost | | Varies | Total measure cost. |
| ***Measure Name: Duct Sealing*** | | | |
| Savings | *ΔkWh* | | *((((Pre_CFM25 - Post_CFM25) / (Cool_Capacity * 400)) * EFLH_cool * BTUH_cool) / 1000 / ηCool) + ((((Pre_CFM25 - Post_CFM25) / (Heat_Capacity * 400)) * EFLH_heat * BTUH_heat) / 1000000 / ηHeat * 293.1)* |
| Savings | *ΔkW* | | *((((Pre_CFM25 - Post_CFM25) / (Cool_Capacity * 400)) * EFLH_cool * BTUH_cool) / 1000 / ηCool) / EFLH_cool * CF* |
| Input | *Pre_CFM25* | Varies | Tracking data. |
| Input | *Post_CFM25* | Varies | Tracking data. |
| Input | *Cool_Capacity* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *BTUH_cool* | Varies | Tracking data. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *Heat_Capacity* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *BTUH_heat* | Varies | Tracking data. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 116. |
| EUL | | 20 | Mid-Atlantic TRM V9.0, p. 119. |
| Inc Cost | | Varies | Total measure cost. |

### 2.3.2 Methodology for Estimating Net Savings

This section presents the approach used to evaluate the net energy impacts of the Home Performance Program.

Survey responses were used to estimate the net savings ratio of the Home Performance program. The survey data collection methodology is described in Section 2.2.1.

Of the 136 respondents that completed the survey, 126 received direct install measures and were asked free ridership questions about those measures, while another 18 received major measures and were asked questions about those measures.

#### 2.3.2.1 Free Ridership Estimation – Direct Install Measures

The Evaluation Team developed free ridership estimates for the direct install measures based on survey responses to questions about the following factors:

- Prior planning to purchase energy efficiency measures that were provided through the program;
- The likelihood of having participated the items in the absence of the program;
- The number of items the customer planned on purchasing; and
- Demonstrated behavior in purchasing similar equipment absent Program assistance.

Participant responses were used to develop a free ridership score based on the presence of prior plans to install the measure, the likelihood of installing the measure in the absence of the program, and a quantity adjustment based on the number of items the respondent expected to install in the absence of the program.

##### 2.3.2.1.1 Prior Planning

The presence of prior plans to install the items was determined based on respondents stated presence of prior plans and the participant's previous experience installing the items. Specifically, evidence of prior plans was based on responses to the following questions:

- Had you purchased and installed any [MEASURE] before you received them for free through the program?
- Did you have plans to purchase and install [MEASURE] before you learned about the Home Performance program?

Participants who indicated that they did not have prior plans to install the measures or indicated that they had not previously purchased them were assigned a free ridership score of 0%. For all other respondents, a free ridership score was developed based on their likelihood of installing the item and the number of items they expected to install.

##### 2.3.2.1.2 Likelihood of Purchasing Items without the Program

Participants were asked about the likelihood of installing the items had they not been provided for free through the program. Specifically, participants were asked:

- If you had not received them for free through the program, how many of the [MEASURE] that you received would you have purchased and installed on your own within 12 months?

A likelihood of installing the measure in the absence of the program score was developed by dividing the participants 0 to 10 response by 10.

##### 2.3.2.1.3 Quantity Adjustment

Participants were asked to report on the number of measures that they believed they would purchase in the next 12 months had they not been provided through the program. The response to this question was used to calculate a quantity adjustment that was equal to the number of items

the respondent believed they would purchase divided by the total number of items that they received.

2.3.2.1.4 Overall Free Ridership Score

The overall free ridership score was equal to 0 for participants who did not meet the criteria for the presence of prior plans. For all other respondents, the free ridership score was calculated as equal to the likelihood of installing the items score multiplied by the quantity adjustment.

### 2.3.2.2 Free Ridership Estimation – Major (Rebated) Measures

The Evaluation Team developed free ridership estimates for the major measures based on survey responses to questions about the following factors:

- Financial ability to install the measures;
- Prior planning to purchase energy efficiency measures that were provided through the program;
- The likelihood of having participated the items in the absence of the program; and
- The program impact on timing of measure installation.

Participant responses were used to develop a free ridership score based on these factors.

2.3.2.2.1 Financial Ability

Participants were asked the following question about their financial ability to pay for the rebated measure:

- Would you have been financially able to install the [MEASURE] without the financial assistance provided through the program?

Participants who indicated that they would not have been able to install the measures were deemed to not be free riders.

2.3.2.2.2 Prior Planning

Two questions were used to assess the presence of prior plans to install the measure before learning about the program:

- Prior to learning about the Home Performance program, did you have plans to install the [MEASURE]?, and as applicable;
- Just to be clear, did you have plans to specifically install an energy efficient [MEASURE] as opposed to a standard efficiency [MEASURE]?

For participants that installed measures for which a standard efficiency option was available, such as air conditioning equipment, a determination of the presence of plans was made based on participants stating "Yes" to both questions listed above. For all other respondents, the presence of plans was based on respondents stating "Yes" to the first question.

Participants who indicated that they did not have prior plans to install the measures were assigned a free ridership score of 0%.

2.3.2.2.3 Likelihood of Purchasing Items without the Program

Participants were asked about the likelihood of installing the items had they not been provided for free through the program. Specifically, participants were asked:

- On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have installed the same [MEASURE] if it was not recommended through the home energy assessment?
- On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have installed the same [MEASURE] if the financial assistance was not available?

A likelihood of installing the measure in the absence of the program score was developed by dividing the minimum of the participants 0 to 10 response to the two questions listed above by 10.

2.3.2.2.4 Timing Adjustment

The following two questions were asked to assess program impacts on the deferral of free ridership:

- Did you install the [MEASURE] sooner than you would have if the information and financial assistance from the program had not been available?
- When might you have installed the same [MEASURE] if you had not participated in the program?

Based on responses to this question, a timing adjustment score was developed in the following manner:

*Table 2-7 Timing Score*

| *Response Option* | *Timing Score* |
|---|---|
| Within 6 months of when you purchased it | 0.75 |
| Between 6 months and 1 year | 0.25 |
| In more than 1 year to 2 years | 0 |
| In two years or more | 0 |
| Don't know | 0.5 |

2.3.2.2.5 Overall Free Ridership Score

Participants who indicated that they could not have afforded to install the efficiency measures without the financial support of the program, or who indicated that they did not have prior plans to install the measures were assigned a free ridership score of 0. For all other respondents, a free

ridership score was developed by multiplying the likelihood of implementing the measure in the absence of the program by the timing score.

Separate free ridership values were developed for direct install and major measures.

#### 2.3.2.3 Spillover Estimation

For the Home Performance Program, the Evaluation Team used the participant survey to conduct a spillover savings assessment for program participants. The survey questions were designed to gather information regarding:

- Whether program participants have purchased and installed additional, non-incentivized energy saving measures since participating in the program;
- Which additional, non-incentivized energy saving measures program participants have purchased and installed since participating in the program; and
- The extent to which the Home Performance Program influenced the purchase of these additional non-incentivized energy saving measures.

Survey respondents were first asked the following question:

- "Because of your experience with the [Home Performance Program], have you bought any additional energy efficient items on your own without a financial incentive or utility rebate?"

Respondents answering "Yes" to the above question were then provided with a list of common residential energy efficiency measures such as energy efficient lighting, appliances, and air sealing improvements, and were asked to indicate which of the items they had purchased, and how many they had purchased, since participating in the Home Performance Program.[2] Respondents were then asked whether they had installed all, some, or none of the items they indicated, and were asked to state the month and year that they installed the items.

Respondents who indicate that they have installed at least one additional energy efficient measure since participating in the program are then asked two questions to determine the level of influence that the program may have had on the decision to purchase and install the item(s). These two questions are used to calculate the program attribution variable, and are as follows:

- SO1: "On a scale of 0 to 10, where 0 represents "Not at all important" and 10 represents "Extremely important", how important was your experience with the Home Performance Program in your decision to purchase and install these additional items?"
- SO2: "On a scale of 0 to 10, where 0 represents "Not at all likely" and 10 represents "Extremely likely", how likely would you have been to purchase these additional non-rebated energy efficient items if you had never participated in the Home Performance Program?"

[2] A full list of the energy efficiency measures included in this question can be found in Appendix A.

The Program Influence Score (PI Score) was then calculated as the average of the responses to these two questions, where the numeric scale from SO2 is reversed by subtracting the SO2 score from 10 total possible points:

$$\text{PI Score} = ((\text{SO1 Score}) + (10 - \text{SO2 Score}))/2$$

For example, a respondent providing a rating of 9 to SO1 and a rating of 3 to SO2 would receive a PI Score as follows:

$$\text{PI Score} = (9 + (10 - 3))/2$$

$$\text{PI Score} = 8$$

Respondents whose PI Scores are above 7 are considered to have made additional energy efficiency purchases that were significantly influenced by the program. The spillover methodology described above represents a threshold approach, where additional energy efficiency measures implemented by program participants are either 100% attributable to program influence or 0% attributable.

Energy savings of additional program-attributable measures purchased and installed by these respondents are then calculated by applying the methodologies listed in the Mid-Atlantic TRM V9.0, referencing measure characteristics associated with program participants or stipulated savings calculation input data.

### 2.3.3 Impact Evaluation Results

The following subsections summarize the results of the impact evaluation conducted for the 2021 Home Performance Program.

#### 2.3.3.1 Energy Savings and Demand Reduction Results

Table 2-8 below presents the annual gross and net savings for each energy efficiency measure in the 2021 Home Performance Program.

*Table 2-8 Home Performance Program Realized Gross and Net Energy Savings*

| *Category* | *Measure Name* | *Ex Ante kWh Savings* | *Gross Ex Post kWh Savings* | *Gross Realization Rate* | *Net Ex Post kWh Savings* | *Net-to-Gross Ratio* | *Net Lifetime kWh Savings* |
|---|---|---|---|---|---|---|---|
| Envelope | Duct Sealing | 1,239 | 1,223 | 99% | 797 | 65% | 15,939 |
| | Attic Insulation | 101,809 | 51,316 | 50% | 33,436 | 65% | 835,891 |
| HVAC | Air Source Heat Pump | 203,241 | 104,321 | 51% | 67,972 | 65% | 566,895 |
| | Minisplit Heat Pump | 272,829 | 243,686 | 89% | 158,777 | 65% | 1,380,807 |
| | Smart Thermostat | 17,237 | 10,078 | 58% | 6,566 | 65% | 49,248 |
| Lighting | Globe 5 Watt | 41,200 | 29,652 | 72% | 23,657 | 80% | 385,603 |
| | 4w Candelabra (Medium Base) | 36,618 | 34,406 | 94% | 27,449 | 80% | 447,423 |
| | 4w Candelabra (Small Base) | 80,451 | 65,330 | 81% | 52,121 | 80% | 849,567 |
| | Standard 9 Watt | 372,194 | 228,095 | 61% | 181,975 | 80% | 2,966,186 |
| | Standard 8 Watt | 12,973 | 6,621 | 51% | 5,283 | 80% | 86,106 |
| | Reflector 8 Watt | 107,436 | 94,515 | 88% | 75,404 | 80% | 1,229,090 |
| Water Heating | Water Heater Pipe Wrap | 662 | 1,221 | 184% | 974 | 80% | 14,607 |
| | Bathroom Aerator | 2,877 | 4,124 | 143% | 3,290 | 80% | 32,900 |
| | Fixed Shower Head | 23,402 | 15,890 | 68% | 12,677 | 80% | 126,771 |
| | Handheld Shower Head | 34,578 | 23,587 | 68% | 18,818 | 80% | 188,176 |
| | Kitchen Aerator | 2,608 | 2,063 | 79% | 1,646 | 80% | 16,455 |
| | Water Heater Tank Wrap | 715 | 662 | 93% | 529 | 80% | 2,643 |
| | Water Heater Temp Setback | 0 | 477 | N/A | 381 | 80% | 761 |
| Total | | 1,312,068 | 917,268 | 70% | 671,749 | 73% | 9,195,069 |

Gross and net peak ex post kW reductions are summarized below in Table 2-9.

*Table 2-9 Home Performance Program Peak kW Reductions Summary*

| *Category* | *Measure Name* | *Ex Ante kW Savings* | *Gross Ex Post kW Savings* | *Gross Realization Rate* | *Net Ex Post kW Savings* | *Net-to-Gross Ratio* |
|---|---|---|---|---|---|---|
| Envelope | Duct Sealing | 0.38 | 0.38 | 100% | 0.25 | 65% |
| | Attic Insulation | 92.54 | 2.64 | 3% | 1.71 | 65% |
| HVAC | Air Source Heat Pump | 6.32 | 6.01 | 95% | 3.89 | 65% |
| | Minisplit Heat Pump | 44.60 | 29.79 | 67% | 19.28 | 65% |
| | Smart Thermostat | - | - | N/A | - | N/A |
| Lighting | Globe 5 Watt | 4.62 | 3.79 | 82% | 3.00 | 79% |
| | 4w Candelabra (Medium Base) | 4.10 | 4.34 | 106% | 3.44 | 79% |
| | 4w Candelabra (Small Base) | 8.98 | 8.30 | 92% | 6.59 | 79% |
| | Standard 9 Watt | 41.68 | 28.92 | 69% | 22.94 | 79% |
| | Standard 8 Watt | 1.42 | 0.83 | 59% | 0.66 | 79% |
| | Reflector 8 Watt | 12.12 | 12.14 | 100% | 9.63 | 79% |
| Water Heating | Water Heater Pipe Wrap | 0.08 | 0.14 | 184% | 0.11 | 79% |
| | Bathroom Aerator | 0.17 | 0.46 | 268% | 0.37 | 79% |
| | Fixed Shower Head | 1.33 | 1.39 | 104% | 1.10 | 79% |
| | Handheld Shower Head | 1.97 | 2.06 | 105% | 1.63 | 79% |
| | Kitchen Aerator | 0.16 | 0.08 | 52% | 0.07 | 79% |
| | Water Heater Tank Wrap | 0.08 | 0.08 | 93% | 0.06 | 79% |
| | Water Heater Temp Setback | - | 0.05 | N/A | 0.04 | 79% |
| Total | | 220.54 | 101.40 | 46% | 74.77 | 74% |

### 2.3.3.2 Supplementary Econometric Analysis

To supplement the impact evaluation, the Evaluation Team utilized IPMVP Option C by performing regression analysis to assess the presence of energy savings during the period subsequent to implementation of program measures. The Evaluation Team obtained monthly energy usage data of program participants from the Company. The analysis was performed using data associated with customers with energy usage data available for at least six months after implementation of program measures. For the Home Performance Program, such data was available for a total of 405 PY2021 program participants. The variables described in Table 2-10 were included in the analysis.

*Table 2-10 Analysis Model Variables*

| *Variable Name* | *Variable Description* |
|---|---|
| kWh | Dependent variable; participant monthly energy use. |
| CDH | MAX (Outdoor Temperature - 65°F, 0) calculated hourly and averaged across month. |
| HDH | MAX (65°F - Outdoor Temperature, 0) calculated hourly and averaged across month. |
| Post | 1 during post-implementation period; otherwise 0. |

A mixed effects regression model was employed with to estimate the incremental impact of implementation of program measures on participant energy use. The following equation was modeled:

*Equation 1*

$$kWh_{it} = \beta_0 + \beta_1 Post_{it} + \beta_2 CDH_{it} + \beta_3 HDH_{it} + e_{it}$$

Table 2-11 presents the results of the regression analysis.

*Table 2-11 Parameter Estimates for Regression Model*

| *Variable Name* | *Estimate* | *Standard Error* | *Z score* | *p value* | *90% Confidence Interval* | |
|---|---|---|---|---|---|---|
| | | | | | *Lower Bound* | *Upper Bound* |
| CDH | 0.093 | 0.005 | 18.15 | 0 | 0.085 | 0.102 |
| HDH | 0.09 | 0.002 | 52.75 | 0 | 0.088 | 0.093 |
| Post | 101.024 | 19.484 | 5.18 | 0 | 68.975 | 133.073 |
| Intercept | 872.575 | 33.058 | 26.4 | 0 | 818.199 | 926.951 |
| Number of Observations | | | | | | 9,279 |
| Number of Groups | | | | | | 405 |

Intuitively, the weather variables (*CDH* and *HDH*) have positive coefficients indicating the presence of weather-sensitive energy usage and the *Post* variable has a negative coefficient indicating lower energy use during the post-implementation period. The coefficient of *Post* indicates that average monthly energy use of Home Performance participants included in the analysis during the period after implementation of program measures is about 101 kWh lower, controlling for weather-related effects.

The energy savings estimate of 101 kWh associated with the mixed effects regression model is equal to 202% of the average monthly account-level ex post gross savings of 50 kWh for the 405 accounts included in the econometric analysis. The average monthly ex post gross kWh savings estimate is below the 90% confidence interval of the savings estimate associated with the model *Post* variable coefficient.

## 2.4 Process Evaluation

The following section presents key findings from the process evaluation conducted for the 2021 Home Performance Program.

### 2.4.1 Program Participation Findings

This section presents the results of the program database review conducted by the Evaluation Team. This analysis is based on an end-of-year tracking data file containing all projects completed during 2021.

Table 2-12 displays the overall savings resulting from the program measures. Direct install measures provided during home energy assessments accounted for the largest share of expected program savings. This was due to the volume of homes receiving the measures. Although comparatively few participants installed HVAC systems, these systems accounted for the second largest share of energy savings because of the amount of savings associated with each installation. Direct install, HVAC, and envelope installations all increased in 2021 from 2020.

*Table 2-12 Number of Participating Homes and Expected Savings per Home by Measure Type*

| *Measure Type* | *Number of Participants* | *Ex Ante kWh Savings* | *Ex Ante kWh per Home* |
|---|---|---|---|
| eScore Assessment | 1125 | 0 | 0 |
| Direct Install | 1024 | 715,714 | 699 |
| Major - Envelope | 84 | 101,809 | 1,212 |
| Major - HVAC | 80 | 476,660 | 5,958 |
| Major - Smart Thermostat | 29 | 17,237 | 594 |
| Major - Duct Sealing | 3 | 1,239 | 413 |

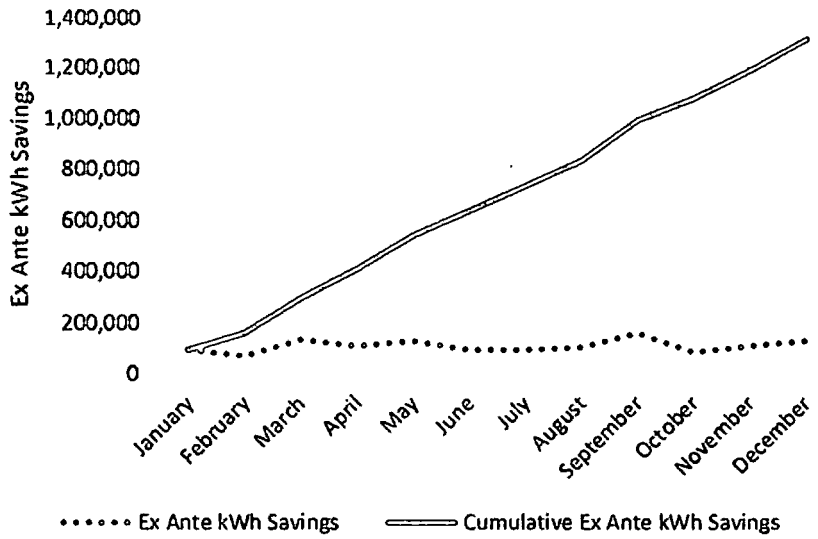
Table 2-13 summarizes the number end-use types addressed in participants homes. On average, participants received measures covering 1.21 end-uses and about 80% received measures for a single end-use. The results reflect an increase in single end-use installations during 2021.

*Table 2-13 Number of Participating Homes and Expected Savings per Home by Measure Type*

| *Number of End-Uses Addressed* | *Number of Participants* |
|---|---|
| 1 | 884 |
| 2 | 214 |
| 3 | 7 |
| Average Number of End-Uses Addressed | 1.21 |

Figure 2-1 summarizes the accrual of energy savings during the year. As shown, the savings generating activity continued at a generally steady pace during the year.

*Figure 2-1 Ex Ante Savings During the Program Year*




To understand the types of measures that different participants received, the Evaluators clustered participants by measure type implemented through the program. The results are shown in Table 2-14. As shown, the most common form of participation was to receive an assessment with direct install measures.

*Table 2-14 Summary of Measures Received by Participants*

| *Number of Participants* | *Total Ex Ante kWh Savings* | *Average kWh Savings per Participant* | *Home Performance Assessment* | *Direct Install Measures* | *Building Envelope Major Measure* | *HVAC Major Measure* | *Smart Thermostat Major Measure* | *Duct Sealing Major Measure* |
|---|---|---|---|---|---|---|---|---|
| 930 | 652,417 | 702 | ■ | ■ | | | | |
| 72 | 0 | 0 | ■ | | | | | |
| 49 | 91,144 | 1,860 | ■ | ■ | ■ | | | |
| 26 | 161,879 | 6,226 | ■ | ■ | | ■ | | |
| 21 | 24,184 | 1,152 | | | ■ | | | |
| 20 | 121,220 | 6,061 | | | | ■ | | |
| 14 | 97,826 | 6,988 | ■ | | | ■ | | |
| 12 | 13,027 | 1,086 | ■ | | ■ | | | |
| 11 | 80,450 | 7,314 | ■ | ■ | | ■ | ■ | |
| 6 | 47,463 | 7,911 | | | | ■ | ■ | |
| 4 | 3,351 | 838 | ■ | ■ | | | ■ | |
| 4 | 1,393 | 348 | | | | | ■ | |
| 2 | 3,489 | 1,745 | ■ | ■ | | | | ■ |
| 2 | 5,130 | 2,565 | ■ | | | ■ | ■ | |

| Number of Participants | Total Ex Ante kWh Savings | Average kWh Savings per Participant | Home Performance Assessment | Direct Install Measures | Building Envelope Major Measure | HVAC Major Measure | Smart Thermostat Major Measure | Duct Sealing Major Measure |
|---|---|---|---|---|---|---|---|---|
| 1 | 5,700 | 5,700 | ■ | ■ | ■ | ■ | | |
| 1 | 3,403 | 3,403 | ■ | ■ | ■ | | ■ | |
| 1 | 380 | 380 | ■ | | | | ■ | |
| 1 | 200 | 200 | | | | | | ■ |

Customers can initiate participation in Home Performance in various ways including by initially receiving an energy assessment and then installing rebated major measures, or by installing rebated major measures and then receiving a Home Performance assessment.

Table 2-15 summarizes how customers participated in the program in PY2021. Overall, the primary participation tracks involve customers who:

- Receive Home Performance assessments and direct install measures but do not subsequently install major rebated measures (78.3%).
- Receive Home Performance assessments but do not install any measures (6.1%). The share of these participants increased from 3.4% in 2020.
- Install a major measure and subsequently receive direct install measures and an assessment (5.2%).
- Receive an assessment and direct install measures, and then subsequently install a major measure (2.8%).
- Install a major measure and then receive an energy assessment (2.3%).

*Table 2-15 Summary of Participation Steps*

| Measure Type Implemented in First Participation Step | Measure Type Implemented in Second Participation Step | Number of Participants | Percent of Participants | Total Average Ex Ante kWh Savings |
|---|---|---|---|---|
| Direct Install and Assessment | | 922 | 78.3% | 704 |
| Assessment | | 72 | 6.1% | 0 |
| Major Measure | Direct Install and Assessment | 61 | 5.2% | 3,666 |
| Major Measure | | 52 | 4.4% | 3,740 |
| Direct Install and Assessment | Major Measure | 33 | 2.8% | 3,811 |
| Major Measure | Assessment | 27 | 2.3% | 4,075 |
| Assessment | Direct Install | 8 | 0.7% | 402 |
| Assessment | Major Measure | 2 | 0.2% | 3,167 |

* Steps were sequenced by date using the Created Date field in the program data.

### 2.4.2 Program Design and Operations

#### 2.4.2.1 Program Design

The Home Performance Program provides multiple entry points to customers. Customers may initiate participation by completing an online self-assessment, by receiving an in-home or virtual assessment performed by the program implementation contractor, or by implementing one of the program major measures. Customers that receive an in-home or virtual assessment may also receive direct install measures if they do not currently have the efficiency measures installed and do not refuse them.

#### 2.4.2.2 Program Data Tracking and Quality Control and Assurance Processes

Program data is tracked in a Salesforce-based platform.

The program database can track customer participation in other programs provided by the Companies, though staff manually associate the other forms of participation with the Home Performance tracking system.

Quality control inspections are completed for 10% of the homes assessed by the implementation contractor's energy advisors. Staff reported that verifications are performed on all major measure implementation work completed by program trade allies. The inspection of all installed measures allows for review of the trade ally's work as well as a chance for staff to perform the home energy audit.

Inspections are completed using the program Home Performance app. The Home Performance app includes data validation elements to ensure that data is collected and entered for all aspects of the inspection. Additionally, 10% of the inspection data is randomly selected for review by the program manager on a weekly basis to identify any issues with inspection data that the software cannot automatically validate.

If a major measure installation fails inspection, the installing trade ally is given 30 days to correct the issue. Trade allies must pass 80% of inspections in the prior 12-month period to continue in the program.

QA inspection findings are reviewed on a weekly basis. Issues with specific staff are addressed on an individual basis and broader issues are addressed through training.

Additionally, the program regularly administers surveys to participants to get feedback on their experience with the program.

### 2.4.3 Participant Survey Results

The Evaluation Team conducted surveys with customers who participated in the Home Performance Program from program year 2020. The purpose of the survey was to gather information from participants regarding how they learned about the program, satisfaction with program elements, implementation of energy efficiency recommendations, and other program-related information. Many of the questions included in the survey were used to inform the gross and net impact analyses for the program. These data are discussed in the Impact Results section

of the report (Section 2.3.3), while this section summarizes participant feedback about their experience participating in the program.

#### 2.4.3.1 Customer Awareness and Initiating Participation

**Most participants contacted the program telephonically to enroll.** As shown in Table 2-16, customers called a program contact (62%), used the Home Performance portal (42%), or through the contractor who completed the improvements (six percent).

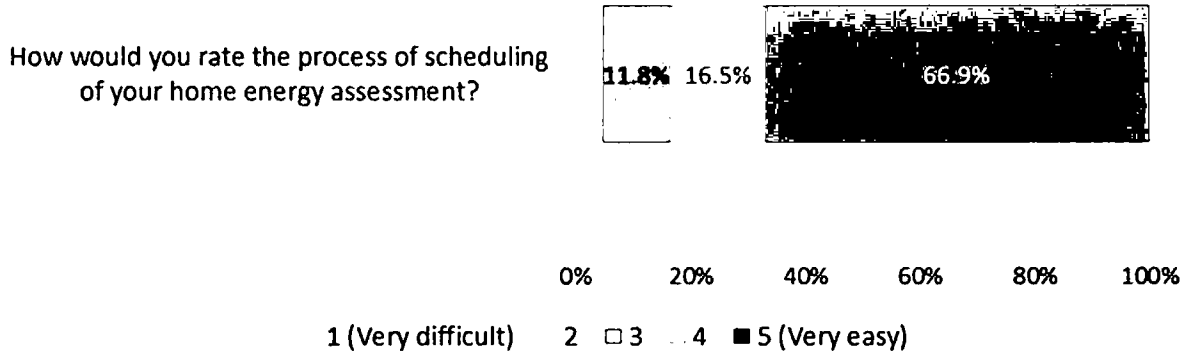
*Table 2-16 How Customers began Participation in the Program*

| *Rating* | *Percent of Respondents (n = 116)* |
|---|---|
| You called the program contact number | 52.2% |
| You enrolled using the Home Performance portal | 41.6% |
| The contractor that completed the efficiency improvements enrolled you | 6.2% |

#### 2.4.3.2 Experience with Home Energy Assessment

**Participants had little difficulty scheduling the energy assessment.** Ninety-nine percent of respondents stated they personally scheduled the home energy assessment. A large share of the respondents who scheduled the visit (83.4%) indicated it was easy or very easy to schedule.

*Figure 2-2 Ease of Scheduling Home Energy Assessment*




#### 2.4.3.3 Satisfaction with Program

**Satisfaction with the installed measures and the program overall was high.** Eight-four percent of respondents were somewhat or very satisfied with the measures installed and 79% were satisfied with the program overall, as shown in Figure 2-3.

About 14% of the respondents were dissatisfied with the program. Table 2-17 summarizes the reasons for participants dissatisfaction. The most mentioned issues were not receiving the home

assessment and a slow rebate process. Additionally, two respondents were not clear and what the next steps were to continue with a rebate check.

While the number of individuals citing the above issues for dissatisfaction were small, the share of customers who were dissatisfied was somewhat high at 14% and represents an increase from the 2% who reported dissatisfaction with the program in 2020.

*Figure 2-3 Satisfaction of the Home Performance Program*

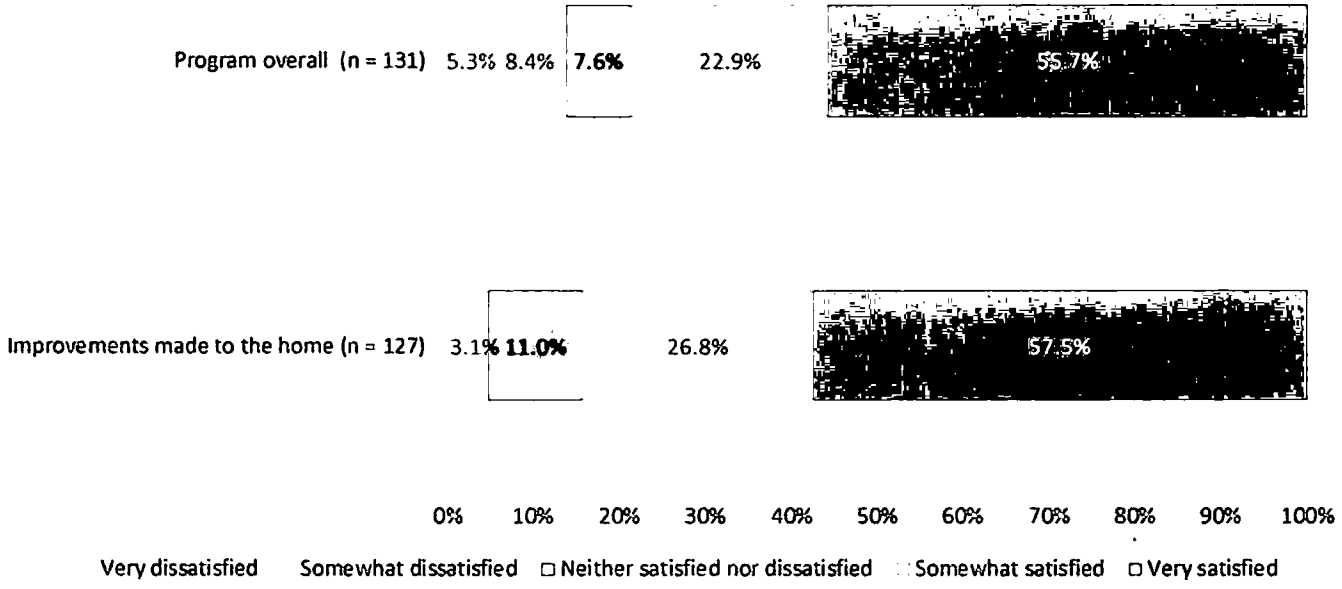



*Table 2-17 Summary of Reasons for Dissatisfaction*

| *Type of Comment* | *Number of Responses* |
|---|---|
| Did not receive energy report | 4 |
| Slow rebate process | 3 |
| Did not understand next step after assessment / how to get rebates | 2 |
| Assessment was not informative | 2 |
| Could not afford improvements | 1 |
| Scheduling difficulty | 1 |
| Contractor did not understand the program | 1 |
| Slow getting report | 1 |
| Did not understand how to get rebates | 1 |

## 2.5 Findings and Recommendations

- **Program participation increased in 2021 compared 2020.** The number of customers participating in the program increased in comparison to 2020. Increases were seen across the various participation channels.
- **Participants continue to participate in a variety of ways in the program.** The most common ways in which customers participated in the Home Performance program were by receiving direct install measures and an assessment, an assessment without direct install measures, and completing a major measure project followed by receiving direct install measures and an assessment.
- **Most participants were satisfied with the program, although 14% reported dissatisfaction with it.** The most common reasons given for dissatisfaction were not receiving the assessment report and slow rebate payments. Additionally, some customers reported a lack of understanding of the next steps.
    - **Recommendation 1:** Review the process of delivering assessment reports to ensure that customers are receving the report.
    - **Recommendation 2:** Review the rebate payment process to identify opportunities for streamlining and expediting rebate payments.
    - **Recommendation 3:** Consider following up with customers who receive a rebate to provide additional information and clarify next steps for participants. Although a small number of participants reported that this was an issue, it suggests there may be additional opportunities to encourage customers to make efficiency improvements.

# 3 Low-Income Single Family Program

## 3.1 Program Description

The LISF Program is designed to provide home energy services to APCo's Virginia customers with limited income to assist them in reducing their electric energy usage and to manage their utility costs. The LISF Program helps facilitate the implementation of electric energy-saving measures in residential low-income single family households.

The program reduces energy consumption by educating residential customers about the energy and money saving benefits associated with energy efficiency in the home. All customers participating in this program receive educational materials and an opportunity to discuss ways that they can continue to conserve and maintain the energy efficiency of their home after the weatherization process has been completed.

The LISF Program targets measures which have been proven to save energy, reduce consumption, and protect the health and safety of occupants while helping to lower their electric bills. Eligible measures include, but are not limited to, those listed below.

- Energy efficient lighting
- Water saving devices (for homes with electric water heaters)
- Water heater pipe wrap insulation (for homes with electric water heaters)
- HVAC replacement and maintenance
- ENERGY STAR® appliance upgrades
- Insulation and air sealing measures
- Electrical system upgrades and maintenance
- Home ventilation measures
- Programmable thermostat upgrades
- General health and safety measures

Equipment and installation costs for all measures are provided at no cost to eligible customers and properties.

### 3.1.1 Program Eligibility Requirements

To qualify for the program, a household's income cannot exceed 60% of State Median Income and must have electric heating. The Company does not offer this Program directly; it is managed by (Community Housing Partners) CHP in conjunction with the Weatherization Service Providers. When a customer applies for an energy assistance program through an agency, they are also applying for this program.

### 3.1.2 Summary of Savings by Eligible Rate Schedule

Table 3-1 compares average participant ex post net energy savings with the average energy usage of accounts for the applicable eligible rate schedule.

*Table 3-1 Summary of Savings by Eligible Rate Schedule*

| *Rate Schedule* | *Total Net Ex Post kWh Savings* | *Number of Participating Accounts* | *Average Participant Account-Level Net Ex Post kWh Savings* | *Average Rate Schedule Account-Level kWh Usage* | *Average Participant Account-Level Net Ex Post kWh Savings as Percentage of Average Rate Schedule Account-Level kWh Usage* |
|---|---|---|---|---|---|
| RS | 477,853 | 165 | 2,896.1 | 15,417 | 18.78% |

## 3.2 Data Collection

### 3.2.1 Participant Survey

Data collection from a participant survey was used to:

- Verify measures to estimate gross savings impacts; and
- Collect data on participants experience with the program to inform the process evaluation.

To estimate the sufficiency of the sample size, the Evaluation Team calculated the sample size needed to meet the 90/10 precision and confidence level. The sample size to meet 90/10 requirements is calculated using the coefficient of variation defined as:

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

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 by the following equation:

$$n = \left(\frac{1.645\ cv}{D}\right)^2$$

Where,

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

CV = Coefficient of Variation

D = Desired Precision, 10% in this evaluation

To account for the number of participants in the program, a finite population correction is applied with the following formula in order to calculate an adjusted sample size:

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

Where,

$n_0$ = Sample size calculated prior to application of finite population correction.

N = Population size (number of program participants)

With the application of the finite population correction factor for the program participant population size of 164, the sample size required to meet 90% confidence and 10% precision is 48.

Table 3-2 summarizes the survey data collection effort. The Evaluation Team attempted to complete a survey with program participants and was able to reach 10 participants through telephone surveying.

*Table 3-2 Survey Response Summary*

| *Survey* | *Mode* | *Fielding Period* | *Number of Contacts* | *Number of Survey/Interview Completions* |
|---|---|---|---|---|
| Low-Income Single Family Program Participant | Telephone | January 2022 | 81 | 10 |

## 3.3 Impact Evaluation

This chapter addresses the impacts of energy savings and peak demand reductions resulting from measures installed in facilities of customers that obtained incentives under the Residential Low-Income Single Family Program during the period January 2021 through December 2021.

### 3.3.1 Methodology for Estimating Gross Savings

The methodology used for estimating gross savings is described in this section. The methodology used to estimate savings deviated from the preliminary EM&V plan set forth in the program filing. The preliminary EM&V plan stated that the Evaluation Team would perform on-site visits to verify measure installations. Instead, the Evaluation Team utilized telephone and online surveys to verify measures as a safety precaution in response to COVID-19.

The M&V approach for the 2021 Low-Income Single Family Program is aimed at the following:

- Determining the number of weatherization measures reported as being installed through the program;
- Verifying the extent to which the reported weatherization measures are currently installed;
- Estimating annual kWh savings for measures implemented; and
- Estimating annual kW reduction for measures implemented.

Table 3-3 below summarizes the inputs needed for gross savings calculations and the source of each input.

*Table 3-3 Data Sources for Gross Impact Parameters – Low-Income Single Family Program*

| *Parameter* | *Source* |
|---|---|
| Number of Participants | Program Tracking Data |
| Measures Installed | Program Tracking Data/ Telephone Surveys |
| Measures Still In Use | Participant Surveying/ Telephone Surveys |
| Home characteristics | Program Tracking Data / Telephone Surveys |

### 3.3.1.1 Measure Attributes Tracked

Under this program, energy auditors collect details on home and equipment characteristics, documenting this through use of Excel-based project tracking workbooks. The workbooks facilitate tracking of information on baseline home and equipment characteristics as well as information regarding specific recommended improvements that are subsequently implemented under the program.

Table 3-4 presents information on the equipment specification data tracked by the program.

*Table 3-4 Gross Impact Attributes Tracked by Program – Low-Income Single Family Program*

| *Measure* | *Attributes Tracked* |
|---|---|
| HVAC Measures | Heating and Cooling System Types and Efficiency Levels |
| Lighting Measures | Light Level (Lumens) |
| | Wattage |
| | Installation Location (Room) |
| Water Heating Measures | Water Heating Type, Installation Location (Room) for Aerators |
| Envelope Measures | Existing and New Insulation Levels, Heating and Cooling System Types |

### 3.3.1.2 Verification of Measure Installation

The initial step in conducting measurements of program activity is to verify the number of weatherization measures installed. The Evaluation Team took several steps in verifying the number of weatherization measures installed which consists of the following:

- Validating Program tracking data provided by CHP by checking for duplicate or erroneous entries;
- Verifying that participants were part of the program according to the agreed-upon process between CHP and the Company; and

Conducting verification surveys with a sample of program participants (the focus of these verification surveys is to confirm that customers listed in the program tracking database did indeed participate and that the number of measures installed was accurate).

Table 3-5 summarizes the in-service and verification rates for the Residential Low-Income Single Family Program.

*Table 3-5 Installation Rates by Measure Type – Low Income Single Family Program*

| *Measure* | *In-Service/ Verification Rate* |
|---|---|
| Air sealing | 100.0% |
| Insulation | 90.0% |
| Duct sealing/insulation | 100.0% |
| Heat pump | 100.0% |
| Heating and cooling system tune-up | 100.0% |
| Hot water heater pipe wrap | 100.0% |
| Water heater tank wrap | 100.0% |
| Water heater | 100.0% |
| Kitchen or bathroom ventilation fan | 100.0% |
| LEDs | 100.0% |
| Bathroom aerators | 100.0% |
| Showerhead | 100.0% |

#### 3.3.1.3 Weather Dependent Inputs

Many measures utilize common weather dependent factors, such as effective full load heating hours and cooling hours (EFLH), cooling degree hours (CDH), heating degree days (HDD) and cooling degree days (CDD).

The method utilized by the Mid-Atlantic TRM to estimate full load hours (EFLH) from the EmPower metering study multiplied by the ratio of the Energy Star full load hours of the analyzed city to the study city, was developed for the eight Virginia and West Virginia cities referenced in the Energy Star full load data.

The heating degree days were developed for 932 zip codes in Virginia from TMY3 weather data and the Mid-Atlantic TRM method with the referenced base balance point outdoor air temperature. The data from 11 weather stations with TMY3 data were obtained along with the TRM heating balance point of 60F and a TRM cooling balance point of 65F to develop CDD and HDD. From these 11 weather stations, the HDD and CDD values were assigned by the nearest radial distance to 932 zip codes. The CDH was determined for each zip code by a similar Mid-Atlantic TRM method, with the referenced balance point of 75F.

#### 3.3.1.4 Measure Specific Calculations

Table 3-6 summarizes the equations and inputs used to estimate the savings of the program measures. The savings calculated using the approaches outlined in the table were adjusted by the

verification and in-service rates developed from the survey of program participants to estimate the gross program savings.

