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Ameren Missouri Program Year 2022 Annual EM&V Report

Volume 2: Residential Portfolio Report

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1. Executive Summary

This volume of the PY2022 Annual Report presents evaluation results from the Ameren Missouri PY2022 portfolio of residential energy efficiency programs as described in Ameren Missouri's 2019–21 Missouri Energy Efficiency Investment Act (MEEIA) Energy Efficiency Plan[1] and the subsequent *Unanimous Stipulation and Agreement Regarding the Implementation of Certain MEEIA Programs Through Plan Year 2022*[2] ("Stipulation PY2022"). In this document, the evaluation team provides portfolio-level results for PY2022, as well as detailed findings for each program. Results for the business and demand response portfolios are provided in separate volumes.

During PY2022, Ameren Missouri offered four programs for residential customers. The portfolio of programs included:

- Heating, Ventilation, and Air Conditioning (HVAC)
- Residential Efficient Products (REP)
- Multifamily Market Rate (MFMR)
- Pay as You Save (PAYS)

In addition to these four programs, Ameren Missouri offered three programs targeted specifically to residential customers who meet certain income requirements. As such, this volume also covers the Multifamily and Single-Family Income Eligible Programs (SFIE and MFIE, respectively), along with the Community Lighting Program. Collectively, the seven programs referenced here are referred to as the "residential programs" throughout this volume.

The following sections present key evaluation findings and recommendations for the residential portfolio. Per the Stipulation PY2022, this evaluation focused on the assessment of gross impacts, with process-related investigations limited to the new PAYS Program and forthcoming net-to-gross (NTG) work, for potential prospective application, limited to the HVAC midstream channel and the PAYS Program. The remainder of this volume is organized as follows:

- Chapter 2 presents the general evaluation approach for the residential programs, including overarching evaluation objectives and an overview of the PY2022 evaluation activities and methodologies.
- Chapters 3–9 present evaluation results for the nine residential programs.

1.1 Portfolio Impact Results

At the portfolio level, the PY2022 Ameren Missouri residential programs fell short of their first year gross energy and demand savings goals, achieving 42,237 MWh and 24.17 MW respectively (Table 1).

[1] Ameren Missouri. *2019-21 Missouri Energy Efficiency Investment Act (MEEIA) Energy Efficiency Plan.* October 25, 2018.

[2] *Unanimous Stipulation and Agreement Regarding the Implementation of Certain MEEIA Programs Through Plan Year 2022* ("Stipulation PY2022"). July 10, 2020. File No. EO-2018-0211.

Table 1. PY2022 Residential Portfolio Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal	NTGR [a]	Ex Post Net
Energy Savings (MWh)	50,045	84%	42,237	56,302	75%	82.5%	34,846
Demand Savings (MW)	30.06	80%	24.17	26.18	92%	82.5%	19.94

[a] In accordance with Stipulation PY2022, PY2022 NTGRs are deemed at 82.5% for the Residential portfolio.

Portfolio performance in PY2022 was largely driven by the Residential HVAC Program, which contributed approximately 73% of Ameren Missouri's first year residential savings. As shown in Table 2, the residential portfolio achieved 75% of first year energy savings goals and 92% of first year demand savings goals. Notably, the HVAC Program came close to its first year energy savings goal (93%) and exceeded its first year demand savings goal (114%). The PAYS Program, on the other hand, fell well short of its gross savings goals, achieving only 10% of its energy and 9% of its demand savings goal.

Table 2. PY2022 Residential Portfolio First Year Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal	NTGR	Ex Post Net
First Year Energy Savings (MWh)							
HVAC	38,158	80%	30,668	33,087	93%	82.5%	25,301
REP	8,070	100%	8,050	10,161	79%	82.5%	6,641
MFMR	2,801	94%	2,621	4,319	61%	82.5%	2,162
PAYS	1,016	89%	899	8,735	10%	82.5%	741
Total Residential	**50,045**	**84%**	**42,237**	**56,302**	**75%**	**82.5%**	**34,846**
First Year Demand Savings (MW)							
HVAC	25.49	77%	19.72	17.23	114%	82.5%	16.27
REP	2.97	100%	2.97	3.36	88%	82.5%	2.45
MFMR	1.19	95%	1.12	1.52	74%	82.5%	0.93
PAYS	0.41	89%	0.37	4.07	9%	82.5%	0.30
Total Residential	**30.06**	**80%**	**24.17**	**26.18**	**92%**	**82.5%**	**19.94**

Collectively, the residential income eligible programs exceeded their first year energy savings goal and came close to their demand savings goal (see Table 3). However, performance against goals was somewhat mixed at the individual program level. While the MFIE Program and Community Lighting Program exceeded their first year energy savings goals (115% and 429%, respectively), the SFIE Program did not (65%). Neither the MFIE or SFIE Program met its first year demand savings goals (88% and 81%, respectively). Additionally, the MFIE Program performed well against the average percent of energy savings per property metric established in the Stipulation PY2022 (i.e., achieving at least 15% per property for MFIE). The MFIE Program achieved an average of 41% savings per property (see Chapter 7).

Table 3. PY2022 Residential Income Eligible First Year Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal	NTGR [a]	Ex Post Net
First Year Energy Savings (MWh)							
MFIE	12,086	93%	11,247	9,754	115%	100%	11,247
Community Lighting	2,625	92%	2,425	565	429%	100%	2,425
SFIE	1,110	95%	1,056	1,622	65%	100%	1,056
Total Residential IE	**15,821**	**93%**	**14,728**	**11,941**	**123%**	**100%**	**14,728**
First Year Demand Savings (MW)							
MFIE	7.34	39%	2.88	3.29	88%	100%	2.88
Community Lighting	0.41	92%	0.38	0.08	470%	100%	0.38
SFIE	0.49	98%	0.48	0.59	81%	100%	0.48
Total Residential IE	**8.23**	**45%**	**3.73**	**3.96**	**94%**	**100%**	**3.73**

[a] Per industry standard practice, we assume a NTGR of 100% for the Income Eligible portfolio.

1.2 Key Evaluation Findings

In the fourth year of MEEIA Cycle III, the Ameren Missouri residential portfolio had mixed performance against energy and demand savings goals.