*Table 3-6 Measure Specific Calculations*

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| ***Measure Name: Low Flow Faucet Aerator*** | | | |
| Savings | *ΔkWh* | | *(((GPM_base * Throttle_base) - (GPM_low * Throttle_low)) * Time_faucet * #people * 365 * DR) * 8.3 * (TEMP_faucet - TEMP_in) / DHW_RE / 3412* |
| Savings | *ΔkW* | | *((((GPM_base * Throttle_base) - (GPM_low * Throttle_low)) * Time_faucet * #people * 365 * DR) * 8.3 * (TEMP_faucet - TEMP_in) / DHW_RE / 3412) / Hours * CF* |
| Input | *#people* | Varies | Tracking data. |
| Input | *GPM_base* | 2.2 | Mid-Atlantic TRM V10.0, p. 133. |
| Input | *Throttle_base* | 0.83 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *GPM_low* | 1.5 | Tracking data. |
| Input | *Throttle_low* | 0.95 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *Time_faucet* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *TEMP_faucet* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *TEMP_in* | 60.9 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *DHW_RE* | 0.98 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *DR* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *Hours* | Calculation | Calculation: #people * Time_faucet / 60 * 365. |
| Input | *CF* | 0.00262 | Mid-Atlantic TRM V10.0, p. 135. |
| EUL | | 10 | Mid-Atlantic TRM V10, p. 136. |
| ***Measure Name: Low Flow Showerhead*** | | | |
| Savings | *ΔkWh* | | *((GPMbase - GPMlow) * Time_shower * #people * Showers_per_person * 365 / ShowerHeads_per_home) * 8.3 * 1 * (TEMP_sh - TEMP_in) / DHW_RE / 3412* |
| Savings | *ΔkW* | | *(((GPMbase - GPMlow) * Time_shower * #people * Showers_per_person * 365 / ShowerHeads_per_home) * 8.3 * 1 * (TEMP_sh - TEMP_in) / DHW_RE / 3412) / Hours * CF* |
| Input | *#people* | | Tracking data. |
| Input | *GPMbase* | 2.5 | Mid-Atlantic TRM V10.0, p. 137. |
| Input | *GPMlow* | 1.5 | Tracking data. |
| Input | *Time_shower* | 7.8 | Mid-Atlantic TRM V10.0, p. 137. |
| Input | *TEMP_sh* | 105 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *TEMP_in* | 60.9 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *Showers_per_person* | 0.6 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *ShowerHeads_per_home* | 1.6 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *DHW_RE* | 0.98 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *Hours* | Calculation | Calculation: (TimeShower * #people * Showers_per_person) / (ShowerHeads_per_home * 60) * 365. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *CF* | 0.00371 | Mid-Atlantic TRM V10.0, p. 139. |
| EUL | | 10 | Mid-Atlantic TRM V10, p. 140. |
| ***Measure Name: Water Heater Tank Wrap*** | | | |
| Savings | *ΔkWh* | | *(((U_base * A_base) - (U_insul * A_insul)) * ΔT * Hours) / (3412 * ηDHW)* |
| Savings | *ΔkW* | | *((((U_base * A_base) - (U_insul * A_insul)) * ΔT * Hours) / (3412 * ηDHW)) / 8760* |
| Input | *U_base* | Varies | Mid-Atlantic TRM V10.0, p. 141. |
| Input | *A_base* | Varies | Mid-Atlantic TRM V10.0, p. 142, based on WH capacity |
| Input | *U_insul* | Varies | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *A_insul* | Varies | Mid-Atlantic TRM V10.0, p. 142, based on WH capacity. |
| Input | *ΔT* | 60 | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *Hours* | 8760 | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *ηDHW* | 0.98 | Mid-Atlantic TRM V10.0, p. 143. |
| EUL | | 5 | Mid-Atlantic TRM V10.0, p. 144. |
| ***Measure Name: Water Heater Pipe Insulation*** | | | |
| Savings | *ΔkWh* | | *(((1 / Rexist) - (1 / Rnew)) * L * C * ΔT * 8760) / n_DHW / 3413* |
| Savings | *ΔkW* | | *((((1 / Rexist) - (1 / Rnew)) * L * C * ΔT * 8760) / n_DHW / 3413) / 8760* |
| Input | *Rexist* | 1 | Mid-Atlantic TRM V9.0, p. 186. |
| Input | *Rnew* | Varies | Tracking data. |
| Input | *L* | Varies | Tracking data. |
| Input | *C* | Varies | Tracking data. |
| Input | *ΔT* | 65 | Mid-Atlantic TRM V9.0, p. 187. |
| Input | *n_DHW* | Varies | Mid-Atlantic TRM V9.0, p. 187. |
| EUL | | 15 | Mid-Atlantic TRM V9.0, p. 188. |
| ***Measure Name: Air Sealing*** | | | |
| Savings | *ΔkWh* | | *(((((CFM50_Exist - CFM50_New) / N - cool) * 60 * CDH * DUA * 0.018) / 1000 / ηCool) * LM) + (((((CFM50_Exist - CFM50_New) / N - heat) * 60 * 24 * HDD * 0.018) / 1000000 / ηHeat) * 293.1)* |
| Savings | *ΔkW* | | *(((((CFM50_Exist - CFM50_New) / N - cool) * 60 * CDH * DUA * 0.018) / 1000 / ηCool) * LM) / EFLH_cool * CF* |
| Input | *CFM50_Exist* | Varies | Tracking data. |
| Input | *CFM50_New* | Varies | Tracking data. |
| Input | *N-cool* | Varies | Based on location. |
| Input | *CDH* | Varies | Applicable weather data. |
| Input | *DUA* | 0.75 | Mid-Atlantic TRM V9.0, p. 254. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *LM* | Varies | Based on location: Mid-Atlantic TRM method. |
| Input | *N-heat* | Varies | Based on location. |
| Input | *HDD* | Varies | Applicable weather data. |
| Input | *ηHeat* | Varies | Tracking data. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 257. |
| EUL | | 15 | Mid-Atlantic TRM V9.0, p. 259. |
| ***Measure Name: Direct Install Lighting*** | | | |
| Savings | *ΔkWh* | | *(WattsBase - WattsEE) / 1000 * Hours * HCIF_kWh* |
| Savings | *ΔkW* | | *(WattsBase - WattsEE) / 1000 * HCIF_kW * CF* |
| Input | *WattsEE* | Varies | Tracking data. |
| Input | *WattsBase* | Varies | Mid-Atlantic TRM V10.0, p.27-28. |
| Input | *Hours* | 679 | Mid-Atlantic TRM V9.0, p.34. Interior lighting. |
| Input | *HCIF_kWh* | Varies | ADM Protypical Builiding Model. |
| Input | *HCIF_kW* | Varies | ADM Protypical Builiding Model. |
| Input | *CF* | 0.059 | Mid-Atlantic TRM V9.0, p. 37. |
| EUL | | 16.3 | Mid-Atlantic TRM V10.0, p. 34. |
| ***Measure Name: Duct Insulation*** | | | |
| Savings | *ΔkWh* | | *(Sum of: (BTUH_heat_bare - BTUH_heat_insulated) * A) * EFLH_heat / (3412 * COP_heat) + (Sum of: (BTUH_cool_bare - BTUH_cool_insulated) * A) * EFLH_cool / (3412 * COP_cool)* |
| Savings | *ΔkW* | | *Sum of: (BTUH_cool_bare - BTUH_cool_insulated) * A * CF / (3412 * COP_heat)* |
| Input | *BTUH_heat_bare* | Varies | Based on insulation location: Connecticut's 2021 Program Savings Document, p.99. |
| Input | *BTUH_heat_insulated* | Varies | Based on insulation location: Connecticut's 2021 Program Savings Document, p.99. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *A* | Varies | Tracking data. Area insulated (sqft). |
| Input | *COP_heat* | Varies | Tracking data. |
| Input | *BTUH_cool_bare* | Varies | Based on insulation location: Connecticut's 2021 Program Savings Document, p.99. |
| Input | *BTUH_cool_insulated* | Varies | Based on insulation location: Connecticut's 2021 Program Savings Document, p.99. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *COP_cool* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 116. |
| EUL | | 20 | Mid-Atlantic TRM V9.0, p. 119. |
| ***Measure Name: Smart Thermostat*** | | | |
| Savings | *ΔkWh* | | *(Capacity_cool / SEER * EFLH_cool * SF_cool / 1000) + (Capacity_heat / HSPF * EFLH_heat * SF_heat / 1000)* |
| Savings | *ΔkW* | | *0* |
| Input | *Capacity_cool* | Varies | Tracking data. |
| Input | *SEER* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *Capacity_heat* | Varies | Tracking data. |
| Input | *HSPF* | Varies | Tracking data. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SF_cool* | 0.06 | Mid-Atlantic TRM V9.0, p. 104. |
| Input | *SF_heat* | 0.07 | Mid-Atlantic TRM V9.0, p. 104. |
| EUL | | 7.5 | Mid-Atlantic TRM V10.0, p. 106. |
| ***Measure Name: Attic Insulation*** | | | |
| Savings | *ΔkWh* | | *((1 / Rexist - 1 / Rnew) * CDH * DUA * Area / 1000 / ηCool * ADJcool) + ((1 / Rexist - 1 / Rnew) * HDD * 24 * Area / 1000000 / ηHeat * 293.1 * ADJheat)* |
| Savings | *ΔkW* | | *((1 / Rexist - 1 / Rnew) * CDH * DUA * Area / 1000 / ηCool) / EFLH_cool * CF* |
| Input | *Rexist* | Varies | Tracking data. |
| Input | *Rnew* | Varies | Tracking data. |
| Input | *CDH* | Varies | Applicable weather data. |
| Input | *DUA* | 0.75 | Mid-Atlantic TRM V9.0, p. 261. |
| Input | *Area* | Varies | Tracking data. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *ADJcool* | Varies | Mid-Atlantic TRM V9.0, p. 261. |
| Input | *HDD* | Varies | Applicable weather data. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *ADJheat* | 0.6 | Mid-Atlantic TRM V9.0, p. 263. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 263. |
| EUL | | 25 | Mid-Atlantic TRM V9.0, p. 265. |
| ***Measure Name: Duct Sealing*** | | | |
| Savings | *ΔkWh* | | *((((Pre_CFM25 - Post_CFM25) / (Cool_Capacity * 400)) * EFLH_cool * BTUH_cool) / 1000 / ηCool) + ((((Pre_CFM25 - Post_CFM25) / (Heat_Capacity * 400)) * EFLH_heat * BTUH_heat) / 1000000 / ηHeat * 293.1)* |
| Savings | *ΔkW* | | *((((Pre_CFM25 - Post_CFM25) / (Cool_Capacity * 400)) * EFLH_cool * BTUH_cool) / 1000 / ηCool) / EFLH_cool * CF* |
| Input | *Pre_CFM25* | Varies | Tracking data. |
| Input | *Post_CFM25* | Varies | Tracking data. |
| Input | *Cool_Capacity* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *BTUH_cool* | Varies | Tracking data. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *Heat_Capacity* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *BTUH_heat* | Varies | Tracking data. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 116. |
| EUL | | 20 | Mid-Atlantic TRM V9.0, p. 119. |

| Variable Type | Variable Name | Variable Value | Variable Value Source |
|---|---|---|---|
| ***Measure Name: Heat Pump Clean & Tune*** | | | |
| Savings | *ΔkWh* | | *(((FLHcool * Capacity_cool * (1 / SEER)) / 1000 * Mfe) + (FLHheat * Capacity_heat * (1 / HSPF)) / 1000 * Mfe)* |
| Savings | *ΔkW* | | *Capacity_cool * (1 / EER) / 1000 * MFd * CF* |
| Input | *FLHcool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *FLHheat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *Capacity_cool* | Varies | Tracking data. |
| Input | *Mfe* | 0.05 | IL-TRM V8, p. 132. |
| Input | *SEER* | Varies | Tracking data. |
| Input | *Capacity_heat* | Varies | Tracking data. |
| Input | *HSPF* | Varies | Tracking data. |
| Input | *EER* | Calculation | Calculation: (-0.02 * SEER * SEER) + (1.12 * SEER). |
| Input | *MFd* | 0.02 | IL-TRM V8, p. 134. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 124. |
| EUL | | 3 | IL-TRM V8, p. 131. |
| ***Measure Name: Air Source Heat Pump*** | | | |
| Savings | *ΔkWh* | | *(((Capacity_heat_ee / HSPF_base) - (Capacity_heat_ee / HSPF_ee)) / 1000 * EFLH_heat * HLAF) + (((Capacity_cool_ee / SEER_base) - (Capacity_cool_ee / SEER_ee)) / 1000 * EFLH_cool * CLAF) + (((Capacity_heat_ee / HSPF_exist) - (Capacity_heat_exist / HSPF_base)) / 1000 * Heating_ER_Factor * EFLH_heat * HLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / SEER_exist) - (Capacity_cool_ee / SEER_base)) / 1000 * Cooling_ER_Factor * EFLH_cool * CLAF),0)* |
| Savings | *ΔkW* | | *(((Capacity_cool_ee / EER_base) - (Capacity_cool_ee / EER_ee)) / 1000 * CF * CLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / EER_exist) - (Capacity_cool_ee / EER_base)) / 1000 * Cooling_ER_Factor * CF * CLAF),0)* |
| Input | *Capacity_cool_exist* | Varies | Tracking data. |
| Input | *Capacity_cool_ee* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SEER_exist* | Varies | Tracking data. |
| Input | *SEER_base* | 14 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *SEER_ee* | Varies | Tracking data. |
| Input | *EER_exist* | Varies | Tracking data. |
| Input | *EER_base* | 11.8 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *EER_ee* | Varies | Tracking data. |
| Input | *Capacity_heat_exist* | Varies | Tracking data. |
| Input | *Capacity_heat_ee* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *HSPF_exist* | Varies | Tracking data. |
| Input | *HSPF_base* | 8.2 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *HSPF_ee* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 95. |
| Input | *CLAF* | Varies | Cooling load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *HLAF* | Varies | Heating load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *Cooling_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Heating_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Baseline_Cooling* | Varies | Equals 1 if there was pre-project cooling, else 0. |
| EUL - 1 | | 6 | Mid-Atlantic TRM V10.0, p. 87. |
| EUL - 2 | | 12 | Mid-Atlantic TRM V10.0, p. 87. |
| ***Measure Name: Mini Split Heat Pump*** | | | |
| Savings | *ΔkWh* | | *(((Capacity_heat_ee / HSPF_base) - (Capacity_heat_ee / HSPF_ee)) / 1000 * EFLH_heat * HLAF) + (((Capacity_cool_ee / SEER_base) - (Capacity_cool_ee / SEER_ee)) / 1000 * EFLH_cool * CLAF) + (((Capacity_heat_ee / HSPF_exist) - (Capacity_heat_exist / HSPF_base)) / 1000 * Heating_ER_Factor * EFLH_heat * HLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / SEER_exist) - (Capacity_cool_ee / SEER_base)) / 1000 * Cooling_ER_Factor * EFLH_cool * CLAF),0)* |
| Savings | *ΔkW* | | *(((Capacity_cool_ee / EER_base) - (Capacity_cool_ee / EER_ee)) / 1000 * CF * CLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / EER_exist) - (Capacity_cool_ee / EER_base)) / 1000 * Cooling_ER_Factor * CF * CLAF),0)* |
| Input | *Capacity_cool_exist* | Varies | Tracking data. |
| Input | *Capacity_cool_ee* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SEER_exist* | Varies | Tracking data. |
| Input | *SEER_base* | 14 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *SEER_ee* | Varies | Tracking data. |
| Input | *EER_exist* | Varies | Tracking data. |
| Input | *EER_base* | 11.8 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *EER_ee* | Varies | Tracking data. |
| Input | *Capacity_heat_exist* | Varies | Tracking data. |
| Input | *Capacity_heat_ee* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *HSPF_exist* | Varies | Tracking data. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *HSPF_base* | 8.2 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *HSPF_ee* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 124. |
| Input | *CLAF* | Varies | Cooling load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *HLAF* | Varies | Heating load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *Cooling_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Heating_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Baseline_Cooling* | Varies | Equals 1 if there was pre-project cooling, else 0. |
| EUL - 1 | | 6 | Mid-Atlantic TRM V10.0, p. 94. |
| EUL - 2 | | 12 | Mid-Atlantic TRM V10.0, p. 94. |
| ***Measure Name: Mobile Home Floor Insulation*** | | | |
| Savings | *ΔkWh* | | *(((1 / R_Old_AG - 1 / (R_Old_AG + R_Added_AG)) * L_Basement_Wall * H_Basement_Wall_AG * (1 - Framing_Factor) * CDH * DUA) / (1000 * ηCool) * AdjBasementcool) + (((1 / R_Old_AG - 1 / (R_Old_AG + R_Added_AG)) * L_Basement_Wall * H_Basement_Wall_AG * (1 - Framing_Factor) * HDD * 24) / (3412 * ηHeat) * AdjBasementheat)* |
| Savings | *ΔkW* | | *(((1 / R_Old_AG - 1 / (R_Old_AG + R_Added_AG)) * L_Basement_Wall * H_Basement_Wall_AG * (1 - Framing_Factor) * CDH * DUA) / (1000 * ηCool) * AdjBasementcool) / EFLH_cool * CF* |
| Input | *R_Old_AG* | Varies | Tracking data. |
| Input | *R_Added_AG* | Varies | Tracking data. |
| Input | *L_Basement_Wall* | Varies | Tracking data. |
| Input | *H_Basement_Wall_AG* | Varies | Tracking data. |
| Input | *Framing_Factor* | Varies | Mid-Atlantic TRM V9.0, p. 270. |
| Input | *CDH* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *DUA* | 0.75 | Mid-Atlantic TRM V9.0, p. 270. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *AdjBasementcool* | 0.8 | Mid-Atlantic TRM V9.0, p. 271. |
| Input | *HDD* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *AdjBasementheat* | 0.6 | Mid-Atlantic TRM V9.0, p. 271. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 274. |
| EUL | | 25 | Mid-Atlantic TRM V9.0, p. 265. |

### 3.3.2 Methodology for Estimating Net Savings

The purpose of the Residential Low-Income Single Family Program is to assist income-qualified customers who would benefit from higher level standard home weatherization measures such as ceiling insulation, home infiltration reduction, and duct sealing. The NTG ratio for the LISFP was assumed to be 1.0 in line with common practice for estimation of low-income program net savings.[3]

### 3.3.3 Impact Evaluation Results

The following subsections summarize the results of the impact evaluation conducted for the 2021 Low-Income Single Family Program.

#### 3.3.3.1 Results of Database Review

The Evaluation Team first examined the tracking database for systemic entry errors for each channel, i.e., duplicate entries and/or erroneous entries (such as data entered into improper columns). Upon receiving final program tracking databases, the Evaluation Team found quantities and unit specifications to match the implementer's records.

#### 3.3.3.2 Annual kWh Savings and Peak kW Reduction

The program-level PY2021 realized net energy savings are presented below in Table 3-7. During this period, realized gross and net energy savings totaled 466,577 kWh. The gross kWh realization rate of the program is 69%. The net-to-gross ratio for the program is assumed to be 1.0 in line with common practice for estimation of net energy savings for low income programs.[4]

*Table 3-7 Low-Income Single Family Program Realized Net Energy Savings*

| *Measure Name* | *Ex Ante kWh Savings* | *Gross Ex Post kWh Savings* | *Gross Realization Rate* | *Net Ex Post kWh Savings* | *Net-to-Gross Ratio* | *Net Lifetime kWh Savings* |
|---|---|---|---|---|---|---|
| Air Sealing | 76,942 | 78,466 | 102% | 78,466 | 100% | 1,176,983 |
| Attic Insulation | 16,454 | 19,081 | 116% | 19,081 | 100% | 477,017 |
| Duct Sealing | 65,724 | 65,302 | 99% | 65,302 | 100% | 1,306,042 |
| Duct Insulation | 6,038 | 4,779 | 79% | 4,779 | 100% | 95,578 |
| Mobile Home Attic Insulation | 19,316 | 9,067 | 47% | 9,067 | 100% | 226,663 |
| Mobile Home Floor | 107,330 | 9,106 | 8% | 9,106 | 100% | 227,647 |

[3] See Violette and Rathbun, Chapter 21: Estimating Net Savings: Common Practices. The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, available electronically at https://www.nrel.gov/docs/fy17osti/68578.pdf, p. 45

[4] See Violette and Rathbun, Chapter 21: Estimating Net Savings: Common Practices. The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, available electronically at https://www.nrel.gov/docs/fy17osti/68578.pdf, p. 45.

| *Measure Name* | *Ex Ante kWh Savings* | *Gross Ex Post kWh Savings* | *Gross Realization Rate* | *Net Ex Post kWh Savings* | *Net-to-Gross Ratio* | *Net Lifetime kWh Savings* |
|---|---|---|---|---|---|---|
| Insulation | | | | | | |
| Air Source Heat Pump | 262,714 | 185,205 | 70% | 185,205 | 100% | 1,256,696 |
| Mini Split Heat Pump | 21,002 | 14,437 | 69% | 14,437 | 100% | 115,421 |
| Smart Thermostat | 943 | 868 | 92% | 868 | 100% | 6,511 |
| Heat Pump Clean & Tune | 876 | 612 | 70% | 612 | 100% | 1,835 |
| Direct Install Lighting | 27,996 | 27,629 | 99% | 27,629 | 100% | 450,352 |
| Low Flow Faucet Aerator | 4,313 | 1,921 | 45% | 1,921 | 100% | 19,213 |
| Low Flow Showerhead | 13,966 | 8,426 | 60% | 8,426 | 100% | 84,263 |
| Water Heater Tank Wrap | 25,101 | 25,970 | 103% | 25,970 | 100% | 129,849 |
| Water Heater Pipe Insulation | 30,236 | 26,985 | 89% | 26,985 | 100% | 404,774 |
| Total | 678,953 | 477,853 | 70% | 477,853 | 100% | 5,978,841 |

Table 3-8 shows the realized net peak kW reduction attributable to the Low-Income Single Family Program for PY2021.

*Table 3-8 Low-Income Single Family Program Realized Peak kW Reductions*

| *Measure Name* | *Ex Ante kW Savings* | *Gross Ex Post kW Savings* | *Gross Realization Rate* | *Net Ex Post kW Savings* | *Net-to-Gross Ratio* |
|---|---|---|---|---|---|
| Air Sealing | 89.44 | 5.77 | 6% | 5.77 | 100% |
| Attic Insulation | 19.57 | 0.89 | 5% | 0.89 | 100% |
| Duct Sealing | 24.68 | 20.92 | 85% | 20.92 | 100% |
| Duct Insulation | 8.06 | 1.15 | 14% | 1.15 | 100% |
| Mobile Home Attic Insulation | 22.72 | 0.39 | 2% | 0.39 | 100% |
| Mobile Home Floor Insulation | - | 0.39 | N/A | 0.39 | 100% |
| Air Source Heat Pump | 61.25 | 53.49 | 87% | 53.49 | 100% |
| Mini Split Heat Pump | 0.28 | 1.31 | 470% | 1.31 | 100% |
| Smart Thermostat | - | - | N/A | - | N/A |
| Heat Pump Clean & Tune | 0.06 | 0.09 | 139% | 0.09 | 100% |
| Direct Install Lighting | 6.91 | 3.57 | 52% | 3.57 | 100% |
| Low Flow Faucet Aerator | 1.66 | 0.20 | 12% | 0.20 | 100% |
| Low Flow Showerhead | 8.90 | 0.85 | 10% | 0.85 | 100% |
| Water Heater Tank Wrap | 2.87 | 2.96 | 103% | 2.96 | 100% |
| Water Heater Pipe Insulation | 3.45 | 3.08 | 89% | 3.08 | 100% |
| Total | 249.86 | 95.09 | 38% | 95.09 | 100% |

### 3.3.3.3 Supplementary Econometric Analysis

To supplement the impact evaluation, the Evaluation Team utilized IPMVP Option C by performing regression analysis to assess the presence of energy savings during the period subsequent to implementation of program measures. The Evaluation Team obtained monthly energy usage data of program participants from the Company. The analysis was performed using data associated with customers with energy usage data available for at least six months after implementation of program measures. For the Low-Income Single Family Program, such data was available for a total of 59 PY2021 program participants. The variables described in Table 3-9 were included in the analysis.

*Table 3-9 Analysis Model Variables*

| *Variable Name* | *Variable Description* |
|---|---|
| kWh | Dependent variable; participant monthly energy use. |
| CDH | MAX (Outdoor Temperature - 65°F, 0) calculated hourly and averaged across month. |
| HDH | MAX (65°F - Outdoor Temperature, 0) calculated hourly and averaged across month. |
| Post | 1 during post-implementation period; otherwise 0. |

A mixed effects regression model was employed with to estimate the incremental impact of implementation of program measures on participant energy use. The following equation was modeled:

*Equation 2*

$$kWh_{it} = \beta_0 + \beta_1 Post_{it} + \beta_2 CDH_{it} + \beta_3 HDH_{it} + e_{it}$$

Table 3-10 presents the results of the regression analysis.

*Table 3-10 Parameter Estimates for Regression Model*

| *Variable Name* | *Estimate* | *Standard Error* | *Z score* | *p value* | *90% Confidence Interval* | |
|---|---|---|---|---|---|---|
| | | | | | *Lower Bound* | *Upper Bound* |
| CDH | 0.042 | 0.011 | 3.68 | 0 | 0.023 | 0.061 |
| HDH | 0.099 | 0.004 | 25.97 | 0 | 0.093 | 0.105 |
| Post | -217.746 | 41.579 | -5.24 | 0 | -286.138 | -149.354 |
| Intercept | 984.925 | 71.74 | 13.73 | 0 | 866.923 | 1102.927 |
| Number of Observations | | | | | | 1,351 |
| Number of Groups | | | | | | 59 |

Intuitively, the weather variables (*CDH* and *HDH*) have positive coefficients indicating the presence of weather-sensitive energy usage and the *Post* variable has a negative coefficient indicating lower energy use during the post-implementation period. The coefficient of *Post* indicates that average monthly energy use of Low-Income Single Family participants included in

the analysis during the period after implementation of program measures is about 218 kWh lower, controlling for weather-related effects.

The energy savings estimate of 218 kWh associated with the mixed effects regression model is equal to 95% of the average monthly account-level ex post gross savings of 230 kWh for the 59 accounts included in the econometric analysis. The average monthly ex post gross kWh savings estimate is within the 90% confidence interval of the model *Post* variable coefficient.

## 3.4 Process Evaluation

This chapter presents key findings from the limited process evaluation conducted for the 2021 Low-Income Single Family Program through the Company. The 2021 process findings are based on surveys of a sample of participating customers.

### 3.4.1 Program Design and Operations

The low-program income weatherization program design and operations remained consistent with that of prior program years. The program continues to co-fund efficiency measures delivered through the Community Housing Partners. The weatherization agencies that perform the work leveraging federal weatherization funds, state home repair funds, and state crisis heating funds.

The Company has one program manager who works with the non-profit third-party implementer, CHP. CHP is responsible for the recruiting and training of the contractors, and all aspects of program operations.

#### 3.4.1.1 Quality Control Procedures

Participant income qualifications are assessed in one of two ways. First, any customer who is eligible for the Energy Assistance Program run through the Department of Social Services is qualified for the Low-Income Single Family Program because the income test is the same for the two programs. For other participants, the staff collects documentation to verify the participant's income. Program staff collect a copy of the participants utility bill to verify that the participant receives electrical service through the Company.

Energy auditors who collect diagnostic information and other details on the home characteristics are licensed by the state of Virginia and are also required to receive additional training on the weatherization program. These staff enter information on the home characteristics and performance information into audit tool software that generates a list of approved efficiency and health and safety improvements.

All program contractors receive training through CHP's Research and Training Center. There are different training programs for various roles in implementing weatherization measures such as installers, crew leader training, and HVAC installations.

In addition to training requirements, there are standards for the installation of measures and for the material requirements for the materials issued by the National Renewable Energy Laboratory.[5]

All homes receive a quality control inspection. These inspections are mostly done by agency staff but in some cases, the agency subcontracts the inspection to another entity. The inspection verifies that the measures are installed properly and includes a discussion with the resident about the work performed. Additionally, there is a client response form that each participant can return to provide comments about the work performed.

Additionally, the Association of Energy Conservation Professionals (AECP) that serves as a support and resource for the Virginia Weatherization Assistance Program, inspects approximately 5% of the homes and performs site visits to the individually agencies. AECP reviews all measures reported to the Company and issues a detailed report of findings.

### 3.4.2 Participant Survey Results

The Evaluation Team conducted surveys with program participants as part of the evaluation effort. These surveys were designed to gather information related to both the impact and process components of the program evaluation. This section summarizes participant feedback on sources of program awareness, the participation experience and overall satisfaction with the program.

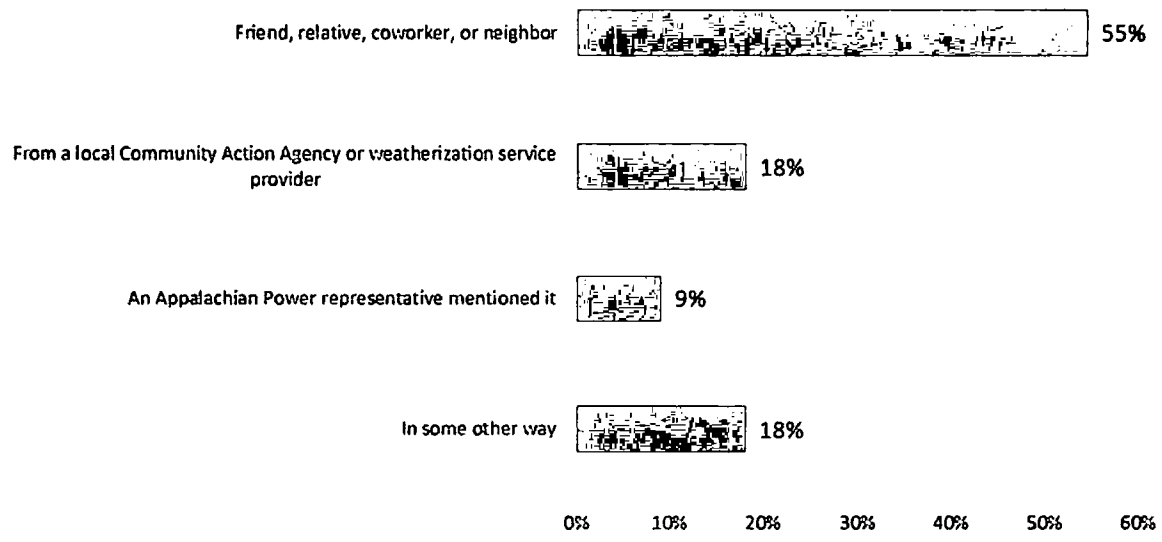
#### 3.4.2.1 Customer Awareness of Program

**Participant awareness is driven by community action agencies/weatherization service providers or through word of mouth.** As shown in Figure 3-1 respondents most commonly (55%) learned of the program from a friend, relative, coworker, or neighbor (word-of-mouth), followed by from a community action agency or weatherization service provider (18%).

[5] Installation standards document: https://sws.nrel.gov/spec/1

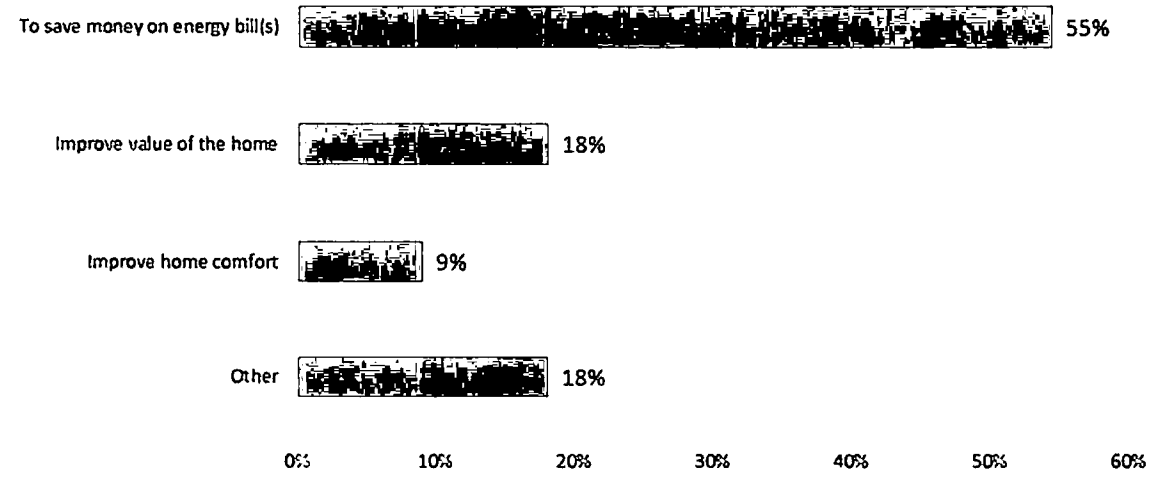
Materials standards document: https://www.govinfo.gov/app/details/CFR-2011-title10-vol3/CFR-2011-title10-vol3-part440-appA/summary

*Figure 3-1 How Customers Learned about the Program*[6]




**Saving money and improving home comfort were the two primary motivations for participating.** Survey respondents provided feedback on why they chose to participate in the program. Respondents most commonly reported participating because they wanted to save money on their energy bill(s) (55%). A summary of all the reasons for participating are displayed in Figure 3-2.

*Figure 3-2 Why Customers Participated in the Program*[7]




[6] Respondents were able to select more than one response and the sum of percentages shown in the figure exceeds 100%.

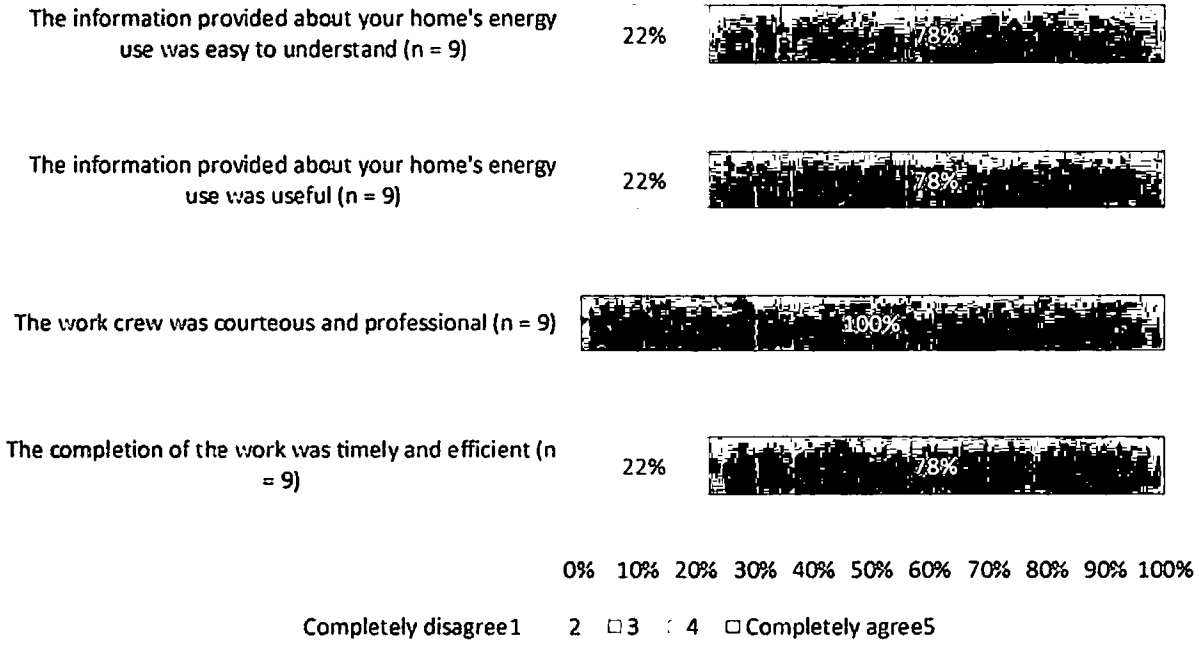
[7] Respondents were able to select more than one response and the sum of percentages shown in the figure exceeds 100%.

### 3.4.2.2 Experience with Audit

**Most participants found the process of scheduling the audit to be easy and were satisfied with the performance of the audit and the information provided.** Ninety percent (90%) of survey participants reported that someone visited their household to discuss ways to save energy and to install energy efficient equipment. Those who scheduled the appointment stated the process to schedule was easy to schedule.

All respondents who recalled the visit reported that their appliances or building structure were examined for energy efficiency. A majority of participants (78%) stated the program representative talked to them about how to save energy in their home or provided recommendations on how to use their appliances and equipment in an energy efficient way. Most survey respondents somewhat or completely agreed that the completion of the work was timely and efficient, the work crew was courteous and professional, and the information provided about their home's energy use was useful (see Figure 3-3).

*Figure 3-3 Customer Feedback on Work Performed*




### 3.4.2.3 Customer Satisfaction

**All participants were satisfied with the program and the work performed.** All respondents reported being very or somewhat satisfied with the efficiency of the efficiency improvements to their homes. All but one respondent was satisfied with the program overall. The respondent who was somewhat dissatisfied with the program said that the work crew left a mess and "cemented over my heat ducts," but did say they were quick and efficient. The respondent was happy with the HVAC contractor, however.

## 3.5 Findings

- **Participant satisfaction continues to be high.** All survey respondents were satisfied with the work performed and all but one was satisfied with the program overall.

# 4 Low-Income Multifamily Family Program

## 4.1 Program Description

The LIMF Program aims to reduce energy consumption by educating residential customers about the energy and money saving benefits associated with energy efficiency in the home. All customers participating in this program receive educational materials and an opportunity to discuss ways that they can continue to conserve and maintain the efficiency of their home after the services have been performed.

The LIMF Program targets measures which have been proven to save energy, reduce consumption, and protect the health and safety of occupants while helping to lower their electric bills. Eligible measures include, but are not limited to, those listed below.

- Electric Baseload Reduction
  - Energy efficient lighting
  - Electric water heating measures (aerators, pipe wrap, showerheads, etc.)
  - ENERGY STAR® appliance upgrades
- Electric Weatherization Measures
  - HVAC replacement and maintenance
  - Insulation and air sealing measures
  - Duct system sealing and replacement
- Health and Safety
  - Electrical system upgrades and maintenance
  - Home ventilation

In general, equipment and installation costs for all measures are provided at no cost to eligible customers and properties.

### 4.1.1 Program Eligibility Requirements

Multifamily properties that are individually metered and within the Company's service area and meet one of the two following requirements are eligible to receive services through the program

- A minimum of 66% (50% for any buildings under 5 units) of the dwelling units in the building are occupied by a family unit whose household annual income does not exceed 80% of the Virginia State Median Income.
- The building is listed on the HUD-DOE approved multifamily list.

### 4.1.2 Summary of Savings by Eligible Rate Schedule

Table 4-1 compares average participant ex post net energy savings with the average energy usage of accounts for the applicable eligible rate schedule.

*Table 4-1 Summary of Savings by Eligible Rate Schedule*

| *Rate Schedule* | *Total Net Ex Post kWh Savings* | *Number of Participating Accounts* | *Average Participant Account-Level Net Ex Post kWh Savings* | *Average Rate Schedule Account-Level kWh Usage* | *Average Participant Account-Level Net Ex Post kWh Savings as Percentage of Average Rate Schedule Account-Level kWh Usage* |
|---|---|---|---|---|---|
| RS | 982,294 | 546 | 1,799.1 | 15,417 | 11.67% |

## 4.2 Data Collection

### 4.2.1 Participant Survey

Data collection from tenant and property manager surveys was used to:

- Verify measures to estimate gross savings impacts; and
- Collect data on tenant and property manager experience with the program to inform the process evaluation.

To estimate the sufficiency of the sample size, the Evaluation Team calculated the sample size needed to meet the 90/10 precision and confidence level. The sample size to meet 90/10 requirements is calculated using the coefficient of variation defined as:

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

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 by the following equation:

$$n = \left(\frac{1.645\ cv}{D}\right)^2$$

Where,

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

CV = Coefficient of Variation

D = Desired Precision, 10% in this evaluation

To account for the number of participants in the program, a finite population correction is applied with the following formula in order to calculate an adjusted sample size:

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

Where,

$n_0$ = Sample size calculated prior to application of finite population correction.

N = Population size (number of program participants)

The sample size required to meet 90% confidence and 10% precision is 68 for the tenant survey. For the property manager survey, with a population of four contacts, a census would be needed to achieve the precision and confidence targets.

Table 4-2 summarizes the tenant survey data collection effort. The Evaluation Team attempted to complete a survey with a census of tenants with contact information available and was able to complete 17 surveys through an online survey. All tenant contacts were offered a $10 gift card to if they completed the survey.

*Table 4-2 Tenant Survey Response Summary*

| *Survey* | *Mode* | *Fielding Period* | *Number of Contacts* | *Number of Survey/Interview Completions* |
|---|---|---|---|---|
| Low Income Multifamily Program Tenant Survey | Online | September 2021 | 91 | 4 |
| | Online | January 2022 | 180 | 13 |
| Total | | | 271 | 17 |

Table 4-3 summarizes the property manager survey effort.

*Table 4-3 Property Manger Survey Response Summary*

| *Survey* | *Mode* | *Fielding Period* | *Number of Contacts* | *Number of Survey/Interview Completions* |
|---|---|---|---|---|
| Low Income Multifamily Program Property Manager Survey | Online | January 2022 | 4 | 2 |

### 4.2.2 Staff Interviews

The Evaluation Team interviewed the implementation contractor. The objective of the interview was to understand the program implementation procedures.

## 4.3 Impact Evaluation

This chapter addresses the impacts of energy savings and peak demand reductions resulting from measures installed in facilities of customers that obtained incentives under the Low-Income Multifamily Program during the period January 2021 through December 2021.

### 4.3.1 Methodology for Estimating Gross Savings

The M&V approach for the 2021 Low-Income Multifamily Program is aimed at the following:

- Determining the number of weatherization measures reported as being installed through the program;
- Verifying the extent to which the reported weatherization measures are currently installed;
- Estimating annual kWh savings for measures implemented; and
- Estimating annual kW reduction for measures implemented.

Table 4-4 below summarizes the inputs needed for gross savings calculations and the source of each input.

*Table 4-4 Data Sources for Gross Impact Parameters – Low-Income Multifamily Program*

| *Parameter* | *Source* |
|---|---|
| Number of Participants | Program Tracking Data |
| Measures Installed | Program Tracking Data/ Telephone Surveys |
| Measures Still In Use | Participant Surveying/ Telephone Surveys |
| Home characteristics | Program Tracking Data / Telephone Surveys |

#### 4.3.1.1 Measure Attributes Tracked

Under this program, energy auditors collect details on home and equipment characteristics, documenting this through use of Excel-based project tracking workbooks. The workbooks facilitate tracking of information on baseline home and equipment characteristics as well as information regarding specific recommended improvements that are subsequently implemented under the program.

Table 4-5 presents information on the equipment specification data tracked by the program.

*Table 4-5 Gross Impact Attributes Tracked by Program – Low-Income Multifamily Program*

| *Measure* | *Attributes Tracked* |
|---|---|
| HVAC Measures | Heating and Cooling System Types and Efficiency Levels |
| Lighting Measures | Light Level (Lumens) |
| | Wattage |
| | Installation Location (Room) |
| Water Heating Measures | Water Heating Type, Installation Location (Room) for Aerators |
| Envelope Measures | Existing and New Insulation Levels, Heating and Cooling System Types |

#### 4.3.1.2 Verification of Measure Installation

The initial step in conducting measurements of program activity is to verify the number of weatherization measures installed. The Evaluation Team took several steps in verifying the number of weatherization measures installed which consists of the following:

- Validating Program tracking data provided by CHP by checking for duplicate or erroneous entries;
- Verifying that participants were part of the program according to the agreed-upon process between CHP and the Company; and
- Conducting verification surveys with a sample of program tenants and property managers. The focus of the tenant surveys was to understand if any installed items were removed and the purpose of the property manager interviews was to verify that the work was performed. ADM used survey responses from property managers to verify that the equipment was installed and tenant survey responses to understand if any measures were removed by the tenant.

The verification and in-service findings are summarized below:

- Both of the property managers that responded to the survey verified that all measures recorded in the program data were in fact installed.
- The survey sample included 185 LEDs installed by the program, six LEDs were removed by tenants (97% remained in-service).
- The survey sample included 23 aerators installed by the program, one of which was removed (96% remained in-service).
- The survey sample included 10 showerheads installed by the program, three of which were removed (70% remained in-service).

Table 4-6 summarizes the in-service and verification rates for the measures installed through the LIMF program.

PART 2





*Table 4-6 Installation Rates by Measure Type – Low Income Multifamily Program*

| *Measure* | *In-Service/ Verification Rate* |
|---|---|
| Low Flow Faucet Aerator | 96% |
| Low Flow Showerhead | 70% |
| Water Heater Tank Wrap | 100% |
| Water Heater Pipe Insulation | 100% |
| Air Sealing | 100% |
| Direct Install Lighting | 97% |
| Energy Star Ceiling Fan | 100% |
| Smart Thermostat | 100% |
| Attic Insulation | 100% |
| Duct Sealing | 100% |
| Heat Pump Clean & Tune | 100% |
| Smart Powerstrip | 92% |
| Air Source Heat Pump | 100% |
| Mini Split Heat Pump | 100% |

#### 4.3.1.3 Weather Dependent Inputs

Many measures utilize common weather dependent factors, such as effective full load heating hours and cooling hours (EFLH), cooling degree hours (CDH), heating degree days (HDD) and cooling degree days (CDD).

The method utilized by the Mid-Atlantic TRM to estimate full load hours (EFLH) from the EmPower metering study multiplied by the ratio of the Energy Star full load hours of the analyzed city to the study city, was developed for the eight Virginia and West Virginia cities referenced in the Energy Star full load data.

The heating degree days were developed for 932 zip codes in Virginia from TMY3 weather data and the Mid-Atlantic TRM method with the referenced base balance point outdoor air temperature. The data from 11 weather stations with TMY3 data were obtained along with the TRM heating balance point of 60F and a TRM cooling balance point of 65F to develop CDD and HDD. From these 11 weather stations, the HDD and CDD values were assigned by the nearest radial distance to 932 zip codes. The CDH was determined for each zip code by a similar Mid-Atlantic TRM method, with the referenced balance point of 75F.

#### 4.3.1.4 Measure Specific Calculations

Table 4-7 summarizes the equations and inputs used to estimate the savings of the program measures. The savings calculated using the approaches outlined in the table were adjusted by the verification and in-service rates developed from the survey of program participants to estimate the gross program savings.

*Table 4-7 Measure Specific Calculations*

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| ***Measure Name: Low Flow Faucet Aerator*** | | | |
| Savings | *ΔkWh* | | *(((GPM_base * Throttle_base) - (GPM_low * Throttle_low)) * Time_faucet * #people * 365 * DR) * 8.3 * (TEMP_faucet - TEMP_in) / DHW_RE / 3412* |
| Savings | *ΔkW* | | *((((GPM_base * Throttle_base) - (GPM_low * Throttle_low)) * Time_faucet * #people * 365 * DR) * 8.3 * (TEMP_faucet - TEMP_in) / DHW_RE / 3412) / Hours * CF* |
| Input | *#people* | 2.1 | IL-TRM V8.0, p. 197. Multi-family value. |
| Input | *GPM_base* | 2.2 | Mid-Atlantic TRM V10.0, p. 133. |
| Input | *Throttle_base* | 0.83 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *GPM_low* | Varies | Tracking data. |
| Input | *Throttle_low* | 0.95 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *Time_faucet* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *TEMP_faucet* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *TEMP_in* | 60.9 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *DHW_RE* | 0.98 | Mid-Atlantic TRM V10.0, p. 134. |
| Input | *DR* | Varies | Mid-Atlantic TRM V10.0, p. 134. Varies by aerator type. |
| Input | *Hours* | Calculation | Calculation: #people * Time_faucet / 60 * 365. |
| Input | *CF* | 0.00262 | Mid-Atlantic TRM V10.0, p. 135. |
| EUL | | 10 | Mid-Atlantic TRM V10, p. 136. |
| ***Measure Name: Low Flow Showerhead*** | | | |
| Savings | *ΔkWh* | | *((GPMbase - GPMlow) * Time_shower * #people * Showers_per_person * 365 / ShowerHeads_per_home) * 8.3 * 1 * (TEMP_sh - TEMP_in) / DHW_RE / 3412* |
| Savings | *ΔkW* | | *(((GPMbase - GPMlow) * Time_shower * #people * Showers_per_person * 365 / ShowerHeads_per_home) * 8.3 * 1 * (TEMP_sh - TEMP_in) / DHW_RE / 3412) / Hours * CF* |
| Input | *#people* | 2.1 | IL-TRM V8.0, p. 206. Multi-family value. |
| Input | *GPMbase* | 2.5 | Mid-Atlantic TRM V10.0, p. 137. |
| Input | *GPMlow* | Varies | Tracking Data |
| Input | *Time_shower* | 7.8 | Mid-Atlantic TRM V10.0, p. 137. |
| Input | *TEMP_sh* | 105 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *TEMP_in* | 60.9 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *Showers_per_person* | 0.6 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *ShowerHeads_per_home* | 1.6 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *DHW_RE* | 0.98 | Mid-Atlantic TRM V10.0, p. 138. |
| Input | *Hours* | Calculation | Calculation: (TimeShower * #people * Showers_per_person) / (ShowerHeads_per_home * 60) * 365. |
| Input | *CF* | 0.00371 | Mid-Atlantic TRM V10.0, p. 139. |
| EUL | | 10 | Mid-Atlantic TRM V10, p. 140. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| ***Measure Name: Water Heater Tank Wrap*** | | | |
| Savings | *ΔkWh* | | *(((U_base * A_base) - (U_insul * A_insul)) * ΔT * Hours) / (3412 * ηDHW)* |
| Savings | *ΔkW* | | *((((U_base * A_base) - (U_insul * A_insul)) * ΔT * Hours) / (3412 * ηDHW)) / 8760* |
| Input | *U_base* | Varies | Mid-Atlantic TRM V10.0, p. 141. |
| Input | *A_base* | Varies | Mid-Atlantic TRM V10.0, p. 142, based on WH capacity |
| Input | *U_insul* | Varies | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *A_insul* | Varies | Mid-Atlantic TRM V10.0, p. 142, based on WH capacity. |
| Input | *ΔT* | 60 | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *Hours* | 8760 | Mid-Atlantic TRM V10.0, p. 142. |
| Input | *ηDHW* | 0.98 | Mid-Atlantic TRM V10.0, p. 143. |
| EUL | | 5 | Mid-Atlantic TRM V10.0, p. 144. |
| ***Measure Name: Water Heater Pipe Insulation*** | | | |
| Savings | *ΔkWh* | | *(((1 / Rexist) - (1 / Rnew)) * L * C * ΔT * 8760) / n_DHW / 3413* |
| Savings | *ΔkW* | | *((((1 / Rexist) - (1 / Rnew)) * L * C * ΔT * 8760) / n_DHW / 3413) / 8760* |
| Input | *Rexist* | 1 | Mid-Atlantic TRM V9.0, p. 186. |
| Input | *Rnew* | Varies | Tracking data. |
| Input | *L* | Varies | Tracking data. |
| Input | *C* | Varies | Tracking data. |
| Input | *ΔT* | 65 | Mid-Atlantic TRM V9.0, p. 187. |
| Input | *n_DHW* | Varies | Mid-Atlantic TRM V9.0, p. 187. |
| EUL | | 15 | Mid-Atlantic TRM V9.0, p. 188. |
| ***Measure Name: Air Sealing*** | | | |
| Savings | *ΔkWh* | | *(((((CFM50_Exist - CFM50_New) / N - cool) * 60 * CDH * DUA * 0.018) / 1000 / ηCool) * LM) + (((((CFM50_Exist - CFM50_New) / N - heat) * 60 * 24 * HDD * 0.018) / 1000000 / ηHeat) * 293.1)* |
| Savings | *ΔkW* | | *(((((CFM50_Exist - CFM50_New) / N - cool) * 60 * CDH * DUA * 0.018) / 1000 / ηCool) * LM) / EFLH_cool * CF* |
| Input | *CFM50_Exist* | Varies | Tracking data. |
| Input | *CFM50_New* | Varies | Tracking data. |
| Input | *N-cool* | Varies | Based on location. |
| Input | *CDH* | Varies | Applicable weather data. |
| Input | *DUA* | 0.75 | Mid-Atlantic TRM V9.0, p. 254. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *LM* | Varies | Based on location: Mid-Atlantic TRM method. |
| Input | *N-heat* | Varies | Based on location. |
| Input | *HDD* | Varies | Applicable weather data. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 257. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| EUL | | 15 | Mid-Atlantic TRM V9.0, p. 259. |
| ***Measure Name: Direct Install Lighting*** | | | |
| Savings | *ΔkWh* | | *(WattsBase - WattsEE) / 1000 * Hours * HCIF_kWh* |
| Savings | *ΔkW* | | *(WattsBase - WattsEE) / 1000 * HCIF_kW * CF* |
| Input | *WattsEE* | Varies | Tracking data. |
| Input | *WattsBase* | Varies | Mid-Atlantic TRM V10.0, p.27-28. |
| Input | *Hours* | 679 | Mid-Atlantic TRM V9.0, p.34. Interior lighting. |
| Input | *HCIF_kWh* | Varies | ADM Protypical Builiding Model. |
| Input | *HCIF_kW* | Varies | ADM Protypical Builiding Model. |
| Input | *CF* | 0.059 | Mid-Atlantic TRM V9.0, p. 37. |
| EUL | | 16.3 | Mid-Atlantic TRM V10.0, p. 34. |
| ***Measure Name: Enery Star Ceiling Fan*** | | | |
| Savings | *ΔkWh* | | *(Days * FanHours * ((%Lowbase * WattsLowbase) + (%Medbase * WattsMedbase) + (%Highbase * WattsHighbase)) / 1000) - (Days * FanHours * ((%LowES * WattsLowES) + (%MedES * WattsMedES) + (%HighES * WattsHighES)) / 1000)* |
| Savings | *ΔkW* | | *((WattsHighbase - WattsHighES) /1000) * CF* |
| Input | *Days* | 365.25 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *FanHours* | 3 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *%Lowbase* | 0.4 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *WattsLowbase* | 15 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *%Medbase* | 0.4 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *WattsMedbase* | 34 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *%Highbase* | 0.2 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *WattsHighbase* | 67 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *%LowES* | 0.4 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *WattsLowES* | 6 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *%MedES* | 0.4 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *WattsMedES* | 23 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *%HighES* | 0.2 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *WattsHighES* | 56 | Mid-Atlantic TRM V10.0, p.125. |
| Input | *CF* | 0.3 | Mid-Atlantic TRM V10.0, p.126. |
| EUL | | 15 | Mid-Atlantic TRM V10.0, p. 128. |
| ***Measure Name: Smart Thermostat*** | | | |
| Savings | *ΔkWh* | | *(Capacity_cool / SEER * EFLH_cool * SF_cool / 1000) + (Capacity_heat / HSPF * EFLH_heat * SF_heat / 1000)* |
| Savings | *ΔkW* | | *0* |
| Input | *Capacity_cool* | Varies | Tracking data. |
| Input | *SEER* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *Capacity_heat* | Varies | Tracking data. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *HSPF* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SF_cool* | 0.06 | Mid-Atlantic TRM V9.0, p. 104. |
| Input | *SF_heat* | 0.07 | Mid-Atlantic TRM V9.0, p. 104. |
| EUL | | 7.5 | Mid-Atlantic TRM V10.0, p. 106. |
| ***Measure Name: Attic Insulation*** | | | |
| Savings | *ΔkWh* | | *((1 / Rexist - 1 / Rnew) * CDH * DUA * Area / 1000 / ηCool * ADJcool) + ((1 / Rexist - 1 / Rnew) * HDD * 24 * Area / 1000000 / ηHeat * 293.1 * ADJheat)* |
| Savings | *ΔkW* | | *((1 / Rexist - 1 / Rnew) * CDH * DUA * Area / 1000 / ηCool) / EFLH_cool * CF* |
| Input | *Rexist* | Varies | Tracking data. |
| Input | *Rnew* | Varies | Tracking data. |
| Input | *CDH* | Varies | Applicable weather data. |
| Input | *DUA* | 0.75 | Mid-Atlantic TRM V9.0, p. 261. |
| Input | *Area* | Varies | Tracking data. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *ADJcool* | Varies | Mid-Atlantic TRM V9.0, p. 261. |
| Input | *HDD* | Varies | Applicable weather data. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *ADJheat* | 0.6 | Mid-Atlantic TRM V9.0, p. 263. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 263. |
| EUL | | 25 | Mid-Atlantic TRM V9.0, p. 265. |
| ***Measure Name: Duct Sealing*** | | | |
| Savings | *ΔkWh* | | *((((Pre_CFM25 - Post_CFM25) / (Cool_Capacity * 400)) * EFLH_cool * BTUH_cool) / 1000 / ηCool) + ((((Pre_CFM25 - Post_CFM25) / (Heat_Capacity * 400)) * EFLH_heat * BTUH_heat) / 1000000 / ηHeat * 293.1)* |
| Savings | *ΔkW* | | *((((Pre_CFM25 - Post_CFM25) / (Cool_Capacity * 400)) * EFLH_cool * BTUH_cool) / 1000 / ηCool) / EFLH_cool * CF* |
| Input | *Pre_CFM25* | Varies | Tracking data. |
| Input | *Post_CFM25* | Varies | Tracking data. |
| Input | *Cool_Capacity* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *BTUH_cool* | Varies | Tracking data. |
| Input | *ηCool* | Varies | Tracking data. |
| Input | *Heat_Capacity* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *BTUH_heat* | Varies | Tracking data. |
| Input | *ηHeat* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 116. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| EUL | | 20 | Mid-Atlantic TRM V9.0, p. 119. |
| ***Measure Name: Heat Pump Clean & Tune*** | | | |
| Savings | *ΔkWh* | | *(((FLHcool * Capacity_cool * (1 / SEER)) / 1000 * Mfe) + (FLHheat * Capacity_heat * (1 / HSPF)) / 1000 * Mfe)* |
| Savings | *ΔkW* | | *Capacity_cool * (1 / EER) / 1000 * MFd * CF* |
| Input | *FLHcool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *FLHheat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *Capacity_cool* | Varies | Tracking data. |
| Input | *Mfe* | 0.05 | IL-TRM V8, p. 132. |
| Input | *SEER* | Varies | Tracking data. |
| Input | *Capacity_heat* | Varies | Tracking data. |
| Input | *HSPF* | Varies | Tracking data. |
| Input | *EER* | Calculation | Calculation: (-0.02 * SEER * SEER) + (1.12 * SEER). |
| Input | *MFd* | 0.02 | IL-TRM V8, p. 134. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 124. |
| EUL | | 3 | IL-TRM V8, p. 131. |
| ***Measure Name: Smart Powerstrip*** | | | |
| Savings | *ΔkWh* | | *(kWhoffice * Weightingoffice + kWhEnt * WeightingEnt)* |
| Savings | *ΔkW* | | *(kWhoffice * Weightingoffice + kWhEnt * WeightingEnt) * WeightingEnt / Hours* |
| Input | *kWhoffice* | 31 | Mid-Atlantic TRM V9, p. 290. |
| Input | *Weightingoffice* | 0.41 | Mid-Atlantic TRM V9, p. 290. |
| Input | *kWhEnt* | 75.1 | Mid-Atlantic TRM V9, p. 290. |
| Input | *WeightingEnt* | 0.59 | Mid-Atlantic TRM V9, p. 290. |
| Input | *Hours* | 6351 | Mid-Atlantic TRM V9, p. 290. |
| Input | *CF* | 0.8 | Mid-Atlantic TRM V9, p. 291. |
| EUL | | 4 | Mid-Atlantic TRM V9, p. 291. |
| ***Measure Name: Air Source Heat Pump*** | | | |
| Savings | *ΔkWh* | | *(((Capacity_heat_ee / HSPF_base) - (Capacity_heat_ee / HSPF_ee)) / 1000 * EFLH_heat * HLAF) + (((Capacity_cool_ee / SEER_base) - (Capacity_cool_ee / SEER_ee)) / 1000 * EFLH_cool * CLAF) + (((Capacity_heat_ee / HSPF_exist) - (Capacity_heat_exist / HSPF_base)) / 1000 * Heating_ER_Factor * EFLH_heat * HLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / SEER_exist) - (Capacity_cool_ee / SEER_base)) / 1000 * Cooling_ER_Factor * EFLH_cool * CLAF),0)* |
| Savings | *ΔkW* | | *(((Capacity_cool_ee / EER_base) - (Capacity_cool_ee / EER_ee)) / 1000 * CF * CLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / EER_exist) - (Capacity_cool_ee / EER_base)) / 1000 * Cooling_ER_Factor * CF * CLAF),0)* |
| Input | *Capacity_cool_exist* | Varies | Tracking data. |
| Input | *Capacity_cool_ee* | Varies | Tracking data. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *SEER_exist* | Varies | Tracking data. |
| Input | *SEER_base* | 14 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *SEER_ee* | Varies | Tracking data. |
| Input | *EER_exist* | Varies | Tracking data. |
| Input | *EER_base* | 11.8 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *EER_ee* | Varies | Tracking data. |
| Input | *Capacity_heat_exist* | Varies | Tracking data. |
| Input | *Capacity_heat_ee* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *HSPF_exist* | Varies | Tracking data. |
| Input | *HSPF_base* | 8.2 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *HSPF_ee* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 95. |
| Input | *CLAF* | Varies | Cooling load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *HLAF* | Varies | Heating load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *Cooling_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Heating_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Baseline_Cooling* | Varies | Equals 1 if there was pre-project cooling, else 0. |
| EUL - 1 | | 6 | Mid-Atlantic TRM V10.0, p. 87. |
| EUL - 2 | | 12 | Mid-Atlantic TRM V10.0, p. 87. |
| ***Measure Name: Mini Split Heat Pump*** | | | |
| Savings | *ΔkWh* | | *(((Capacity_heat_ee / HSPF_base) - (Capacity_heat_ee / HSPF_ee)) / 1000 * EFLH_heat * HLAF) + (((Capacity_cool_ee / SEER_base) - (Capacity_cool_ee / SEER_ee)) / 1000 * EFLH_cool * CLAF) + (((Capacity_heat_ee / HSPF_exist) - (Capacity_heat_exist / HSPF_base)) / 1000 * Heating_ER_Factor * EFLH_heat * HLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / SEER_exist) - (Capacity_cool_ee / SEER_base)) / 1000 * Cooling_ER_Factor * EFLH_cool * CLAF),0)* |
| Savings | *ΔkW* | | *(((Capacity_cool_ee / EER_base) - (Capacity_cool_ee / EER_ee)) / 1000 * CF * CLAF) + IF(Baseline_Cooling=1,(((Capacity_cool_exist / EER_exist) - (Capacity_cool_ee / EER_base)) / 1000 * Cooling_ER_Factor * CF * CLAF),0)* |
| Input | *Capacity_cool_exist* | Varies | Tracking data. |
| Input | *Capacity_cool_ee* | Varies | Tracking data. |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *SEER_exist* | Varies | Tracking data. |
| Input | *SEER_base* | 14 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *SEER_ee* | Varies | Tracking data. |
| Input | *EER_exist* | Varies | Tracking data. |
| Input | *EER_base* | 11.8 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *EER_ee* | Varies | Tracking data. |
| Input | *Capacity_heat_exist* | Varies | Tracking data. |
| Input | *Capacity_heat_ee* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *HSPF_exist* | Varies | Tracking data. |
| Input | *HSPF_base* | 8.2 | Mid-Atlantic TRM V10.0, p. 88. |
| Input | *HSPF_ee* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 124. |
| Input | *CLAF* | Varies | Cooling load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *HLAF* | Varies | Heating load adjustment factor, based on analysis of baseline energy usage data. Value is less than or equal to 1. |
| Input | *Cooling_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Heating_ER_Factor* | 1 | Assumption, low income program. |
| Input | *Baseline_Cooling* | Varies | Equals 1 if there was pre-project cooling, else 0. |
| EUL - 1 | | 6 | Mid-Atlantic TRM V10.0, p. 94. |
| EUL - 2 | | 12 | Mid-Atlantic TRM V10.0, p. 94. |

### 4.3.2 Methodology for Estimating Net Savings

The purpose of the Residential Low-Income Multifamily Program is to assist income-qualified customers who would benefit from higher level standard home weatherization measures such as ceiling insulation, home infiltration reduction, and duct sealing. The NTG ratio for the LIMFP was assumed to be 1.0 in line with common practice for estimation of low-income program net savings.[8]

[8] See Violette and Rathbun, Chapter 21: Estimating Net Savings: Common Practices. The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, available electronically at https://www.nrel.gov/docs/fy17osti/68578.pdf, p. 45

### 4.3.3 Impact Evaluation Results

The following subsections summarize the results of the impact evaluation conducted for the 2021 Low-Income Multifamily Program.

#### 4.3.3.1 Results of Database Review

The Evaluation Team first examined the tracking database for systemic entry errors for each channel, i.e., duplicate entries and/or erroneous entries (such as data entered into improper columns). Upon receiving final program tracking databases, the Evaluation Team found quantities and unit specifications to match the implementer's records.

#### 4.3.3.2 Annual kWh Savings and Peak kW Reduction

The program-level PY2021 realized net energy savings are presented below in Table 4-8. During this period, realized gross and net energy savings totaled 982,294 kWh. The gross kWh realization rate of the program is 82%. The net-to-gross ratio for the program is assumed to be 1.0 in line with common practice for estimation of net energy savings for low income programs.[9]

*Table 4-8 Low-Income Multifamily Program Realized Net Energy Savings*

| *Measure Name* | *Ex Ante kWh Savings* | *Gross Ex Post kWh Savings* | *Gross Realization Rate* | *Net Ex Post kWh Savings* | *Net-to-Gross Ratio* | *Net Lifetime kWh Savings* |
|---|---|---|---|---|---|---|
| Air Sealing | 42,207 | 37,963 | 90% | 37,963 | 100% | 569,439 |
| Attic Insulation | 45,259 | 26,979 | 60% | 26,979 | 100% | 674,477 |
| Duct Sealing | 113,501 | 99,978 | 88% | 99,978 | 100% | 1,999,559 |
| Air Source Heat Pump | 48,080 | 23,714 | 49% | 23,714 | 100% | 247,749 |
| Mini Split Heat Pump | 612,594 | 436,945 | 71% | 436,945 | 100% | 4,302,987 |
| Smart Thermostat | 329 | 168 | 51% | 168 | 100% | 1,257 |
| Heat Pump Clean & Tune | 17,272 | 14,213 | 82% | 14,213 | 100% | 42,639 |
| Direct Install Lighting | 79,639 | 90,220 | 113% | 90,220 | 100% | 1,470,582 |
| Energy Star Ceiling Fan | 541 | 89 | 17% | 89 | 100% | 1,341 |
| Smart Powerstrip | 2,131 | 2,203 | 103% | 2,203 | 100% | 8,813 |
| Low Flow Faucet Aerator | 42,562 | 29,944 | 70% | 29,944 | 100% | 299,444 |
| Low Flow Showerhead | 88,823 | 54,632 | 62% | 54,632 | 100% | 546,317 |
| Water Heater Tank Wrap | 80,011 | 80,011 | 100% | 80,011 | 100% | 400,057 |
| Water Heater Pipe Insulation | 95,504 | 85,235 | 89% | 85,235 | 100% | 1,278,526 |
| Total | 1,268,455 | 982,294 | 77% | 982,294 | 100% | 11,843,186 |

[9] See Violette and Rathbun, Chapter 21: Estimating Net Savings: Common Practices. The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, available electronically at https://www.nrel.gov/docs/fy17osti/68578.pdf, p. 45.

Table 4-9 shows the realized net peak kW reduction attributable to the Low-Income Multifamily Program for PY2021.

*Table 4-9 Low-Income Multifamily Program Realized Peak kW Reductions*

| *Measure Name* | *Ex Ante kW Savings* | *Gross Ex Post kW Savings* | *Gross Realization Rate* | *Net Ex Post kW Savings* | *Net-to-Gross Ratio* |
|---|---|---|---|---|---|
| Air Sealing | 53.86 | 2.29 | 4% | 2.29 | 100% |
| Attic Insulation | 57.75 | 0.83 | 1% | 0.83 | 100% |
| Duct Sealing | 42.75 | 31.43 | 74% | 31.43 | 100% |
| Air Source Heat Pump | 19.03 | 5.32 | 28% | 5.32 | 100% |
| Mini Split Heat Pump | 191.53 | 148.56 | 78% | 148.56 | 100% |
| Smart Thermostat | - | - | N/A | - | N/A |
| Heat Pump Clean & Tune | 1.32 | 1.84 | 140% | 1.84 | 100% |
| Direct Install Lighting | 19.15 | 11.67 | 61% | 11.67 | 100% |
| Energy Star Ceiling Fan | 0.09 | 0.03 | 28% | 0.03 | 100% |
| Smart Powerstrip | 0.27 | 0.20 | 76% | 0.20 | 100% |
| Low Flow Faucet Aerator | 21.48 | 2.20 | 10% | 2.20 | 100% |
| Low Flow Showerhead | 56.63 | 5.42 | 10% | 5.42 | 100% |
| Water Heater Tank Wrap | 9.13 | 9.13 | 100% | 9.13 | 100% |
| Water Heater Pipe Insulation | 10.90 | 9.73 | 89% | 9.73 | 100% |
| Total | 483.90 | 228.65 | 47% | 228.65 | 100% |

#### 4.3.3.3 Supplementary Econometric Analysis

To supplement the impact evaluation, the Evaluation Team utilized IPMVP Option C by performing regression analysis to assess the presence of energy savings during the period subsequent to implementation of program measures. The Evaluation Team obtained monthly energy usage data of program participants from the Company. The analysis was performed using data associated with customers with energy usage data available for at least six months after implementation of program measures. For the Low-Income Multifamily Program, such data was available for a total of 169 PY2021 program participants. The variables described in Table 4-10 were included in the analysis.

*Table 4-10 Analysis Model Variables*

| *Variable Name* | *Variable Description* |
|---|---|
| kWh | Dependent variable; participant monthly energy use. |
| CDH | MAX (Outdoor Temperature - 65°F, 0) calculated hourly and averaged across month. |
| HDH | MAX (65°F - Outdoor Temperature, 0) calculated hourly and averaged across month. |
| Post | 1 during post-implementation period; otherwise 0. |

A mixed effects regression model was employed with to estimate the incremental impact of implementation of program measures on participant energy use. The following equation was modeled:

*Equation 3*

$$kWh_{it} = \beta_0 + \beta_1 Post_{it} + \beta_2 CDH_{it} + \beta_3 HDH_{it} + e_{it}$$

Table 4-11 presents the results of the regression analysis.

*Table 4-11 Parameter Estimates for Regression Model*

| *Variable Name* | *Estimate* | *Standard Error* | *Z score* | *p value* | *90% Confidence Interval* | |
|---|---|---|---|---|---|---|
| | | | | | *Lower Bound* | *Upper Bound* |
| CDH | 0.044 | 0.003 | 13.78 | 0 | 0.038 | 0.049 |
| HDH | 0.036 | 0.001 | 33.59 | 0 | 0.034 | 0.038 |
| Post | -111.503 | 14.094 | -7.91 | 0 | -134.686 | -88.32 |
| Intercept | 651.191 | 29.224 | 22.28 | 0 | 603.122 | 699.261 |
| Number of Observations | | | | | | 3,884 |
| Number of Groups | | | | | | 169 |

Intuitively, the weather variables (*CDH* and *HDH*) have positive coefficients indicating the presence of weather-sensitive energy usage and the *Post* variable has a negative coefficient indicating lower energy use during the post-implementation period. The coefficient of *Post* indicates that average monthly energy use of Low-Income Multifamily participants included in the analysis during the period after implementation of program measures is about 112 kWh lower, controlling for weather-related effects.

The energy savings estimate of 112 kWh associated with the mixed effects regression model is equal to 73% of the average monthly account-level ex post gross savings of 153 kWh for the 169 accounts included in the econometric analysis. The average monthly ex post gross kWh savings estimate is above the 90% confidence interval of the model *Post* variable coefficient.

## 4.4 Process Evaluation

This chapter presents key findings from the limited process evaluation conducted for the 2021 Low-Income Multifamily Program through the Company. The 2021 process findings are based

on surveys of a sample of participating customers, a review of the program database, and interviews with staff from the Company.

### 4.4.1 Program Design and Operations

The LIMF Program aims to reduce energy consumption by educating residential customers about the energy and money saving benefits associated with energy efficiency in the home. The program is implemented by Community Housing Partners (CHP). CHP's weatherization crews may perform the weatherization work or subcontract it to another weatherization agency.

The Company works with the non-profit third-party implementer, CHP. CHP is responsible for the recruiting and training of the contractors, and all aspects of program implementation.

#### 4.4.1.1 Marketing and Outreach

In-person outreach was central to the program's 2021 recruitment activities. The implementation contractor engaged in cold calling on properties and organizing meetings with decision makers to discuss the program. The implementation contractor is also working with the Company in coordinating outreach to focus on identifying and qualifying the Company's customers and referencing HUD listed properties. The organization has also leveraged properties they have worked with through the Federal Weatherization Assistance Program in the past to make deeper energy saving retrofits.

The program has also focused on developing case studies to promote the program. The case studies were developed, in part, to offset the frequently raised concern that the program is not legitimate. ADM reviewed the case study developed of a project completed at the Christiansburg Bluff apartments. The case study presents the value of the upgrades provided through the program and the estimated value of the energy savings. The case study discusses the key role of the installed heat pumps in saving energy, as well as description of the other improvements made. The case study includes a quote from a resident and the property manager. The quote from the resident emphasizes the professional treatment and speed with which the improvements were made. The property manager quote notes the ease of participation "the Energy Solutions crew made this process seamless." All of these elements – the value of the improvements and energy cost savings, the quotes emphasizing the ease of participation and minimal disruption – are likely to be effective in helping to promote projects with other property managers who are likely to have concerns about the legitimacy of the offer, the potential benefits, and the degree of difficulty in completing a participant.

The case studies are included in a packet of outreach materials provided to property management contacts.

The program implementation contractor noted that they had a property management firm participate that manages multiple properties in the service area. Identifying and engaging these larger management firms will contribute to the continued success of the program.

#### 4.4.1.2 Participation Process

An initial step in the participation process is to complete a program application. The program application collects information needed to qualify the property (i.e., if the property is individually metered, if service is provided by the Company, and if the property meets the income qualifications). The implementation contractor stated that an early step is to complete a preliminary assessment of the property to ensure that "everyone is on board" and record information on the units and building. If the property proceeds with a project, the next step is to complete an audit that includes duct and air leakage testing. The audit is performed by a subcontractor on a sample of 10% of the units.

Once the audit is complete the property receives the results of the audit and a proposal for the project that describes the measures to be installed. If the proposal is approved, the project is then scheduled.

The property manager provides notices to tenants about the work performed, but implementation contractor assists them by providing information on what to include in the notice.

A component of the program is the delivery of an educational packet. The implementation contractor noted that the tenant is typically not at home when the measures are installed, and this makes delivery of the education component a bit challenging. For that reason, a packet of educational materials is left with the implementers contact information.

The implementation contractor also noted that they have COVID-19 safety protocols in place for completing the work, and that with these in place, there has not been significant hesitation to participate because of the pandemic.

#### 4.4.1.3 Comprehensiveness of Retrofits

Review of project data indicates that the majority of the work performed includes installation of a majority of the program efficiency measures. Advanced power strips, however, were installed at a limited number of properties. The implementation contractor was aware of this and noted that increasing measure diversity was in part an education process, but that also there were specific challenges obtaining the advanced power strips for the allowed incentive cost during the year.

#### 4.4.1.4 Quality Control Procedures

The program implementation contractor engages in multiple quality assurance and control procedures. The procedures used to confirm that the property meets the income qualification requirement and the procedures to verify and inspect the installation of the measures installed are documented below.

##### 4.4.1.4.1 Income Verification

The LIMF program is targeted towards low-income customers and there are two pathways to qualify a building as meeting the income requirement:

- The building is on the HUD-DOE approved multifamily list; and

- A minimum of 66% of the units in the building have an income that does not exceed 80% of Virginia State Median Income. If the building has fewer than 5 units, the requirement is 50% of the units.

Although there are formally two independent pathways, the implementation contractor reported that they perform the income verification step, regardless of the buildings listing on the HUD-DOE website. Property management has this income information as part of qualifying tenants for rent subsidies, and the information is obtained from them.

The entire building is qualified if the standard for the share of income qualified units is met.

#### 4.4.1.4.2 Measure Installation Quality Control

As an initial step of the project process, an energy audit is performed on the building. The audit is composed of a visual inspection of the entire property, diagnostic testing (duct and air leakage) on a minimum of 15% of the units, and delivery of a client education packet.

During the measure installation process, each measure is documented in terms of specifications (existing lamp wattage, flow rates) and photographs are taken of the installed and replaced measures.

The measure installation process is followed by the quality control inspection. The quality control inspection consists of a visual inspection of all work performed, review of energy audit diagnostic numbers, and diagnostic testing of each unit that received such testing during the audit. This testing is essentially the test-out procedure used to record change in leakage rates. The visual inspection consists of comparing the measure installations against the National Renewable Energy Laboratory Standard Work Specifications requirements.[10]

The final step is a quality assurance inspection by CHP program management. This inspection is performed on 10% of multifamily properties. The quality assurance inspection consists of a visual inspection of all the installation work, review of the energy audit and quality control inspection diagnostic results, re-testing of units that received diagnostic testing.

A final step of the process is compiling information for case studies of the projects. The case studies involve speaking with property management staff and tenants to get feedback on the work performed.

The program has plans to require BPI certification for individuals performing diagnostic testing in the future.

Overall, the quality control process as described is thorough and aligns with the quality control process for the Federal Weatherization Program.

### 4.4.2 Tenant Survey Responses

This section summarizes tenant feedback on their experience with the LIMF Program.

[10] https://sws.nrel.gov/

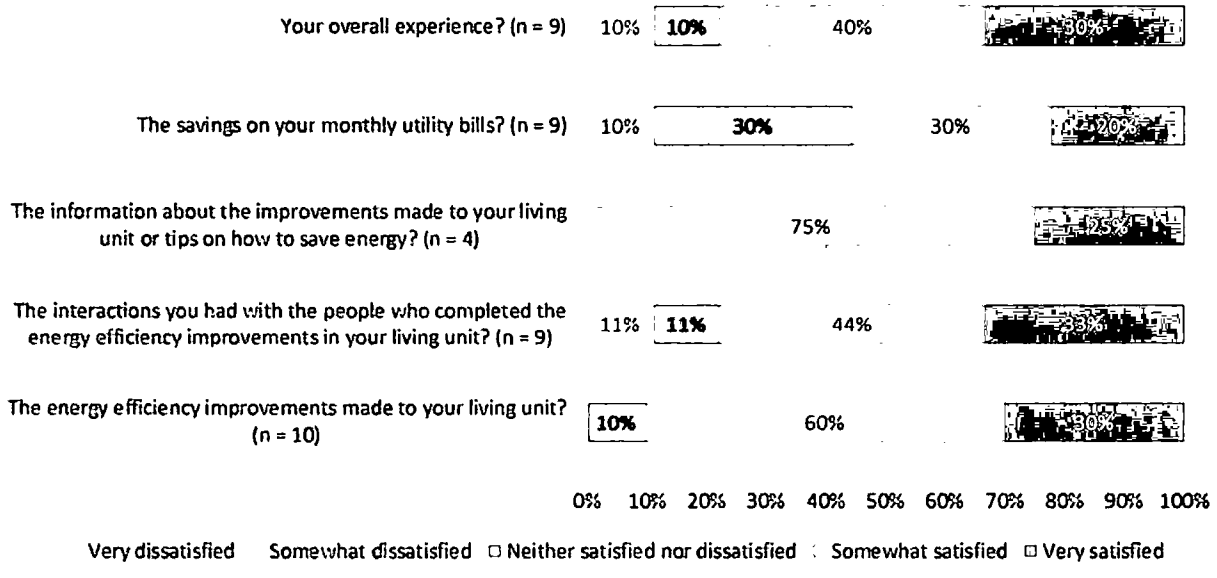
**A majority of tenants did not recall receiving information on energy saving tips, although the program leaves materials behind for tenants.** Table 4-12 summarizes responses to tenants' recollection of discussion with representatives about energy saving types and the receipt of printed material. Although 90% of respondents (not shown) said they were at home when the installation work was performed, 40% said they spoke with a person about energy saving tips and 20% recalled receiving printed material.

*Table 4-12 Tenant Receipt of Energy Saving Tips Information*

| *Response* | *Did a program representative speak with you about tips on how to save energy? (n = 10)* | *Did you receive any printed material from the program with tips on how to save energy? (n = 10)* |
|---|---|---|
| Yes | 40% | 20% |
| No | 60% | 80% |

**Most tenants were satisfied with their experience with the program.** As shown in Figure 4-1, most tenants were satisfied with each rated aspect of the program. One respondent indicated they were dissatisfied with their overall experience, the savings on their monthly bill, and the program representatives they interacted with. In response to a question about their dissatisfaction, this respondent stated that they were expecting to save energy, but their bill had increased. The respondent did not comment on any aspect of the installation process or their interactions with the program representatives.

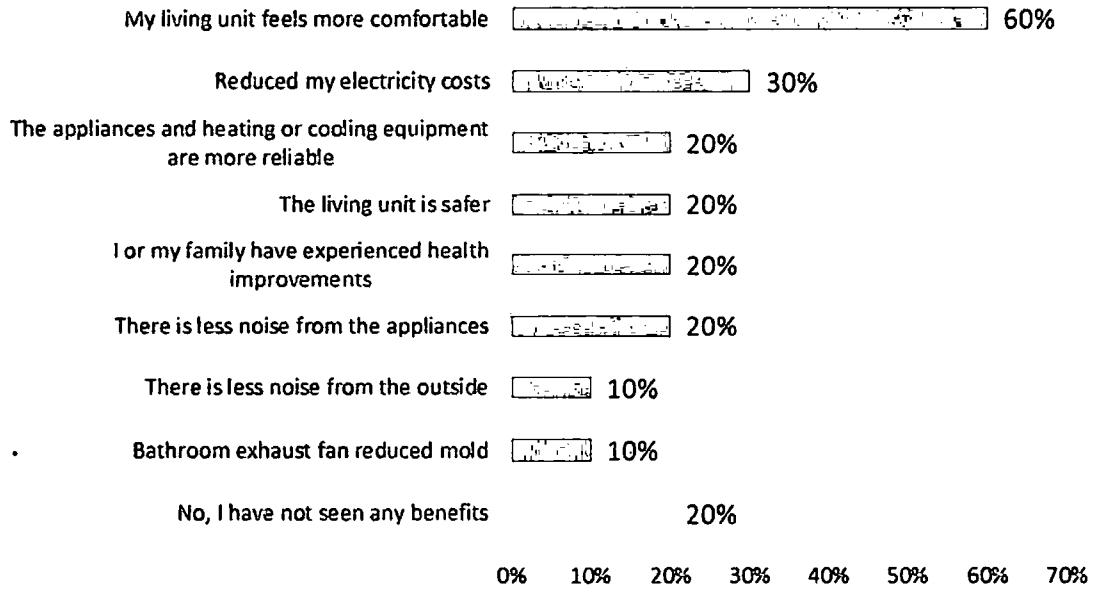
*Figure 4-1 Tenant Satisfaction*




**A majority of survey respondents reported that they had experienced benefits resulting from the home improvements.** As shown in the figure below, 80% of participants reported that

they had experienced benefits from the work done on their home. The work performed includes both the energy efficiency improvements and health and safety improvements. As shown, improved comfort was the most common benefit experienced and was noted by 60% of the respondents.