- As noted in Section 1.1, both market rate and income eligible residential program performance was mixed in PY2022.
  - Market rate residential programs realized 84% and 80% of ex ante energy and demand savings, respectively, and fell short of first year gross savings goals (75% of energy and 92% of demand). Residential portfolio performance was driven largely by the HVAC program (representing approximately 73% of first year ex post energy savings for the portfolio).
    - Early replacement (ER) rates for HVAC measures continues to be a key driver of HVAC Program impacts. The evaluation team's application of participant survey-derived ER rates resulted in a significant reduction in savings across all central air conditioner and heat pump measures and was the main driver of low realization rates for these measures (see Section 3.3.1 for more detail).
  - Income eligible residential programs realized 93% of ex ante energy savings and exceeded first year gross savings goals (123% of the combined goals). Additionally, while collectively the residential income eligible programs realized only 45% of ex ante demand savings, the programs came close to meeting first year gross savings goals (94% of combined goals). The MFIE Program was the largest contributor to first year energy savings across the residential income eligible programs (representing 76% of first year energy savings for all three programs combined). While the MFIE's strong performance in PY2022 drove performance for the portfolio more broadly, one substantial change to demand savings calculations for air source heat pump during the impact evaluation drastically reduced ex post demand savings for the program (see Section 7.3.1 for more detail).
- For several residential market rate and income eligible programs, the use of different versions of the Ameren Missouri technical reference manual (TRM) is a main source of discrepancies between ex ante and ex post savings estimates. The implementation team used the most recent version of the TRM

available at the start of PY2022 (Version 5.0 of the TRM approved in September of 2021), while the evaluation team used a combination of actual, project-specific information and the updated version of the TRM (Version 6.0, approved in October 2022) to estimate ex post impacts. Alignment of TRMs for planning and evaluation purposes would help reduce discrepancies between ex ante and ex post savings estimates.

- Though our primary focus for the PY2022 evaluation was on gross impacts, we completed a full process evaluation of the PAYS Program with the goal of highlighting success and challenges in its second year of implementation. Overall, participants who received PAYS measures were satisfied with the different elements of the Program and with their participation overall. Additionally, participating Trade Allies reported that their experience with the PAYS Program had improved during its second year of operation and were generally satisfied with their experience. However below, we highlight two key challenges reported by Ameren Missouri customers and Trade Allies as it pertains to their experience (see Section 6.3.2 for full details of the PAYS Program process evaluation).
  - Customers, including participants and non-participants, as well as trade allies, point to communication challenges when attempting to coordinate with implementer staff. Many customers who completed the online PAYS Assessment Form are highly interested in participating but reported not having received follow-up communication to schedule a home assessment.[3] Those who did receive a home assessment often reported waiting long periods both to schedule their assessment and to receive an Easy Plan following the assessment.
  - Some Trade Allies reported challenges associated with shouldering the cost of projects while awaiting project closeout and payment, which sometimes occurs months after the work begins. This can be especially challenging for smaller trade ally companies, given the increasing costs of equipment, labor, and operation in general.

1.3 Cost-Effectiveness Results

The cost-effectiveness analysis compares the benefits of an energy efficiency or demand response program with the cost of delivering it, expressed as the ratio of the net present value (NPV) of lifetime benefits to the costs. A cost-effectiveness ratio of greater than 1.0 means that the benefits generated by the program exceeded its costs. Cost-effectiveness can be assessed from several different "perspectives" using different tests, with each test including a slightly different set of benefits and costs.

The evaluation team assessed the cost-effectiveness of all seven Ameren Missouri Residential energy efficiency programs, using all five costs-effectiveness tests recommended by the California Standard Practice Manual and used in prior evaluations:[4]

- **Total Resource Cost (TRC) Test:** Perspective of all utility customers (participants and nonparticipants) in the utility service territory
- **Utility Cost Test (UCT):** Perspective of utility, government agency, or third-party program implementer
- **Ratepayer Impact Measure (RIM) Test:** Impact of efficiency measure on nonparticipating ratepayers overall
- **Participant Cost Test (PCT):** Perspective of the customers installing the measures

[3] We note that, according to interviews with and documentation provided by the PAYS Program implementation team, staff do attempt to contact most customers who indicate an interest in participating in the PAYS Program.
[4] *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*. October 2001.

- **Societal Cost Test (SCT):** Perspective of all utility customers (participants and nonparticipants) in the utility service territory[5]

Table 4 summarizes the cost-effectiveness results for the seven residential programs, including three residential Income Eligible Portfolio programs. All programs were cost-effective in PY2022 based on the TRC test except the Single Family Income Eligible and PAYS programs.[6] The Single Family Income Eligible, Multifamily Income Eligible Program, Community Lighting, and PAYS programs were also not cost effective under the UCT, and all programs had RIM results below 1.0.

Table 4. Summary of Residential Cost-Effectiveness Results

Program	TRC	UCT	RIM	PCT
MFIE	1.30	0.81	0.37	5.31
Community Lighting	1.74	0.98	0.38	n/a
SFIE	0.38	0.29	0.22	3.19
HVAC	1.74	1.90	0.66	4.06
REP	1.24	1.36	0.53	3.94
MFMR	1.59	1.61	0.58	4.47
PAYS	0.61	0.71	0.40	3.03

Cost-effectiveness results for the overall Residential Portfolio – including the Residential Demand Response Program but excluding the Single Family Income Eligible, Multifamily Income Eligible, and Community Lighting Programs – are presented in Volume 1.

[5] Although we developed SCT results as a part of our evaluation, this section does not show the results because they are equivalent to TRC results due to two factors: (1) Ameren Missouri does not include non-energy impacts in cost-effectiveness testing and (2) Ameren Missouri uses the same planning assumptions for both tests, including the discount rate.

[6] MEEIA and the Revised Statues of Missouri (RSMo) acknowledge low-income programs as a special circumstance and do not require the programs to be cost-effective as implemented. Results are shown for comparative and planning purposes.

2. Evaluation Approach

While the evaluation team conducted separate evaluations of each of the residential programs, most research objectives and evaluation activities were common across the programs. To reduce repetition, this chapter discusses research objectives common to all residential programs and presents an overview of the evaluation approach and activities conducted to address the research objectives. Additional, program-specific detail, where needed, is presented in the individual program chapters.

2.1 Research Objectives

The evaluation team designed the PY2022 residential portfolio evaluation to address several objectives. The evaluation focused on gross impact evaluation activities, new free ridership (FR) research for the HVAC midstream channel and the PAYS Program (forthcoming; for potential prospective application), cost-effectiveness analysis, and a process evaluation of the new PAYS Program. A fifth category of objectives focused on responding to the five key research questions stipulated in 20 CSR 4240-22.070(8).[7] The research objectives addressed by the PY2022 residential portfolio evaluations include:

Gross Impact Objectives

- Verify program-tracking data.
- Estimate the first year ex post gross energy (MWh) and demand (MW) savings.

Attribution/Net Impact Objectives

- Estimate the first year ex post net energy (kWh) and demand (kW) savings using a deemed net-to-gross (NTG) value of 82.5% (except for the income eligible programs, which use a deemed NTG value of 100%).
- Develop free ridership (FR) values for potential future application (HVAC and PAYS programs; results will be provided in standalone memoranda).

Cost-Effectiveness

- Assess the cost-effectiveness of each residential program, and the residential portfolio as a whole, using industry-standard cost-effectiveness tests.
- Ensure alignment of cost-effectiveness testing assumptions and parameters with the PY2022 residential evaluation results, Ameren Missouri's TRM Version 6.0, and industry best practices.[8]
- Provide total program benefits, costs, net benefits, and cost-effectiveness testing results.