*Figure 4-2 Tenant Benefits (n = 10)*




### 4.4.3 Property Manager Survey Responses

**Both property managers reported that all units at the property received efficiency improvements and that none had requested removals or modifications.** These responses suggest the program is not missing units and that the efficiency measures are remaining in place after installation.

**Property managers did not report any challenges with the installation of the measures that the program could influence.** One property manager mentioned that scheduling with tenants and ensuring that the units were sufficiently clean to access it was a challenge, but that the implementer and its subcontractors were "great to work with through this process."

**Improving conditions for tenants motivated both property managers to make the improvements.** Both property managers reported that they wanted to improve tenant comfort and satisfaction, and to reduce tenant utility bills. Both also mentioned a motivation to replace old or non-functioning equipment.

**One property manager recalled an audit of the property and provided positive feedback on the experience.** The property manager agreed that the representative was courteous and knowledgeable, completed the assessment efficiently, that the assessment was comprehensive, and that the recommendations made sense for the property.

**Property managers were satisfied with the installation process.** Both property managers were satisfied with the installer's timeliness, courtesy and professionalism, willingness to help, knowledge of the program, preparedness, quality of the installation, quality of educational materials left behind, and their overall experience with the installation. One property manager was satisfied, and the other was neutral when it came to the length of time for the installation and the condition the site was left in.

**Both property managers were satisfied with the program overall. Both respondents said they were very likely to recommend the program to a colleague.** Additionally, both were satisfied with the steps required to participate and the efficiency improvements made.

**Both property managers also reported that they had heard mostly positive feedback from the tenants about the improvements.** Both respondents stated that the new heat pump units were liked by the tenants. One respondent stated that the new units worked better, and both said they had heard from tenants that they cost less to run.

## 4.5 Findings and Recommendations

- **Feedback from property managers was positive.** Participating property managers were satisfied with the program and likely to recommend it to colleagues. Both respondents provided a favorable assessment of the installation process and one noted that the implementer and its subcontractors were "great to work with through this process."
- **Most surveyed tenants were satisfied with the measures received and their experience with the program.** Overall, tenants provided positive feedback on the measures and 80% reported realizing multiple benefits.
- **The program has quality control and assurance processes in place.** The program has multiple levels of quality control and assurance in place. These processes cover the quality of the installations, review of data collected during audits and results of diagnostic testing. Additionally, the program is documenting installed and replaced measure specifications and photographing the items. Future inclusion of BPI certification of individuals performing diagnostic testing will add an additional measure of quality assurance to the process. One aspect, that additional attention should be placed on is the installation of advanced power strips. These devices have the potential to cause dissatisfaction among tenants who do not understand them and the risk of being used improperly.
    - **Recommendation 1: ADM recommends providing guidance to installers on the installation of the advanced power strips.** Installers should be informed that they should use customer input in determining what components should be plugged into control and switched locations of the device. Generally devices with hard drives should not be installed in the switched locations.
    - **Recommendation 2: ADM recommends recording information on the use of the advanced power strips.** An enhancement to the program data is to record

whether the device is controlling entertainment or computer/office equipment. The estimating savings for these two types of equipment vary.

- **In-person outreach has been the primary recruitment tactic.** Staff reported that in-person outreach in the form of cold calling on individual properties has been the primary means of recruiting participant. This is a best practice for these types of programs, but there may be opportunities to engage in other forms of outreach.
  - **Recommendation 3: ADM recommends in other forms of best-practice outreach for multifamily programs.**[11] Other best practices include outreach to housing associations and identifying property management firms that manage multiple properties.

[11] For example, see ACEEE (2014). Effective Marketing and Outreach Strategies for Multifamily Energy Efficiency Programs.

# 5 Bring Your Own Thermostat Program

## 5.1 Program Description

The Bring Your Own Thermostat (BYOT) program is a demand response program that offers customers a one-time $50 incentive to enroll a qualifying smart thermostat and a $5 a month incentive, up to $25 a year, for allowing adjustments to their thermostat to reduce air conditioner usage during peak event periods. Participating customers can earn the incentive for each of the five months during the peak season (May through September). Nest, Honeywell, and Ecobee thermostats are eligible for the program.

The program sets a maximum of 15 load management events during the program year. The events typically last two to three hours. During a load management event, a signal is sent to the thermostat to either cycle the A/C unit or raise the set point of the thermostat. Fifteen events were called during PY2021. The events were called during periods when demand for electricity was high on the PJM RTO.

### 5.1.1 Program Eligibility Requirements

The program is open to residential customers in the Company's Virginia service territory. To qualify, customers:

- Have an approved thermostat;
- Must have central air conditioner in working order that is controlled by the smart thermostat; and
- Have a Wi-Fi network compatible with your smart thermostat.

The program is open to property owners and renters.

### 5.1.2 Summary of Savings by Eligible Rate Schedule

Table 5-1 compares average participant ex post net energy savings with the average energy usage of accounts for the applicable eligible rate schedule.

*Table 5-1 Summary of Savings by Eligible Rate Schedule*

| *Rate Schedule* | *Total Net Ex Post kWh Savings* | *Number of Participating Accounts* | *Average Participant Account-Level Net Ex Post kWh Savings* | *Average Rate Schedule Account-Level kWh Usage* | *Average Participant Account-Level Net Ex Post kWh Savings as Percentage of Average Rate Schedule Account-Level kWh Usage* |
|---|---|---|---|---|---|
| RS | 191,256 | 4,031 | 47.4 | 15,417 | 0.31% |

## 5.2 Data Collection

Data collection from a participant survey was used to collect data on participants experience with the program to inform the process evaluation.

To estimate the sufficiency of the sample size, the Evaluation Team calculated the sample size needed to meet the 90/10 precision and confidence level. The sample size to meet 90/10 requirements is calculated using the coefficient of variation defined as:

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

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 by the following equation:

$$n = \left(\frac{1.645\ cv}{D}\right)^2$$

Where,

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

CV = Coefficient of Variation

D = Desired Precision, 10% in this evaluation

The estimated sample size needed to meet 10% precision at the 10% level of confidence is 68.

Table 5-2 summarizes the survey data collection effort. The Evaluation Team completed surveys with 122 participants who enrolled during 2021.

*Table 5-2 Survey Response Summary*

| *Mode* | *Fielding Period* | *Number of Contacts* | *Number of Survey/Interview Completions* |
|---|---|---|---|
| Online | September 2021 | 800 | 122 |

## 5.3 Impact Evaluation

This section addresses the estimation of peak kW reductions and gross kWh savings resulting from the BYOT Program.

### 5.3.1 Evaluation Objectives

As part of the evaluation effort for 2021, the Evaluation Team collaborated with the Company and its implementation contractor to determine the following metrics:

- What was the maximum achieved demand reduction in summer 2021?
- What were the total energy savings per event and for the entire 2021 event season?

The following sections discuss the methodology and impacts for the 2021 BYOT Program.

### 5.3.2 Methodology for Estimating Gross Savings

Peak reduction and energy savings for each event were calculated using AMI energy usage data from a subsample of 3,097 of the participating devices for which seasonal data were available.

To support estimation of sampling precision, the coefficient of variation (CV) is calculated as the standard deviation of hourly energy usage during event hours divided by average hourly energy usage during event hours – here, CV is calculated as 0.83. A sample size $n$ supporting estimation of savings at the 90% confidence level may be calculated as:

$$n = (1.645 * cv / D)^2$$

where:

$n$ = desired sample size

$cv$ = coefficient of variation (0.83)

$D$ = desired statistical precision (0.1)

Given the calculated coefficient of variation, estimation of savings with +/-10% statistical precision at a 90% confidence level calls for a sample of 61 devices:

$$(1.645 * 0.83 / 0.1)^2 = 197$$

The sample of 3,097 devices exceeds this threshold.

Regional weather data and participant equipment characteristics were also used to perform the savings analysis.

#### 5.3.2.1 Measure Attributes Tracked

Table 5-3 presents information on the equipment specification data tracked by the program.

*Table 5-3 Gross Impact Attributes Tracked by Program – BYOT Program*

| *Attributes Tracked* |
|---|
| Thermostat Location (Zip Code) |
| HVAC Unit Serial Number |
| HVAC Unit Hourly Cooling Run-Time |

#### 5.3.2.2 Baseline Energy Usage Calculation

The baseline energy usage was estimated for each participant by hour using a regression model of energy usage vs a construct known as the weighted temperature humidity index (WTHI). This method, which was originally proposed by PJM, is often used in M&V efforts to estimate residential direct load control.

Temperature and humidity measurements from the closest weather station to each participant (Roanoke or Lynchburg weather stations) were used. WTHI is calculated as shown in Equation 4 from the temperature humidity index (THI) from the current and previous days. THI, as shown in Equation 5, is calculated from the temperature and humidity. The maximum daily WTHI was used in the analysis.

*Equation 4*

$$WTHI = \frac{4 * THI_{Current\ Day} + THI_{Previous\ Day}}{5}$$

*Equation 5*

$$THI = Temperature_{°F} - .55 * \left(1 - \frac{\%\ Relative\ Humidity}{100}\right) * (Temperature_{°F} - 58.0)$$

Regression models (Equation 6) were generated for each participant for each hour using hourly ending energy usage data for non-event days from May through September, which was provided by the implementation contractor and the WTHI data. The estimated energy usage could then be calculated using the slope, intercept, and WTHI for event days to generate baseline energy usage on event days by day and hour for each participant. Regression models were only generated for participants that had greater than 50 days of energy usage data, to increase the stability of the models.

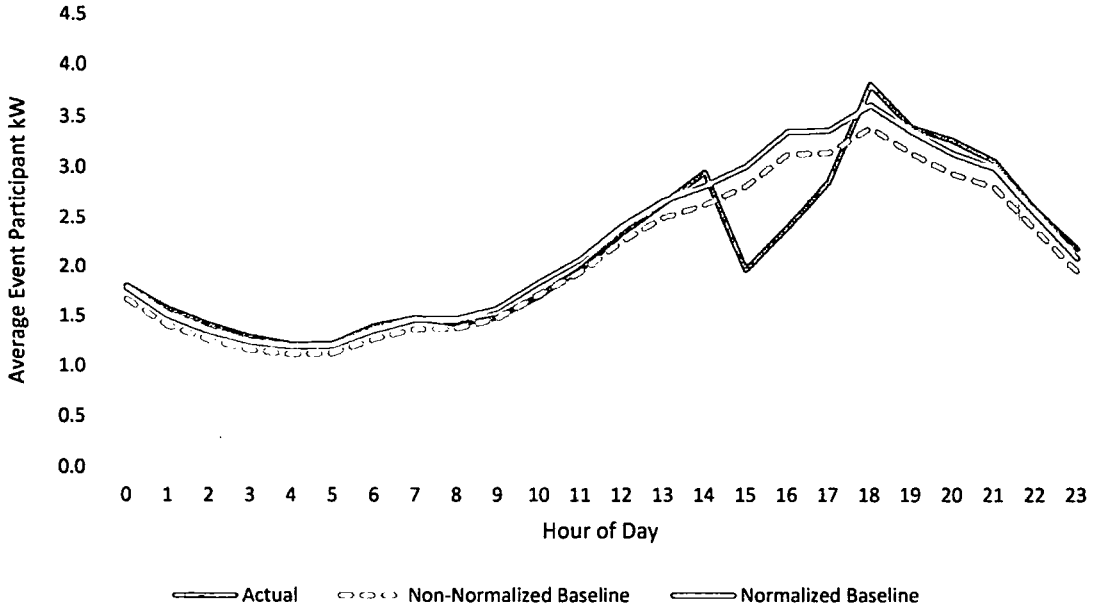
*Equation 6*

$$kWh = Slope * WTHI + Intercept$$

#### 5.3.2.3 kW and kWh Savings Calculation

The average baseline and actual energy usage by hour were calculated over all the participants using energy usage data for each event day. A normalization constant, which is calculated as the ratio of the average actual and baseline energy usage two hours before the event, was applied to the baseline energy usage to account for any differences between the groups. An example of the plotted normalized baselines and actual energy usage for the 8/26/2021 event is shown below.

*Figure 5-1 Event Plot Example*




The energy usage reduction for each event hour on event days was calculated by taking the difference between the normalized-baseline hourly energy usage and actual hourly energy usage, as shown in Equation 7.

*Equation 7*

$$kW\ reduction = kW_{baseline} - kW_{actual}$$

Total hourly kW reduction was calculated by multiplying the mean hourly kW reduction per participant by the number in the entire participant population (Equation 9).

*Equation 8*

$$Hourly\ kW\ reduction\ per\ participant = \frac{1}{n}\sum_{i=1}^{n} kW\ reduction_{i,hour}$$

Where,

$n$ = Number of event participant with energy usage data

*Equation 9*

$$kW\ Reduction = kW\ reduction\ per\ participant * N$$

Where,

$N$ = Total number of event participants

The kWh savings per participant for each event was calculated by summing the average energy usage reduction across all event hours and one hour pre-cooling periods and one hour snapback periods and multiplying by the average kW per unit for the entire population (Equation 10). The

kWh Savings was calculated for each event by multiplying the kWh saving per participant by number in the entire participant population, according to Equation 11.

*Equation 10*

$$kWh\ per\ participant = \sum_{hour=1}^{m} \left( \frac{1}{n} \sum_{i=1}^{n} kW\ reduction_{i,hour} \right)$$

*Equation 11*

$$kWh\ savings = kWh\ savings\ per\ participant * N$$

### 5.3.3 Methodology for Estimating Net Savings

The methodology for developing savings resulting from demand reduction events are net savings estimated. In addition to these savings, the program may influence the installation of smart thermostats that generate savings during non-peak periods. That is, some portion of customers may have purchased thermostats because of the information and incentives (i.e., the $50 enrollment incentive and $25 end of summer incentive) available through the BYOT program.

To assess what share of the enrolled thermostats that were purchased and installed because of the program, the evaluation team administered a survey to participating customers that included questions on the program influence on the decision to install the thermostats. Specifically, the survey asked the following three questions:

- SO1: Did you already have a smart thermostat when you first learned about the [BYOT] program?
- SO2: We would like to know if the program affected your decision to purchase and install the smart thermostat. How likely would you have been to purchase a smart thermostat if the [BYOT] program $50 enrollment incentive and the $25 end of the summer incentive was NOT available?
- SO3: How important was the information and incentives provided through the [BYOT] program in your decision to install a smart thermostat?

The first question solicited a "yes" or "no" response, whereas the second two questions were rated on 10-point scales. For respondents who indicated that they purchased the smart thermostat after learning of the program by answer "no" to SO1, a spillover score was calculated as:

Spillover Score = Average(10 – SO1, SO2)

The savings associated with the thermostats were attributed to the program for customers whose spillover score was greater than 7. Energy savings of program-attributable thermostats purchased and installed by respondents are then calculated by applying the methodologies listed in the Mid-Atlantic TRM (Version 9). The following assumptions were made about the heating and cooling equipment:

- We assumed a heat pump the met current efficiency standards (14 SEER and 8.2 HSPF).
- We assumed a 14 SEER air conditioner.

- We assumed the heating and cooling capacities were 36 kBTU/hr.
- We assumed that the share of participants with electric heating was equal to the share of the Company's customers that have electric heating (59.9%) and that customer with electric heating had a heat pump that meets current efficiency standards.

To extrapolate the savings to the population, we calculated the average per participant spillover savings and multiplied this by the total number of participants that enrolled in 2021. We subtracted five thermostats from the total enrolled that were rebated through the Home Performance program.

### 5.3.4 Energy Savings and Demand Reduction Results

The Company initiated 15 load management events during the summer of 2021. As shown in Table 5-4 below, the Company was successful in initiating events that coincided with all five PJM coincident peak (CP) hours.

*Table 5-4 Demand Response Event Times*

| *Date* | *Event Start Time* | *Event Stop Time* | *Event Coincident with 5CP* | *PJM Coincident Peak Occurred During Hour Ending* |
|---|---|---|---|---|
| 6/28/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 6/29/2021 | 3:00 PM | 6:00 PM | Yes | 5:00 PM |
| 6/30/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 7/6/2021 | 3:00 PM | 6:00 PM | Yes | 5:00 PM |
| 7/7/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 7/15/2021 | 4:00 PM | 6:00 PM | No | N/A |
| 7/26/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 7/27/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 8/11/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 8/12/2021 | 3:00 PM | 6:00 PM | Yes | 5:00 PM |
| 8/13/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 8/24/2021 | 3:00 PM | 6:00 PM | Yes | 6:00 PM |
| 8/25/2021 | 3:00 PM | 6:00 PM | No | N/A |
| 8/26/2021 | 3:00 PM | 6:00 PM | Yes | 5:00 PM |
| 8/27/2021 | 3:00 PM | 6:00 PM | No | N/A |

The demand reductions were calculated for each event hour. Hourly results are provided below in Table 5-5 for both the demand response events, as well as the one-hour precooling and one-hour snapback period following the event. Event hours are represented with gray fill and 5CP hours are represented with red font.

*Table 5-5 kW Reductions for Event Days by Hour*

| *Hour* | *2:00 PM - 3:00 PM* | *3:00 PM - 4:00 PM* | *4:00 PM - 5:00 PM* | *5:00 PM - 6:00 PM* | *6:00 PM - 7:00 PM* | *Event-Level Mean Hourly kW Reduction* | *Maximum Event Hour kW Reduction* | *Participants* |
|---|---|---|---|---|---|---|---|---|
| 6/28/2021 | -638.23 | 4,250.27 | 4,274.15 | 1,649.95 | -1,662.07 | 3,391.45 | 4,274.15 | 3,902 |
| 6/29/2021 | -656.12 | 3,963.89 | 3,619.32 | 2,494.20 | -1,447.75 | 3,359.14 | 3,963.89 | 3,902 |
| 6/30/2021 | -680.80 | 3,797.36 | 3,279.51 | 2,063.02 | -1,425.40 | 3,046.63 | 3,797.36 | 3,893 |
| 7/6/2021 | -695.40 | 4,061.93 | 3,334.52 | 2,086.34 | -1,454.52 | 3,160.93 | 4,061.93 | 3,911 |
| 7/7/2021 | -616.35 | 3,275.75 | 2,663.12 | 2,009.79 | -1,223.94 | 2,649.55 | 3,275.75 | 3,910 |
| 7/15/2021 | | -674.24 | 4,310.75 | 2,704.27 | -1,397.06 | 3,507.51 | 4,310.75 | 3,926 |
| 7/26/2021 | -546.98 | 3,362.72 | 4,079.86 | 4,122.63 | -742.06 | 3,855.07 | 4,122.63 | 3,981 |
| 7/27/2021 | -270.77 | -1,134.17 | 5,119.90 | 3,460.91 | -1,910.40 | 2,482.21 | 5,119.90 | 3,985 |
| 8/11/2021 | -344.27 | 2,816.78 | 2,746.53 | 1,895.13 | -1,391.25 | 2,486.15 | 2,816.78 | 4,018 |
| 8/12/2021 | -605.86 | 4,049.55 | 4,839.44 | 4,077.11 | 750.10 | 4,322.03 | 4,839.44 | 4,017 |
| 8/13/2021 | -576.28 | 4,640.35 | 4,398.79 | 4,352.73 | 478.65 | **4,463.95** | 4,640.35 | 4,031 |
| 8/24/2021 | -793.38 | 4,206.76 | 3,546.09 | 2,101.80 | -1,516.72 | 3,284.88 | 4,206.76 | 4,068 |
| 8/25/2021 | -633.82 | 4,512.16 | 3,869.84 | 2,426.23 | -855.04 | 3,602.74 | 4,512.16 | 4,067 |
| 8/26/2021 | -555.42 | 4,244.17 | 3,867.88 | 2,057.37 | -795.10 | 3,389.81 | 4,244.17 | 4,069 |
| 8/27/2021 | -661.90 | 3,832.82 | 3,685.48 | 1,741.21 | -826.27 | 3,086.50 | 3,832.82 | 4,070 |

The Evaluation Team determined that the peak demand reduction in Virginia was 4,463.95 kW on August 13, 2021, a as shown in Table 5-5. At this point in the season, there were 4,031 active participants during this event day.

The energy savings associated with each event day are presented in Table 5-6. Summing the energy savings across all events results in overall kWh savings of 122,389 kWh.

*Table 5-6 kWh Savings During Event Days*

| *Event* | *Event kWh Saving (a)* | *Shoulder Hour kWh (b)* | *kWh Savings (a + b)* |
|---|---|---|---|
| 6/28/2021 | 10,174 | (2,300) | 7,874 |
| 6/29/2021 | 10,077 | (2,104) | 7,974 |
| 6/30/2021 | 9,140 | (2,106) | 7,034 |
| 7/6/2021 | 9,483 | (2,150) | 7,333 |
| 7/7/2021 | 7,949 | (1,840) | 6,108 |
| 7/15/2021 | 7,015 | (2,071) | 4,944 |
| 7/26/2021 | 11,565 | (1,289) | 10,276 |
| 7/27/2021 | 7,447 | (2,181) | 5,265 |
| 8/11/2021 | 7,458 | (1,736) | 5,723 |
| 8/12/2021 | 12,966 | 144 | 13,110 |
| 8/13/2021 | 13,392 | (98) | 13,294 |
| 8/24/2021 | 9,855 | (2,310) | 7,545 |

| *Event* | *Event kWh Saving (a)* | *Shoulder Hour kWh (b)* | *kWh Savings (a + b)* |
|---|---|---|---|
| 8/25/2021 | 10,808 | (1,489) | 9,319 |
| 8/26/2021 | 10,169 | (1,351) | 8,819 |
| 8/27/2021 | 9,260 | (1,488) | 7,771 |
| Total | 146,758 | (24,369) | 122,389 |

From the participant survey results, the Evaluation Team found that there were 21 thermostats installed that qualified as program-attributable units. The average per participant savings resulting from the spillover thermostats was 43 kWh and total program spillover savings were 68,867 kWh. There are no peak demand reductions associated with smart thermostats in the Mid-Atlantic TRM methodology.

Table 5-7 presents the total energy savings and peak demand reductions attributable to the Bring Your Own Thermostat Program for PY2021.

*Table 5-7 Realized kWh Savings and kW Reduction*

| *Expected kWh Savings* | *Expected Peak kW Reduction* | *Realized kWh Savings* | *Realized kW Reduction* | *kWh Gross Realization Rate* | *kW Gross Realization Rate* | *Spillover kWh Savings* | *Net kWh Savings* |
|---|---|---|---|---|---|---|---|
| 122,389 | 4,463.95 | 122,389 | 4,463.95 | 100% | 100% | 68,867 | 191,256 |

## 5.4 Process Evaluation

This chapter presents the results of the limited process evaluation of the Company's Bring Your Own Thermostat (BYOT) Program during 2021. This evaluation is based upon analysis of new participant survey results.

### 5.4.1.1 Quality Control

There are multiple quality control steps integrated into the customer enrollment process. The customers status as an active customer is verified by cross-checking their account number with the list of active accounts. When enrolling the thermostat, the registration system will provide an error message if they do not have an approved device that the system cannot communicate with. Staff also reviews the thermostat information entered and if an issue is discovered, contacts the customer to resolve it.

When processing incentive payments staff verifies that listed devices are enrolled and that no device is enrolled more than once.

At the time of an event, staff has access to information on the number of devices online that responded to the event. Additionally, the program receives data on the set point and customer adjustments to the set point during the event.

### 5.4.2 Participant Survey Results

The following section summarizes the findings of the participant survey.

### 5.4.2.1 Participant Program Awareness

**Direct communication from the company drove awareness of the program.** As shown in Table 5-8, 44% of respondents learned of the program through an Appalachian Power newsletter or email. Fifteen percent learned about it from an email from the thermostat manufacturer, and 15% percent of respondents learned of the program through an Appalachian Power website. Ten percent of the respondents learned of the program through a postcard or other mailing from Appalachian Power.

*Table 5-8 Source of Program Awareness*

| *Response* | *Percent of Respondents (n = 117)* |
|---|---|
| Appalachian Power newsletter or email | 44% |
| Email from thermostat manufacturer | 15% |
| Appalachian Power website | 15% |
| Postcard or other mailing from Appalachian Power | 10% |
| Friend, relative, coworker, or neighbor | 6% |
| Through participating in the eScore program | 3% |
| HVAC contractor | 2% |
| Community organization | 1% |
| Social networking site such as Facebook or Twitter | 1% |
| Some other way | 4% |

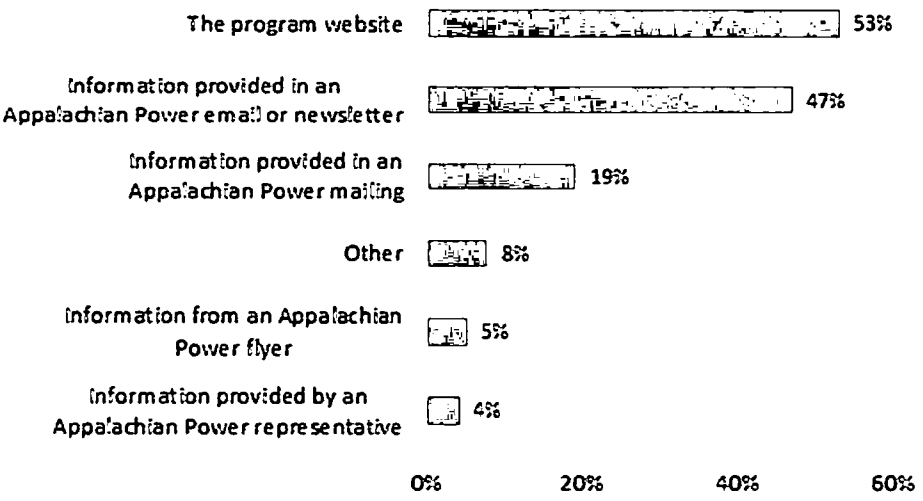
### 5.4.2.2 Participation Decision

**Program information is effectively explaining the program to participants.** The information about the program addressed most participants (80%) questions about. A few customers indicated that the program did not fully address their questions. The program website and an email or newsletter from the Company and material on the program website were the most common sources of information about the program. (Figure 5-2).

*Table 5-9 How Well Program Information Addressed Questions about the Program*

| *Response* | *Percent of Respondents (n = 111)* |
|---|---|
| 5 (Completely) | 41% |
| 4 | 39% |
| 3 | 16% |
| 2 | 3% |
| 1 (Not at all) | 1% |

*Figure 5-2 Sources of Information on How the Program Works (n = 115)*



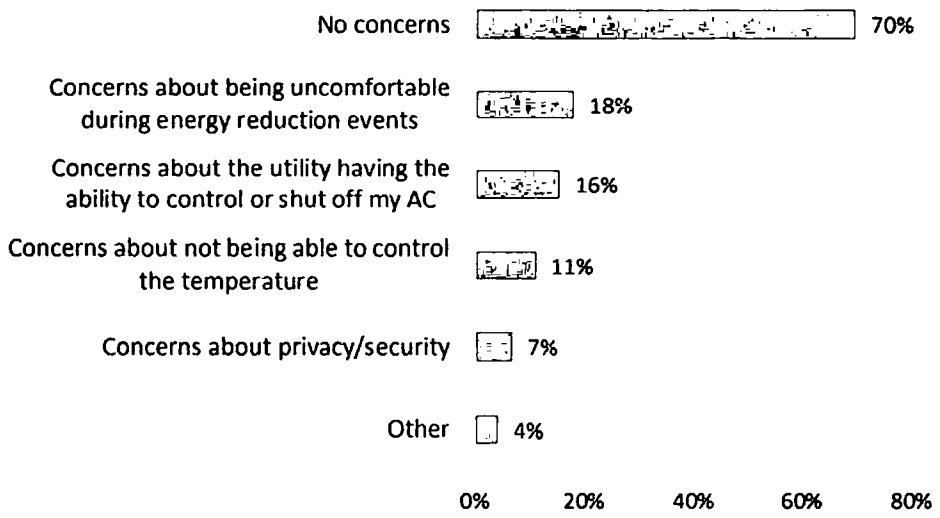

**Saving on energy costs and the incentive were key motivators to participating in the program.** As shown in Table 5-10, 59% of participants participated because of the incentive check and 51% participated to save on energy costs. Additionally, the opportunity to participate in an energy saving programs and environmental concerns were also cited as motivations.

*Table 5-10 Motivation for Participating*

| *Response* | *Percent of Respondents (n = 118)* |
|---|---|
| The incentive check | 59% |
| To save on energy costs | 51% |
| The opportunity to participate in an energy savings program | 49% |
| To reduce energy use for environmental reasons | 32% |
| Program was recommended to me by Appalachian Power | 6% |
| Other | 2% |

**Seventy percent of participants did not have concerns about participating.** Comfort was the most commonly reported concern and was cited by 18% of participants. Others reported concern over loss of temperature control (11%) and concerns about the utility being able to control or shut off their air conditioner (16%).

*Figure 5-3 Initial Participation Concerns about Participating in the BYOT Program (n=116)*




### 5.4.2.3 Experience Enrolling the Thermostat

**Most participants (84%) thought enrolling the thermostat was easy or very easy.** Overall, few participants reported difficulty with scheduling the device installation.

*Table 5-11 Ease of Enrolling the Thermostat in the Program*

| *Response* | *Percent of Respondents (n = 117)* |
|---|---|
| 1 (Very difficult) | 3% |
| 2 | 3% |
| 3 | 9% |
| 4 | 22% |
| 5 (Very easy) | 62% |

### 5.4.2.4 Participant Experiences during Reduction Events

**Participants reported modest comfort impacts despite frequently using the air conditioner during the summer months.** As shown in Figure 5-4, 42% of respondents reported that there was either no change in comfort or it was a little uncomfortable during the events and 47% said it was uncomfortable. Eighty-one percent of respondents reported that the air conditioner ran almost every day and night. (Figure 5-5).

*Figure 5-4 Comfort During Events (n = 93)*

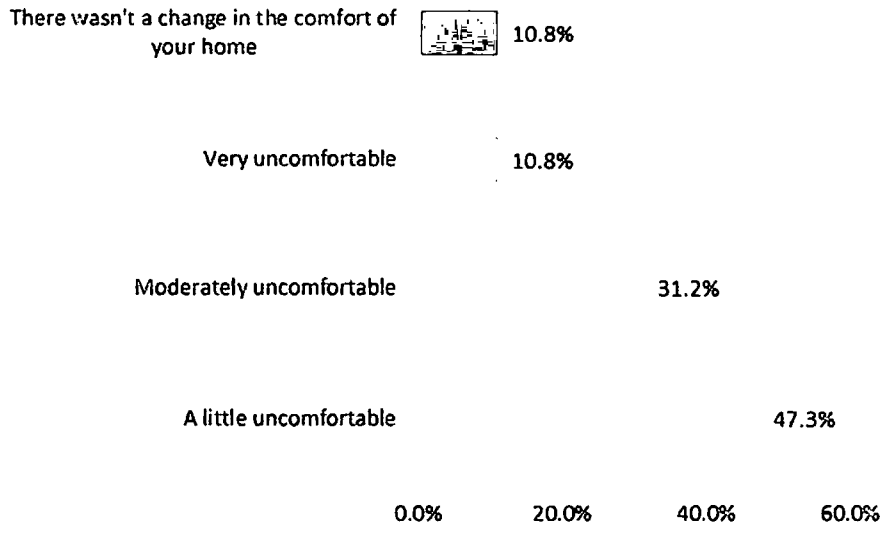
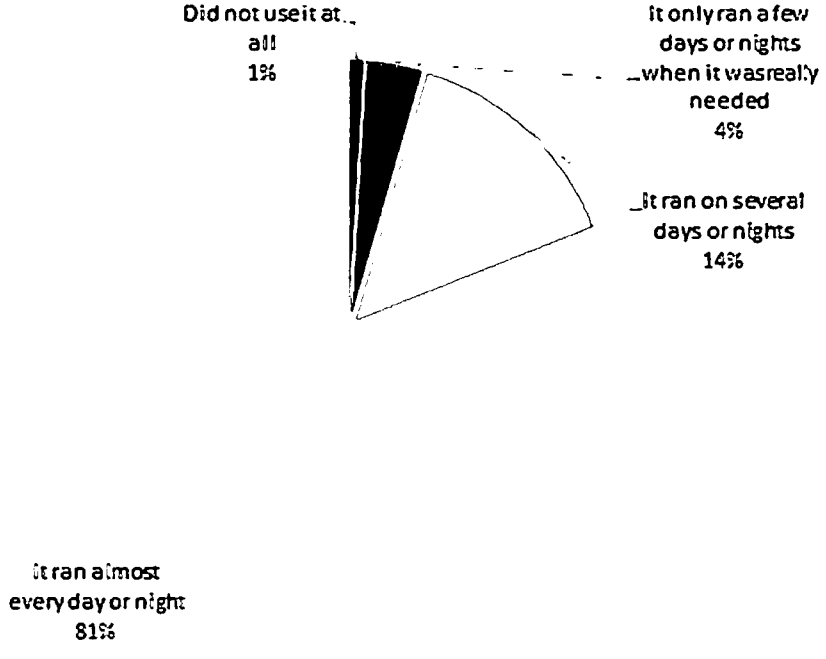



*Figure 5-5 Frequency of Air Conditioner Use During Summer (n = 110)*




**The program effectively manages expectations about the number of events that will occur during the summer.** Seventy-three percent said that the number of events was about what they were expecting or fewer than they were expecting (Figure 5-6). Almost two-thirds of respondents stated that the number of events was what was expected and 28% stated that the number of events was more than expected.

*Figure 5-6 Number of Events Compared to Expected Number of Events (n = 91)*

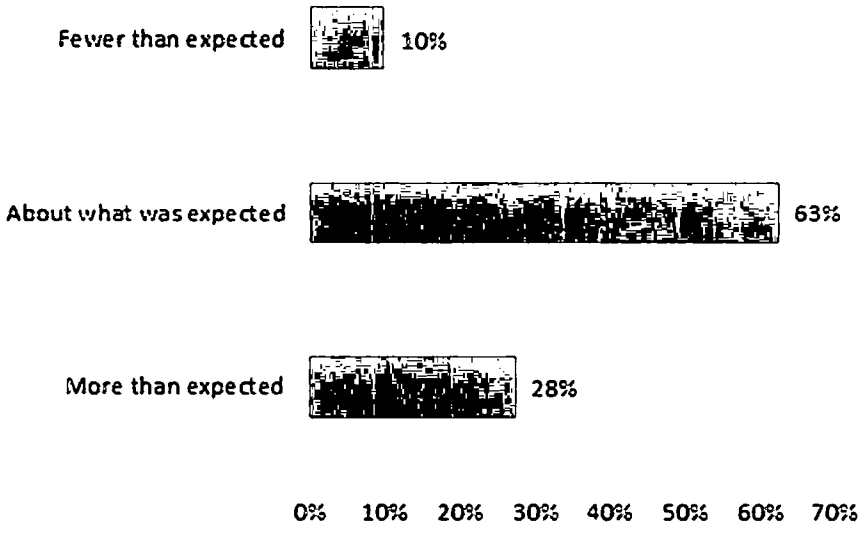
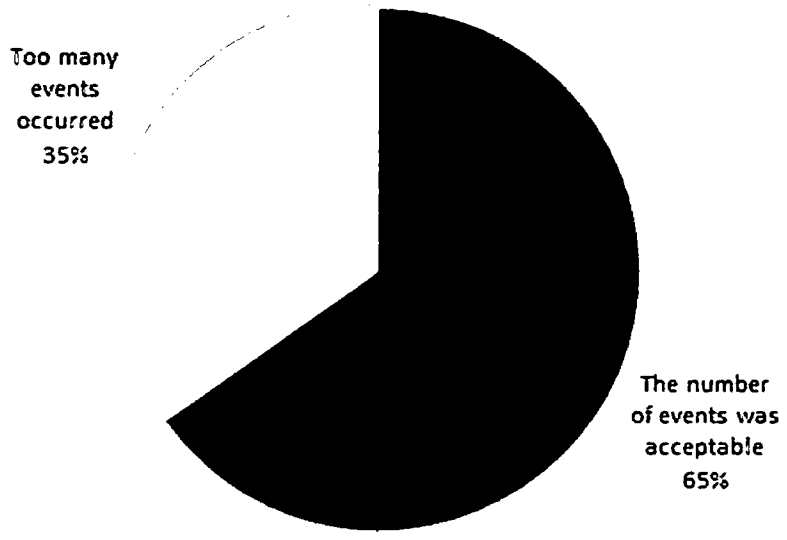



*Figure 5-7 Acceptability of Number of Events (n = 23)*




### 5.4.2.5 Participant Satisfaction

**Overall program satisfaction is high.** Eighty-four percent of respondents reported that they were very or somewhat satisfied with program overall (Table 5-12). A few participants (5%) expressed dissatisfaction with the program. Additionally, most respondents reported that they thought that the response was thorough or very thorough (67%) and timely or very timely (80%) (Table 5-13 and Table 5-14).

*Table 5-12 Overall Satisfaction with Program*

| *Response* | *Percent of Respondents (n = 113)* |
|---|---|
| Very satisfied | 60% |
| Somewhat satisfied | 24% |
| Neither satisfied nor dissatisfied | 12% |
| Somewhat dissatisfied | 2% |
| Very dissatisfied | 3% |

*Table 5-13 Thoroughness of Staff Response*

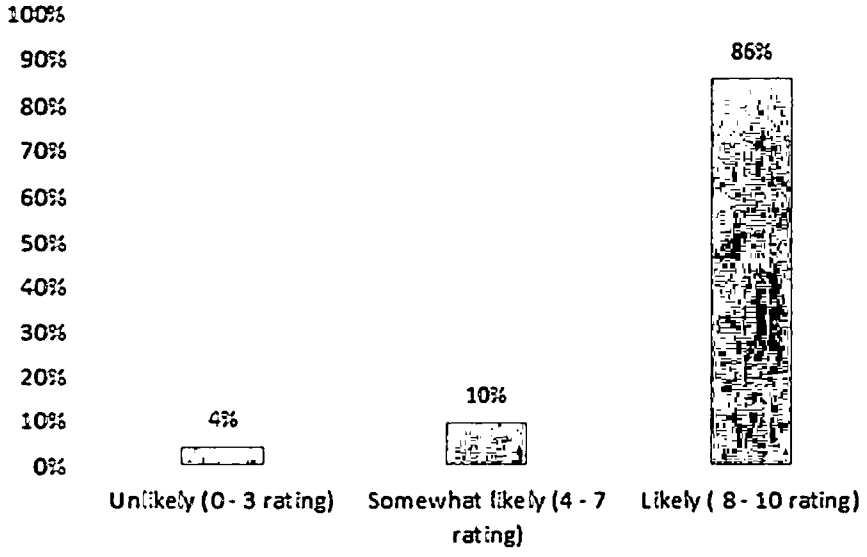
| *Response* | *Percent of Respondents (n = 15)* |
|---|---|
| 1 (Not at all thorough) | 0% |
| 2 | 7% |
| 3 | 27% |
| 4 | 27% |
| 5 (Very thorough) | 40% |

*Table 5-14 Timeliness of Staff Response*

| *Response* | *Percent of Respondents (n = 15)* |
|---|---|
| 1 (Not at all timely) | 0% |
| 2 | 7% |
| 3 | 13% |
| 4 | 20% |
| 5 (Very timely) | 60% |

**Most participants are likely to participate in 2022.** As shown in Figure 5-8, 86% of participants rated their likelihood of participating again in the 8 to 10 range.

*Figure 5-8 Likelihood of Participating in Following Year (n = 114)*




## 5.5 Findings and Recommendations

- **Program information continues to explain the program well.** Nearly all survey respondents indicated that the program information addressed their questions about it. A majority of customers got information on the program from the Company website.
- **Most participants thought that it was easy to enroll their thermostat.** Eighty-four percent of respondents rated the enrollment process as a four or a five on a five-point scale where five represented very easy.
- **Overall satisfaction with the program was high.** Approximately 84% of participants reported that they were very satisfied or somewhat satisfied with the program. Additionally, 86% indicated a high likelihood of participating in the program in the following year.

# 6 ENERGY STAR Manufactured Homes Program

## 6.1 Program Description

The ENERGY STAR Manufactured Homes (ESMH) Program paid incentives in the form of rebates for electrically heated manufactured homes that qualify for the ENERGY STAR label as defined by the U.S. Environmental Protection Agency. ENERGY STAR compliance requires the use of a package of envelope and equipment measures that in combination result in performance that is more energy efficient than comparable homes built to the federal Manufactured Home Construction and Safety Standards, commonly referred to as the HUD code.

For each ENERGY STAR certified home sold to an APCo Virginia customer, incentives of the following amounts are paid:

- APCo customer (home buyer): $700
- HVAC contractor: $50 - $100
- Manufactured home retailer: $600 - $650

### 6.1.1 Program Eligibility Requirements

Virginia homeowners who purchase and install a new ENERGY STAR certified manufactured home that receives service from Appalachian Power are eligible to participate in the program.

### 6.1.2 Summary of Savings by Eligible Rate Schedule

Table 6-1 compares average participant ex post net energy savings with the average energy usage of accounts for the applicable eligible rate schedule.

*Table 6-1 Summary of Savings by Eligible Rate Schedule*

| *Rate Schedule* | *Total Net Ex Post kWh Savings* | *Number of Participating Accounts* | *Average Participant Account-Level Net Ex Post kWh Savings* | *Average Rate Schedule Account-Level kWh Usage* | *Average Participant Account-Level Net Ex Post kWh Savings as Percentage of Average Rate Schedule Account-Level kWh Usage* |
|---|---|---|---|---|---|
| RS | 0 | 145 | 0 | 15,417 | 0.00% |

## 6.2 Data Collection

### 6.2.1 Buyer Survey

Data collection from a participant survey was used to:

- Verify measures to estimate gross savings impacts; and
- Collect data on participants experience with the program to inform the process evaluation.

To estimate the sufficiency of the sample size, the Evaluation Team calculated the sample size needed to meet the 90/10 precision and confidence level. The sample size to meet 90/10 requirements is calculated using the coefficient of variation defined as:

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

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 by the following equation:

$$n = \left(\frac{1.645\,cv}{D}\right)^2$$

Where,

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

CV = Coefficient of Variation

D = Desired Precision, 10% in this evaluation

To account for the number of participants in the program, a finite population correction is applied with the following formula in order to calculate an adjusted sample size:

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

Where,

$n_0$ = Sample size calculated prior to application of finite population correction.

N = Population size (number of program participants)

Table 6-2 summarizes the survey data collection effort. The Evaluation Team attempted to complete a survey with a census of program participants and was able to reach 5 participants through telephone surveying.

*Table 6-2 Survey Response Summary*

| *Mode* | *Fielding Period* | *Number of Contacts* | *Number of Survey/Interview Completions* |
|---|---|---|---|
| Online | December 2021 | 62 | 5 |

### 6.2.2 Retailer Interviews

In December 2021, the Evaluation Team contacted all 14 manufactured home retailers that participated in the Appalachian Power Company's (APCo) Manufactured Homes program. We interviewed representatives of six of the 14 participating retailers that represented more than half (52 of 97) of all homes that went through the program (based on the data available at the time of the interviews). We conducted this research to determine free ridership among retailers and to assess satisfaction with program processes. During the 15-to-20-minute interviews, we asked respondents:

- About their current and past ENERGY STAR home sales
- What, if anything, they do to promote ENERGY STAR homes
- How, if at all, the program influenced their sales of ENERGY STAR homes
- What support they provide to customers to participate in the program
- About their satisfaction with program processes

In early April 2022, the Evaluation Team completed follow-up discussions with three of the six retailers initially interviewed in December. The purpose of these discussions was to clarify information reported by retailers in December on the share of homes that were ENERGY STAR and the share of homes they sell with heat pumps.

### 6.2.3 Staff Interviews

Interviews were conducted with one program staff person from the Company and two staff from the implementation contractor. The objective of the staff interview was to understand any design or implementation changes made to the program since the prior year.

## 6.3 Impact Evaluation

This chapter addresses the impacts of energy savings and peak demand reductions resulting from measures installed in facilities of customers that obtained incentives under the ESMH Program during the period January 2021 through December 2021.

### 6.3.1 Methodology for Estimating Gross Savings

#### 6.3.1.1 Measure Attributes Tracked

During PY2021, the ESMH Program tracked attributes of heat pumps installed under the program, including size, efficiency levels, and AHRI reference numbers.

#### 6.3.1.2 Verification of Measure Installation

The initial step in conducting measurements of program activity is to verify participation in the program and purchase of the ENERGY STAR homes. The Evaluation Team took these steps in verifying the number of ENERGY STAR homes installed:

- Validating Program tracking data provided by SBRA by checking for duplicate or erroneous entries; and
- Conducting verification surveys with a sample of program participants (the focus of these verification surveys is to confirm that customers listed in the program tracking database did indeed participate).

All survey respondents verified that they purchased the ENERGY STAR manufactured home. Additionally, the one respondent that tracking data said received a rebate confirmed receipt of the rebate.

#### 6.3.1.3 Weather Dependent Inputs

Some measures utilize common weather dependent factors, such as effective full load heating hours and cooling hours (EFLH), cooling degree hours (CDH), heating degree days (HDD) and cooling degree days (CDD).

The method utilized by the Mid-Atlantic TRM to estimate full load hours (EFLH) from the EmPower metering study multiplied by the ratio of the Energy Star full load hours of the analyzed city to the study city, was developed for the eight Virginia and West Virginia cities referenced in the Energy Star full load data.

The heating degree days were developed for 932 zip codes in Virginia from TMY3 weather data and the Mid-Atlantic TRM method with the referenced base balance point outdoor air temperature. The data from 11 weather stations with TMY3 data were obtained along with the TRM heating balance point of 60F and a TRM cooling balance point of 65F to develop CDD and HDD. From these 11 weather stations, the HDD and CDD values were assigned by the nearest radial distance to 932 zip codes. The CDH was determined for each zip code by a similar Mid-Atlantic TRM method, with the referenced balance point of 75F.

#### 6.3.1.4 Measure Specific Calculations

Table 6-3 summarizes the equations and inputs used to estimate the savings of the program measures. The savings calculated using the approaches outlined in the table were adjusted by the verification and in-service rates developed from the survey of program participants to estimate the gross program savings. The approach for the air source heat pumps is shown. The Evaluator did not assess other potential measures including envelope measures due to the finding of free ridership discussed in Section 6.3.2.

*Table 6-3 Measure Specific Calculations*

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| ***Measure Name: Air Source Heat Pump*** | | | |
| Savings | *ΔkWh* | | *((EFLH_heat * ((Capacity_heat/HSPF_base)-(Capacity_heat/HSPF_ee))/1000) + (EFLH_cool * ((Capacity_cool/SEER_base)-(Capacity_cool/SEER_ee))/1000))* |
| Savings | *ΔkW* | | *(CF * ((Capacity_cool/EER_base)-(Capacity_cool/EER_ee))/1000))* |
| Input | *EFLH_cool* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |

| *Variable Type* | *Variable Name* | *Variable Value* | *Variable Value Source* |
|---|---|---|---|
| Input | *Capacity_cool_ee* | Varies | Tracking data. |
| Input | *SEER_base* | 14 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *SEER_ee* | Varies | Tracking data. |
| Input | *EER_base* | 11.8 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *EER_ee* | Varies | Tracking data. |
| Input | *Capacity_heat_ee* | Varies | Tracking data. |
| Input | *EFLH_heat* | Varies | Based on location: Mid-Atlantic TRM EFLH method. |
| Input | *HSPF_base* | 8.2 | Mid-Atlantic TRM V10.0, p. 80. |
| Input | *HSPF_ee* | Varies | Tracking data. |
| Input | *CF* | 0.66 | Mid-Atlantic TRM V9.0, p. 95. |
| EUL | | 18 | Mid-Atlantic TRM V10.0, p. 87. |
| Inc Cost | | Varies | Mid-Atlantic TRM V9.0, p. 96. |

### 6.3.2 Methodology for Estimating Net Savings

ADM deviated from the preliminary EM&V plan methodology approach to estimate net savings. The approach outlined in the preliminary plan was to utilize survey responses from purchasers that assessed the influence of the rebate on the buyers' decisions to purchase the ENERGY STAR home. However, a minority of participants applied for a rebate during PY2021. As an alternative ADM completed interviews with a sample of participating retailers to understand how the rebates have influenced their sales of ENERGY STAR manufactured homes.

### 6.3.3 Impact Evaluation Results

The following subsections summarize the results of the impact evaluation conducted for the 2021 ESMH Program.

#### 6.3.3.1 Annual kWh Savings and Peak kW Reduction

The PY2021 realized net energy savings and peak reductions are presented below.

Based on interviews with retailers and reviews of sales data, ADM concluded that the program is not influencing retailer decisions to sell more efficient manufactured homes. Additionally, because few home buyers applied for a rebate for the manufactured homes, the buyer rebate component could not have influenced sales of the program homes. Additionally, surveyed home purchasers also did not report program influence, either from the rebate or via sales processes. This results in a 100% free ridership rate. These findings are discussed in greater detail in the process evaluation section 6.4.

*Table 6-4 ESMH Program Gross and Net kWh Savings*

| *Measure Name* | *Ex Ante kWh Savings* | *Gross Ex Post kWh Savings* | *Gross Realization Rate* | *Net Ex Post kWh Savings* | *Net-to-Gross Ratio* | *Net Lifetime kWh Savings* |
|---|---|---|---|---|---|---|
| Air Source Heat Pump | 0 | 7,940 | N/A | 0 | 0% | 0 |
| Total | 0 | 7,940 | N/A | 0 | 0% | 0 |

*Table 6-5 ESMH Program Gross and Net Peak kW Reductions*

| *Measure Name* | *Ex Ante kW Savings* | *Gross Ex Post kW Savings* | *Gross Realization Rate* | *Net Ex Post kW Savings* | *Net-to-Gross Ratio* |
|---|---|---|---|---|---|
| Air Source Heat Pump | 0 | (4.79) | N/A | 0 | 0% |
| Total | 0 | (4.79) | N/A | 0 | 0% |

## 6.4 Process Evaluation

This chapter presents key findings from the process evaluation conducted for the 2021 ESMF Program through the Company. The 2021 process findings are based on surveys of a sample of home buyers, interviews with a sample of participating retailers, and interviews and discussions with the program implementation contractor and staff from the Company.

### 6.4.1 Program Design and Operations

The ESMH is designed to incentivize the purchase of ENERGY STAR manufactured homes by providing incentives to retailers and the home buyer. Additionally, a small incentive is provided to HVAC contractors to compensate them for the additional work needed to comply with the program requirements.

The program is implemented by Systems Building Research Alliance (SBRA), an entity that provides research for the "factory built housing industry."[12] SBRA works with retailers to educate on the program and the processes they need to follow to participate, as well as how to market the ENERGY STAR home to potential qualifying buyers and explain how they get the rebate.

SBRA leveraged the ENERGY STAR certification because it was recognizable to buyers and it was also used as a tool to educate retailers about energy efficient homes. SBRA also sees the ENERGY STAR home as a steppingstone to net-zeros homes.

[12] https://www.research-alliance.org/pages/home.htm

### 6.4.2 Support of Retailer Marketing

SBRA held group webinars with multiple webinars to encourage their participation, as well as calls with individual retailers to walk through the process. SBRA also provides them materials on the program.

SBRA worked with the Company to develop marketing tools for the program. The Company took the lead on developing the material, but SBRA provided the content in terms of tables and text.

#### 6.4.2.1 Quality Control Procedures

An initial component of the quality control process involves verifying that the home buyer will receive service from the Company at the home site. To do this, retailers use an address look up tool that is based on the zip code or the home site. For customers that are in a zip code that receives service from multiple utilities, the tool generates an email to the Company and SBRA and sends the home address to verify that it is a site that receives service from the Company.

SBRA performs review of the documentation submitted by retailers and manufacturers. This review includes a check to verify that the information about the home submitted by the retailer aligns with the information submitted by the manufacturer. SBRA also verifies that information provided on the heat pump invoice aligns with what I recorded on the application for the rebate. As part of the ENERGY STAR program, onsite verification is done on 10% of equipment, and 2% of the installation of the equipment. This is done on all ENERGY STAR manufactured homes, regardless of whether or not they are part of the Company's program.

### 6.4.3 Buyer Survey Results

The Evaluation Team conducted surveys with home buyers as part of the evaluation effort. These surveys were designed to gather information related to both the impact and process components of the program evaluation. This section summarizes participant feedback on sources of program awareness, the participation experience and overall satisfaction with the program.

**Retailers communicated with buyers about the benefits of the ENERGY STAR homes.** All five respondents reported that the retailers spoke with them about the energy efficiency of the home.

*Table 6-6 Analysis Model Variables*

| *Features of ENERGY STAR Home Mentioned by Retailer* | *Number of Buyers Reporting the Feature was Mentioned (n =5)* |
|---|---|
| Better insulation than a standard home | 4 |
| More efficient windows than a standard home | 3 |
| Better air sealing than a standard home | 3 |
| A programmable thermostat | 3 |
| An energy efficient heat pump | 3 |
| Did not mention any of these | 0 |

**All participants stated that the home they purchased met or exceeded their expectations for comfort and energy costs.** As shown in the table below, all respondents reported that the homes they purchased met, exceeded, far exceeded their expectations. One respondent reported not having any expectations for energy costs.

*Table 6-7 How Well the ENERGY STAR Home Met Buyers' Expectations*

| *Response* | *How Well Home Met Expectations for Comfort (n = 5)* | *How Well Home Met Expectations for Energy Costs (n = 5)* |
|---|---|---|
| Far short of expectations | 0 | 0 |
| Short of expectations | 0 | 0 |
| Met expectations | 2 | 2 |
| Exceeds expectations | 2 | 0 |
| Far exceeds expectations | 1 | 2 |
| Did not have any expectations | 0 | 1 |

**All buyers were very satisfied with the home and the information provided by the retailer.** See the table below for details.

*Table 6-8 Buyer Satisfaction*

| *Response* | *Satisfaction with the Home (n = 5)* | *Satisfaction with the Information the Retailer Provided (n = 4)* |
|---|---|---|
| Very dissatisfied | 0 | 0 |
| Somewhat dissatisfied | 0 | 0 |
| Neither satisfied nor dissatisfied | 0 | 0 |
| Somewhat satisfied | 0 | 0 |
| Very satisfied | 5 | 4 |

**Awareness of the buyer rebate is low.** One of the survey respondents received a rebate and stated that the retailer informed them about the availability of the rebate. None of the four respondents who did not receive a rebate were aware that a rebate was available.

### 6.4.4 Retailer Interview Findings

#### 6.4.4.1 ENERGY STAR Home Sales

**Retailers report that all homes they sell are energy efficient homes, although there is uncertainty as to what share of the homes sold are ENERGY STAR homes.** To understand how the program is affecting retailer sales of ENERGY STAR homes, the Evaluation Team conducted interviews with six participating retailers in December 2021 and follow up interviews

with three retailers in April 2022. The Evaluation Team also reviewed sales data on the total number of homes sold by the manufacturer that accounted for a majority of program homes (Clayton Homes) into zip codes serviced by the company.

As summarized in Table 6-9, four of the six respondents stated that all their manufactured homes are ENERGY STAR because their manufacturer parent only builds ENERGY STAR homes. Two respondents (RESP1 and RESP5) reported selling less than 100% of ENERGY STAR homes because they sell a small percentage of homes from a manufacturer that does not construct all ENERGY STAR homes. RESP1 also noted a decrease in ENERGY STAR home sales from 2020 to 2021 because the manufacturer could not source adequate insulation to meet the ENERGY STAR specifications. This manufacturer elected to sell some homes with less insulation and not meet the specification to meet demand for houses.

*Table 6-9 ENERGY STAR Home Sales, 2020 and 2021*

| *Respondent ID* | *2021 Program Sales* | *Respondent Reported Percent of 2020 Sales that were ENERGY STAR, est.* | *Respondent Reported Percent of 2021 Sales that were ENERGY STAR, est.* |
|---|---|---|---|
| RESP4 | More than 10 | 100% | 100% |
| RESP6 | More than 10 | 100% | 100% |
| RESP2 | Less than 5 | 100% | 100% |
| RESP3 | Less than 5 | 100% | 100% |
| RESP5 | 5 to 10 | 95% | 95% |
| RESP1 | 5 to 10 | 85% | 65% |

Sales data provided by the program implementation contractor suggested that a smaller share of homes sold were ENERGY STAR certified (approximately 45%) than what the interviewed retailers reported. To understand the differences between the sales data and the retailer interview responses, the Evaluation Team spoke a second time with three of the retailers initially interviewed. During these interviews, the Evaluation Team asked retailers about the share of homes that they sell are ENERGY STAR certified and specifically asked if these homes were ENERGY STAR certified or if they were Clayton EnergySmart® homes. The Evaluation Team also asked retailers about the differences between the ENERGY STAR and the EnergySmart homes and about the type of heating system installed on the homes they sell.

In terms of the share of home sales that are ENERGY STAR homes, the retailers fell into two groups. One retailer was adamant that all homes they sell are ENERGY STAR homes and not EnergySmart homes noting that "we don't even give them a choice." The other two retailers indicated that all homes they sell are ENERGY STAR certified or are EnergySmart homes. When asked what the difference was between the two homes, one retailer thought that they were the same and that ENERGY STAR certification only required completion of additional

paperwork. The other retailer did not know the difference between ENERGY STAR and EnergySmart homes.[13]

Retailers were also asked about the heating system included in the homes they sale. All three said all of their homes come from the factory with an electric furnace and that a heat pump is installed on the units as well.

#### 6.4.4.2 Promoting ENERGY STAR Homes

**Most retailers reported featuring energy efficiency characteristics of ENERGY STAR homes.** Five of the six respondents stated they always promote the energy efficiency characteristics of ENERGY STAR homes. For example, one respondent (RESP5) reported talking to potential customers about the extra insulation and heat pumps included in an ENERGY STAR home and another respondent (RESP6) stressed the low-e windows and the heat pumps. The one respondent that reported not promoting the energy efficiency characteristics of the home stated that promoting ENERGY STAR and the associated characteristics was irrelevant because all products are already ENERGY STAR.

#### 6.4.4.3 Program Influence

**The program did not influence retailers to drive sales of ENERGY STAR manufactured homes due to the high percentage of homes that were already sold with that specification.** One respondent (RESP5) estimated that Clayton Homes sold 90% of all manufactured homes in Southwest Virginia and all respondents reported that their manufacturer only builds ENERGY STAR manufactured homes, although this estimate likely includes some Clayton EnergySmart homes as well. Additionally, retailers stated that all homes they sell follow the ENEGY STAR heat pump pathway. The responses indicate that essentially no homes would be sold under the non-heat pump pathway in the absence of the program.

**Most retailers were unaware of the price difference between an ENERGY STAR home and a standard efficiency home.** Four of the six retailers did not know the price difference between an ENERGY STAR home and a standard efficiency home because they only sold ENERGY STAR manufactured homes. One (RESP1) of the two retailers that reported selling both ENERGY STAR and standard efficiency homes estimated there was a $500 price difference and the other retailer (RESP5) estimated there was a $1900 difference. RESP5 stated the $1900 difference was "negligible" in the overall cost of a buying and installing a new manufactured home.

[13] Review of publicly available marketing material for EnergySmart homes indicates that these homes have the same insulation requirements as ENERGY STAR homes and include a smart thermostat (ENERGY STAR requires a programmable thermostat). Detailed information was not available related to duct insulation requirements, window glazing and solar heat gain, and ENERGY STAR requirements for the marriage line seal for multi-section homes.

#### 6.4.4.4 Customer Support

**Most retailers reported they will inform customers of the possibility to get a rebate for purchasing an ENERGY STAR home and they will assist customers with the application in many cases. Four retailers stated they tell customers about their ability to get a rebate.** One of these retailers (RESP5) noted that they sometimes forget to tell the customer about the rebate. Two retailers (RESP2 and RESP6) reported not informing customers about a rebate. RESP2 implied that there was not a customer rebate, and the rebates were for retailers exclusively. RESP6 reported not knowing how the customer got their incentive and did not want to promise an incentive to a customer without knowing how the process works.

*Table 6-10 Retailers Support of Customer Rebate*

| *Respondent ID* | *Inform about rebate?* | *Assist with rebate application?* | *How retailers assist customers.* |
|---|---|---|---|
| RESP3 | Yes | Yes | Complete applications for all customers |
| RESP4 | Yes | Yes | Complete applications for all customers |
| RESP1 | Yes | Sometimes | Complete applications for customers that may need assistance such as the elderly |
| RESP5 | Sometimes | Sometimes | Complete applications for customers when they remember to tell customers about rebate |
| RESP2 | No | No | Not applicable |
| RESP6 | No | No | Not applicable |

#### 6.4.4.5 Program Processes

**Most retailers reported the process of participating in the program for both retailers and customers was straightforward and easy to participate in.** Five of the six retailers answered questions about the clarity of program requirements.

- All five reported program requirements for what made a home rebate eligible were clear.
- Four of the five reported program requirements were clear for what steps a customer had to follow. One (RESP6) did not know anything about the customer process for getting a rebate.
- Four reported program requirements for what steps a retailer had to follow to get a rebate were clear and one reported this process was not clear. This respondent (RESP3) stated that there appeared to be too many players in the rebate process system – APCo, the manufacturer, Blevins, and the retailer. This respondent reported the system could be simpler to navigate and could process rebates faster. According to this respondent, incentives are often not paid for many months requiring her to follow up with program representatives.

### 6.4.5 Energy Trust of Oregon's Support for Households in Manufactured Homes

**Energy Trust of Oregon offers specific incentives to residents of existing manufactured homes by upgrading equipment and, in some income-qualifying instances, replacing pre-1980 manufactured homes with new ones.** Energy Trust offers incentives for manufactured home households to replace inefficient electric resistance heating with ductless and conventional heat pumps. According to Energy Trust, residents of older manufactured homes spend 70 percent more on energy than comparable single-family homes. Upgrading these households with more efficient heating (and cooling) saves energy and reduces utility bills for manufactured home households.

In some income-qualifying instances, Energy Trust and their partner agencies have replaced pre-1980 manufactured homes with brand new ENERGY STAR homes. Rather than investing a lot of money in upgrading an existing manufactured home, Energy Trust and their partners have opted to simply replace a home for residents. Furthermore, by offering manufactured home upgrades and replacements, Energy Trust and their partners are often assisting low-income households as manufactured home households are generally lower-income homeowners.[14]

## 6.5 Findings and Recommendations

- **Overall, the findings of the research into the effect of the ESMH program on sales of higher efficiency homes does not support a conclusion that the program is impacting manufactured home efficiency.** There are two pathways by which the program may influence sales of more efficient homes. First, the program works with retailers to educate them on how to market ENERGY STAR homes and provides financial incentives to the retailer for selling ENERGY STAR homes. This pathway does not appear to be functioning as intended for two reasons. First, retailers either believe all the homes they sell are ENERGY STAR homes or that they do not think there is a difference between ENERGY STAR homes and the Clayton EnergySmart homes that comprise the non-ENERGY STAR homes they sell. This suggest that retailers would not promote one home over the other because they believe they are equivalent. Second, in the interviews performed with the six retailers in December, all said that the program was not at all influential in their decision to sell ENERGY STAR homes. Consequently, it appears the program is not having any impact on retailer behavior and their promotion of the ENERGY STAR homes.

  The other pathway by which the program may impact sales of ENERGY STAR homes is through the influence of the purchaser rebate on their purchase decision. However, very few purchasers applied for that rebate in 2021 and as such most sales happened even without the rebate.

[14] https://energytrust.org/wp-content/uploads/2021/05/Manufactured-Home-Replacement-Pilot-Evaluation_Final-.pdf

The Evaluation Team acknowledges that the difference between SBRA reported sales of ENERGY STAR homes and the larger number of total homes sold by Clayton suggests some non-ENERGY STAR home sales are occurring in the APCo service area and this seems to contradict retailer reports. However, the preponderous of evidence we have suggests that the program is not influencing retailer behavior, nor purchaser behavior. Furthermore, the construction standards for the ENERGY STAR and the EnergySmart Homes may be equivalent as suggested by the available data on the EnergySmart construction standards.

- **Recommendation 1: The Evaluation Team believes that future research on energy savings attribution should focus on the impact of the purchaser rebate on the decision to buy the home and specifically the choice to install a heat pump system.** We note however, that there is significant evaluation risk in that additional research may not support program attribution.

- **Other jurisdictions, such as Oregon, have focused their manufactured homes program services to upgrading the existing stock of manufactured homes.** They have done this to assist low-income households and generate energy savings.

  - **Recommendation 2: Investigate shifting the focus of the APCo program to assisting people, especially low-income households, living in existing manufactured housing by offering rebates and services aimed at upgrading and replacing the existing manufactured housing stock.**

- **Nearly all heat pumps installed in homes met the minimum ENERGY STAR requirements for the heat pump compliance pathway.** Review of the tracking data indicated that most program homes met the minimum requirements of 8.2 HSPF and 14 SEER equipment. There may be the potential to accrue net energy impacts by offering buyers an incentive for heat pumps with a minimum efficiency of 9 HSPF and 16 SEER. The limited number of higher efficiency units suggests that there is the potential to influence the installation of higher efficiency heat pumps.

  - **Recommendation 3: Investigate offering buyer incentives for heat pumps that exceed the ENERGY STAR requirement.**

# 7 Cost Effectiveness Evaluation

The following cost effectiveness tests were performed for each program: Total Resource Cost (TRC) test, Program Administrator Cost Test (PACT), Participant Cost Test (PCT), and Ratepayer Impact Measure (RIM) test. A score above one signifies that, from the perspective of the test, the program benefits were greater than the program costs. The benefits and costs associated with each test are defined in Table 7-1.

*Table 7-1 Summary of Benefits and Costs Included in each Cost Effectiveness Test*

| *Variable* | *Definition* | *PCT* | | *PACT* | | *RIM* | | *TRC* | |
|---|---|---|---|---|---|---|---|---|---|
| | | *Benefit* | *Cost* | *Benefit* | *Cost* | *Benefit* | *Cost* | *Benefit* | *Cost* |
| Incentives | Incentives paid to customers. | ✓ | | | ✓ | | ✓ | | |
| Program Installation Costs | Installation costs paid by program. | | | | ✓ | | ✓ | | ✓ |
| Bill Savings / Lost Revenue | Reduction in electricity costs faced by customers as a result of implementation of program measures. Equal to revenue lost to the utility. | ✓ | | | | | ✓ | | |
| Avoided Energy Costs | Energy-related costs avoided by utility. | | | ✓ | | ✓ | | ✓ | |
| Avoided Capacity Costs | Capacity-related costs avoided by utility, including T&D. | | | ✓ | | ✓ | | ✓ | |
| Incremental Costs | Incremental costs associated with measure implementation, as compared with what would have been done in absence of program. | | ✓ | | | | | | ✓ |
| Program Overhead Costs | Program costs other than incentive or installation costs. | | | | ✓ | | ✓ | | ✓ |

The results of the cost effectiveness analysis are presented in Table 7-2. For reference, for the Bring Your Own Thermostat Program and the Home Performance Program, supplemental test results are presented that are inclusive of PY2021 costs and benefits as well as costs of benefits of the program during PY2022 – PY2026, discounted to PY2021 net present value (NPV).

*Table 7-2 Summary of Cost Effectiveness Test Scores*

| | | *Low-Income Single Family Program* | *Low-Income Multifamily Program* | *ENERGYSTAR Manufactured Homes Program* | *Bring Your Own Thermostat Program* | *Home Performance Program* | *Bring Your Own Thermostat Program (PY2021 + NPV Projected PY2022 - PY2026)* | *Home Performance Program (PY2021 + NPV Projected PY2022 - PY2026)* |
|---|---|---|---|---|---|---|---|---|
| PCT | Benefit | $1,288,661 | $3,415,394 | $94,500 | $241,058 | $888,420 | $11,736,261 | $13,038,084 |
| | Cost | $- | $- | $- | $- | $217,387 | $6,661,655 | $9,601,268 |
| | Score | N/A | N/A | N/A | N/A | 4.09 | 1.76 | 1.36 |
| UCT | Benefit | $187,684 | $391,456 | $- | $152,139 | $363,797 | $8,712,323 | $12,943,584 |
| | Cost | $1,350,547 | $3,620,888 | $148,078 | $710,377 | $1,112,977 | $12,233,106 | $9,751,216 |
| | Score | 0.14 | 0.11 | - | 0.21 | 0.33 | 0.71 | 1.33 |
| RIM | Benefit | $187,684 | $391,456 | $- | $152,139 | $363,797 | $3,285,033 | $22,968,880 |
| | Cost | $1,781,989 | $4,489,543 | $148,078 | $729,435 | $1,781,396 | $13,233,505 | $26,351,125 |
| | Score | 0.11 | 0.09 | - | 0.21 | 0.20 | 0.25 | 0.87 |
| TRC | Benefit | $187,684 | $391,456 | $- | $152,139 | $363,797 | $8,712,323 | $12,943,584 |
| | Cost | $493,328 | $1,074,149 | $53,578 | $488,377 | $1,110,363 | $7,735,805 | $9,654,846 |
| | Score | 0.38 | 0.36 | - | 0.31 | 0.33 | 1.13 | 1.34 |

220450005

# 2021 Virginia Residential Portfolio EM&V Report

Volume II of II

Prepared for:
Appalachian Power Company

April 2022

Prepared by: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# 1. Introduction

Under contract with Appalachian Power Company (herein referred to as the "Company" or "APCo"), ADM Associates, Inc., (ADM) performed evaluation, measurement and verification (EM&V) activities to confirm the energy savings (kWh) and demand reduction (kW) realized through the energy efficiency programs that APCo implemented in Virginia in 2021.

This report is divided into two volumes providing information on the impact, process, and cost effectiveness evaluation of APCo's portfolio of residential programs implemented in Virginia during the 2021 program year. Volume II contains appendices presenting detailed information including data collection instruments and survey results. Volume II is organized as follows:

- Chapter 1: Home Performance Participant Survey Instrument
- Chapter 2: Low Income Single Family Participant Survey Instrument
- Chapter 3: Multifamily Tenant Survey Instrument
- Chapter 4: Low Income Multifamily Tenant Survey Instrument
- Chapter 5: Low Income Multifamily Property Manager Survey Instrument
- Chapter 6: BYOT Program Participant Survey Instrument
- Chapter 7: Manufactured Home Purchaser Survey Instrument
- Chapter 8: Home Performance Participant Survey Results
- Chapter 9: Low Income Single Family Participant Survey Results
- Chapter 10: Multifamily Tenant Survey Results
- Chapter 11: Low Income Multifamily Tenant Survey Results
- Chapter 12: Low Income Multifamily Property Manager Survey Results
- Chapter 13: BYOT Program Participant Survey Results
- Chapter 14: Manufactured Home Purchaser Survey Results

See report Volume I for narrative and summary information pertaining to the evaluation methods and results.

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# 2. Home Performance Participant Survey Instrument

SCREENING BLOCK

1. Our records indicate that you participated in the Appalachian Power Home Performance program in [YEAR].

This program was previously called eScore.

Through this program you received [PROJ_DESC].

Do you recall your household's participation in this program?

1. Yes
2. No [TERMINATE]

AWARENESS AND PROJECT INITIATION BLOCK

2. How did you first hear about the Home Performance Program? [RANDOMIZE ORDER OF 1 – 7]

1. An Appalachian Power newsletter or email
2. Appalachian Power website
3. From a participating contractor
4. From a program representative who visited my home
5. While receiving services at my home through another Appalachian Power program
6. Social networking site such as Facebook or Twitter
7. Friend, relative, coworker, or neighbor
8. In some other way (Please describe)

98. Do not recall

3. How did you begin your participation in the program?

1. You called the program contact number
2. You enrolled using the Home Performance portal
3. The contractor that completed the efficiency improvements enrolled you

98. Do not recall

ASSESSMENT BLOCK

[DISPLAY IF ASSESSMENT = 1]

4. According to our records, a Home Performance Energy Advisor completed an energy assessment of your home. Did you schedule the home energy assessment?

1. Yes
2. No, someone else did
3. No, did not have a home energy assessment completed

[DISPLAY IF Q4 = 1]

5. On a scale of 1 to 5, where 1 is "very difficult" and 5 is "very easy," how would you rate the process of scheduling of your home energy assessment?

1. 1 (Very difficult)
2. 2
3. 3
4. 4
5. 5 (Very easy)

[DISPLAY IF ASSESSMENT = 1]

6. Were you at home during the energy assessment?

1. Yes
2. No

[DISPLAY IF Q6 = 1]

7. Using a scale where 1 means completely disagree and 5 means completely agree, how much do you agree with the following statements about the home energy assessment:

[SCALE: 1 (Completely disagree) = 1, 2 = 2, 3 = 3, 4 = 4, 5 (Completely agree) = 5]

a. The Home Performance Energy Advisor was timely in completing the assessment
b. The Home Performance Energy Advisor was courteous and professional
c. The information provided by the home energy assessment was useful
d. The information provided by the home energy assessment was easy to understand

VERIFICATION BLOCK 1

[DISPLAY IF AIR SEALING = 1 OR INSULATION = 1 OR DUCT_SEALING = 1 OR HEAT_PUMP = 1 OR DUCTLESS = 1 OR FAN = 1 OR SMART_THERMOSTAT = 1 OR TUNEUP = 1 OR PIPEWRAP = 1 OR TANKWRAP = 1 OR TURNDOWN = 1]

8. Now we would like some information on the measures you received through the program.

According to our records you received the following energy efficiency improvements through the program.

Please indicate if the information seems correct.

[SCALE: 1 = Correct, 2 = Incorrect , 98 = Not Sure]

a. [DISPLAY IF AIR SEALING= 1] Air sealing to reduce drafts in your home

b. [DISPLAY IF INSULATION = 1] Attic and/or wall insulation

c. [DISPLAY IF DUCT_SEALING = 1] Sealing of your heating and cooling system ducts

d. [DISPLAY IF HEAT_PUMP = 1] Energy efficient heat pump

e. [DISPLAY IF DUCTLESS = 1] Energy efficient ductless heat pump

f. [DISPLAY IF FAN = 1] High efficiency furnace fan motor

g. [DISPLAY IF SMART_THERMOSTAT = 1] Smart thermostat

h. [DISPLAY IF TUNEUP = 1] Heating and cooling system tune-up or maintenance

i. [DISPLAY IF PIPEWRAP = 1] Hot water heater pipe wrap

j. [DISPLAY IF TANKWRAP = 1] Hot water heater tank wrap

k. [DISPLAY IF TURNDOWN = 1] Reduction in hot water heater temperature

VERIFICATION REMOVABLE ITEMS BLOCK

[DISPLAY IF LED_QUANT > 0 OR FILTER_QUANT > 0 OR AERATOR_QUANT > 0 OR SHOWER_QUANT > 0 OR NIGHTLIGHT_QUANT > 0]

[DISPLAY IF LED_QUANT > 0]

9. Our records show that [LED_QUANT] LED light bulbs were installed in your home. Have any of those light bulbs been removed?

1. No

2. Yes (How many have been removed?)

98. Don't know

[DISPLAY IF FILTER_QUANT > 0]

10. Our records show that [FILTER_QUANT] air filter whistles were installed in your home. Have you removed any of the air filter whistles?

1. No

2. Yes, removed it and no longer use it

3. Yes, removed it when changing the air filter and then reinstalled it

98. Don't know

[DISPLAY IF Q10 = 2]

11. How many of the [FILTER_QUANT] air filter whistles did you remove and no longer use?

[DISPLAY IF AERATOR_QUANT > 0]

12. Our records show that [AERATOR_QUANT] faucet aerators were installed in your home. Have any of those faucet aerators been removed?

1. No

2. Yes (How many have been removed?)

98. Don't know

[DISPLAY IF SHOWER_QUANT > 0]

13. Our records show that [SHOWER_QUANT] showerheads were installed in your home. Have any of those showerheads been removed?

1. No

2. Yes (How many have been removed?)

98. Don't know

[DISPLAY IF SHOWER_QUANT > 0]

14. How many showers does your home have?

1. 1
2. 2
3. 3
4. 4
5. More than 4

[DISPLAY IF NIGHTLIGHT_QUANT > 0]

15. Our records show that [NIGHTLIGHT_QUANT] nightlights were installed in your home. Did any of the LED nightlights that you received replace an existing nightlight?

1. Yes
2. No, none of the nightlights replaced an existing nightlight.

98.Don't know/recall

[DISPLAY IF Q15 =1]

16. About how many of the [NIGHTLIGHT_QUANT] LED nightlights you received replaced an existing nightlight?

[DISPLAY IF Q15 =1]

17. Have you removed any of the new LED nightlights that replaced an existing nightlight?

1. Yes (How many have been removed?)
2. No

98. Don't know

SMART THERMOSTAT BLOCK

[DISPLAY IF Q8g (SMART THERMOSTAT) = 1]

18. Does the smart Wi-Fi thermostat that you got a rebate for control a central cooling system, a central heating system, or both?

1. Central cooling system
2. Central heating system

3. Both cooling and heating systems

98. Don't know

[DISPLAY IF Q18 = 1 OR 3]

19. Is your central air conditioning system a heat pump?

1. Yes

2. No

98. Don't know

[DISPLAY IF Q18 = 2 OR 3]

20. What type of central heating system do you have?

1. Central furnace

2. Heat pump

3. Other (Please specify)

98. Don't know

[DISPLAY IF Q18 = 2 OR 3]

21. What type of fuel does your central heating system use?

1. Natural gas

2. Electricity

3. Oil

4. Propane

5. Wood

98. Don't know

22. What type of thermostat did the rebated smart Wi-Fi thermostat replace?

1. A standard manual thermostat that lets you set on/off temperatures

2. A programmable thermostat that allows you to schedule the temperature settings for different times of the day

3. A different Wi-Fi smart thermostat

4. It was not a replacement

98. Don't know

[DISPLAY IF Q22 = 3]

23. Which of the following best describes why you replaced your old Wi-Fi smart thermostat with a new one?

1. The old Wi-Fi thermostat was not working
2. The old Wi-Fi thermostat was hard to use
3. You wanted to replace it for some other reason
4. You did not replace a Wi-Fi thermostat

HVAC EARLY REPLACEMENT BLOCK [DISPLAY PAGE IF Q8d = 1 OR Q8e = 1 ] VERIFIED HEAT PUMP OR DUCTLESS HEATPUMP

[DISPLAY IF Q8D = 1 OR Q8E = 1]

24. Did the [HEATPUMP_TYPE] replace some old heating and cooling equipment?

1. Yes, it replaced both cooling and heating equipment
2. Yes, it replaced cooling equipment
3. Yes, it replaced heating equipment
4. No, it was a new installation that did not replace any equipment

[DISPLAY Q25 IF Q24 = 1]

25. Did the [HEATPUMP_TYPE] replace a heat pump?

1. Yes
2. No
98. Don't know

HEAT PUMP REPLACEMENT SECTION

[DISPLAY Q26 IF Q25 = 1, REPLACED HEAT PUMP]

26. Thinking about the old heat pump you replaced, which of the following best describes when and how it was originally installed in.

1. You bought the house new and the unit was original equipment when you bought it.
2. It was original equipment in a newly constructed home when the previous owner bought it.
3. It was there when you bought the house from a previous owner.
4. You or your family installed the old unit.
5. Other (Please specify)

[DISPLAY Q27 IF Q26 = 3]

27. Do you know the approximate age of the old heat pump that was replaced?

1. Yes (How old was it?)
2. No

[DISPLAY Q28 IF Q27 = 1]

28. How were you able to determine the age of the old heat pump?

1. Documentation included with the unit
2. Contractor knew or estimated it
3. Age of units was included in description of home when we bought it
4. Previous owner told us
5. Other (Please specify)

[DISPLAY Q29 IF Q27= 2]

29. Which of the following do you think is the most likely age of the old heat pump:

1. More than 20 years old
2. 15 – 20 years old
3. 10 – 15 years old
4. Less than 10 years old

[DISPLAY Q30 IF Q26= 4]

30. About what year did you install the old heat pump?

[DISPLAY Q31 IF Q25 = 1, REPLACED HEAT PUMP]

31. Please provide the seasonal energy efficiency ratio or SEER of the heat pump that you replaced?

1. SEER [TEXT BOX]

98. Don't know

[DISPLAY Q32 IF Q25 = 1, REPLACED HEAT PUMP]

32. Please provide the Heating Seasonal Performance Factor or HSPF of the heat pump that you replaced?

1. HSPF [TEXT BOX]

98. Don't know

OTHER HEATING EQUIPMENT REPLACEMENT SECTION

[DISPLAY Q33 IF [Q24=1 AND Q25 <>1] OR Q24=3, REPLACED HEATING EQUIPMENT]

33. What type of heating system did you have before you installed the [HEATPUMP_TYPE]?

1. Electric resistance heating
2. An air source heat pump
3. Some other kind of heating system
4. No heating equipment
98. Don't know

[DISPLAY Q34 IF Q33=1]

34. Was your electric resistance heating system an electric furnace or baseboard heating?

1. Electric furnace
2. Electric baseboard heating
98. Don't know

[DISPLAY Q35 IF Q33= 3]

35. What type of heating system did you have before installing the [HEATPUMP_TYPE]?

[DISPLAY Q36 IF [Q24=1 AND Q25 <>1] OR Q24=3, REPLACED HEATING EQUIPMENT]

36. Thinking about the old heating system you replaced, which of the following best describes when and how it was originally installed in.

1. You bought the house new and the unit was original equipment when you bought it.
2. It was original equipment in a newly constructed home when the previous owner bought it.
3. It was there when you bought the house from a previous owner.
4. You or your family installed the old unit.
5. Other (Please specify)

[DISPLAY Q37 IF Q36 = 3]

37. Do you know the approximate age of the old heating equipment that was replaced?

1. Yes (How old was it?)
2. No

[DISPLAY Q38 IF Q37 = 1]

38. How were you able to determine the age of the old heating equipment?

1. Documentation included with the unit
2. Contractor knew or estimated it
3. Age of units was included in description of home when we bought it
4. Previous owner told us
5. Other (Please specify)

[DISPLAY Q39 IF Q37 = 2]

39. Which of the following do you think is the most likely age of the old heating equipment:

1. More than 20 years old
2. 15 – 20 years old
3. 10 – 15 years old
4. Less than 10 years old

[DISPLAY Q40 IF Q36= 4]

40. About what year did you install the old heating equipment?

OTHER COOLING EQUIPMENT REPLACEMENT SECTION

[DISPLAY Q41 IF [Q24=1 AND Q25 <>1] OR Q24=2, REPLACED COOLING EQUIPMENT]

41. Was the cooling equipment that you replaced a central air condition?

1. Yes
2. No
98. Don't know

[DISPLAY Q42 IF [Q24=1 AND Q25 <>1] OR Q24=2, REPLACED COOLING EQUIPMENT]

42. Thinking about the old cooling equipment you replaced, which of the following best describes when and how it was originally installed in.