[7] The Missouri Code of State Regulations (20 CSR 4240.22.070(8)) requires that demand-side programs operating as part of a utility's preferred resource plan are subject to ongoing process and impact evaluations that meet certain criteria, including the process evaluation questions presented in this section. Please note, the reference for this CSR was previously 4 CSR 240-22.070(8). As of September 2019, the CSR was moved to the location cited above.

[8] Our ex post evaluation relied on most recent TRM version available. Ameren Missouri revised the approved 2019–2021 MEEIA Cycle Appendix F (Deemed Savings Table) and Appendix H and I (TRM Volumes 2 and 3) in October 2022 (referred to as "Ameren Missouri TRM"). The referenced TRM versions, updated in October 2022, include Appendix H, Version 3 and Appendix F, Version 6.0, unless otherwise noted.

Process Objectives

- Obtain information on program design and planned implementation with a focus on differences from PY2021.
- Understand program staff and implementer perceptions, experiences, and expected program impacts.
- Assess the performance of the PAYS Program in its second year of operation.

CSR Mandated Research Questions (20 CSR 4240-22.070(8))

- What are the primary market imperfections that are common to the target market segment?
- Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?
- Does the mix of enduse measures included in the program appropriately reflect the diversity of enduse energy service needs and existing enduse technologies within the target market segment?
- Are the communication channels and delivery mechanisms appropriate for the target market segment?
- What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the Program?

2.2 Evaluation Activities and Methodologies

The evaluation team met the objectives of the PY2022 evaluation through a combination of research activities, largely focused on estimating program impacts. The evaluation team designed research for each program based on its design, level of participation, and type of energy efficiency technologies among other factors. Table 5 shows the research activities conducted for each program.

Table 5. Research Activities by Offering

Research Activity	HVAC	REP	MFMR	PAYS	MFIE	SFIE	Community Lighting
Program Manager and Implementer Interviews	✓	✓	✓	✓	✓	✓	✓
Program Material Review	✓	✓	✓	✓	✓	✓	✓
Tracking System Review	✓	✓	✓	✓	✓	✓	✓
Participant Research							
Participant Survey	✓	-	-	✓	-	-	-
Trade Ally Interviews	-	-	-	✓	-	-	-
Non-Participant Survey	-	-	-	✓	-	-	-
Gross Impact Analysis							
Database Review	✓	✓	✓	✓	✓	✓	✓
Engineering Analysis	✓	✓	✓	✓	✓	✓	✓
Tier 4 Energy Model Analysis	-	-	-	✓	-	-	-
Attribution/Net Impact Analysis							
NTG (for potential prospective application)	✓			✓			

The following subsections provide a general description of each evaluation activity. Program-specific details are included in each program chapter, where relevant.

2.2.1 Program Manager and Implementer Interviews

To support evaluation planning, we conducted in-depth interviews with program implementation staff in Q3 of 2022. In these interviews, we explored details of the design and planned implementation for each program, and program staff's perceptions of successes and challenges throughout the year. Additionally, we discussed any details associated with program-tracking data, or data collection necessary for estimating ex post impacts.

2.2.2 Program Material Review

We conducted a comprehensive review of all available new or updated program materials, including available marketing and implementation plans, customer communications, and educational and training materials. This review served to familiarize the evaluation team with details of program design and implementation.

2.2.3 Tracking System Review

The evaluation team reviewed program-tracking data reports provided by Franklin Energy twice during the PY2022 evaluation cycle—once to support the interim impact analysis completed in August 2022 and once to support the annual impact evaluation in January 2023. During both reviews, our team focused on ensuring data were complete and free of data tracking and processing errors. Additionally, we ensured that data included information on specific parameters necessary to estimate ex post savings for each program.

2.2.4 Participant Research

The evaluation team conducted research with customers who participated in the HVAC and PAYS programs during PY2022. This participant research consisted of quantitative online surveys with Ameren Missouri residential customers who had participated in the programs during PY2022. Topics covered included,

- Customer experience with the program;
- Satisfaction with the program overall and different program components;
- Recommendations for program improvement; and
- Early replacement (HVAC) and measure in-service rates (HVAC and PAYS).

Details of the individual data collection activities, including population sizes, sampling approaches, and response rates are presented in the individual program chapters. Final data collection instruments used in developing net savings estimates are provided in Appendix D

2.2.5 Gross Impact Analysis

With the exception of the PAYS Program,[9] the evaluation team based PY2022 gross impact analyses for the Ameren Missouri residential programs on the Ameren Missouri TRM. Gross impact activities included review of the program-tracking database.

[9] The evaluation team conducted a review of building simulation models to evaluate PAYS Tier 4 measures. However, our team completed an engineering analysis or deemed savings review for PAYS Tier 1 (i.e., direct install) measures.

Our team developed first and last year ex post gross energy and demand savings. The following details should be noted:

- We applied deemed technology-specific coincidence factors (CF) from Ameren Missouri's TRM to ex post energy savings to calculate ex post demand savings.
- We estimated last year savings for the purposes of cost-effectiveness analyses. Last year ex post energy and demand savings reflect baseline adjustments for early replacement HVAC measures (Central Air Conditioner, Air Source Heat Pumps, Ground Source Heat Pumps, and Ductless Minisplit Heat Pumps). For all other measure types, last year energy and demand savings equal first year savings.

Database Review and Engineering Analysis

To determine gross impacts associated with the majority of Ameren Missouri's PY2022 programs, we first reviewed the program-tracking database to check that project data were recorded fully and correctly, and that the database contained all needed information to estimate program savings. We also examined the incented measures to ensure they met all program requirements. We then conducted an engineering analysis, which involved reviewing program-tracking data to verify the correct TRM algorithms and deemed savings assumptions were used to calculate ex ante savings. We then calculated ex post savings using TRM algorithms, deemed savings assumptions, and any updated evaluation-estimated parameters, such as in-service rates (ISRs) derived from participant survey data.[10]

We resolved any discrepancies found in the databases and provide details related to any gross savings adjustments in the program-specific sections of this report.

2.2.6 Attribution/Net Impact Analysis

Per the Stipulation PY2022, "[t]he throughput disincentive for the PY2022 year will utilize an 82.5% net-to-gross factor with no true-up."[11] As such, this evaluation did not include NTG research for application in PY2022, and the impact results presented in this volume focus on gross savings. The Executive Summary and Volume 1, however, present net savings for the HVAC, REP, MFMR, and PAYS programs, calculated using the following formula:

$$\textit{Ex post net savings} = \textit{Ex post gross savings} * 0.825$$

As described in the PY2022 Evaluation Plan, we assume that customers served by the income eligible programs would not make energy-efficient improvements on their own due to the cost. Therefore, we assume an NTG value of 1.0 when estimating net savings for these programs. As such, the deemed net-to-gross ratio (NTGR) of 0.825 specified in the PY2022 stipulation agreement does not apply to the income eligible programs.

This evaluation did include NTG research with PY2022 participants in the HVAC Program and the PAYS Program for potential future application. This research and the associated analyses will be completed in the spring of 2023 and will be provided in standalone memoranda.

[10] Note that ex ante savings are based on TRM Version 5.0 (approved September 2021) while ex post savings are based on the updated TRM Version 6.0 (approved October 2022). See also Appendix A.
[11] *Unanimous Stipulation and Agreement Regarding the Implementation of Certain MEEIA Programs Through Plan Year 2022*, p. 6.

3. Heating Ventilation and Air Conditioning (HVAC)

This section summarizes the evaluation results and methodology for the PY2022 Ameren Missouri Residential Heating, Ventilation, and Air Conditioning Program, referred to herein as the HVAC Program. The PY2022 evaluation focused on gross impacts but also included a new analysis of FR (forthcoming) for potential prospective application.[12] Details on the methodologies are presented in Section 3.2 and Appendix A.

The Ameren Missouri Residential HVAC Program obtains energy and demand savings by incenting the installation of energy-efficient central air conditioning, heat pump (HP),[13] and advanced thermostat measures. The HVAC Program target market includes single family and multifamily residential homeowners within the Ameren Missouri service territory.

The HVAC Program consists of two channels: Downstream and Midstream. Both channels rely heavily on a network of trade allies to promote the installation of high-efficiency HVAC equipment and complete and submit the rebate application on behalf of their customers. In the Downstream channel, the customer may choose to have the rebate sent directly to them or applied as an instant incentive on their invoice. In the latter case, the contractor fronts the cost of the incentive and receives the rebate from the program after it has been processed. Midstream incentives are paid to the distributors who pass on some, or all, of the incentive amount to the contractors, who in turn pass it on to the customers as an instant rebate, which is denoted as a line item on the contractor's receipt to the customers.[14]

The Midstream channel focuses on the highest efficiency equipment, rated seasonal energy efficiency ratio (SEER) of 18 or higher. The goal of the Midstream channel is to incent this super-efficient equipment more strategically, with the expectation that it will drive changes in distributor stocking and sales patterns. By focusing on the supply side of the equation (i.e., distributors) rather than the demand side (i.e., contractors or customers), the Midstream channel aims to increase the availability of super-efficient units, with the goal of accelerating market transformation. PY2022 was the Midstream channel's third year of implementation.

Contractors are critical to the execution and success of both HVAC Program channels. Contractors influence customer decision-making and can recommend and explain the benefits of energy-efficient (and/or super-efficient) HVAC equipment to their customers. Additionally, contractors obtain and install HVAC equipment for customers, which makes them ideally situated to assist in marketing and promoting the program. To participate in the HVAC Program, contractors must complete the program training course, as well as commit to the Contractor Participation Agreement (CPA) before they may start offering rebates. Once a contractor becomes an Ameren Missouri-approved contractor, they are included on the Ameren Missouri "Find a Contractor" webpage, which is often a customer's first step in the upgrade process. Participating contractors also are assigned a dedicated Account Manager.

Ameren Missouri has continuously implemented mass media and targeted marketing efforts to promote the HVAC Program. Marketing support is provided to contractors through a co-op marketing program, co-branding opportunities, and a public relations tool kit.

[12] The results of the FR analysis will be provided in a standalone memorandum.
[13] Heat pumps eligible for incentives through the HVAC Program include air source heat pumps (ASHPs), ground source heat pumps (GSHPs), and ductless mini split heat pumps (DMSHPs).
[14] Regardless of how the incentive gets split between the distributor and contractor, a minimum amount is required to go to the enduse customer.

3.1 Participation Summary

Participation in the HVAC Program decreased in PY2022. A total of 13,300 unique customers completed 13,504 HVAC projects through the Downstream channel (Table 6), a decrease of approximately 15% for both participants and projects. PY2022 saw a similar, but smaller, decrease in Midstream channel participation. In PY2022, 2,086 unique customers completed 2,138 projects, a decrease of 2% for both participants and projects.

Table 6. PY2022 HVAC Project Completions and Ex Ante Gross Savings

Measure	Participants [a]		Projects [a]		Measures		Ex Ante Gross Savings	
	Number	%	Number	%	Number	%	MWh	%
Downstream								
Central Air Conditioner	11,159	69%	11,275	68%	11,850	68%	19,439	63%
ASHP	1,246	8%	1,264	8%	1,330	8%	9,306	30%
Advanced Thermostat	3,763	23%	3,811	23%	4,049	23%	1,492	5%
GSHP	111	1%	114	1%	144	1%	815	3%
DMSHP	1	<1%	1	<1%	1	<1%	0.3	<1%
Downstream Total	**13,300**	**100%**	**13,504**	**100%**	**17,374**	**100%**	**31,053**	**100%**
Midstream								
Central Air Conditioner	1,548	44%	1,557	44%	1,653	44%	3,394	48%
ASHP	279	8%	284	8%	300	8%	2,770	39%
Advanced Thermostat	1,402	40%	1,413	40%	1,517	40%	507	7%
DMSHP	268	8%	274	8%	328	9%	435	6%
Midstream Total	**2,086**	**100%**	**2,138**	**100%**	**3,798**	**100%**	**7,105**	**100%**

[a] Totals reflect unique counts. Measure-level counts and percentages may not sum to totals because some customers installed/some projects included multiple measures.

3.2 Evaluation Methodology

The evaluation team performed impact evaluation activities to assess the performance of the PY2022 HVAC Program. In addition to the overarching research objectives outlined for the Residential Portfolio, the evaluation team explored the following HVAC Program-specific objectives:

- Characterize program participation with respect to the number and characteristics of participants and installed measures.
- Provide evaluation results to improve the design and implementation of the HVAC Program.
- Develop new estimates of FR for potential prospective application.

Table 7 provides an overview of the HVAC Program evaluation activities. Following the table, we outline program-specific aspects of key evaluation methodologies.

Table 7. PY2022 Evaluation Activities for the HVAC Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews to assess changes in program design and implementation relative to PY2021, key program successes and challenges, program performance, and evaluation priorities.
Program Material Review	▪ Reviewed all program materials to inform evaluation activities.
Tracking System Review	▪ Reviewed implementer's tracking system to ensure data required for the evaluation are being collected.
Participant Survey	▪ Collected data to inform gross impact analysis (e.g., verify installation and early replacement) and prospective NTG.
Database Review	▪ Reviewed program database to check that program data are complete and program-installed measures meet all program requirements.
Engineering Analysis	▪ Verified that ex ante savings calculations used correct deemed savings values. ▪ Estimated overall and measure-level ex post gross impacts using TRM algorithms, site-specific parameters, deemed savings assumptions, and evaluation-estimated parameters.
Prospective Attribution Analysis (Forthcoming)	▪ Conduct distributor interviews. ▪ Develop new estimates of FR for prospective application.

Participant Survey

The evaluation team fielded an online survey with PY2022 participants in two waves. The first wave was fielded in August 2022 and the second wave was fielded in early-January 2023. Overall, the goals of the participant survey were to:

- Verify measure installation to develop in-service rates (ISR);
- Develop estimates of early replacement (ER); and
- Estimate FR (forthcoming; for potential prospective application).

The response rate for the participant survey was 8% in the first wave and 10% in the second wave. The disposition summary for the survey is outlined in Table 8.