1. You bought the house new and the unit was original equipment when you bought it.
2. It was original equipment in a newly constructed home when the previous owner bought it.
3. It was there when you bought the house from a previous owner.
4. You or your family installed the old unit.
5. Other (Please specify)

[DISPLAY Q43 IF Q42 = 3]

43. Do you know the approximate age of the old cooling equipment that was replaced?

1. Yes (How old was it?)
2. No

[DISPLAY Q44 IF Q43 = 1]

44. How were you able to determine the age of the old cooling equipment?

1. Documentation included with the unit
2. Contractor knew or estimated it
3. Age of units was included in description of home when we bought it
4. Previous owner told us
5. Other (Please specify)

[DISPLAY Q45 IF Q43 = 2]

45. Which of the following do you think is the most likely age of the old cooling equipment:

1. More than 20 years old

2. 15 – 20 years old

3. 10 – 15 years old

4. Less than 10 years old

[DISPLAY Q46 IF Q42 = 4]

46. About what year did you install the old cooling equipment?

[DISPLAY Q47 IF [Q24=1 AND Q25 <>1] OR Q24=2, REPLACED COOLING EQUIPMENT]

47. Please provide the seasonal energy efficiency ratio or SEER of the air conditioner that you replaced?

1. SEER [TEXT BOX]

98. Don't know

FREE RIDERSHIP – MAJOR MEASURES FIRST BLOCK [DISPLAY PAGE IF MAJMEAS_COUNT > 0]

[DISPLAY Q48 IF EFF_MEASURE_NUM = 4, 5 OR 6]

48. Did the contractor that you worked with discuss equipment with different efficiency levels when you were deciding on the [STAND_MEASURE1/2] that you installed?

1. Yes

2. No

98. Don't know

[DISPLAY Q49 IF EFF_MEASURE_NUM = 4, 5 OR 6]

49. Did the contractor that you worked with recommend that you install the [EFF_MEASURE1/2] instead of a standard efficiency [STAND_MEASURE1/2]?

1. Yes

2. No

98. Don't know

[DISPLAY Q50 IF EFF_MEASURE_NUM = 4, 5 OR 6]

50. Did the contractor that you worked with tell you there was a rebate available for the efficient equipment through the Home Performance program?

1. Yes

2. No

98. Don't know

[DISPLAY Q51 IF Q49 = 1]

51. On a scale where 0 means "not at all influential and 10 means "extremely influential," how influential was the recommendation in your decision to install the [EFF_MEASURE1/2]?

[SCALE: 0 (Not at all influential) = 0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=8, 9=9, 10 (Very influential) = 10]

52. Prior to learning about the Home Performance program, did you have plans to [INSTALL1/2] the [EFF_MEASURE1/2]?

1. Yes

2. No

98. Don't know

[DISPLAY IF EFF_MEAS_NUM1/2 = 4, 5, 6]

53. Just to be clear, did you have plans to specifically [INSTALL1/2] an [EFF_MEASURE1/2] as opposed to a standard efficiency [STAND_MEASURE1/2]?

1. Yes

2. No

98. Don't know

[DISPLAY IF ASSESSMENT = 1]

54. Was the [EFF_MEASURE1/2] recommended during the home energy assessment?

1. Yes

2. No

98. Don't know

[DISPLAY IF Q54 = 1]

55. On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have [INSTALLED1/2] the same [EFF_MEASURE1/2] if it was not recommended through the home energy assessment?

[SCALE: 0 (Not at all likely) = 0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=8, 9=9, 10 (Very likely) = 10]

56. Would you have been financially able to [INSTALL1/2] the [EFF_MEASURE1/2] without the financial assistance provided through the program?

1. Yes

2. No

98. Don't know

57. Just to confirm, if the rebate was not available through the program, would you still have paid the additional cost to purchase an [EFF_MEASURE1/2] instead of a [STAND_MEASURE1/2]?

1. Yes

2. No

98. Don't know

[DISPLAY IF EFF_MEAS_NUM1/2 = 4, 5, 6]

58. If the rebate was not available, what do you think you most likely would have done at the time when you purchased the [EFF_MEASURE1/2]?

1. Not installed anything

2. Installed a new but less energy efficient [STAND_MEASURE1/2]

3. Installed a similarly energy efficient [STAND_MEASURE1/2]

4. Installed the exact same [STAND_MEASURE1/2]

98. Don't know

59. On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have [INSTALLED1/2] the same [EFF_MEASURE1/2] at about the same time if the financial assistance was not available?

[SCALE: 0 (Not at all likely) = 0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=8, 9=9, 10 (Very likely) = 10]

60. Did you [INSTALL1/2] [A MORE EFFICIENT/MORE1/2] [EFF_MEASURE1/2] than you would have if you had not received a rebate through the program?

1. Yes

2. No

98. Don't know

61. Did you [INSTALL1/2] the [EFF_MEASURE1/2] sooner than you would have if the information and financial assistance from the program had not been available?

1. Yes
2. No
98. Don't know

[DISPLAY Q60 IF Q59 = 1]

62. When might you have [INSTALLED1/2] the same [EFF_MEASURE1/2] if you had not participated in the program? Would you say …

1. Within 6 months of when you purchased or installed it
2. Between 6 months and 1 year
3. In more than 1 year to 2 years
4. In 2 to 3 years
5. In more than 3 years
6. Never
98. Don't know

[REPEAT FOR FREE RIDERSHIP – MAJOR MEASURES SECOND BLOCK2 IF MAJMEAS_COUNT > 1 FOR SECOND MEASURES]

FREE RIDERSHIP – DIRECT INSTALL MEASURES BLOCK 1 [DISPLAY BLOCK IF DIMEASURE_COUNT > 0]

63. Had you purchased and installed any [DIMEASURE1/2/3] before you received them for free through the program?

1. Yes
2. No
98. Don't know

64. Did you have plans to purchase and install [DIMEASURE1/2/3] before you learned about the Home Performance program?

1. Yes
2. No
98. Don't know

[DISPLAY IF DIMEASURE_QUANT1/2/3 > 1]

65. If you had not received them for free through the program, how many of the [DIMEASURE_QUANT] [DIMEASURE1/2/3] that you received would you have purchased and installed on your own within 12 months?

1. None – would not have purchased any
2. Some of them but not all (How many?) [TEXT BOX]
3. The same number that you received for free through the program
98. Don't know

[REPEAT FOR FREE RIDERSHIP – DIRECT INSTALL MEASURES BLOCK 2 AND 3 IF DIMEASURE_COUNT > 1, AND REPEAT AGAIN IF DIMEASURE_COUNT >2]

66. Using a scale where 0 means "not at all likely" and 10 means "very likely", how likely is it that you would have purchased and installed the [DIMEASURE1/2/3] on your own without receiving them for free through the program?

[SCALE: 0 (Not at all likely) = 0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=8, 9=9, 10 (Very likely) = 10]

SPILLOVER BLOCK

67. Have you bought and installed any additional energy efficient items on your own in the past 12 months without a financial incentive or rebate from Appalachian Power because of your experience with the program?

1. Yes
2. No

[DISPLAY IF Q65 =1]

68. What did you purchase and install without getting an Appalachian Power rebate or discount? (Select all that apply) [MULTISELECT]

1. LED (Light Emitting Diode) Bulbs
2. ENERGY STAR appliance such as a refrigerator, dishwasher, clothes washer, or clothes dryer
3. Water heater pipe insulation

4. Water heater jacket, blanket, or insulation
5. Energy and water efficient faucet aerators
6. Energy and water efficient showerheads
7. ENERGY STAR room air conditioner
8. Energy efficient water heater
9. Smart thermostat
10. Something else
98. Don't know

[DISPLAY IF Q66 = 1 - 10]

69. Why did you not get an Appalachian Power rebate, or discount for that energy saving equipment?

1. Did not know an incentive, rebate, or discount was available
2. Did not want to complete an application
3. For some other reason (Please explain)
4. I did get an incentive
98. Don't know

[DISPLAY IF Q66 = 1]

70. We would like to know how many LEDs you purchased that were not discounted by Appalachian Power. Did you purchase any of those LEDs without receiving a discount?

1. Yes
2. No, all of the LEDs purchased were discounted
98. Don't know

[DISPLAY IF Q68 = 1]

71. How many LEDs did you purchase and install that you did not receive a discount for?

[TEXT BOX]

[DISPLAY IF Q66 = 2]

72. What kind of appliance did you purchase?

[TEXT BOX]

[DISPLAY IF Q66 = 2]

73. How do you know it is an energy efficient appliance?

[DISPLAY IF Q66 = 3]

74. About how many feet of water heater pipe insulation did you purchase and install?

[TEXT BOX]

[DISPLAY IF Q66 = 5]

75. How many energy and water efficient faucet aerators did you install in bathroom sinks?

[TEXT BOX]

[DISPLAY IF Q66 = 5]

76. How many energy and water efficient faucet aerators did you install in kitchen sinks?

[TEXT BOX]

[DISPLAY IF Q66 = 6]

77. How many energy and water efficient showerheads did you install?

[TEXT BOX]

[DISPLAY IF Q66 = 7]

78. How many ENERGY STAR room air conditioners did you install?

[TEXT BOX]

[DISPLAY IF Q66 = 7]

79. How many square feet is the room that the ENERGY STAR air conditioner is installed in? If multiple units installed, how many square feet on average are the rooms you installed the air conditioners in?

[TEXT BOX]

[DISPLAY IF Q66 = 8]

80. How do you know that the water heater you installed is an energy efficient water heater?

[DISPLAY Q66 =8]

81. What type of water heater did you install? Was it a…

1. Natural gas storage tank water heater
2. Electric storage tank water heater
3. Heat pump water heater

4. A natural gas tankless water heater
5. Some other type of water heater (Specify)
98. Don't know

[DISPLAY IF Q66 = 10]

82. How many other energy efficient items did you install?

[TEXT BOX]

[DISPLAY IF Q66 = 1 - 10]

83. In approximately what month and year did you install the energy efficient items that you did not receive an discount for?

[TEXT BOX]

[DISPLAY IF Q66 = 1 - 10]

84. On a scale of 0 to 10, where 0 represents "not at all important" and 10 represents "extremely important", how important was the experience with the program in your decision to purchase the items you just mentioned?

[SCALE: 0 = 0 (Not at all important), 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 = 7, 8 = 8, 9 = 9, 10 = 10 (Extremely important)]

[DISPLAY IF Q66 = 1 - 10]

85. On a scale of 0 to 10, where 0 represents "not at all likely" and 10 represents "extremely likely," how likely would you have been to purchase those additional items if you had not participated in the program?

[SCALE: 0 = 0 (Not at all likely), 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 = 7, 8 = 8, 9= 9, 10 = 10 (Extremely likely)]

CONTRACTOR EXPERIENCE BLOCK [MAJMEAS_COUNT > 0]

86. Thinking about the contractor that completed the work in your home for the [ALL_MAJ_MEAURES], how much do you agree with the following statements:

[SCALE: 1 (Completely disagree) = 1, 2 = 2, 3 = 3, 4 = 4, 5 (Completely agree) = 5]

a. The contractor was timely in completing the work
b. The contractor's work was of high quality
c. The contractor was courteous and professional

SATISFACTION BLOCK

[DISPLAY Q85 IF MAJMEAS_COUNT > 0 OR DIMEASURE_COUNT > 0]

87. Overall, how satisfied are you with the efficiency improvements to your home? Would you say you are…

5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied

[DISPLAY IF Q85 = 1 OR 2]

88. Why are you dissatisfied with the efficiency improvements?

89. How satisfied are you with the Appalachian Power Home Performance program, overall? Would you say you are…

5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
98. Don't know

[DISPLAY IF Q87 = 1 OR 2]

90. Why are you dissatisfied with the program?

91. Do you have any suggestions for how Appalachian Power could improve its Home Performance program?

HOME CHARACTERISTICS

The last few final questions are about your household. This information will be kept confidential but you do not need to answer any question you do not want to answer.

92. Do you own the home where the project was completed, rent it, or own it and rent it to someone else?

1. Own
2. Rent
3. Own and rent to someone else

98. Don't know/Prefer not to state

93. Which of the following best describes your home? Is it a…

1. Manufactured home
2. Single-family house detached from any other house
3. Single family house attached to one or more other houses, for example, duplex, row house, or townhome
4. Apartment in a building with 2 to 3 units
5. Apartment in a building with 4 or more units
6. Other (Please describe)
98. Don't know/ Prefer not to state

[DISPLAY IF Q91= 2 OR 3]

94. Is your home…

1. Single story
2. A one and a half story home
3. A two story home
4. A three story home

95. What fuel does your main water heater use?

1. Electricity
2. Natural Gas
3. Propane
4. Something else (Please describe)
5. Don't heat home
98. Don't know/Prefer not to state

96. What fuel does your main heating system use?

1. Electricity
2. Natural Gas
3. Propane
4. Something else (Please specify)
98. Don't know/ Prefer not to state

97. Lastly, we are interested in speaking with Home Performance program participants about the energy efficiency improvements made in their homes. This conversation may occur either by telephone or a video conference.

Randomly selected participants that participate in this additional research will receive a $25 electronic Visa card.

If you are selected, would you be interested in participating this research?

1. Yes
2. No

[DISPLAY Q96 IF Q95 = 1]

98. Please provide the email address where we can best reach you if you are selected to participate.

[TEXT BOX]

# 3. Low Income Single Family Participant Survey Instrument

INTRODUCTION

Hello. My name is _____ and I'm calling on behalf of the Appalachian Power Weatherization Assistance Program.

May I please speak with [Participant Name]? (If refusal: thank and terminate)

(If participant is unavailable, ask the following question)

May I please speak with another member of the household who is familiar with the household's participation in the Appalachian Power Weatherization Assistance Program? (If refusal: thank and terminate.) (If refusal: thank and terminate)

(If the call is transferred to a new individual, use new introductory statement below)

Hello. My name is _____ and I'm calling on behalf of the Appalachian Power Weatherization Assistance Program. May I please speak with you about your household's participation in this program? (If refusal: thank and terminate)

1. We are conducting a study to evaluate the Appalachian Power Weatherization Assistance Program. Appalachian Power will use the results of this evaluation to determine the effectiveness of the program and to make improvements. The interview will take approximately 10 minutes. May I ask you a few questions?
1. Yes
2. No (Thank respondent and terminate interview)

[DISPLAY IF Q1 = 1]

2. Our records indicate that you participated in the Weatherization Assistance Program by completing an energy audit and receiving several energy efficient measures installed in your home. Do you recall participating in this program?
1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY IF Q2 = 2 OR 98 OR 99]

3. Is there anyone else in your household who may be familiar with your household's participation in the program?
1. Yes
2. No (Thank respondent and terminate interview)
98. Don't know (Thank respondent and terminate interview)
99. Refused (Thank respondent and terminate interview)

[DISPLAY IF Q3 = 1]
4. May I speak with that person?
1. Yes (Return to Q1 and begin questions with new respondent)
2. No (Thank respondent and terminate interview)
98. Don't know (Thank respondent and terminate interview)
99. Refused (Thank respondent and terminate interview)

AWARENESS AND MOTIVATION

At this time, I'd like to let you know that your responses to this survey will be kept completely confidential. I'll begin with a few questions about your decision to participate in the program.

5. How did you learn of the Weatherization Assistance Program sponsored by Appalachian Power and administered by your local Community Action Agency? (Select all that apply) [MULTISELECT]
1. An Appalachian Power representative mentioned it
2. The Appalachian Power website
3. From a local Community Action Agency or weatherization service provider
4. Friend, relative, coworker, or neighbor
5. In some other way (Please describe)
98. Don't know
99. Refused

6. Why did you choose to participate in the program? (Select all that apply) [MULTISELECT]
1. To save money on energy bill(s)
2. To reduce energy use for environmental reasons
3. The services were provided free of charge
4. Improve home comfort
5. Improve value of the home
6. Other (Specify)
98. Don't know
99. Refused

PARTICIPATION EFFICIENCY

7. Now I'll ask some questions about the energy audit that was provided as a part of this program.
Did someone visit your household to discuss ways of savings energy and to install energy efficient equipment?
1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY IF Q7 = 1]
8. Did you schedule that appointment?
1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY IF Q8 = 1]
9. On a scale of 1 to 5, where 1 is "very difficult" and 5 is "very easy," how would you rate the process of scheduling of the visit?
1. 1 (Very difficult)
2. 2
3. 3
4. 4
5. 5 (Very easy)
98. Don't know

[DISPLAY IF Q7 = 1]
10. Were you in your household at the time of this visit?
1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY IF Q10 = 1]
11. Did the person who visited your home examine your appliances or building structure for energy efficiency?
1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY IF Q10 = 1]

12. During the visit to your home, did the program representative talk to you about how to save energy in your home, or provide recommendations about how to use your appliances and equipment in an energy efficient way?

1. Yes
2. No
98. Don't know
99. Refused

[DISPLAY IF Q10 = 1]

13. Using a scale where 1 means completely disagree and 5 means completely agree, how much do you agree with the following statements about the work that was done on the home: [SCALE: 1 (Completely disagree) = 1, 2 = 2, 3 = 3, 4 = 4, 5 (Completely agree) = 5, 98 = Don't know]

a. The completion of the work was timely and efficient
b. The work crew was courteous and professional
c. The information provided about your home's energy use was useful
d. The information provided about your home's energy use was easy to understand

MEASURE VERIFICATION

[DISPLAY IF AIR SEALING = 1 OR INSULATION = 1 OR DUCT_SEALING = 1 OR HEAT_PUMP = 1 OR FURNACE = 1 OR TUNEUP = 1 OR PIPEWRAP = 1 OR REFRIGERATOR = 1 OR TANKWRAP = 1 OR TURNDOWN = 1 OR DHW_TANK_REPLACEMENT = 1 OR WINDOW_AC = 1]

14. Now we would like some information on the measures you installed through the program. According to our records you received the following energy efficiency improvements through the program.

Please indicate if the information seems correct. (READ LIST)

[SCALE: 1 = Correct, 2 = Incorrect, 98 = Don't know, 99 = Refused]

a. [DISPLAY IF AIR SEALING= 1] Air sealing to reduce drafts in your home
b. [DISPLAY IF INSULATION = 1] Ceiling, attic, wall, and/or floor insulation
c. [DISPLAY IF DUCT_SEALING = 1] Sealing or insulating your heating and cooling system ducts
d. [DISPLAY IF HEAT_PUMP = 1] An energy efficient heat pump
e. [DISPLAY IF FURNACE = 1] An energy efficient furnace
f. [DISPLAY IF TUNEUP = 1] Heating and cooling system tune-up or maintenance
g. [DISPLAY IF PIPEWRAP = 1] Hot water heater pipe wrap
h. [DISPLAY IF TANKWRAP = 1] Hot water heater tank wrap
i. [DISPLAY IF TURNDOWN = 1] Reduction in hot water heater temperature

j. [DISPLAY IF DHW_TANK_REPLACEMENT = 1] An energy efficient hot water heater
k. [DISPLAY IF REFRIGERATOR = 1] An energy efficient refrigerator
l. [DISPLAY IF WINDOW_AC = 1] An energy efficient window air conditioner
m. [DISPLAY IF VENTILATION_FAN = 1] Kitchen or bathroom ventilation fan
n. [DISPLAY IF FREEZER = 1] An energy efficient freezer

[DISPLAY IF LED_QUANT > 0]
15. Our records show that [LED_QUANT] LED lightbulbs were installed in your home. Have any of those light bulbs been removed?
1. No
2. Yes (How many have been removed?)
98. Don't know

[DISPLAY IF BATH_AERATOR_QUANT > 0]
16. Our records show that [BATH_AERATOR_QUANT] bathroom faucet aerator(s) were installed in your home. Have any of those bathroom faucet aerators been removed?
1. No
2. Yes (How many have been removed?)
98. Don't know

[DISPLAY IF KITCHEN_AERATOR_QUANT > 0]
17. Our records show that [KITCHEN_AERATOR_QUANT] kitchen faucet aerator(s) were installed in your home. Have any of those kitchen faucet aerators been removed?
1. No
2. Yes (How many have been removed?)
98. Don't know

[DISPLAY IF UNSPECIFIED_AERATOR_QUANT > 0]
18. Our records show that [UNSPECIFIED_AERATOR_QUANT] faucet aerators were installed in your home. Have any of those faucet aerators been removed?
1. No
2. Yes (How many have been removed?)
98. Don't know

[DISPLAY IF SHOWER_QUANT > 0]
19. Our records show that [SHOWER_QUANT] showerheads were installed in your home. Have any of those showerheads been removed?
1. No
2. Yes (How many have been removed?)

98. Don't know

[DISPLAY IF SHOWER_QUANT > 0]

20. How many shower heads does your home have in total?

PROGRAM FEEDBACK

21. Overall, how satisfied are you with the efficiency improvements to your home? Would you say you are…

5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
98. Don't know

[DISPLAY IF Q21 = 1 OR 2]

22. Why are you dissatisfied with it?

23. How satisfied are you with the Appalachian Power Weatherization Program, overall? Would you say you are…

5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
98. Don't know

[DISPLAY IF Q23 = 1 OR 2]

24. Why are you dissatisfied with it?

25. Do you have any suggestions for how the Weatherization Program could be improved?

HOME CHARACTERISTICS

Now I have just a few final questions about your household. This information will be kept confidential, but you do not need to answer any question you do not want to answer.

26. Do you own the home where the project was completed, rent it, or own it and rent it to someone else?

1. Own
2. Rent

3. Own and rent to someone else
98. Don't know/Prefer not to state
27. Which of the following best describes your home? Is it a…
1. Manufactured home
2. Single-family house detached from any other house
3. Single family house attached to one or more other houses, for example, duplex, row house, or townhome
4. Apartment in a building with 2 to 3 units
5. Apartment in a building with 4 or more units
6. Other (Please describe)
98. Don't know/Prefer not to state
28. What fuel does your main water heater use?
1. Electricity
2. Natural Gas
3. Propane
4. Something else (Please describe)
5. Don't heat home
98. Don't know/Prefer not to state
29. What fuel does your main heating system use?
1. Electricity
2. Natural Gas
3. Propane
4. Something else (Please specify)
98. Don't know/Prefer not to state

# 4. Low Income Multifamily Tenant Survey Instrument

SCREENING AND VERIFICATION [DO NOT DISPLAY IN SURVEY]

1. This survey is about your experience with the energy efficiency improvements made to your living unit through Appalachian Power Multifamily Program.

Our records indicate that the following energy saving improvements were made to your residence through Appalachian Power Multifamily Program. Can you confirm that the following improvements were made? [1 = Yes, this improvement was made 2 = No, this improvement was not made 98 = Don't know]

a) [If insulation = 1] Added insulation

b) [If tune up = 1] Completed heat pump or air conditioner tune ups

c) [If mini split = 1] Installed mini split heat pumps

d) [If ceiling fan = 1] Installed ceiling fans

e) [If heat pump water heaters = 1] Installed heat pump water heaters

f) [If refrigerator = 1] Installed refrigerators

g) [If smart thermostat = 1] Installed smart thermostats

h) [If tankwrap = 1] Installed water heater blankets / tank wraps

i) [If window AC = 1] Installed window air conditioners

j) [If air source heat pump = 1] Installed air source heat pumps

k) [If faucet aerator = 1] Installed faucet aerators

l) [If pipe insulation = 1] Installed hot water pipe wrap

m) [If LED = 1] Installed LED light bulbs

n) [If showerhead = 1] Installed low flow showerheads

o) [If power strip = 1] Installed advanced power strips

p) [If duct insulation= 1] Insulated your heating and cooling ducts

q) [If duct sealing = 1] Sealed heating and cooling ducts

r) [If setback = 1] Lowered the temperatures on water heaters

s) [If air sealing = 1] Sealed air leaks

[TERMINATE IF NONE = 1]

2. We would also like to know if you have removed and are no longer using any of the equipment that was installed through Appalachian Power Multifamily Program. [1 = No, have not removed equipment, 2 = Yes, removed equipment, 98 = Don't know]

a) [If LEDs verified] LED lightbulb(s)

b) [If faucet aerators verified] Faucet aerator(s)

c) [If showerheads verified] Showerhead(s)

d) [If advanced power strips verified] Advanced power strip(s)

3. [Display if Q2a = 2] How many LED light bulbs did you remove?

4. [Display if Q2b = 2] How many faucet aerators did you remove?

5. [Display if Q2c = 2] How many showerheads did you remove?

6. [Display if Q2d = 2] How many advance power strips did you remove?

7. Were you home when the energy efficiency improvements were completed?

1. Yes

2. No

8. Did a program representative speak with you about tips on how to save energy?

1. Yes

2. No

9. Did you receive any printed material from the program with tips on how to save energy?

1. Yes

2. No

10. Using the scale below, how satisfied or dissatisfied are you with the following…

[Very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied, very dissatisfied, Don't know/not applicable]

a) The energy efficiency improvements made to your living unit?

b) [Display if Q7 = 1] The interactions you had with the people who completed the energy efficiency improvements in your living unit?

c) [Display if Q8 = 1 or Q9 = 1] The information about the improvements made to your living unit or tips on how to save energy?

d) The savings on your monthly utility bills?

e) Your overall experience?

11. Have you seen any benefits from the energy efficiency improvements made to your living units? Please select up to three.

1. My living unit feels more comfortable

2. Reduced my electricity costs

3. There is less noise from the outside

4. There is less noise from the appliances

5. I or my family have experienced health improvements

6. The living unit is safer

7. The appliances and heating or cooling equipment are more reliable

8. Other (Please describe)

9. I have not seen any benefits

12. Using the scale below, please rate how important saving energy in your living unit is to you?

1. Not at all important

2. Slightly important

3. Moderately important

4. Very important

5. Extremely important

13. Is there anything Appalachian Power could do to help you save energy in your living unit?

14. Do you have any other comments about the Appalachian Power Multifamily Program, or the improvements made to your living unit?

PART 3



# 5. Low Income Multifamily Property Manager Survey Instrument

1. According to program records, the [PROPERTY] property participated in Appalachian Power's Low Income Multifamily program by having energy efficient equipment installed at the property.

Are you aware of this property's participation in the program?

1. Yes

2 No [TERMINATE]

2. Program records also indicate that the following energy efficient equipment was installed at the [PROPERTY] property through the program: [PROJECT].

Does that sound correct to you?

1. Yes

2. No

[DISPLAY Q3 IF Q2 =2]

3. Please indicate below what you think is incorrect about our records.

[OPEN-ENDED]

4. How many total residential units are there at [PROPERTY_NAME]?

Total number of units [OPEN-ENDED]

5. To the best of your knowledge, how many of those units received at least one of the improvements?

Total number of units [OPEN-ENDED]

6. Has your office had any requests to remove or modify any of the installed improvements?

1. Yes

2. No

[DISPLAY Q7 IF Q6 =1]

7. Which improvements have you been asked to remove or modify?

[DISPLAY Q8 IF Q6 =1]

8. What was the reason for the request to remove or modify these improvements?

AWARENESS [DO NOT DISPLAY IN SURVEY]

9. How did you first learn about Appalachian Power's energy efficiency improvements for low-income multifamily properties?

1. From a Community Housing Partners program staff person
2. From an Appalachian Power program staff person
3. From a search engine (Google, Yahoo, Bing)
4. From another person in your organization
5. Previously participated in the program
6. Appalachian Power's website
7. Other (Please specify)

10. Could you briefly describe challenges, if any, you face in making energy efficiency improvements to this low income multifamily property or others that you manage and/or own?

[OPEN-ENDED]

11. What were the main reason(s) for deciding to complete the energy efficiency improvements at the property? (Select all that apply) [MULTISELECT]

1. Improve tenant comfort and satisfaction
2. Reduce tenant utility bills
3. Reduce property utility bills
4. To take advantage of rebates/no-cost efficiency improvements
5. To replace old or non-functioning equipment
6. To make the units more attractive to prospective tenants
7. Some other reason (please describe)

ENERGY AUDIT AND ASSISTANCE

12. Did a representative from the Low Income Multifamily Program provide an energy audit of your property?

1. Yes
2. No

[DISPLAY Q13 IF Q12 = 1]

13. Using the scale provided, please indicate your agreement with the following statements regarding the program representative that completed the assessment.

[SCALE: 5 = Strongly agree, 4 = 4, 3 = 3, 2 = 2, 1 = Strongly disagree]

a. The representative was courteous and knowledgeable

b. The assessment was completed efficiently

c. The assessment was comprehensive

d. The recommendations based on the energy assessment were appropriate for my property

[DISPLAY Q14 IF Q12 = 1]

14. Were there any recommended property improvements or equipment replacements that you did not implement?

1. Yes

2. No

98. Don't Know

[DISPLAY Q15 IF Q14=1]

15. Which recommended property improvements or equipment replacements did you not implement and why?

SATISFACTION WITH FIELD SERVICE REPRESENTATIVE [DO NOT DISPLAY IN SURVEY]

16. To the best of your knowledge, what percentage of the units that received improvements was the tenant home when the improvements were made? If you are not sure, please estimate the approximate percentage of units who are at home during the day.

Percentage of units [OPEN-ENDED]

17. Based on your recent experience with the Low Income Multifamily Program, please rate your level of satisfaction with the people who performed work at this property. Please select N/A if an item is not applicable to you.

[SCALE: 5 = Very satisfied, 4 = Satisfied, 3 = Neutral, 2 = Dissatisfied, 1 = Very dissatisfied, 99 = N/A]

a. On-time arrival for appointment

b. Appearance (ID badge, uniform, presentability)

c. Courtesy and professionalism

d. Willingness to help

e. Product/service/program knowledge

f. Preparedness (i.e., came with all tools/parts needed)

g. Length of time required to perform the installation/service

h. Quality of the installation / service

i. Condition in which site was left

j. Quality of the educational materials left behind

k. Your overall experience with the field representative

18. Please use this space to share any additional thoughts on the work performed at this property.

19. Based on this experience, how likely are you to recommend Low Income Multifamily Program to a colleague?

[SCALE: 5 = VERY LIKELY, 4 = SOMEWHAT LIKELY, 3 = NEITHER LIKELY NOR UNLIKELY, 2 = SOMEHWAT UNLIKELY, 1 = VERY UNLIKELY]

CUSTOMER SATISFACTION [DO NOT DISPLAY HEADING; DISPLAY INTRO]

20. Thinking about your most recent experience with the program, how satisfied are you with:

[SCALE: 5 = Very satisfied, 4 = Satisfied, 3 = Neutral, 2 = Dissatisfied, 1 = Very dissatisfied, 99 = N/A]

a. the steps you had to take to get through the program

b. the energy efficiency improvements made through the program

[DISPLAY Q21 IF Q20A OR B = 1 OR 2]

21. Please describe the ways in which you were not satisfied with the aspects of the program mentioned above.

22. Have you heard any feedback from tenants about the energy efficiency improvements made?

1. Yes

2. No

[DISPLAY Q23 IF Q22 = 1]

23. Would you describe the feedback you heard as mostly positive, mostly negative, or mixed?

1. Mostly positive

2. A mix of positive and negative feedback

3. Mostly negative

[DISPLAY Q24 IF Q23 = 1 OR 2]

24. What positive feedback have you heard?

[DISPLAY Q25 IF Q23 = 2 OR 3]

25. What negative feedback have you heard?

26. Do you have any suggestions for improving the Low-Income Multifamily Program?

[OPEN-ENDED]

FIRMOGRAPHIC [DO NOT DISPLAY]

27. The next few questions are about the property that received efficiency improvements through the program.

Does this building have a central system that provides heating to multiple living units or does each unit have its own heating system?

1. Central heating system
2. Each unit has its own heating system

28. What is the primary type of heating fuel used at this property?

1. Electricity
2. Natural gas
3. Propane (bottled gas)
4. Oil
5. Other (Please specify)
98. Don't know

29. What is the primary type of heating system?

1. Forced air furnace with ducts to individual rooms
2. Central boiler with radiators and pipes in each unit
3. District steam with radiators or pipes in each room
4. Air source heat pump
5. Electric resistance baseboard heat
6. Radiant hot water baseboard heat
7. Other (Please specify)

98. Don't know

30. Does this property have a central system that provides hot water to multiple tenant units?

1. Yes
2. No
98. Don't know

31. What is the primary type of water heating equipment used?

1. Self-contained tank (similar to a residential water heater tank)
2. Instantaneous water heater (does not have a tank)
3. Part of the heating system boiler
4. Other (Please specify)
98. Don't know

32. What is the primary fuel source for water heating?

1. Electricity
2. Natural gas
3. Propane (bottled gas)
4. Oil
5. Other (Please specify)
98. Don't know

33. Does your organization manage, own, or own and manage the [PROPERTY] property?

1. Own it only
2. Manage it only
3. Both own and manage it
98. I don't know

34. What is your role/title relating to the [PROPERTY] property?

1. Property Owner
2. President/CEO/COO
3. General manager
4. Property facilities/maintenance
5. Financial manager
6. Other (Please specify) [OPEN-ENDED]
98. I don't know

35. Which of the following best describes your authority to make decisions about upgrades or improvements to the [PROPERTY] property?

1. No authority
2. Authority is limited to improvements below a certain cost
3. Authority is limited in some other way
4. Full authority

98. I don't know

36. Do tenants pay their own electric bills, or are electricity costs included in the rent?

1. Tenants pay their own bills

2. Electricity costs are included as part of the rent

3. There is another type of arrangement (Please describe) [OPEN-ENDED]

98. I don't know

37. Approximately what percentage of the units receive some type of federal, state or other housing assistance?

1. 0 – 25%

2. 26 – 50%

3. 51 – 75%

4. 76 – 100%

98. I don't know

Those are all the questions we have. We would sincerely like to thank you for your help with this survey and for sharing information about your experience!

220450006

# 6. BYOT Program Participant Survey Instrument

1. Our records indicate that you enrolled in Appalachian Power's Bring Your Own Thermostat Program by enrolling your smart thermostat to allow Appalachian Power to make brief changes to its settings during peak demand periods.

Is this correct?

1. Yes
2. No [TERMINATE]
98. Not sure [TERMINATE]

2. How did you first learn about Appalachian Power's Bring Your Own Thermostat program? [RANDOMIZE ORDER OF 1-8]

1. An Appalachian Power newsletter or email
2. A postcard or other mailing from Appalachian Power
3. Appalachian Power website
4. From an HVAC contractor
5. Through a community organization
6. Through participating in the eScore program
7. email from [OEM]
7. Social networking site such as Facebook or Twitter
8. Friend, relative, coworker, or neighbor
9. In some other way (Please specify)
98. Do not recall

3. Why did you choose to participate in this program? (select all that apply) [MULTISELECT] [RANDOMIZE ORDER OF 1-6]

1. The opportunity to participate in an energy savings program
2. Program was recommended to me by Appalachian Power
3. The incentive check
4. To reduce energy use for environmental reasons
5. To save on energy costs
6. Other (please specify)

98. Do not recall

4. When you decided to enroll, how often did you expect that someone would be at home when the air conditioner was reduced during peak demand periods?

1. Never
2. Less than half the time
3. About half of the time
4. More than half of the time
5. All of the time
98. Not sure

5. Thinking about this past summer period of May through September, about how often was someone home during an event?

1. Never
2. Less than half the time
3. About half of the time
4. More than half of the time
5. All of the time
98. Not sure

6. Before your decision to participate in the Bring Your Own Thermostat program, did you have any concerns about participating in it?

1. Yes
2. No
98. Don't Know

[DISPLAY IF Q6= 1]

7. What concerns did you have? (Please select all that apply) [MULTISELECT] [RANDOMIZE ORDER OF 1 -5]

1. Concerns about being uncomfortable during energy reduction events
3. Concerns about the utility having the ability to control or shut off my AC
4. Concerns about not being able to control the temperature
5. [DISPLAY IF BYOT = 1] Concerns about privacy/security

6. Other (Please specify)

98. Do not recall

8. Where did you get information about how the program works? (Select all that apply) [MULTISELECT] [RANDOMIZE ORDER OF 1 -5]

1. Information provided by an Appalachian Power representative

2. The program website

3. Information provided in an Appalachian Power email or newsletter

4. Information from an Appalachian Power flyer

5. Information provided in an Appalachian Power mailing

6. Other (please specify)

98. Do not recall

9. Thinking about any information that you received or viewed before you decided to participate, how well did that information address any questions you had?

1. 1 (Not at all)

2. 2

3. 3

4. 4

5. 5 (Completely)

97. Not applicable/No opinion

[DISPLAY IF Q9 < 4]

10. What additional information would you have liked to have had?

11. Did you already have a smart thermostat when you first learned about the Bring Your Own Thermostat program?

1. Yes

2. No, purchased a smart thermostat after I learned about the program

98. Don't know

[DISPLAY IF Q11 = 2]

12. We would like to know if the program affected your decision to purchase and install the smart thermostat.

How likely would you have been to purchase a smart thermostat if the Bring Your Own Thermostat program $50 enrollment incentive and the $25 end of the summer incentive was NOT available?

[SCALE: 0 (Not at all likely) = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 = 7, 8 = 8, 9 = 9, 10 (Extremely likely) = 10, 98 = Don't know]

[DISPLAY IF Q11 = 2]

13. How important was the information and incentives provided through the Bring Your Own Thermostat program in your decision to install a smart thermostat?

[SCALE: 0 (Not at all important) = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 = 7, 8 = 8, 9 = 9, 10 (Extremely important) = 10, 98 = Don't know]

14. Using the scale below, how would you rate the process of enrolling your thermostat in the program?

1. 1 (Very difficult)
2. 2
3. 3
4. 4
5. 5 (Very easy)

98. Don't know

[DISPLAY IF Q14 < 3]

15. What made the enrollment process difficult?

16. Which of the following statements best describes the way you used your central air conditioner last summer?

1. Did not use it at all
2. It only ran a few days or nights when it was really needed
3. It ran on several days or nights
4. It ran almost every day or night

98. Not sure

17. Were you at home during any of the energy reduction events that reduced the cooling from your air conditioner?

1. Yes
2. No, not that you are aware of

[DISPLAY IF Q17 = 1]

18. Now thinking about all the energy reduction events, during these events, would you say that your home became:

1. A little uncomfortable
2. Moderately uncomfortable
3. Very uncomfortable
4. There wasn't a change in the comfort of your home

98. Don't recall

19. Was the number of events that occurred this summer about what you were expecting when you signed up for the program, more than you were expecting, or fewer than you were expecting?

1. More than expected
2. About what was expected
3. Fewer than expected

98. Don't know

[DISPLAY IF Q19 = 1]

20. Do you think that the number of events that occurred this year was acceptable or that too many events occurred?

1. The number of events was acceptable
2. Too many events occurred

98. Don't know

[DISPLAY IF Q20 = 2]

21. What would be an acceptable number of events?

22. Did you contact Appalachian Power program staff about any issues or questions that you had during the past year?

1. Yes
2. No

98. Don't know

[DISPLAY IF Q22 = 1]

23. How thorough was the response from Appalachian Power staff?

1. 1 (Not at all thorough)
2. 2
3. 3
4. 4
5. 5 (Very thorough)
98. Don't know

[DISPLAY IF Q22 = 1]

24. How timely was the response from Appalachian Power staff?

1. 1 (Not at all timely)
2. 2
3. 3
4. 4
5. 5 (Very timely)
98. Don't know

25. Using a scale where 0 means "not at all likely" and 10 means "very likely," how likely is it that you will participate in the program next year?

[SCALE: 0 (Not at all likely) = 0, 1 = 1, 2 = 2, 3 = 3, 4 = 4, 5 = 5, 6 = 6, 7 = 7, 8 = 8, 9 = 9, 10 (Very likely) = 10, 98 = Don't know]

[DISPLAY IF Q25 < 7]

26. Why might you not participate in the program next year?

27. How satisfied are you with the Appalachian Power Bring Your Own Thermostat program, overall?

5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied

98. Don't know

[DISPLAY IF Q27 = 1 OR 2]

28. Why were you dissatisfied?

29. Have you recommended the Bring Your Own Thermostat program to friends, family members, or colleagues?

1. Yes

2. No

98. Don't know

## DEMOGRAPHICS / HOME CHARACTERISTICS

30. Do you own the home that participated in the program, rent it, or own it and rent it to someone else?

1. Own

2. Rent

3. Own and rent to someone else

98. Don't know/Prefer not to state

31. Which of the following best describes your home?

1. Manufactured home

2. Single-family house detached from any other house

3. Single family house attached to one or more other houses, for example, duplex, row house, or townhome

4. Apartment in a building with 2 to 3 units

5. Apartment in a building with 4 or more units

6. Other (Please describe)

98. Don't know/Prefer not to state

32. What is your highest level of education?

1. Less than high school

2. High school graduate

3. Associates degree, vocational/technical school, or some college

4. Four-year college degree

5. Graduate or professional degree

98. Don't know/Prefer not to state

33. Do you have any suggestions for improving Appalachian Power's Bring Your Own Thermostat program?

# 7. Manufactured Home Purchaser Survey Instrument

SCREENING

1. To begin, can you confirm that you purchased a manufactured home from [RETAILER]?

1. Yes

2. No [THANK AND TERMINATE SURVEY]

PROGRAM AWARENESS AND DECISION MAKING

[DISPLAY IF REBATE = 1]

2. Can you also confirm that you received a rebate from Appalachian Power for the purchase of your ENERGY STAR home?

1. Yes

2. No

3. Were you aware that the home you purchased was an ENERGY STAR certified home?

1. Yes

2. No

4. When you purchased your home, did the retailer talk to you about the energy efficiency of the home?

1. Yes

2. No

[DISPLAY IF Q2 = 1]

5. When did you first learn about the rebate for buying an ENERGY STAR manufactured home?

1. Before you spoke with a retailer about purchasing an ENERGY STAR home

2. After speaking with a retailer but before deciding to purchase an ENERGY STAR home manufactured home.

3. After deciding to purchase an ENERGY STAR home

4. During the purchase of an ENERGY STAR home

5. After completing the purchase of an ENEGY STAR home

[DISPLAY IF Q2 = 1]

6. How did you first learn about the Appalachian Power rebate?

1. Manufactured home retailer

2. Real estate agent

3. Appalachian Power website

4. Friend, family member, or colleague

5. Appalachian Power email

6. Appalachian Power newsletter

7. Social media

8. Through an internet search (e.g., Google search)

9. Through an internet advertisement

10. From a manufactured home retailer radio, television, or newspaper advertisement

11. Other, please specify: [OPEN-ENDED]

98. Don't know

7. Below is a list of the features that an energy efficient ENERGY STAR home has that a standard home does not have. Please mark any that the retailer mentioned to you when you purchased your home.