Table 8. Participant Survey Disposition Summary

Disposition	Wave 1	Wave 2	Overall
Completed Surveys	253	640	893
Downstream	220	557	777
Midstream	33	83	116
Partial Complete	76	195	271
No Response	2,524	5,333	7,857
Screened Out	29	69	98
Bounced E-mail	127	277	404
Opt Out	0	14	14
Total Participants in Sample	**3,009**	**6,528**	**9,537**

Impact Analysis

We conducted an engineering analysis of all program measures to estimate ex post gross savings. We first reviewed program-tracking data to identify database errors and duplicate records, and verify that ex ante savings calculations used correct TRM algorithms and savings assumptions. We then calculated ex post savings using Ameren Missouri TRM algorithms, site-specific parameters from the program-tracking database, and deemed savings assumptions.[15] In addition, the evaluation team developed and applied measure-level ISRs and ER rates in the ex post analysis, based on the participant survey.

Measure Verification

We used responses to the PY2022 participant survey to develop ISRs for the HVAC Program at the measure level. We used the same ISR methodology as in the PY2021 evaluation, asking program participants (1) to confirm they installed the number of measures shown in the program-tracking database, and (2) how many of the measures were still installed. The ISRs developed for the PY2022 ex post analysis are shown in Table 9.

Table 9. PY2022 HVAC ISR Results

Measure Category	ISR
Central Air Conditioner	99.9%
Heat Pump (ASHP, GSHP, DMSHP)	100.0%
Advanced Thermostat	97.9%
Overall Program	**100%**

Early Replacement

The PY2022 evaluation used an operational/functional definition of ER, based on a combination of program-tracking data and participant survey responses. Under this approach, central air conditioner and heat pump units are considered ER if they turned on (based on the program-tracking data) and either already met the conditioning needs of the participant or could have been repaired (based on survey responses). Units with a failed compressor (based on the program-tracking data) or that did not meet the participant's conditioning needs and were not feasible to repair (based on survey responses) are considered replacement on failure (ROF). Table 10 summarizes the ER rates applied in the ex post analysis. Appendix B provides additional detail on the ER methodology.

Table 10. PY2022 HVAC ER Rates

Measure Category	ER Rate
Central Air Conditioners	49%
Heat Pumps (ASHP, GSHP, DMSHP)	48%

[15] Note that ex ante savings are based on Appendix F Version 5.0 (approved September 2021) while ex post savings are based on the updated Appendix F Version 6.0 (approved October 2022). See also the *Appendix F Reference Table* in Appendix A.

3.3 Evaluation Results

3.3.1 Gross Impact Results

Gross Impact Results

This section summarizes gross impact results for the PY2022 HVAC Program, which was the largest program in Ameren Missouri's Residential Portfolio in PY2022, contributing 73% of ex post gross energy savings and 82% of ex post gross demand savings.

As presented in Table 11, the PY2022 HVAC Program achieved 30,668 MWh and 19.72 MW in ex post gross savings, representing gross realization rates of 80.4% for energy savings and 77.4% for demand savings.

Table 11. PY2022 HVAC Program Annual Savings

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal
First Year Savings					
Energy Savings (MWh)	38,158	80.4%	30,668	33,087	93%
Demand Savings (MW)	25.49	77.4%	19.72	17.23	114%

Table 12 summarizes PY2022 HVAC Program ex ante and ex post energy savings (MWh), demand savings (MW), and realization rates by channel and measure. The Downstream channel accounted for the majority of ex post gross energy savings (81%), slightly down from PY2021 (83%). Central air conditioners continued to provide the majority of the program's ex post gross energy savings (58%, down from 63% in PY2021), followed by ASHPs (33%, up from 30% in PY2021). The remaining measures comprised the other 9% of program ex post gross energy savings.

Table 12. PY2022 HVAC Program First Year Gross Impacts

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Realization Rate	Ex Post (MW)
Downstream Channel						
Central Air Conditioner	19,439	77.3%	15,024	18.42	77.3%	14.23
ASHP	9,306	82.6%	7,685	1.89	69.7%	1.31
Advanced Thermostat	1,492	86.3%	1,287	0.73	81.1%	0.59
GSHP	815	94.1%	767	0.29	88.6%	0.26
DMSHP	<1	130.3%	<1	<1	130.3%	<1
Downstream Total	**31,053**	**79.7%**	**24,763**	**21.33**	**76.9%**	**16.40**
Midstream Channel						
Central Air Conditioner	3,394	81.5%	2,764	3.22	81.5%	2.62
ASHP	2,741	84.4%	2,315	0.54	72.7%	0.39
Advanced Thermostat	507	82.7%	419	0.27	72.5%	0.20
DMSHP	463	87.7%	406	0.13	82.7%	0.10
Midstream Total	**7,105**	**83.1%**	**5,905**	**4.16**	**79.8%**	**3.32**
Total	**38,158**	**80.4%**	**30,668**	**25.49**	**77.4%**	**19.72**

Reasons for Discrepancies

We detail the reasons for the discrepancies that impacted the energy and demand savings realization rates for the PY2022 HVAC Program below. While realization rates for measures differ by channel, we discuss the Downstream and Midstream channels together because differences were impacted by the same overarching themes.

- Central Air Conditioners
  - The primary driver of central air conditioner realization rates was the evaluation team's application of the ex post ER rate of 49%, compared to the ER rate of 88% in the program-tracking data. This change reduced first year savings by 40% for both energy savings and demand savings.
  - Ex post savings also reflect a desk review factor (DR%) of 98.3% to account for past evaluation findings relating to data tracking discrepancies not accounted for in our engineering analysis.
  - Application of the ER rate and the DR% accounts for the majority of the discrepancy between ex ante and ex post savings. Without these factors, the first year energy and demand savings realization rate would have both been 120%, due to the ex post analysis using program-tracked system characteristics in place of deemed assumptions included in Appendix F of the Ameren Missouri TRM. In particular, the SEER rating of existing early replaced air conditioning equipment is approximately 7% lower than the deemed value in TRM Appendix F, resulting in increased energy and demand savings.
- Advanced Thermostats
  - The implementation team claimed savings for multiple thermostats per household. According to Ameren Missouri TRM Appendix I, the installation of more than one thermostat per household does not accrue additional savings. The evaluation team only awarded savings for one thermostat per household, identified as unique electric account numbers. As a result, 448 thermostats (304 or 7.5% of Downstream thermostats and 144 or 9.5% of Midstream thermostats) received zero ex post savings. This decreased both energy and demand savings by 8%.
  - Another driver of advanced thermostat realization rates was the use of TRM cooling capacity (36,000 Btuh) and efficiency (SEER 13) assumptions by the implementation team. The evaluation team used actual values cross-referenced from the program-tracking data for customers who also received central air conditioning, ASHP, or GSHP measures. The average capacity and SEER efficiency of those participants was 38,700 Btuh and SEER 17. This decreased energy savings by 7%.
  - The implementation team classified 22% of thermostats as controlling a type of HVAC system that is inconsistent with the information provided in the program-tracking data. The evaluation team reassigned these units to the appropriate TRM reference ID, based on the system type provided in the program-tracking data. This increased energy savings by 2%.
  - Ex post savings reflect an ISR of 97.9% for advanced thermostats, slightly decreasing first year energy and demand savings.
- Air Source Heat Pumps (ASHPs)
  - Ex post savings for ASHPs reflect an ER rate of 48%, derived from the 2022 participant survey. In contrast, the program-tracking data indicates 87% of incented measures were early replacements. Application of the ER rate reduced first year savings by 11% for both energy and demand savings.

- Ex post savings also reflect a DR% of 90.2% to account for past evaluation findings relating to data tracking discrepancies not accounted for in our engineering analysis.
- Application of the ER rate and the DR% accounts for the majority of the discrepancy between ex ante and ex post savings from ASHPs. Without these factors, the first year realization rates would have been 103% for energy savings and 117% for demand savings. The main reason for the 103% energy savings realization rate would have been the evaluation team's use of program-tracked system characteristics in place of TRM Appendix F deemed assumptions, while the discrepancy in demand savings is due to TRM Appendix F versioning (ex ante savings are based on Appendix F Version 5.0, while ex post savings are based on Appendix F Version 6.0).

- **Ground Source Heat Pumps (GSHPs)**
  - The driving factors of the 94% energy and 89% demand realization rates for GSHPs were a combination of the evaluation team's use of an ER rate of 48% compared to program data suggesting 62% of units were early replacements, and the evaluation team's use of actual tracked GSHP system characteristics in place of the TRM Appendix F values used by the implementation team.
- **Ductless Mini-Split Heat Pumps (DMSHPs)**
  - The driver of DMSHP realization rates was the evaluation team's use of actual tracked values. Actual values for cooling and heating capacity were 15% and 20% lower than TRM Appendix F deemed values, respectively, and the existing equipment's SEER was 4% higher (i.e., more efficient) than deemed values leading to decreased savings overall.
  - The evaluation team applied an ER rate of 48%, while 86% of DMSHP records were listed as early replacement in the program data. However, application of the ER rate had a small effect on savings because the program-tracking data identified the majority of DMSHPs (81%) as new construction units, to which the ER determination does not apply.

3.3.2 Process Results

The PY2022 evaluation did not include an assessment of program processes for the HVAC Program. However, to meet the requirements of Missouri CSR for demand-side process evaluations, as set in 20 CSR 4240-22.070(8), we respond to the five required process evaluation questions in Table 13.

Table 13. Summary of Responses to CSR Process Evaluation Requirements

CSR Required Process Evaluations Questions	Findings
What are the primary market imperfections that are common to the target market segment?	The primary market imperfections for the HVAC program include the upfront cost of high-efficiency heating and cooling equipment. Incentives are designed to defray this high upfront cost. The Downstream channel is more accessible to low- to moderate-income households as the systems incented through this channel typically cost less than systems incented through the Midstream channel. Contractors play an important role in educating customers about the benefits of higher efficiency equipment compared to standard efficiency equipment and promoting program incentives. The Midstream channel's market imperfections include the upfront cost of high-efficiency HVAC equipment and a lack of customer awareness regarding the benefits of such systems (e.g., energy and utility bill savings). Distributors educate and encourage contractors to purchase high-efficiency equipment through the Midstream channel who in turn educate and upsell customers looking to replace their HVAC equipment. Similar to previous program years, there are differences between customer segments in Midstream and Downstream channels.

CSR Required Process Evaluations Questions	Findings
	Midstream participants tend to be highly educated and have moderate to high incomes. Downstream participants have similar education levels to Midstream participants but tend to have lower incomes than Midstream participants. A summary of survey participant demographics is included in the Appendix to this volume. Another potential market imperfection the Midstream channel is designed to address relates to the availability of the highest-efficiency equipment. The channel seeks to encourage distributors to increase their inventory of this highest-efficiency equipment to ensure it is available when customers need it. Notably, responses to the participant survey indicate that some Midstream customers would only wait a short period of time for a new, highest-efficiency system if it was not immediately available to them; otherwise, they would select a less efficient system. The forthcoming prospective FR research explores this potential market imperfection in more detail.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The HVAC Program's target market segment includes single family and multifamily residential homeowners with central cooling systems that are older or in need of replacement prior to failure. Low-income customers are served by the CommunitySavers® Program and are not part of the program's target market. The introduction of the Midstream channel, which focuses on more costly systems of the highest efficiency, resulted in a de facto sub-segmentation of the non-low income market, by income: Based on contractor research conducted in PY2020, systems available through the Midstream channel tend to be inaccessible to a large portion of the non-low income market, due to the even higher upfront cost compared to equipment incented through the Downstream channel.
Does the mix of enduse measures included in the program appropriately reflect the diversity of enduse energy service needs and existing enduse technologies within the target market segment?	The HVAC Program is one of several residential programs offered by Ameren Missouri. It focuses on major heating and cooling equipment (central air conditioners and HPs) at various efficiency levels and offers smart thermostats to achieve additional savings by better managing the use of the new equipment. While the HVAC Program does not offer the full range of potential HVAC measures (and measures of other enduses) that might be of interest to the target market, this focus is appropriate given the program's specialized delivery through a network of approved trade allies (and distributors, in the case of the Midstream channel).
Are the communication channels and delivery mechanisms appropriate for the target market segment?	The HVAC Program's participation is primarily driven by contractors and customer-facing marketing materials. Aside from contractors, marketing materials such as e-mails, newsletters, bill inserts, the Ameren Missouri website, home energy reports, and mass media advertising contribute to program awareness. Collectively, these channels are effectively reaching a wide range of customers, but as noted above, some customers are still likely limited from accessing energy-efficient HVAC equipment for various reasons.
What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the Program?	Segment the HVAC customer population with respect to outreach to ensure alignment of messaging with the unique set of barriers and needs faced by the different segments. The Midstream channel should continue to work with distributors to increase their inventory of the highest-efficiency units to ensure that systems are available when customers need/want them. (The degree to which the program has been successful at this will be explored as part of the forthcoming prospective FR research.)

3.4 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following conclusions and recommendations for the HVAC Program:

- **Conclusion #1:** Consistent with previous program years, the HVAC Program continues to have high program satisfaction among both Downstream and Midstream participants. Over 90% of both participant groups rated their satisfaction with the program as "Somewhat Satisfied" or "Very Satisfied." The highest rated components of the program were the equipment installed through the program and the contractor who installed the equipment with 86% and 85%, respectively, rating their satisfaction as "Very Satisfied."
- **Conclusion #2:** Participation in the Downstream channel of the HVAC program decreased by 15% in PY2022. Participation in the Midstream channel remained relatively consistent, decreasing slightly by 2% compared to PY2021.
- **Conclusion #3:** The evaluation team's application of participant survey-derived ER rates resulted in a significant reduction in savings across all central air conditioner and heat pump measures and was the main driver of low realization rates for these measures.
  - **Recommendation:** During PY2022, the evaluation team worked with the implementation team to develop a simple set of questions for inclusion in the Terms and Conditions document all participants sign. These questions mirror those currently asked in the participant survey. Access to this information, for all customers and in real-time, will allow the implementation team to use more realistic ER assumptions when developing ex ante savings. We recommend that the implementation team continue to collect the current information on the replaced unit's operating condition and use it in combination with the newly collected information in the ex ante ER/ROF classification for each incented unit. This will improve alignment between program-claimed replacements and evaluation findings and should lead to significantly higher realization rates.