[RANDOMIZE 1 – 5]

1. Better insulation than a standard home

2. More efficient windows than a standard home

3. Better air sealing than a standard home

4. A programmable thermostat

5. An energy efficient heat pump

6. Did not mention any of these

8. What were the main reasons or features that lead you to purchase an energy efficient ENERGY STAR home? Please select all that apply.

1. Uses less energy

2. Lower utility costs

3. Improved home comfort

4. [DISPLAY IF Q2 = 1] Availability of rebate

5. Only home available

6. Other (Please describe)

FREE RIDERSHIP

[DISPLAY SECTION IF Q2 = 1 OR Q3 = 1 OR Q4 = 1]

9. The next questions ask you about your plans and decision to purchase the energy efficient ENERGY STAR home as compared with a manufactured home that was not an ENERGY STAR home.

Note, an ENERGY STAR home uses less energy due to the following reasons:

- Better insulation
- More efficient windows
- Better air sealing, and
- Programmable thermostat
- Energy efficient heat pump

10. Did you know that you could purchase an energy efficient ENERGY STAR certified home instead of a standard efficiency home before speaking with a salesperson at [RETAILER]?

1. Yes
2. No

11. Did you have plans to purchase an energy efficient ENERGY STAR certified home instead of a standard efficiency home before speaking with the salesperson at [RETAILER]?

1. Yes
2. No

[DISPLAY IF REBATE = 1]

12. Could you have afforded to pay the additional cost of $700 for an ENERGY STAR certified manufactured home if the rebate was not available?

1. Yes
2. No

98. Unsure

[DISPLAY IF Q12= 2]

13. To confirm, without the rebate, you would not have been able to pay the additional cost of the energy efficient ENERGY STAR home?

1. Yes, that is correct
2. No, that is incorrect as I would have been able to purchase without the rebate.

98. Unsure

[DISPLAY IF REBATE = 1]

14. ]If the program rebate was not available, how likely would you have been to buy an ENERGY STAR manufactured home? [INSERT 0 10 SCALE AS DESCRIBED ABOVE]

15. Did a salesperson at [RETAILER] talk to you about homes that were not ENRGY STAR certified?

1. Yes

2. No

16. Did a salesperson at [RETAILER] recommend that you buy an energy efficient ENERGY STAR home?

1. Yes

2. No

[DISPLAY IF Q15 = 1]

17. How likely would you have been to buy an ENERGY STAR if the salesperson had not recommended it? [INSERT 0 10 SCALE AS DESCRIBED ABOVE]

18. Did a salesperson at [RETAILER] provide you with information on the benefits of an ENERGY STAR manufactured home?

1. Yes

2. No

[DISPLAYIF Q18 = 1]

19. If the salesperson had not provided you information on the benefits of an ENERGY STAR home, how likely would you have been to purchase an ENERGY STAR home instead of a standard efficiency home? [INSERT 0 10 SCALE AS DESCRIBED ABOVE,]

SATISFACTION

20. How well has the ENERGY STAR manufactured home met your expectations for comfort?

1. Far short of expectations

2. Short of expectations

3. Equals expectations

4. Exceeds expectations

5. Far exceeds expectations

6. Did not have any expectations

21. How well has the ENERGY STAR manufactured home met your expectations for energy costs?

1. Far short of expectations

2. Short of expectations

3. Equals expectations

4. Exceeds expectations

5. Far exceeds expectations

6. Did not have any expectations

22. Please rate your satisfaction with the following: [INSERT 1-5 SCALE AS DEFINED ABOVE,]

1. The manufactured home you purchased

2. The ENERGY STAR information received from the retailer on the ENERGY STAR home you purchased

[DISPLAY IF Q21(1) <3]

23. Please explain why you are not satisfied with the home you purchased.

[OPEN-ENDED]

[DISPLAY IF Q21(2) <3]

24. Why are you not satisfied with the information the retailer gave you about the ENERGY STAR home?

[OPEN-ENDED]

DEMOGRAPHICS

The last final section of questions are about your household. This information will be kept confidential, however you can select "Prefer not to answer."

25. How many people, including you, live in your household?

1. 1 person

2. 2 people

3. 3 people

4. 4 people

5. 5 people

6. 6 people

7. 7 people

8. 8 or more people

99. Prefer not to answer

26. Is the manufactured home you purchased…

1. Your primary residence
2. A residence that you rent to someone else
3. A vacation property that is not occupied year-round
4. Something else (Please specify)

27. Is your total household income less than or more than the following amount?

[SCALE: 1 = Less than, 2 = More than, 99 = Prefer not to answer]

1. [DISPLAY IF Q25 = 1] $33,944
2. [DISPLAY IF Q25 = 2] $44,454
3. [DISPLAY IF Q25 = 3] $54,913
4. [DISPLAY IF Q25 = 4] $65,373
5. [DISPLAY IF Q25 = 5] $75,833
6. [DISPLAY IF Q25 = 6] $86,292
7. [DISPLAY IF Q25 = 7] $88,254
8. [DISPLAY IF Q25 = 8] $90,215

28. Please visit this website if you are interested in learning more about the rebate available for the home you purchased.

https://takechargeva.com/programs/for-your-home/energy-star-manufactured-homes-program

# 8. Home Performance Program Participant Survey Results

**Q1 - Our records indicate that you participated in the Appalachian Power Home Performance program in [Field-YEAR]. Through this program you received [Field-PROJ_DESC]. This program was previously called eScore. Do you recall your household's participation in this program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 136 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 136 |

**Q2 - How did you first hear about the Home Performance Program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | An Appalachian Power newsletter or email | 73.1% | 95 |
| 2 | Appalachian Power website | 14.6% | 19 |
| 3 | From a participating contractor | 5.4% | 7 |
| 4 | From a program representative who visited my home | 0.0% | 0 |
| 5 | While receiving services at my home through another Appalachian Power program | 0.8% | 1 |
| 6 | Social networking site such as Facebook or Twitter | 0.8% | 1 |
| 7 | Friend, relative, coworker, or neighbor | 3.1% | 4 |
| 8 | In some other way (Please describe) | 2.3% | 3 |
| | Total | 100% | 130 |

### Q3 - How did you begin your participation in the program?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | You called the program contact number | 52.2% | 59 |
| 2 | You enrolled using the Home Performance portal | 41.6% | 47 |
| 3 | The contractor that completed the efficiency improvements enrolled you | 6.2% | 7 |
| | Total | 100% | 113 |

### Q4 - According to our records, a Home Performance Energy Advisor completed an energy assessment of your home. Did you schedule the home energy assessment?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 96.2% | 127 |
| 2 | No, someone else did | 3.0% | 4 |
| 3 | No, did not have a home energy assessment completed | 0.8% | 1 |
| | Total | 100% | 132 |

### Q5 - On a scale of 1 to 5, where 1 is "very difficult" and 5 is "very easy," how would you rate the process of scheduling of your home energy assessment?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 (Very difficult) | 3.9% | 5 |
| 2 | 2 | 0.8% | 1 |
| 3 | 3 | 11.8% | 15 |
| 4 | 4 | 16.5% | 21 |
| 5 | 5 (Very easy) | 66.9% | 85 |
| | Total | 100% | 127 |

## Q6 - Were you at home during the energy assessment?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 98.5% | 130 |
| 2 | No | 1.5% | 2 |
| | Total | 100% | 132 |

**Q7 - Using a scale where 1 means completely disagree and 5 means completely agree, how much do you agree with the following statements about the home energy assessment:**

| # | Question | 1 (Completely disagree) | | 2 | | 3 | | 4 | | 5 (Completely agree) | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | The Home Performance Energy Advisor was timely in completing the assessment | 5.4% | 7 | 2.3% | 3 | 0.0% | 0 | 9.2% | 12 | 83.1% | 108 | 130 |
| 2 | The Home Performance Energy Advisor was courteous and professional | 2.3% | 3 | 0.8% | 1 | 0.8% | 1 | 7.0% | 9 | 89.1% | 115 | 129 |
| 3 | The information provided by the home energy assessment was useful | 5.5% | 7 | 1.6% | 2 | 8.6% | 11 | 10.2% | 13 | 74.2% | 95 | 128 |
| 4 | The information provided by the home energy assessment was easy to understand | 3.8% | 5 | 0.8% | 1 | 3.1% | 4 | 13.8% | 18 | 78.5% | 102 | 130 |

**Q8 - Now we would like some information on the measures you received through the program. According to our records you received the following energy efficiency improvements through the program. Please indicate if the information seems correct.**

| # | Question | Correct | | Incorrect | | Total |
|---|---|---|---|---|---|---|
| 1 | Air sealing to reduce drafts in your home | 0.0% | 0 | 0.0% | 0 | undefined |
| 2 | Attic and/or wall insulation | 100.0% | 9 | 0.0% | 0 | 9 |
| 3 | Sealing of your heating and cooling system ducts | 100.0% | 1 | 0.0% | 0 | 1 |
| 4 | Energy efficient heat pump | 100.0% | 3 | 0.0% | 0 | 3 |
| 5 | Energy efficient ductless heat pump | 75.0% | 3 | 25.0% | 1 | 4 |
| 6 | High efficiency furnace fan motor | 0.0% | 0 | 0.0% | 0 | undefined |
| 7 | Smart thermostat | 100.0% | 2 | 0.0% | 0 | 2 |
| 8 | Heating and cooling system tune-up or maintenance | 0.0% | 0 | 0.0% | 0 | undefined |
| 9 | Hot water heater pipe wrap | 100.0% | 2 | 0.0% | 0 | 2 |
| 10 | Hot water heater tank wrap | 100.0% | 1 | 0.0% | 0 | 1 |
| 11 | Reduction in hot water heater temperature | 0.0% | 0 | 0.0% | 0 | undefined |

**Q9 - Our records show that [Field-LED_QUANT] LED light bulbs were installed in your home. Have any of those light bulbs been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 93.3% | 112 |
| 2 | Yes (How many have been removed?) | 6.7% | 8 |
| | Total | 100% | 120 |

**Q10 - Our records show that [Field-FILTER_QUANT] air filter whistles were installed in your home. Have you removed any of the air filter whistles?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 0.0% | 0 |
| 2 | Yes, removed it and no longer use it | 0.0% | 0 |
| 99 | Yes, removed it when changing the air filter and then reinstalled it | 0.0% | 0 |
| | Total | | 0 |

**Q12 - Our records show that [Field-AERATOR_QUANT] faucet aerators were installed in your home. Have any of those faucet aerators been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 75.0% | 3 |
| 2 | Yes (How many have been removed?) | 25.0% | 1 |
| | Total | 100% | 4 |

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 | 100.0% | 1 |
| | Total | 100% | 1 |

**Q13 - Our records show that [Field-SHOWER_QUANT] showerheads were installed in your home. Have any of those showerheads been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 88.9% | 8 |
| 2 | Yes (How many have been removed?) | 11.1% | 1 |
| | Total | 100% | 9 |

**Q15 - Our records show that [Field-NIGHTLIGHT_QUANT] nightlights were installed in your home. Did any of the LED nightlights that you received replace an existing nightlight?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No, none of the nightlights replaced an existing nightlight | 0.0% | 0 |
| | Total | | 0 |

**Q18 - Does the smart Wi-Fi thermostat that you got a rebate for control a central cooling system, a central heating system, or both?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Central cooling system | 0.0% | 0 |
| 2 | Central heating system | 0.0% | 0 |
| 3 | Both cooling and heating systems | 100.0% | 2 |
| | Total | 100% | 2 |

## Q19 - Is your central air conditioning system a heat pump?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 2 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 2 |

## Q20 - What type of central heating system do you have?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Central furnace | 0.0% | 0 |
| 2 | Heat pump | 100.0% | 2 |
| 3 | Other (Please specify) | 0.0% | 0 |
| | Total | 100% | 2 |

Q20_3_TEXT - Other (Please specify)
Other (Please specify) - Text

## Q21 - What type of fuel does your central heating system use?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Natural gas | 0.0% | 0 |
| 2 | Electricity | 100.0% | 2 |
| 3 | Oil | 0.0% | 0 |
| 4 | Propane | 0.0% | 0 |
| 5 | Wood | 0.0% | 0 |
| | Total | 100% | 2 |

## Q22 - What type of thermostat did the rebated smart Wi-Fi thermostat replace?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | A standard manual thermostat that lets you set on/off temperatures | 50.0% | 1 |
| 2 | A programmable thermostat that allows you to schedule the temperature settings for different times of the day | 50.0% | 1 |
| 3 | A different Wi-Fi smart thermostat | 0.0% | 0 |
| 4 | It was not a replacement | 0.0% | 0 |
| | Total | 100% | 2 |

## Q23 - Which of the following best describes why you replaced your old Wi-Fi smart thermostat with a new one?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | The old Wi-Fi thermostat was not working | 0.0% | 0 |
| 2 | The old Wi-Fi thermostat was hard to use | 0.0% | 0 |
| 3 | You wanted to replace it for some other reason | 0.0% | 0 |
| 4 | You did not replace a Wi-Fi thermostat | 0.0% | 0 |
| | Total | | 0 |

## Q24 - Did the [Field-HEATPUMP_TYPE] replace some old heating and cooling equipment?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes, it replaced both cooling and heating equipment | 50.0% | 3 |
| 2 | Yes, it replaced cooling equipment | 0.0% | 0 |
| 3 | Yes, it replaced heating equipment | 50.0% | 3 |
| 4 | No, it was a new installation that did not replace any equipment | 0.0% | 0 |
| | Total | 100% | 6 |

## Q25 - Did the [Field-HEATPUMP_TYPE] replace a heat pump?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 2 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 2 |

**Q26 - Thinking about the old heat pump you replaced, which of the following best describes when and how it was originally installed in.**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | You bought the house new and the unit was original equipment when you bought it. | 0.0% | 0 |
| 2 | It was original equipment in a newly constructed home when the previous owner bought it. | 0.0% | 0 |
| 3 | It was there when you bought the house from a previous owner. | 50.0% | 1 |
| 4 | You or your family installed the old unit. | 50.0% | 1 |
| 5 | Other (Please specify) | 0.0% | 0 |
| | Total | 100% | 2 |

Q26_7_TEXT - Other (Please specify)
Other (Please specify) - Text

## Q27 - Do you know the approximate age of the old heat pump that was replaced?

| # | Answer | % | Count |
|---|---|---|---|
| 4 | Yes (How old was it?) | 100.0% | 1 |
| 5 | No | 0.0% | 0 |
| | Total | 100% | 1 |

## Q28 - How were you able to determine the age of the old heat pump?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Documentation included with the unit | 0.0% | 0 |
| 4 | Contractor knew or estimated it | 0.0% | 0 |
| 5 | Age of units was included in description of home when we bought it | 100.0% | 1 |
| 6 | Previous owner told us | 0.0% | 0 |
| 7 | Other (Please specify) | 0.0% | 0 |
| | Total | 100% | 1 |

## Q29 - Which of the following do you think is the most likely age of the old heat pump:

| # | Answer | % | Count |
|---|---|---|---|
| 1 | More than 20 years old | 0.0% | 0 |
| 4 | 15 – 20 years old | 0.0% | 0 |
| 5 | 10 – 15 years old | 0.0% | 0 |
| 6 | Less than 10 years old | 0.0% | 0 |
| | Total | | 0 |

**Q31 - Please provide the seasonal energy efficiency ratio or SEER of the heat pump that you replaced?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | SEER | 100.0% | 1 |
| | Total | 100% | 1 |

**Q32 - Please provide the Heating Seasonal Performance Factor or HSPF of the heat pump that you replaced?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | HSPF | 0.0% | 0 |
| | Total | | 0 |

**Q33 - What type of heating system did you have before you installed the [Field-HEATPUMP_TYPE]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electric resistance heating | 50.0% | 2 |
| 2 | An air source heat pump | 25.0% | 1 |
| 3 | Some other kind of heating system | 25.0% | 1 |
| 4 | No heating equipment | 0.0% | 0 |
| | Total | 100% | 4 |

## Q34 - Was your electric resistance heating system an electric furnace or baseboard heating?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electric furnace | 0.0% | 0 |
| 3 | Electric baseboard heating | 100.0% | 2 |
| | Total | 100% | 2 |

## Q36 - Thinking about the old equipment you replaced, which of the following best describes when and how it was originally installed in.

| # | Answer | % | Count |
|---|---|---|---|
| 1 | You bought the house new and the unit was original equipment when you bought it. | 25.0% | 1 |
| 2 | It was original equipment in a newly constructed home when the previous owner bought it. | 0.0% | 0 |
| 3 | It was there when you bought the house from a previous owner. | 25.0% | 1 |
| 4 | You or your family installed the old unit. | 25.0% | 1 |
| 5 | Other (Please specify) | 25.0% | 1 |
| | Total | 100% | 4 |

## Q37 - Do you know the approximate age of the equipment that was replaced?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes (How old was it?) | 0.0% | 0 |
| 2 | No | 100.0% | 1 |
| | Total | 100% | 1 |

## Q38 - How were you able to determine the age of the old equipment?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Documentation included with the unit | 0.0% | 0 |
| 2 | Contractor knew or estimated it | 0.0% | 0 |
| 3 | Age of units was included in description of home when we bought it | 0.0% | 0 |
| 4 | Previous owner told us | 0.0% | 0 |
| 5 | Other (Please specify) | 0.0% | 0 |
| | Total | | 0 |

## Q39 - Which of the following do you think is the most likely age of the old equipment:

| # | Answer | % | Count |
|---|---|---|---|
| 1 | More than 20 years old | 100.0% | 1 |
| 2 | 15 – 20 years old | 0.0% | 0 |
| 3 | 10 – 15 years old | 0.0% | 0 |
| 4 | Less than 10 years old | 0.0% | 0 |
| | Total | 100% | 1 |

## Q41 - Was the cooling equipment that you replaced a central air condition?

| # | Answer | % | Count |
|---|---|---|---|
| 4 | Yes | 100.0% | 1 |
| 5 | No | 0.0% | 0 |
| | Total | 100% | 1 |

## Q42 - Thinking about the old cooling equipment you replaced, which of the following best describes when and how it was originally installed in.

| # | Answer | % | Count |
|---|---|---|---|
| 1 | You bought the house new and the unit was original equipment when you bought it. | 100.0% | 1 |
| 2 | It was original equipment in a newly constructed home when the previous owner bought it. | 0.0% | 0 |
| 3 | It was there when you bought the house from a previous owner. | 0.0% | 0 |
| 4 | You or your family installed the old unit. | 0.0% | 0 |
| 5 | Other (Please specify) | 0.0% | 0 |
| | Total | 100% | 1 |

## Q43 - Do you know the approximate age of the old cooling equipment that was replaced?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes (How old was it?) | 0.0% | 0 |
| 2 | No | 0.0% | 0 |
| | Total | | 0 |

## Q44 - How were you able to determine the age of the old cooling equipment?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Documentation included with the unit | 0.0% | 0 |
| 2 | Contractor knew or estimated it | 0.0% | 0 |
| 3 | Age of units was included in description of home when we bought it | 0.0% | 0 |
| 4 | Previous owner told us | 0.0% | 0 |
| 5 | Other (Please specify) | 0.0% | 0 |
| | Total | | 0 |

## Q45 - Which of the following do you think is the most likely age of the old cooling equipment:

| # | Answer | % | Count |
|---|---|---|---|
| 4 | More than 20 years old | 0.0% | 0 |
| 5 | 15 – 20 years old | 0.0% | 0 |
| 6 | 10 – 15 years old | 0.0% | 0 |
| 7 | Less than 10 years old | 0.0% | 0 |
| | Total | | 0 |

**Q48 - Did the contractor that you worked with discuss equipment with different efficiency levels when you were deciding on the [Field-STAND_MEASURE1] that you installed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 7 |
| 2 | No | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 7 |

**Q49 - Did the contractor that you worked with recommend that you install the [Field-EFF_MEASURE1] instead of a standard efficiency [Field-STAND_MEASURE1]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 71.4% | 5 |
| 2 | No | 28.6% | 2 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 7 |

**Q50 - Did the contractor that you worked with tell you there was a rebate available for the efficient equipment through the Home Performance program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 57.1% | 4 |
| 2 | No | 42.9% | 3 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 7 |

**Q51 - On a scale where 0 means "not at all influential and 10 means "extremely influential," how influential was the recommendation in your decision to install the [Field-EFF_MEASURE1]?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all influential) | 20.0% | 1 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 20.0% | 1 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 20.0% | 1 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 20.0% | 1 |
| 10 | 10 (Very influential) | 20.0% | 1 |
| | Total | 100% | 5 |

**Q52 - Did you learn about the Home Performance program rebate before deciding to [Field-INSTALL1] the [Field-EFF_MEASURE1], after deciding to [Field-INSTALL1] the [Field-EFF_MEASURE1], or while making your decision?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Before deciding | 30.8% | 4 |
| 2 | After deciding | 23.1% | 3 |
| 3 | While deciding | 46.2% | 6 |
| | Total | 100% | 13 |

**Q53 - Prior to learning about the Home Performance program, did you have plans to [Field-INSTALL1] the [Field-EFF_MEASURE1]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 83.3% | 15 |
| 2 | No | 11.1% | 2 |
| 98 | Don't know | 5.6% | 1 |
| | Total | 100% | 18 |

**Q54 - Just to be clear, did you have plans to specifically [Field-INSTALL1] an [Field-EFF_MEASURE1] as opposed to a standard efficiency [Field-STAND_MEASURE1]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 7 |
| 2 | No | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 7 |

**Q55 - Was the [Field-EFF_MEASURE1] recommended during the home energy assessment?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 53.8% | 7 |
| 2 | No | 46.2% | 6 |
| | Total | 100% | 13 |

**Q56 - On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have [Field-INSTALLED1] the same [Field-EFF_MEASURE1] if it was not recommended through the home energy assessment?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all likely) | 0.0% | 0 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 14.3% | 1 |
| 3 | 3 | 14.3% | 1 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 14.3% | 1 |
| 7 | 7 | 14.3% | 1 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 (Very likely) | 42.9% | 3 |
| | Total | 100% | 7 |

**Q57 - Would you have been financially able to [Field-INSTALL1] the [Field-EFF_MEASURE1] without the financial assistance provided through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 94.1% | 16 |
| 2 | No | 5.9% | 1 |
| | Total | 100% | 17 |

**Q58 - Just to confirm, if the rebate was not available through the program, would you still have paid the additional cost to purchase an [Field-EFF_MEASURE1] instead of a [Field-STAND_MEASURE1]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 93.3% | 14 |
| 2 | No | 6.7% | 1 |
| | Total | 100% | 15 |

**Q59 - If the rebate was not available, what do you think you most likely would have done at the time when you purchased the [Field-EFF_MEASURE1]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Not installed anything | 25.0% | 1 |
| 4 | Installed a new but less energy efficient ${e://Field/STAND_MEASURE1} | 50.0% | 2 |
| 5 | Installed a similarly energy efficient ${e://Field/STAND_MEASURE1} | 25.0% | 1 |
| 6 | Installed the exact same ${e://Field/STAND_MEASURE1} | 0.0% | 0 |
| | Total | 100% | 4 |

**Q60 - On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have [Field-INSTALLED1] the same [Field-EFF_MEASURE1] at about the same time if the financial assistance was not available?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all likely) | 11.1% | 2 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 5.6% | 1 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 5.6% | 1 |
| 5 | 5 | 11.1% | 2 |
| 6 | 6 | 11.1% | 2 |
| 7 | 7 | 5.6% | 1 |
| 8 | 8 | 5.6% | 1 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 (Very likely) | 44.4% | 8 |
| | Total | 100% | 18 |

**Q61 - Did you [Field-INSTALL1] [Field-A_MORE_EFFICIENT_MORE1] [Field-EFF_MEASURE1] than you would have if you had not received a rebate through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 33.3% | 6 |
| 2 | No | 66.7% | 12 |
| | Total | 100% | 18 |

**Q62 - Did you [Field-INSTALL1] the [Field-EFF_MEASURE1] sooner than you would have if the information and financial assistance from the program had not been available?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 29.4% | 5 |
| 2 | No | 70.6% | 12 |
| | Total | 100% | 17 |

**Q63 - When might you have [Field-INSTALLED1] the same [Field-EFF_MEASURE1] if you had not participated in the program? Would you say ...**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Within 6 months of when you purchased or installed it | 20.0% | 1 |
| 2 | Between 6 months and 1 year | 60.0% | 3 |
| 3 | In more than 1 year to 2 years | 20.0% | 1 |
| 4 | In 2 to 3 years | 0.0% | 0 |
| 5 | In more than 3 years | 0.0% | 0 |
| 6 | Never | 0.0% | 0 |
| | Total | 100% | 5 |

**Q64 - Did the contractor that you worked with discuss equipment with different efficiency levels when you were deciding on the [Field-STAND_MEASURE2] that you installed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 0.0% | 0 |
| | Total | | 0 |

**Q65 - Did the contractor that you worked with recommend that you install the [Field-EFF_MEASURE2] instead of a standard efficiency [Field-STAND_MEASURE2]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 0.0% | 0 |
| | Total | | 0 |

**Q66 - Did the contractor that you worked with tell you there was a rebate available for the efficient equipment through the Home Performance program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 0.0% | 0 |
| | Total | | 0 |

**Q67 - On a scale where 0 means "not at all influential and 10 means "extremely influential," how influential was the recommendation in your decision to install the [Field-EFF_MEASURE2]?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all influential) | 0.0% | 0 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 0.0% | 0 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 (Very influential) | 0.0% | 0 |
| | Total | | 0 |

**Q68 - Did you learn about the Home Performance program rebate before deciding to [Field-INSTALL2] the [Field-EFF_MEASURE2], after deciding to [Field-INSTALL2] the [Field-EFF_MEASURE2], or while making your decision?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Before deciding | 0.0% | 0 |
| 2 | After deciding | 0.0% | 0 |
| 3 | While deciding | 0.0% | 0 |
| | Total | | 0 |

**Q69 - Prior to learning about the Home Performance program, did you have plans to [Field-INSTALL2] the [Field-EFF_MEASURE2]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 1 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 1 |

**Q70 - Just to be clear, did you have plans to specifically [Field-INSTALL2] an [Field-EFF_MEASURE2] as opposed to a standard efficiency [Field-STAND_MEASURE2]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 1 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 1 |

**Q71 - Was the [Field-EFF_MEASURE2] recommended during the home energy assessment?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 100.0% | 1 |
| | Total | 100% | 1 |

**Q72 - On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have [Field-INSTALLED2] the same [Field-EFF_MEASURE2] if it was not recommended through the home energy assessment?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all likely) | 0.0% | 0 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 0.0% | 0 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 (Very likely) | 0.0% | 0 |
| | Total | | 0 |

**Q73 - Would you have been financially able to [Field-INSTALL2] the [Field-EFF_MEASURE2] without the financial assistance provided through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 1 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 1 |

**Q74 - Just to confirm, if the rebate was not available through the program, would you still have paid the additional cost to purchase an [Field-EFF_MEASURE2] instead of a [Field-STAND_MEASURE2]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 1 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 1 |

**Q75 - If the rebate was not available, what do you think you most likely would have done at the time when you purchased the [Field-EFF_MEASURE2]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Not installed anything | 0.0% | 0 |
| 4 | Installed a new but less energy efficient ${e://Field/STAND_MEASURE2} | 0.0% | 0 |
| 5 | Installed a similarly energy efficient ${e://Field/STAND_MEASURE2} | 0.0% | 0 |
| 6 | Installed the exact same ${e://Field/STAND_MEASURE2} | 0.0% | 0 |
| | Total | | 0 |

**Q76 - On a scale of 0 to 10 where 0 represents "Not at all likely" and 10 represents "Very likely," how likely is it that you would have [Field-INSTALLED2] the same [Field-EFF_MEASURE2] at about the same time if the financial assistance was not available?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all likely) | 0.0% | 0 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 0.0% | 0 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 (Very likely) | 100.0% | 1 |
| | Total | 100% | 1 |

**Q77 - Did you [Field-INSTALL2] [Field-A_MORE_EFFICIENT_MORE2] [Field-EFF_MEASURE2] than you would have if you had not received a rebate through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 1 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 1 |

**Q78 - Did you [Field-INSTALL2] the [Field-EFF_MEASURE2] sooner than you would have if the information and financial assistance from the program had not been available?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 1 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 1 |

**Q79 - When might you have [Field-INSTALLED2] the same [Field-EFF_MEASURE2] if you had not participated in the program? Would you say ...**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Within 6 months of when you purchased or installed it | 100.0% | 1 |
| 2 | Between 6 months and 1 year | 0.0% | 0 |
| 3 | In more than 1 year to 2 years | 0.0% | 0 |
| 4 | In 2 to 3 years | 0.0% | 0 |
| 5 | In more than 3 years | 0.0% | 0 |
| 6 | Never | 0.0% | 0 |
| | Total | 100% | 1 |

**Q80 - Had you purchased and installed any [Field-DIMEASURE1] before you received them for free through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 80.8% | 101 |
| 2 | No | 16.0% | 20 |
| 98 | Don't know | 3.2% | 4 |
| | Total | 100% | 125 |

**Q81 - Did you have plans to purchase and install [Field-DIMEASURE1] before you learned about the Home Performance program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 82.0% | 91 |
| 2 | No | 18.0% | 20 |
| | Total | 100% | 111 |

**Q82 - If you had not received them for free through the program, how many of the ${e://Field/DIMEASUR**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | None – would not have purchased any | 14.4% | 14 |
| 2 | Some of them but not all (How many?) | 56.7% | 55 |
| 3 | The same number that you received for free through the program | 28.9% | 28 |
| | Total | 100% | 97 |

**Q83 - Using a scale where 0 means "not at all likely" and 10 means "very likely", how likely is it that you would have purchased and installed the [Field-DIMEASURE1] on your own without receiving them for free through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all likely) | 6.3% | 8 |
| 1 | 1 | 2.4% | 3 |
| 2 | 2 | 5.6% | 7 |
| 3 | 3 | 3.2% | 4 |
| 4 | 4 | 4.0% | 5 |
| 5 | 5 | 11.1% | 14 |
| 6 | 6 | 8.7% | 11 |
| 7 | 7 | 7.1% | 9 |
| 8 | 8 | 11.9% | 15 |
| 9 | 9 | 4.8% | 6 |
| 10 | 10 (Very likely) | 34.9% | 44 |
| | Total | 100% | 126 |

**Q84 - Had you purchased and installed any [Field-DIMEASURE2] before you received them for free through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 46.2% | 6 |
| 2 | No | 53.8% | 7 |
| | Total | 100% | 13 |

**Q85 - Did you have plans to purchase and install [Field-DIMEASURE2] before you learned about the Home Performance program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 25.0% | 3 |
| 2 | No | 75.0% | 9 |
| | Total | 100% | 12 |

**Q86 - If you had not received them for free through the program, how many of the ${e://Field/DIMEASUR**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | None – would not have purchased any | 42.9% | 3 |
| 2 | Some of them but not all (How many?) | 42.9% | 3 |
| 3 | The same number that you received for free through the program | 14.3% | 1 |
| | Total | 100% | 7 |

**Q87 - Using a scale where 0 means "not at all likely" and 10 means "very likely", how likely is it that you would have purchased and installed the [Field-DIMEASURE2] on your own without receiving them for free through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all likely) | 23.1% | 3 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 30.8% | 4 |
| 4 | 4 | 7.7% | 1 |
| 5 | 5 | 7.7% | 1 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 7.7% | 1 |
| 8 | 8 | 7.7% | 1 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 (Very likely) | 15.4% | 2 |
| | Total | 100% | 13 |

**Q88 - Had you purchased and installed any [Field-DIMEASURE3] before you received them for free through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 100.0% | 3 |
| | Total | 100% | 3 |

**Q89 - Did you have plans to purchase and install [Field-DIMEASURE3] before you learned about the Home Performance program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 100.0% | 3 |
| | Total | 100% | 3 |

**Q90 - If you had not received them for free through the program, how many of the ${e://Field/DIMEASUR**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | None – would not have purchased any | 100.0% | 1 |
| 2 | Some of them but not all (How many?) | 0.0% | 0 |
| 3 | The same number that you received for free through the program | 0.0% | 0 |
| | Total | 100% | 1 |

**Q91 - Using a scale where 0 means "not at all likely" and 10 means "very likely", how likely is it that you would have purchased and installed the [Field-DIMEASURE3] on your own without receiving them for free through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 (Not at all likely) | 66.7% | 2 |
| 1 | 1 | 33.3% | 1 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 0.0% | 0 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 (Very likely) | 0.0% | 0 |
| | Total | 100% | 3 |

**Q92 - Have you bought and installed any additional energy efficient items on your own in the past 12 months without a financial incentive or rebate from Appalachian Power because of your experience with the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 43.0% | 58 |
| 2 | No | 57.0% | 77 |
| | Total | 100% | 135 |

## Q93 - What did you purchase and install without getting an Appalachian Power rebate or discount? (Select all that apply)

| # | Answer | % | Count |
|---|---|---|---|
| 1 | LED (Light Emitting Diode) Bulbs | 50.0% | 29 |
| 2 | ENERGY STAR appliance such as a refrigerator, dishwasher, clothes washer, or clothes dryer | 36.2% | 21 |
| 3 | Water heater pipe insulation | 15.5% | 9 |
| 4 | Water heater jacket, blanket, or insulation | 8.6% | 5 |
| 5 | Energy and water efficient faucet aerators | 13.8% | 8 |
| 6 | Energy and water efficient showerheads | 24.1% | 14 |
| 7 | ENERGY STAR room air conditioner | 8.6% | 5 |
| 8 | Energy efficient water heater | 13.8% | 8 |
| 9 | Smart thermostat | 27.6% | 16 |
| 10 | Something else | 31.0% | 18 |
| | Total | 100% | 58 |

## Q94 - Why did you not get an Appalachian Power rebate, or discount for that energy saving equipment?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Did not know an incentive, rebate, or discount was available | 52.9% | 27 |
| 2 | Did not want to complete an application | 3.9% | 2 |
| 3 | For some other reason (Please explain) | 35.3% | 18 |
| 4 | I did get an incentive | 7.8% | 4 |
| | Total | 100% | 51 |

**Q111 - Thinking about the contractor that completed the work in your home for the [Field-ALL_MAJ_MEASURES], how much do you agree with the following statements:**

| # | Question | 1 (Completely agree) | | 2 | | 3 | | 4 | | 5 (Completely agree) | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | The contractor was timely in completing the work | 17.6% | 3 | 0.0% | 0 | 0.0% | 0 | 23.5% | 4 | 58.8% | 10 | 17 |
| 2 | The contractor's work was of high quality | 11.8% | 2 | 5.9% | 1 | 0.0% | 0 | 17.6% | 3 | 64.7% | 11 | 17 |
| 3 | The contractor was courteous and professional | 17.6% | 3 | 0.0% | 0 | 5.9% | 1 | 5.9% | 1 | 70.6% | 12 | 17 |

**Q112 - Overall, how satisfied are you with the efficiency improvements to your home? Would you say you are...**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very dissatisfied | 1.6% | 2 |
| 2 | Somewhat dissatisfied | 3.1% | 4 |
| 3 | Neither satisfied nor dissatisfied | 11.0% | 14 |
| 4 | Somewhat satisfied | 26.8% | 34 |
| 5 | Very satisfied | 57.5% | 73 |
| | Total | 100% | 127 |

**Q114 - How satisfied are you with the Appalachian Power Home Performance program, overall? Would you say you are...**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very dissatisfied | 5.3% | 7 |
| 2 | Somewhat dissatisfied | 8.4% | 11 |
| 3 | Neither satisfied nor dissatisfied | 7.6% | 10 |
| 4 | Somewhat satisfied | 22.9% | 30 |
| 5 | Very satisfied | 55.7% | 73 |
| | Total | 100% | 131 |

**Q118 - Do you own the home where the project was completed, rent it, or own it and rent it to someone else?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Own | 98.4% | 127 |
| 2 | Rent | 0.8% | 1 |
| 3 | Own and rent to someone else | 0.8% | 1 |
| | Total | 100% | 129 |

## Q119 - Which of the following best describes your home? Is it a...

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Manufactured home | 1.6% | 2 |
| 2 | Single-family house detached from any other house | 90.7% | 117 |
| 3 | Single family house attached to one or more other houses, for example, duplex, row house, or townhome | 6.2% | 8 |
| 4 | Apartment in a building with 2 to 3 units | 0.0% | 0 |
| 5 | Apartment in a building with 4 or more units | 0.0% | 0 |
| 6 | Other (Please describe) | 1.6% | 2 |
| | Total | 100% | 129 |

## Q120 - Is your home...

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Single story | 31.2% | 39 |
| 2 | A one and a half story home | 14.4% | 18 |
| 3 | A two story home | 40.0% | 50 |
| 4 | A three story home | 14.4% | 18 |
| | Total | 100% | 125 |

## Q121 - What fuel does your main water heater use?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electricity | 76.0% | 98 |
| 2 | Natural Gas | 17.1% | 22 |
| 3 | Propane | 4.7% | 6 |
| 4 | Something else (Please describe) | 2.3% | 3 |
| 5 | Don't heat home | 0.0% | 0 |
| | Total | 100% | 129 |

## Q122 - What fuel does your main heating system use?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electricity | 75.0% | 96 |
| 2 | Natural Gas | 16.4% | 21 |
| 3 | Propane | 3.9% | 5 |
| 4 | Something else (Please describe) | 4.7% | 6 |
| 5 | Don't heat home | 0.0% | 0 |
| | Total | 100% | 128 |

# 9. Low Income Single Family Participant Survey Results

**Q2 - We are conducting a study to evaluate the Appalachian Power Weatherization Assistance Program. Appalachian Power will use the results of this evaluation to determine the effectiveness of the program and to make improvements. The interview will take approximately 10 minutes. May I ask you a few questions?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 10 |
| 2 | No (Thank respondent and terminate interview) | 0.0% | 0 |
| | Total | 100% | 10 |

**Q3 - Our records indicate that you participated in the Weatherization Assistance Program by completing an energy audit and receiving several energy efficient measures installed in your home. Do you recall participating in this program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 10 |
| 2 | No | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 10 |

**Q7 - How did you learn of the Weatherization Assistance Program sponsored by Appalachian Power and administered by your local Community Action Agency? (Select all that apply)**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | An Appalachian Power representative mentioned it | 10.0% | 1 |
| 2 | The Appalachian Power website | 0.0% | 0 |
| 3 | From a local Community Action Agency or weatherization service provider | 20.0% | 2 |
| 4 | Friend, relative, coworker, or neighbor | 60.0% | 6 |
| 5 | In some other way | 20.0% | 2 |
| 98 | Don't know | 10.0% | 1 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 10 |

**Q9 - Why did you choose to participate in the program? (Select all that apply)**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | To save money on energy bill(s) | 60.0% | 6 |
| 2 | To reduce energy use for environmental reasons | 0.0% | 0 |
| 3 | The services were provided free of charge | 0.0% | 0 |
| 4 | Improve home comfort | 10.0% | 1 |
| 5 | Improve value of the home | 20.0% | 2 |
| 6 | Other | 20.0% | 2 |
| 98 | Don't know | 0.0% | 0 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 10 |

**Q11 - Now I'll ask some questions about the energy audit that was provided as a part of this program. Did someone visit your household to discuss ways of savings energy and to install energy efficient equipment?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 90.0% | 9 |
| 2 | No | 0.0% | 0 |
| 98 | Don't know | 10.0% | 1 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 10 |

**Q12 - Did you schedule that appointment?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 66.7% | 6 |
| 2 | No | 22.2% | 2 |
| 98 | Don't know | 11.1% | 1 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 9 |

**Q13 - On a scale of 1 to 5, where 1 is "very difficult" and 5 is "very easy," how would you rate the process of scheduling of the visit?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 (Very difficult) | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 33.3% | 2 |
| 5 | 5 (Very easy) | 66.7% | 4 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 6 |

**Q14 - Were you in your household at the time of this visit?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 9 |
| 2 | No | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 9 |

**Q15 - Did the person who visited your home examine your appliances or building structure for energy efficiency?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 77.8% | 7 |
| 2 | No | 22.2% | 2 |
| 98 | Don't know | 0.0% | 0 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 9 |

**Q16 - During the visit to your home, did the program representative talk to you about how to save energy in your home, or provide recommendations about how to use your appliances and equipment in an energy efficient way?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 77.8% | 7 |
| 2 | No | 11.1% | 1 |
| 98 | Don't know | 11.1% | 1 |
| 99 | Refused | 0.0% | 0 |
| | Total | 100% | 9 |

**Q17 - Using a scale where 1 means completely disagree and 5 means completely agree, how much do you agree with the following statements about the work that was done on the home:**

| # | Question | Completely disagree1 | | 2 | | 3 | | 4 | | Completely agree5 | | Don't know | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | The completion of the work was timely and efficient | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 22.2% | 2 | 77.8% | 7 | 0.0% | 0 | 9 |
| 2 | The work crew was courteous and professional | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 9 | 0.0% | 0 | 9 |
| 3 | The information provided about your home's energy use was useful | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 22.2% | 2 | 77.8% | 7 | 0.0% | 0 | 9 |
| 4 | The information provided about your home's energy use was easy to understand | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 22.2% | 2 | 77.8% | 7 | 0.0% | 0 | 9 |

**Q18 - Now we would like some information on the measures you installed through the program. According to our records you received the following energy efficiency improvements through the program. Please indicate if the information seems correct. (READ LIST)**

| # | Question | Correct | | Incorrect | | Don't know | | Refused | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Air sealing to reduce drafts in your home | 100.0% | 6 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 6 |
| 2 | Ceiling, attic, wall, and/or floor insulation | 90.0% | 9 | 10.0% | 1 | 0.0% | 0 | 0.0% | 0 | 10 |
| 3 | Sealing or insulating your heating and cooling system ducts | 100.0% | 1 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 1 |
| 4 | An energy efficient heat pump | 100.0% | 5 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 5 |
| 5 | An energy efficient furnace | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 6 | Heating and cooling system tune-up or maintenance | 100.0% | 1 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 1 |
| 7 | Hot water heater pipe wrap | 83.3% | 5 | 0.0% | 0 | 16.7% | 1 | 0.0% | 0 | 6 |
| 8 | Hot water heater tank wrap | 100.0% | 5 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 5 |
| 9 | Reduction in hot water heater temperature | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 10 | An energy efficient hot water heater | 100.0% | 1 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 1 |
| 11 | An energy efficient refrigerator | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 12 | An energy efficient window air conditioner | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 13 | Kitchen or bathroom ventilation fan | 100.0% | 1 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 1 |
| 14 | An energy efficient freezer | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |

**Q19 - Our records show that [Field-LED_QUANT] LED lightbulbs were installed in your home. Have any of those light bulbs been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 100.0% | 5 |
| 2 | Yes (How many have been removed?) | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 5 |

**Q20 - Our records show that [Field-BATH_AERATOR_QUANT] bathroom faucet aerator(s) were installed in your home. Have any of those bathroom faucet aerators been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 100.0% | 2 |
| 2 | Yes (How many have been removed?) | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 2 |

**Q21 - Our records show that [Field-KITCHEN_AERATOR_QUANT] kitchen faucet aerator(s) were installed in your home. Have any of those kitchen faucet aerators been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 0.0% | 0 |
| 2 | Yes (How many have been removed?) | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | | 0 |

**Q22 - Our records show that [Field-UNSPECIFIED_AERATOR_QUANT] faucet aerators were installed in your home. Have any of those faucet aerators been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 0.0% | 0 |
| 2 | Yes (How many have been removed?) | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | | 0 |

**Q23 - Our records show that [Field-SHOWER_QUANT] showerheads were installed in your home. Have any of those showerheads been removed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No | 100.0% | 3 |
| 2 | Yes (How many have been removed?) | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 3 |

## Q24 - How many shower heads does your home have in total?

How many shower heads does your home have in total?