4. Residential Efficient Products (REP)

This chapter summarizes the PY2022 evaluation methodology and results for the Residential Efficient Products (REP) Program. The PY2022 evaluation of the REP Program included an engineering analysis to develop gross energy and demand savings estimates.

The REP Program raises customer awareness of the benefits of high-efficiency products to educate residential customers about energy use in their homes and to offer information, products, and services to save energy cost-effectively. The target market consists of all residential customers within the Ameren Missouri service territory.

The REP Program is an umbrella program that incorporates various program partners, products, and program-delivery strategies. It is flexible by design: as the program evolves and evaluation activities track program performance, Ameren Missouri may revise the assortment of eligible measures, incentive amounts, or qualification criteria as the market dictates.

In PY2022, Ameren Missouri offered rebates for four measures through the program: advanced thermostats, two categories of power strips, and heat pump water heaters. Table 14 summarizes the incentive levels and program requirements.

Table 14. PY2022 Measures Offered Through the Residential Efficient Products Program

Measure	Rebate Offered
Advanced Thermostats[a]	$100 rebate per unit; limited to one thermostat per system and up to three thermostats per residential electric account
Tier 1 Power Strips	$9 rebate per unit; limited to five power strips per residential electric account
Tier 2 Power Strips	$25 rebate per unit; limited to three power strips per residential electric account
Heat Pump Water Heaters	$350 rebate per unit; limited to two rebates per residential electric account

[a] Although program customers could purchase more than one thermostat, and ex ante savings reflect this, the Ameren Missouri TRM 2019–21 MEEIA Plan (Appendix F, Revision 6.0, October 2022) states, "*Energy savings are applicable at the household level; all thermostats controlling household heat should be programmable and installation of multiple advanced thermostats per home does not accrue additional savings.*" (p. 57, emphasis added) As such, the evaluation team included only one thermostat per customer account number in ex post savings computations. As a result, we excluded a total of 532 advanced thermostat records present in the program tracking data from ex post computations.

As in past years, the REP Program provided two delivery channels in PY2022 (although, of the following, the Online Store channel is the path that nearly all participating Ameren Missouri customers use):

- **Online Store:** Ameren Missouri's Online Store sells advanced thermostats and power strips directly to customers and applies rebates immediately at checkout.[16]
- **Mail-In Channel:** Customers can purchase program-qualified thermostats,[17] heat pump water heaters, and pool pumps anywhere and then submit a rebate application via mail-in or e-mail.

4.1 Participation Summary

The vast majority of PY2022 program activity is associated with the Online Store channel (94% of participants and 94% of measures). The Online Store channel served the most participants, sold the most measures, and

[16] To view the current Online Store main page, visit https://amerenmissouristore.com/.
[17] PY2020 was the first year that the Mail-In Channel rebated thermostats. Only the Online Store rebated thermostats prior to PY2020.

generated the greatest ex ante gross savings for the REP Program. In all, the Online Store accounted for nearly all (90%) of PY2022 REP Program ex ante gross savings; the remaining savings, constituting a tenth (10%) of the total, were associated with mail-in rebates (Table 15).

Table 15. PY2022 REP Program Participation by Channel

Channel	Participants		Measures		Ex Ante Savings	
	Number	%	Number	%	MWh	%
Online Store	15,667[a]	94%	17,097	94%	7,284	90%
Mail-in	1,032	6%	1,059	6%	785	10%
Total	**16,667[b]**	**100%**	**18,156**	**100%**	**8,070**	**100%**

[a] The Online Store offers several measures, but this table only includes the counts for measures for which Ameren Missouri claims savings (advanced thermostats and Tier 1 and 2 advanced power strips).

[b] The total number of participants shown in the table (16,667) is less than the sum of the number of participants across both channels (16,699) because some participants (defined by unique electric account numbers) purchased products from both channels.

Looking at the various measures rebated through each channel in PY2022, advanced thermostats were the most popular product that the REP Program offered (89% of all measures sold through the Online Store and Mail-in combined (Table 16). Tier 1 power strips were the next most popular measure (9% of the Online Store channel and the REP Program more broadly). Tier 2 power strips and heat pump water heaters each accounted for 1% of the Online Store and Mail-in channels, respectively, and all REP Program measures. Accordingly, the bulk of ex ante gross MWh program savings (94%) came from sales of advanced thermostats (via both channels combined), while heat pump water heaters contributed 5% of ex ante MWh program savings. The power strips accounted for relatively small portions of ex ante gross MWh savings—Tier 1 represented 1%; Tier 2 represented less than 1%.

Table 16. PY2022 REP Program Participation Summary by Measure

Channel	Measure	Participants		Measures		Ex Ante Savings	
		Number	% of Total	Number	% of Total	MWh	% of Total
Online Store	Advanced Thermostats	15,398	92%	15,350[a]	85%	7,168	89%
	Tier 1 Power Strips	636	4%	1,566	9%	88	1%
	Tier 2 Power Strips	120	1%	181	1%	28	0.4%
Mail-In	Advanced Thermostats	898	5%	898	5%	419	5%
	Heat Pump Water Heaters	160	1%	161	1%	366	5%
Total		**16,667[b]**	**100%**	**18,156**	**100%[c]**	**8,070**	**100%**

[a] The number of advanced thermostats is smaller than the number of participants because 71 thermostats claimed in prior program years but returned during PY2022 were subtracted from the number of smart thermostats claimed in PY2022.

[b] The total number of participants shown in the table (16,667) is less than the number of unique participants across channels and measures (17,212) because some participants (defined by unique electric account numbers) purchased products from more than one enduse category.

[c] Individual values may not sum to totals due to rounding.

4.2 Evaluation Methodology

For PY2022, similar to other programs, the evaluation team focused efforts on an impact evaluation. Table 17 provides an overview of the PY2022 REP Program evaluation activities.

Table 17. PY2022 Evaluation Activities for the REP Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in Q3 of PY2022 to understand program staff's perspective on program implementation.
Program Material Review	▪ Reviewed new program materials to inform evaluation activities.
Gross Impact Analysis—Database Review	▪ Reviewed program database to check that program data were complete and included the parameters required to estimate ex post savings.
Gross Impact Analysis—Engineering Analysis	▪ Verified that ex ante savings used correct TRM-based deemed savings values. ▪ Estimated overall and measure-level ex post gross impacts using TRM algorithms and deemed savings assumptions.