2

2

2

## Q25 - Overall, how satisfied are you with the efficiency improvements to your home? Would you say you are...

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very dissatisfied | 0.0% | 0 |
| 2 | Somewhat dissatisfied | 0.0% | 0 |
| 3 | Neither satisfied nor dissatisfied | 0.0% | 0 |
| 4 | Somewhat satisfied | 10.0% | 1 |
| 5 | Very satisfied | 80.0% | 8 |
| 98 | Don't know | 10.0% | 1 |
| | Total | 100% | 10 |

**Q27 - How satisfied are you with the Appalachian Power Weatherization Program, overall? Would you say you are...**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very dissatisfied | 0.0% | 0 |
| 2 | Somewhat dissatisfied | 10.0% | 1 |
| 3 | Neither satisfied nor dissatisfied | 0.0% | 0 |
| 4 | Somewhat satisfied | 0.0% | 0 |
| 5 | Very satisfied | 90.0% | 9 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 10 |

**Q29 - Do you have any suggestions for how the Weatherization Program could**

**Q31 - Do you own the home where the project was completed, rent it, or own it and rent it to someone else?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Own | 80.0% | 8 |
| 2 | Rent | 20.0% | 2 |
| 3 | Own and rent to someone else | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 10 |

## Q32 - Which of the following best describes your home?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Manufactured home | 30.0% | 3 |
| 2 | Single-family house detached from any other house | 50.0% | 5 |
| 3 | Single family house attached to one or more other houses, for example, duplex, row house, or townhome | 0.0% | 0 |
| 4 | Apartment in a building with 2 to 3 units | 0.0% | 0 |
| 5 | Apartment in a building with 4 or more units | 0.0% | 0 |
| 6 | Other | 20.0% | 2 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 10 |

## Q33 - What fuel does your main water heater use?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electricity | 100.0% | 10 |
| 2 | Natural Gas | 0.0% | 0 |
| 3 | Propane | 0.0% | 0 |
| 4 | Something else | 0.0% | 0 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 10 |

## Q35 - What fuel does your main heating system use?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electricity | 70.0% | 7 |
| 2 | Natural Gas | 0.0% | 0 |
| 3 | Propane | 20.0% | 2 |
| 4 | Something else | 10.0% | 1 |
| 98 | Don't know | 0.0% | 0 |
| | Total | 100% | 10 |

# 10. Low Income Multifamily Tenant Survey Results

**Q1 - This survey is about your experience with the energy efficiency improvements made to your living unit through Appalachian Power Multifamily Program. Our records indicate that the following energy saving improvements were made to your residence through Appalachian Power Multifamily Program. Can you confirm that the following improvements were made?**

| # | Question | Yes, this improvement was made | | No, this improvement was not made | | Don't know | | Total |
|---|---|---|---|---|---|---|---|---|
| 1 | Installed LED light bulb(s) | 80.0% | 8 | 20.0% | 2 | 0.0% | 0 | 10 |
| 2 | Installed hot water heater pipe wrap | 80.0% | 8 | 10.0% | 1 | 10.0% | 1 | 10 |
| 3 | Installed a water heater blanket / tank wrap | 66.7% | 6 | 0.0% | 0 | 33.3% | 3 | 9 |
| 4 | Lowered the temperature on the water heater | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 5 | Installed faucet aerator(s) | 70.0% | 7 | 20.0% | 2 | 10.0% | 1 | 10 |
| 6 | Installed low flow showerhead(s) | 100.0% | 6 | 0.0% | 0 | 0.0% | 0 | 6 |
| 7 | Installed a heat pump water heater | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 8 | Installed an air source heat pump | 80.0% | 4 | 20.0% | 1 | 0.0% | 0 | 5 |
| 9 | Installed a mini split heat pump | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 10 | Added insulation | 66.7% | 2 | 0.0% | 0 | 33.3% | 1 | 3 |
| 11 | Sealed air leaks | 50.0% | 5 | 10.0% | 1 | 40.0% | 4 | 10 |
| 12 | Sealed your heating and cooling ducts | 100.0% | 3 | 0.0% | 0 | 0.0% | 0 | 3 |
| 13 | Insulated your heating and cooling ducts | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |

| # | Question | Yes, this improvement was made | | No, this improvement was not made | | Don't know | | Total |
|---|---|---|---|---|---|---|---|---|
| 14 | Completed a tune up of your heat pump or air conditioner | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 15 | Installed a smart thermostat | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 16 | Installed a window air conditioner(s) | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 17 | Installed a refrigerator | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 18 | Installed a ceiling fan | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | undefined |
| 19 | Installed power strip(s) | 66.7% | 2 | 0.0% | 0 | 33.3% | 1 | 3 |

**Q2 - We would also like to know if you have removed and are no longer using any of the equipment that was installed through Appalachian Power Multifamily Program. For each of the following, please indicate if you have removed and are no longer using that equipment. Also, please write the number of items removed, if applicable.**

| # | Question | No, have not removed equipment | | Yes, removed equipment | | Total |
|---|---|---|---|---|---|---|
| 1 | LED light bulb(s) | 87.5% | 7 | 12.5% | 1 | 8 |
| 2 | Faucet aerator(s) | 85.7% | 6 | 14.3% | 1 | 7 |
| 3 | Showerhead(s) | 66.7% | 4 | 33.3% | 2 | 6 |
| 4 | Advanced power strip(s) | 50.0% | 1 | 50.0% | 1 | 2 |

**Q7 - Were you home when the energy efficiency improvements were completed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 90.0% | 9 |
| 2 | No | 10.0% | 1 |
| | Total | 100% | 10 |

**Q8 - Did a program representative speak with you about tips on how to save energy?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 40.0% | 4 |
| 2 | No | 60.0% | 6 |
| | Total | 100% | 10 |

**Q9 - Did you receive any printed material from the program with tips on how to save energy?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 20.0% | 2 |
| 2 | No | 80.0% | 8 |
| | Total | 100% | 10 |

## Q10 - Using the scale below, how satisfied or dissatisfied are you with the following...

| # | Question | Very satisfied | | Somewhat satisfied | | Neither satisfied nor dissatisfied | | Somewhat dissatisfied | | Very dissatisfied | | Don't know/ Not applicable | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | The energy efficiency improvements made to your living unit? | 30.0% | 3 | 60.0% | 6 | 10.0% | 1 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 10 |
| 2 | The interactions you had with the people who completed the energy efficiency improvements in your living unit? | 33.3% | 3 | 44.4% | 4 | 11.1% | 1 | 0.0% | 0 | 11.1% | 1 | 0.0% | 0 | 9 |
| 3 | The information about the improvements made to your living unit or tips on how to save energy? | 25.0% | 1 | 75.0% | 3 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 4 |
| 4 | The savings on your monthly utility bills? | 20.0% | 2 | 30.0% | 3 | 30.0% | 3 | 0.0% | 0 | 10.0% | 1 | 10.0% | 1 | 10 |
| 5 | Your overall experience? | 30.0% | 3 | 40.0% | 4 | 10.0% | 1 | 0.0% | 0 | 10.0% | 1 | 10.0% | 1 | 10 |

**Q12 - Have you seen any benefits from the energy efficiency improvements made to your living unit? Please select up to three.**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | My living unit feels more comfortable | 60.0% | 6 |
| 2 | Reduced my electricity costs | 30.0% | 3 |
| 3 | There is less noise from the outside | 10.0% | 1 |
| 4 | There is less noise from the appliances | 20.0% | 2 |
| 5 | I or my family have experienced health improvements | 20.0% | 2 |
| 6 | The living unit is safer | 20.0% | 2 |
| 7 | The appliances and heating or cooling equipment are more reliable | 20.0% | 2 |
| 8 | Other (Please describe) | 20.0% | 2 |
| 9 | No, I have not seen any benefits | 20.0% | 2 |
| | Total | 100% | 10 |

**Q13 - Using the scale below, please rate how important saving energy in your living unit is to you?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Not at all important | 0.0% | 0 |
| 2 | Slightly important | 0.0% | 0 |
| 3 | Moderately important | 20.0% | 2 |
| 4 | Very important | 40.0% | 4 |
| 5 | Extremely important | 40.0% | 4 |
| | Total | 100% | 10 |

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# 11. Low Income Multifamily Property Manager Survey Results

**Q1 - According to program records, the [Field-Property] property participated in Appalachian Power's Low Income Multifamily program by having energy efficient equipment installed at the property. Are you aware of this property's participation in the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 2 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 2 |

**Q2 - The program records indicate that the following improvements were made at the property. For each of these improvements, please indicate if the improvement was made at the property.**

| # | Question | Yes | | No | | Total |
|---|---|---|---|---|---|---|
| 1 | Added insulation | 0.0% | 0 | 0.0% | 0 | undefined |
| 2 | Completed heat pump or air conditioner tune ups | 100.0% | 2 | 0.0% | 0 | 2 |
| 3 | Installed mini split heat pumps | 0.0% | 0 | 0.0% | 0 | undefined |
| 4 | Installed ceiling fans | 0.0% | 0 | 0.0% | 0 | undefined |
| 5 | Installed heat pump water heaters | 0.0% | 0 | 0.0% | 0 | undefined |
| 6 | Installed refrigerators | 0.0% | 0 | 0.0% | 0 | undefined |
| 7 | Installed smart thermostats | 0.0% | 0 | 0.0% | 0 | undefined |
| 8 | Installed water heater blankets / tank wraps | 100.0% | 1 | 0.0% | 0 | 1 |
| 9 | Installed window air conditioners | 0.0% | 0 | 0.0% | 0 | undefined |
| 10 | Installed air source heat pumps | 100.0% | 2 | 0.0% | 0 | 2 |
| 11 | Installed faucet aerators | 100.0% | 1 | 0.0% | 0 | 1 |
| 12 | Installed hot water pipe wrap | 100.0% | 1 | 0.0% | 0 | 1 |
| 13 | Installed LED light bulbs | 0.0% | 0 | 0.0% | 0 | undefined |
| 14 | Installed low flow showerheads | 100.0% | 1 | 0.0% | 0 | 1 |
| 15 | Installed advanced power strips | 0.0% | 0 | 0.0% | 0 | undefined |
| 16 | Insulated your heating and cooling ducts | 0.0% | 0 | 0.0% | 0 | undefined |
| 17 | Sealed heating and cooling ducts | 0.0% | 0 | 0.0% | 0 | undefined |
| 18 | Lowered the temperatures on water heaters | 0.0% | 0 | 0.0% | 0 | undefined |
| 19 | Sealed air leaks | 0.0% | 0 | 0.0% | 0 | undefined |

**Q5 - Did all of the tenant units at this property have energy efficiency improvements made to them through the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 2 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 2 |

**Q6 - Has your office had any requests to remove or modify any of the installed improvements?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 100.0% | 2 |
| | Total | 100% | 2 |

**Q9 - How did you first learn about Appalachian Power's energy efficiency improvements for low-income multifamily properties?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | From a Community Housing Partners program staff person | 50.0% | 1 |
| 2 | From an Appalachian Power program staff person | 0.0% | 0 |
| 3 | From a search engine (Google, Yahoo, Bing) | 0.0% | 0 |
| 4 | From another person in your organization | 0.0% | 0 |
| 5 | Previously participated in the program | 0.0% | 0 |
| 6 | Appalachian Power's website | 0.0% | 0 |
| 7 | Other | 50.0% | 1 |
| | Total | 100% | 2 |

**Q12 - What were the main reason(s) for deciding to complete the energy efficiency improvements at the property? (Select all that apply)**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Improve tenant comfort and satisfaction | 100.0% | 2 |
| 2 | Reduce tenant utility bills | 100.0% | 2 |
| 3 | Reduce property utility bills | 50.0% | 1 |
| 4 | To take advantage of rebates/no-cost efficiency improvements | 0.0% | 0 |
| 5 | To replace old or non-functioning equipment | 100.0% | 2 |
| 6 | To make the units more attractive to prospective tenants | 0.0% | 0 |
| 7 | Some other reason | 0.0% | 0 |
| | Total | 100% | 2 |

**Q14 - Did a representative from the Low Income Multifamily Program provide an energy audit of your property?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 50.0% | 1 |
| 2 | No | 50.0% | 1 |
| | Total | 100% | 2 |

**Q15 - Using the scale provided, please indicate your agreement with the following statements regarding the program representative that completed the assessment.**

| # | Question | Strongly disagree1 | | 2 | | 3 | | 4 | | Strongly agree5 | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | The representative was courteous and knowledgeable | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 1 | 1 |
| 2 | The assessment was completed efficiently | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 1 | 1 |
| 3 | The assessment was comprehensive | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 1 | 1 |
| 4 | The recommendations based on the energy assessment were appropriate for my property | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 1 | 1 |

**Q16 - Were there any recommended property improvements or equipment replacements that you did not implement?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 0.0% | 0 |
| | Total | | 0 |

**Q18 - To the best of your knowledge, what percentage of the units that received improvements was the tenant home when the improvements were made? If you are not sure, please estimate the approximate percentage of units who are at home during the day.**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Percentage of units | 100.0% | 2 |
| | Total | 100% | 2 |

| # | Answer | % | Count |
|---|---|---|---|
| 60 | 60 | 50.0% | 1 |
| 75 | 75 | 50.0% | 1 |
| | Total | 100% | 2 |

**Q19 - Based on your recent experience with the Low Income Multifamily Program, please rate your level of satisfaction with the people who performed work at this property. Please select N/A if an item is not applicable to you.**

| # | Question | Very dissatisfied | | Somewhat dissatisfied | | Neutral | | Somewhat satisfied | | Very satisfied | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | On-time arrival for appointment | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 50.0% | 1 | 50.0% | 1 | 2 |
| 2 | Courtesy and professionalism | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 2 |
| 3 | Willingness to help | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 2 |
| 4 | Product/service/program knowledge | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 2 |
| 5 | Preparedness (i.e., came with all tools/parts needed) | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 2 |
| 6 | Length of time required to perform the installation/service | 0.0% | 0 | 0.0% | 0 | 50.0% | 1 | 50.0% | 1 | 0.0% | 0 | 2 |
| 7 | Quality of the installation / service | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 0.0% | 0 | 2 |
| 8 | Condition in which site was left | 0.0% | 0 | 0.0% | 0 | 50.0% | 1 | 0.0% | 0 | 50.0% | 1 | 2 |
| 9 | Quality of the educational materials left behind | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 50.0% | 1 | 50.0% | 1 | 2 |
| 10 | Your overall experience with the field representative | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 2 |

**Q21 - Based on this experience, how likely are you to recommend Low Income Multifamily Program to a colleague?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very unlikely | 0.0% | 0 |
| 2 | Somewhat unlikely | 0.0% | 0 |
| 3 | Neither likely nor unlikely | 0.0% | 0 |
| 4 | Somewhat likely | 0.0% | 0 |
| 5 | Very likely | 100.0% | 2 |
| | Total | 100% | 2 |

**Q22 - Thinking about your most recent experience with the program, how satisfied are you with:**

| # | Question | Very dissatisfied | | Dissatisfied | | Neutral | | Satisfied | | Very satisfied | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | the steps you had to take to get through the program | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 0.0% | 0 | 2 |
| 2 | the energy efficiency improvements made through the program | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 100.0% | 2 | 2 |

**Q24 - Have you heard any feedback from tenants about the energy efficiency improvements made?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 2 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 2 |

**Q25 - Would you describe the feedback you heard as mostly positive, mostly negative, or mixed?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Mostly positive | 100.0% | 2 |
| 2 | A mix of positive and negative feedback | 0.0% | 0 |
| 3 | Mostly negative | 0.0% | 0 |
| | Total | 100% | 2 |

## Q30 - What is the primary type of heating fuel used at this property?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electricity | 100.0% | 2 |
| 2 | Natural gas | 0.0% | 0 |
| 3 | Propane (bottled gas) | 0.0% | 0 |
| 4 | Oil | 0.0% | 0 |
| 5 | Other | 0.0% | 0 |
| | Total | 100% | 2 |

## Q32 - What is the primary type of heating system?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Forced air furnace with ducts to individual rooms | 50.0% | 1 |
| 2 | Central boiler with radiators and pipes in each unit | 0.0% | 0 |
| 3 | District steam with radiators or pipes in each room | 0.0% | 0 |
| 4 | Air source heat pump | 50.0% | 1 |
| 5 | Electric resistance baseboard heat | 0.0% | 0 |
| 6 | Radiant hot water baseboard heat | 0.0% | 0 |
| 7 | Other | 0.0% | 0 |
| | Total | 100% | 2 |

| | | |
|---|---|---|
| Q32_7_TEXT<br>Other - Text | - | Other |

## Q34 - Does this property have a central system that provides hot water to multiple tenant units?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 100.0% | 2 |
| | Total | 100% | 2 |

## Q35 - What is the primary type of water heating equipment used?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Self-contained tank (similar to a residential water heater tank) | 100.0% | 2 |
| 2 | Instantaneous water heater (does not have a tank) | 0.0% | 0 |
| 3 | Part of the heating system boiler | 0.0% | 0 |
| 4 | Other | 0.0% | 0 |
| | Total | 100% | 2 |

## Q37 - What is the primary fuel source for water heating?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Electricity | 100.0% | 2 |
| 2 | Natural gas | 0.0% | 0 |
| 3 | Propane (bottled gas) | 0.0% | 0 |
| 4 | Oil | 0.0% | 0 |
| 5 | Other | 0.0% | 0 |
| | Total | 100% | 2 |

## Q39 - Does your organization manage, own, or own and manage the [Field-Property] property?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Own it only | 0.0% | 0 |
| 2 | Manage it only | 0.0% | 0 |
| 3 | Both own and manage it | 100.0% | 2 |
| | Total | 100% | 2 |

## Q40 - What is your role/title relating to the [Field-Property] property?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Property Owner | 0.0% | 0 |
| 2 | President/CEO/COO | 0.0% | 0 |
| 3 | General manager | 100.0% | 2 |
| 4 | Property facilities/maintenance | 0.0% | 0 |
| 5 | Financial manager | 0.0% | 0 |
| 6 | Other | 0.0% | 0 |
| | Total | 100% | 2 |

## Q42 - Which of the following best describes your authority to make decisions about upgrades or improvements to the [Field-Property] property?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | No authority | 0.0% | 0 |
| 2 | Authority is limited to improvements below a certain cost | 100.0% | 2 |
| 3 | Authority is limited in some other way | 0.0% | 0 |
| 4 | Full authority | 0.0% | 0 |
| | Total | 100% | 2 |

## Q43 - Do tenants pay their own electric bills, or are electricity costs included in the rent?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Tenants pay their own bills | 100.0% | 2 |
| 2 | Electricity costs are included as part of the rent | 0.0% | 0 |
| 3 | There is another type of arrangement | 0.0% | 0 |
| | Total | 100% | 2 |

**Q45 - Approximately what percentage of the units receive some type of federal, state or other housing assistance?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 0 – 25% | 0.0% | 0 |
| 2 | 26 – 50% | 0.0% | 0 |
| 3 | 51 – 75% | 0.0% | 0 |
| 4 | 76 – 100% | 100.0% | 2 |
| | Total | 100% | 2 |

# 12. BYOT Program Participant Survey Results

**Q1 - Our records indicate that you enrolled in Appalachian Power's Bring Your Own Thermostat Program by enrolling your smart thermostat to allow Appalachian Power to make brief changes to its settings during peak demand periods. Is this correct?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 122 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 122 |

**Q2 - How did you first learn about Appalachian Power's Bring Your Own Thermostat program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | An Appalachian Power newsletter or email | 43.6% | 51 |
| 2 | A postcard or other mailing from Appalachian Power | 10.3% | 12 |
| 3 | Appalachian Power website | 14.5% | 17 |
| 4 | From an HVAC contractor | 1.7% | 2 |
| 5 | Through a community organization | 0.9% | 1 |
| 6 | Through participating in the eScore program | 2.6% | 3 |
| 7 | email from ${e://Field/OEM} | 15.4% | 18 |
| 8 | Social networking site such as Facebook or Twitter | 0.9% | 1 |
| 9 | Friend, relative, coworker, or neighbor | 6.0% | 7 |
| 10 | In some other way | 4.3% | 5 |
| | Total | 100% | 117 |

## Q4 - Why did you choose to participate in this program? (Select all that apply)

| # | Answer | % | Count |
|---|---|---|---|
| 1 | The opportunity to participate in an energy savings program | 49.2% | 58 |
| 2 | Program was recommended to me by Appalachian Power | 5.9% | 7 |
| 3 | The incentive check | 58.5% | 69 |
| 4 | To reduce energy use for environmental reasons | 32.2% | 38 |
| 5 | To save on energy costs | 50.8% | 60 |
| 6 | Other | 1.7% | 2 |
| | Total | 100% | 118 |

## Q6 - When you decided to enroll, how often did you expect that someone would be at home when the air conditioner was reduced during peak demand periods?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Never | 1.8% | 2 |
| 2 | Less than half the time | 23.9% | 27 |
| 3 | About half of the time | 19.5% | 22 |
| 4 | More than half of the time | 25.7% | 29 |
| 5 | All of the time | 29.2% | 33 |
| | Total | 100% | 113 |

**Q7 - Thinking about this past summer period of May to September, about how often was someone home during an event?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Never | 2.9% | 3 |
| 2 | Less than half the time | 14.3% | 15 |
| 3 | About half of the time | 17.1% | 18 |
| 4 | More than half of the time | 33.3% | 35 |
| 5 | All of the time | 32.4% | 34 |
| | Total | 100% | 105 |

**Q8 - Did you have any concerns about participating in the Bring Your Own Thermostat Program when deciding to participate in it?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 30.2% | 35 |
| 2 | No | 69.8% | 81 |
| | Total | 100% | 116 |

**Q11 - Where did you get information about how the program works? (Select all that apply)**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Information provided by an Appalachian Power representative | 4.3% | 5 |
| 2 | The program website | 53.0% | 61 |
| 3 | Information provided in an Appalachian Power email or newsletter | 47.0% | 54 |
| 4 | Information from an Appalachian Power flyer | 5.2% | 6 |
| 5 | Information provided in an Appalachian Power mailing | 19.1% | 22 |
| 6 | Other | 7.8% | 9 |
| | Total | 100% | 115 |

**Q13 - Thinking about any information that you received or viewed before you decided to participate, how well did that information address any questions you had?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 (Not at all) | 0.9% | 1 |
| 2 | 2 | 2.7% | 3 |
| 3 | 3 | 16.2% | 18 |
| 4 | 4 | 38.7% | 43 |
| 5 | 5 (Completely) | 41.4% | 46 |
| | Total | 100% | 111 |

**Q15 - Did you already have a smart thermostat when you first learned about the Bring Your Own Thermostat program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 49.6% | 58 |
| 2 | No, purchased a smart thermostat after I learned about the program | 50.4% | 59 |
| | Total | 100% | 117 |

**Q16 - We would like to know if the program affected your decision to purchase and install the smart thermostat. How likely would you have been to purchase a smart thermostat if the Bring Your Own Thermostat program $50 enrollment incentive and the $25 end of the summer incentive was NOT available?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | Not at all likely0 | 13.8% | 8 |
| 1 | 1 | 5.2% | 3 |
| 2 | 2 | 5.2% | 3 |
| 3 | 3 | 10.3% | 6 |
| 4 | 4 | 6.9% | 4 |
| 5 | 5 | 13.8% | 8 |
| 6 | 6 | 6.9% | 4 |
| 7 | 7 | 8.6% | 5 |
| 8 | 8 | 6.9% | 4 |
| 9 | 9 | 6.9% | 4 |
| 10 | Extremely likely10 | 15.5% | 9 |
| | Total | 100% | 58 |

**Q17 - How important was the information and incentives provided through the Bring Your Own Thermostat program in your decision to install a smart thermostat?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | Not at all important0 | 5.3% | 3 |
| 1 | 1 | 1.8% | 1 |
| 2 | 2 | 1.8% | 1 |
| 3 | 3 | 1.8% | 1 |
| 4 | 4 | 5.3% | 3 |
| 5 | 5 | 3.5% | 2 |
| 6 | 6 | 7.0% | 4 |
| 7 | 7 | 10.5% | 6 |
| 8 | 8 | 19.3% | 11 |
| 9 | 9 | 12.3% | 7 |
| 10 | Extremely important10 | 31.6% | 18 |
| | Total | 100% | 57 |

**Q18 - Using the scale below, how would you rate the process of enrolling your thermostat in the program?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 (Very difficult) | 3.4% | 4 |
| 2 | 2 | 3.4% | 4 |
| 3 | 3 | 9.4% | 11 |
| 4 | 4 | 22.2% | 26 |
| 5 | 5 (Very easy) | 61.5% | 72 |
| | Total | 100% | 117 |

**Q20 - Which of the following statements best describes the way you used your central air conditioner last summer?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Did not use it at all | 0.9% | 1 |
| 2 | It only ran a few days or nights when it was really needed | 3.6% | 4 |
| 3 | It ran on several days or nights | 14.5% | 16 |
| 4 | It ran almost every day or night | 80.9% | 89 |
| | Total | 100% | 110 |

**Q21 - Were you at home during any of the energy reduction events that reduced the cooling from your air conditioner?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 82.8% | 96 |
| 2 | No, not that you are aware of | 17.2% | 20 |
| | Total | 100% | 116 |

**Q22 - Now thinking about all the energy reduction events, during these events, would you say that your home became:**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | A little uncomfortable | 47.3% | 44 |
| 2 | Moderately uncomfortable | 31.2% | 29 |
| 3 | Very uncomfortable | 10.8% | 10 |
| 4 | There wasn't a change in the comfort of your home | 10.8% | 10 |
| | Total | 100% | 93 |

**Q23 - Was the number of events that occurred this summer about what you were expecting when you signed up for the program, more than you were expecting, or fewer than you were expecting?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | More than expected | 27.5% | 25 |
| 2 | About what was expected | 62.6% | 57 |
| 3 | Fewer than expected | 9.9% | 9 |
| | Total | 100% | 91 |

**Q24 - Do you think that the number of events that occurred this year was acceptable or that too many events occurred?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | The number of events was acceptable | 65.2% | 15 |
| 2 | Too many events occurred | 34.8% | 8 |
| | Total | 100% | 23 |

**Q26 - Did you contact Appalachian Power program staff about any issues or questions that you had during the past year?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 14.0% | 16 |
| 2 | No | 86.0% | 98 |
| | Total | 100% | 114 |

## Q27 - How thorough was the response from Appalachian Power staff?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 (Not at all thorough) | 0.0% | 0 |
| 2 | 2 | 6.7% | 1 |
| 3 | 3 | 26.7% | 4 |
| 4 | 4 | 26.7% | 4 |
| 5 | 5 (Very thorough) | 40.0% | 6 |
| | Total | 100% | 15 |

## Q28 - How timely was the response from Appalachian Power staff?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 (Not at all timely) | 0.0% | 0 |
| 2 | 2 | 6.7% | 1 |
| 3 | 3 | 13.3% | 2 |
| 4 | 4 | 20.0% | 3 |
| 5 | 5 (Very timely) | 60.0% | 9 |
| | Total | 100% | 15 |

**Q29 - Using a scale where 0 means "not at all likely" and 10 means "very likely," how likely is it that you will participate in the program next year?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Not at all likely0 | 2.6% | 3 |
| 2 | 1 | 0.0% | 0 |
| 3 | 2 | 0.0% | 0 |
| 4 | 3 | 1.8% | 2 |
| 5 | 4 | 0.9% | 1 |
| 6 | 5 | 1.8% | 2 |
| 7 | 6 | 2.6% | 3 |
| 8 | 7 | 4.4% | 5 |
| 9 | 8 | 10.5% | 12 |
| 10 | 9 | 6.1% | 7 |
| 11 | Very likely10 | 69.3% | 79 |
| | Total | 100% | 114 |

**Q31 - How satisfied are you with the Appalachian Power Bring Your Own Thermostat program, overall?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very satisfied | 60.2% | 68 |
| 2 | Somewhat satisfied | 23.9% | 27 |
| 3 | Neither satisfied nor dissatisfied | 11.5% | 13 |
| 4 | Somewhat dissatisfied | 1.8% | 2 |
| 5 | Very dissatisfied | 2.7% | 3 |
| | Total | 100% | 113 |

### Q33 - Have you recommended the Bring Your Own Thermostat program to friends, family members, or colleagues?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 55.5% | 61 |
| 2 | No | 44.5% | 49 |
| | Total | 100% | 110 |

### Q34 - Do you own the home that participated in the program, rent it, or own it and rent it to someone else?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Own | 95.6% | 108 |
| 2 | Rent | 4.4% | 5 |
| 3 | Own and rent to someone else | 0.0% | 0 |
| | Total | 100% | 113 |

### Q35 - Which of the following best describes your home?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Manufactured home | 6.2% | 7 |
| 2 | Single-family house detached from any other house | 82.3% | 93 |
| 3 | Single family house attached to one or more other houses, for example, duplex, row house, or townhome | 8.8% | 10 |
| 4 | Apartment in a building with 2 to 3 units | 0.9% | 1 |
| 5 | Apartment in a building with 4 or more units | 1.8% | 2 |
| 6 | Other | 0.0% | 0 |
| | Total | 100% | 113 |

## Q36 - What is your highest level of education?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Less than high school | 0.0% | 0 |
| 2 | High school graduate | 7.1% | 8 |
| 3 | Associates degree, vocational/technical school, or some college | 24.1% | 27 |
| 4 | Four-year college degree | 23.2% | 26 |
| 5 | Graduate or professional degree | 45.5% | 51 |
| | Total | 100% | 112 |

# 13. Manufactured Home Purchaser Survey Results

**Q1 - To begin, can you confirm that you purchased a manufactured home from [Field-RETAILER]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 5 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 5 |

**Q2 - Can you also confirm that you received a rebate from Appalachian Power for the purchase of your ENERGY STAR home?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 1 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 1 |

**Q3 - Were you aware that the home you purchased was an ENERGY STAR certified home?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 5 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 5 |

**Q4 - When you purchased your home, did the retailer talk to you about the energy efficiency of the home?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 5 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 5 |

**Q5 - When did you first learn about the rebate for buying an ENERGY STAR manufactured home?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Before you spoke with a retailer about purchasing an ENERGY STAR home. | 0.0% | 0 |
| 2 | After speaking with a retailer, but before deciding to purchase an ENERGY STAR home manufactured home. | 0.0% | 0 |
| 3 | After deciding to purchase an ENERGY STAR home. | 0.0% | 0 |
| 4 | During the process of purchasing an ENERGY STAR home. | 100.0% | 1 |
| 5 | After completing the purchase of an ENEGY STAR home. | 0.0% | 0 |
| | Total | 100% | 1 |

## Q6 - How did you first learn about the Appalachian Power rebate?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Manufactured home retailer | 100.0% | 1 |
| 2 | Real estate agent | 0.0% | 0 |
| 3 | Appalachian Power website | 0.0% | 0 |
| 4 | Friend, family member, or colleague | 0.0% | 0 |
| 5 | Appalachian Power email | 0.0% | 0 |
| 6 | Appalachian Power newsletter | 0.0% | 0 |
| 7 | Social media | 0.0% | 0 |
| 8 | Through an internet search (e.g., Google search) | 0.0% | 0 |
| 9 | Through an internet advertisement | 0.0% | 0 |
| 10 | From a manufactured home retailer radio, television, or newspaper advertisement | 0.0% | 0 |
| 11 | Other, please specify: | 0.0% | 0 |
| | Total | 100% | 1 |

## Q7 - Below is a list of the features that an energy efficient ENERGY STAR home has that a standard home does not have. Please mark any that the retailer mentioned to you when you purchased your home.

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Better insulation than a standard home | 80.0% | 4 |
| 2 | More efficient windows than a standard home | 60.0% | 3 |
| 3 | Better air sealing than a standard home | 60.0% | 3 |
| 4 | A programmable thermostat | 60.0% | 3 |
| 5 | An energy efficient heat pump | 60.0% | 3 |
| 6 | Did not mention any of these | 0.0% | 0 |
| | Total | 100% | 5 |

**Q8 - What were the main reasons or features that lead you to purchase an energy efficient ENERGY STAR home? Please select all that apply.**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Uses less energy | 60.0% | 3 |
| 2 | Lower utility costs | 60.0% | 3 |
| 3 | Improved home comfort | 40.0% | 2 |
| 4 | Availability of rebate | 0.0% | 0 |
| 5 | Only home available | 0.0% | 0 |
| 6 | Other (Please describe) | 20.0% | 1 |
| | Total | 100% | 5 |

**Q10 - Did you know that you could purchase an energy efficient ENERGY STAR certified home instead of a standard efficiency home before speaking with a salesperson at [Field-RETAILER]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 20.0% | 1 |
| 2 | No | 80.0% | 4 |
| | Total | 100% | 5 |

**Q11 - Did you have plans to purchase an energy efficient ENERGY STAR certified home instead of a standard efficiency home before speaking with the salesperson at [Field-RETAILER]?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 40.0% | 2 |
| 2 | No | 60.0% | 3 |
| | Total | 100% | 5 |

**Q12 - Could you have afforded to pay the additional cost of $700 for an energy efficient ENERGY STAR certified manufactured home if the rebate was not available?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 0.0% | 0 |
| 98 | Unsure | 100.0% | 1 |
| | Total | 100% | 1 |

**Q13 - To confirm, without the rebate, you would not have been able to pay the additional cost of the energy efficient ENERGY STAR home?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes, that is correct. | 0.0% | 0 |
| 2 | No, that is incorrect as I would have been able to purchase without the rebate. | 0.0% | 0 |
| 98 | Unsure | 0.0% | 0 |
| | Total | | 0 |

**Q14 - If the program rebate was not available, how likely would you have been to buy an ENERGY STAR manufactured home?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 Not at all likely | 0.0% | 0 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 0.0% | 0 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 Very likely | 100.0% | 1 |
| | Total | 100% | 1 |

**Q15 - Did the salesperson at [Field-RETAILER] talk to you about homes that were not ENERGY STAR certified?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 20.0% | 1 |
| 2 | No | 80.0% | 4 |
| | Total | 100% | 5 |

**Q16 - Did the salesperson at [Field-RETAILER] recommend that you buy an energy efficient ENERGY STAR home?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 40.0% | 2 |
| 2 | No | 60.0% | 3 |
| | Total | 100% | 5 |

**Q17 - How likely would you have been to buy an ENERGY STAR home if the salesperson had not recommended it?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 Not at all likely | 0.0% | 0 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 0.0% | 0 |
| 7 | 7 | 50.0% | 1 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 0.0% | 0 |
| 10 | 10 Very likely | 50.0% | 1 |
| | Total | 100% | 2 |

**Q18 - Did a salesperson at [Field-RETAILER] provide you with information on the benefits of an ENERGY STAR manufactured home?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 5 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 5 |

**Q19 - If the salesperson had not provided you information on the benefits of an ENERGY STAR home, how likely would you have been to purchase an ENERGY STAR home instead of a standard efficiency home?**

| # | Answer | % | Count |
|---|---|---|---|
| 0 | 0 Not at all likely | 0.0% | 0 |
| 1 | 1 | 0.0% | 0 |
| 2 | 2 | 0.0% | 0 |
| 3 | 3 | 0.0% | 0 |
| 4 | 4 | 0.0% | 0 |
| 5 | 5 | 0.0% | 0 |
| 6 | 6 | 20.0% | 1 |
| 7 | 7 | 0.0% | 0 |
| 8 | 8 | 0.0% | 0 |
| 9 | 9 | 20.0% | 1 |
| 10 | 10 Very likely | 60.0% | 3 |
| | Total | 100% | 5 |

**Q20 - How well has your manufactured home met your expectations for comfort?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Far short of expectations | 0.0% | 0 |
| 2 | Short of expectations | 0.0% | 0 |
| 3 | Met expectations | 40.0% | 2 |
| 4 | Exceeds expectations | 40.0% | 2 |
| 5 | Far exceeds expectations | 20.0% | 1 |
| 6 | Did not have any expectations | 0.0% | 0 |
| | Total | 100% | 5 |

**Q21 - How well has your manufactured home met your expectations for energy costs?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Far short of expectations | 0.0% | 0 |
| 2 | Short of expectations | 0.0% | 0 |
| 3 | Met expectations | 40.0% | 2 |
| 4 | Exceeds expectations | 0.0% | 0 |
| 5 | Far exceeds expectations | 40.0% | 2 |
| 6 | Did not have any expectations | 20.0% | 1 |
| | Total | 100% | 5 |

## Q22 - How satisfied are you with the manufactured home you purchased?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very dissatisfied | 0.0% | 0 |
| 2 | Somewhat dissatisfied | 0.0% | 0 |
| 3 | Neither satisfied nor dissatisfied | 0.0% | 0 |
| 4 | Somewhat satisfied | 0.0% | 0 |
| 5 | Very satisfied | 100.0% | 5 |
| | Total | 100% | 5 |

## Q23 - How satisfied are you with the information the retailer gave you on the home you purchased?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Very dissatisfied | 0.0% | 0 |
| 2 | Somewhat dissatisfied | 0.0% | 0 |
| 3 | Neither satisfied nor dissatisfied | 0.0% | 0 |
| 4 | Somewhat satisfied | 0.0% | 0 |
| 5 | Very satisfied | 100.0% | 4 |
| | Total | 100% | 4 |

## Q27 - How many people, including you, live in your household?

| # | Answer | % | Count |
|---|---|---|---|
| 1 | 1 person | 40.0% | 2 |
| 2 | 2 people | 0.0% | 0 |
| 3 | 3 people | 20.0% | 1 |
| 4 | 4 people | 0.0% | 0 |
| 5 | 5 people | 20.0% | 1 |
| 6 | 6 people | 20.0% | 1 |
| 7 | 7 people | 0.0% | 0 |
| 8 | 8 or more people | 0.0% | 0 |
| 99 | Prefer not to answer | 0.0% | 0 |
| | Total | 100% | 5 |

## Q28 - Is the manufactured home you purchased...

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Your primary residence | 100.0% | 5 |
| 2 | A residence that you rent to someone else | 0.0% | 0 |
| 3 | A vacation property that is not occupied year-round | 0.0% | 0 |
| 4 | Something else (Please specify) | 0.0% | 0 |
| 99 | Prefer not to answer | 0.0% | 0 |
| | Total | 100% | 5 |

**Q30 - Our records indicate that you did not receive an Appalachian Power rebate for the manufactured home you purchased. Did the retailer you purchased the home from tell you that a rebate was available?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 100.0% | 4 |
| | Total | 100% | 4 |

**Q31 - Did you know that a rebate was available for the home you purchased before taking this survey?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 0.0% | 0 |
| 2 | No | 100.0% | 4 |
| | Total | 100% | 4 |

**Q32 - Why did you not apply for the rebate?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Did not get around to it | 0.0% | 0 |
| 2 | Was not worth the effort | 0.0% | 0 |
| 3 | Did not know how to apply for it | 0.0% | 0 |
| 4 | For some other reason (Please describe) | 0.0% | 0 |
| | Total | | 0 |

**Q33 - Would you like to be redirected to the Appalachian Power website with more information on how to apply for the rebate?**

| # | Answer | % | Count |
|---|---|---|---|
| 1 | Yes | 100.0% | 4 |
| 2 | No | 0.0% | 0 |
| | Total | 100% | 4 |

# 14. Confidential: EM&V Costs

Information relating to PY2021 EM&V costs is presented in Table 14-1.

*Table 14-1 PY2021 EM&V Costs*

| *Program* | *EM&V Cost* |
|---|---|
| ENERGYSTAR Manufactured Homes Program | [redacted] |
| Bring Your Own Thermostat Program | [redacted] |
| Home Performance Program | [redacted] |
| Low-Income Single Family Program | [redacted] |
| Low-Income Multifamily Program | [redacted] |
| Residential Portfolio Total | [redacted] |