4.3 Evaluation Results

4.3.1 Gross Impact Results

This section provides the PY2022 REP Program gross impact findings. Overall, the REP Program was the second largest contributor to residential portfolio ex post gross energy and demand savings (19% and 12%, respectively). Table 18 compares first year ex ante and ex post gross savings at the program level. As shown, the PY2022 REP Program achieved 8,050 MWh and 2.97 MW of ex post gross savings, resulting in 99.7% realization rates for both energy and demand savings. The program achieved 79% of Ameren Missouri's gross energy savings goal and 88% of the gross demand savings goal.

Table 18. PY2022 REP Program Savings Summary

	Ex Ante Gross	Gross Realization Rate [a]	Ex Post Gross	Goal Gross	% of Goal
First Year Savings					
Energy Savings (MWh)	8,070	99.7%	8,050	10,161	79%
Demand Savings (MW)	2.97	99.7%	2.97	3.36	88%

Table 19 shows the ex post gross savings and realization rates by channel and measure. The realization rates are 100.0% for Tier 2 Power Strips, rebated through the Online Store channel, and Heat Pump Water Heaters, rebated through the Mail-In channel. On the low end, the realization rate is 99.7% for advanced thermostats rebated through both channels. The Mail-In channel has a much more even split in ex ante savings by measure category than the Online Store channel, which is dominated by advanced thermostats.

Table 19. PY2022 REP Program Annual First Year Gross Impacts

Channel	Measure Category/Enduse	Energy Savings			Demand Savings		
		Ex Ante (MWh)	Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Realization Rate	Ex Post (MW)
Online Store	Advanced Thermostats	7,168	99.7%	7,150	2.77	99.7%	2.76
	Tier 1 Power Strips	88	99.9%	88	0.01	99.9%	0.01
	Tier 2 Power Strips	28	100.0%	28	0.00	100.0%	0.00
Mail-in	Advanced Thermostats	419	99.7%	418	0.16	99.7%	0.16
	Heat Pump Water Heaters	366	100.0%	366	0.03	100.0%	0.03
Total		**8,070**	**99.7%**	**8,050**	**2.97**	**99.7%**	**2.97**

Discrepancies between ex ante savings calculated by the program team and ex post savings calculated by the evaluation team are primarily driven by updates to parameter values in the most recent TRM (Appendix F version 6.0 updated October 2022) and the use of participant-specific information from the program tracking data when available instead of TRM default values.

Below, we detail the key reasons, by channel and measure, for realization rate discrepancies:

- **Online Store: Advanced Thermostats (89% of ex ante energy and demand savings).** The gross realization rate for advanced thermostats through the Online Store is 99.7% for electric energy and 99.7% for demand.
  - Ex ante estimates included savings for multiple thermostats per household. According to the Ameren Missouri TRM, however, the installation of more than one thermostat per household does not accrue additional incremental savings. When calculating ex post, the evaluation team only awarded savings for one thermostat per household (identified as unique electric account numbers). After accounting for customers who returned thermostats, 41 thermostats were removed from the ex post analysis because of TRM guidelines that only one thermostat can be claimed per household.
  - To avoid double counting savings, the evaluation team excluded four advanced thermostat records from the PY2022 evaluation because they were already included in the PY2021 evaluation.
- **Advanced Power Strips – Tier 1 (4% of ex ante energy and 1% of ex ante demand savings).** The gross realization rate for Tier 1 advanced power strips is 99.9% for electric energy and 99.9% for demand.
  - To avoid double counting savings, the evaluation team excluded two Tier 1 advanced power strip records from the PY2022 evaluation because they were already included in the PY2021 evaluation.

4.3.2 Process Results

To meet the requirements of Missouri CSR for demand-side process evaluations, we respond to the five required process evaluation questions in Table 20.[18] As we did not conduct any process evaluation activities for PY2022, we based information included in the table below, in part, on prior evaluations.

Table 20. Summary of Responses to CSR Process Evaluation Requirements

CSR Required Process Evaluations Questions	Findings
What are the primary market imperfections that are common to the target market segment?	The primary market imperfections for the REP Program are lack of customer awareness of energy-efficient product options and their benefits, and the higher price of efficient products. In terms of knowledge, many customers are not aware of energy efficiency and energy-efficient technologies. And even those who are aware are often not informed of actual energy savings opportunities available in their homes. For programs like the REP Program, customer awareness of the availability of the rebate is paramount. Customers need to be proactive and search out the rebates, or they need to be informed of them via marketing or a contractor. For PY2019, we found that only 36% of residential customers were aware of the REP Program, which limits participation.

[18] The Missouri Code of State Regulations (20 CSR 4240.22.070(A)) requires that demand-side programs operating as part of a utility's preferred resource plan are subject to ongoing process and impact evaluations that meet certain criteria, including the process evaluation questions presented in this section. Please note, the reference for this CSR was previously 4 CSR 240-22.070(8). As of September 2019, the CSR was moved to the location cited above.

CSR Required Process Evaluations Questions	Findings
	Additionally, while nearly every home has at least one thermostat, thermostats do not routinely fail, so customers will need another reason to replace existing thermostats. The desire for advanced technology is a factor driving advanced thermostat uptake. Thermostats have become a consumer product, and like other advanced technologies, many people appreciate and want the technology. Still, others do not and could view advanced thermostats as overly complicated or expensive. Greater customer awareness of new thermostat technology and its energy savings potential could help drive customers to advanced thermostats.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Officially (per MEEIA III), the target market for the REP Program is all residential customers within the Ameren Missouri service territory. However, when we consider the program's mix of measures (heat pump water heaters, advanced power strips, and advanced thermostats), the actual market is predominantly homeowners and does not seem to require further subdivision.
Does the mix of enduse measures included in the program appropriately reflect the diversity of enduse energy service needs and existing enduse technologies within the target market segment?	The REP Program currently offers only four measures: (1) advanced thermostats, (2) Tier 1 power strips, (3) Tier 2 power strips, and (4) heat pump water heaters. When one considers the diversity of energy-consuming items for typical residential customers (the target market), a very wide range of other enduse measures appear potentially applicable to the REP Program. Of course, we need to consider cost-effectiveness and overlap with other programs. The development of program targets/goals in 2018 included ENERGY STAR®[19] room air conditioners, air purifiers, and dehumidifiers, so these devices may be good candidates for measure expansion.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	Similar to previous years, program marketing efforts in PY2022 included social media posts/ads, TV/radio ads, direct e-mail marketing, newsletters, paid search optimization, and rebates and discounts particularly during holiday sales such as Black Friday and Cyber Monday. For heat pump water heaters, marketing was targeted at contractors via discounts or larger savings offers. In PY2022, program staff reported that these marketing efforts have helped encourage program participation. Among these marketing activities, direct e-mail marketing helped generate the most participation in PY2022. Continuing to market to contractors for heat pump water heaters and other HVAC measures to be offered and increasing direct e-mail activity particularly at specific times of the year such as before and during holidays may help increase participation.
What can be done to overcome the identified market imperfections more effectively and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the program?	In PY2019, customers seemed largely satisfied with both the Online Store and Mail-In Channels. Increased participation can likely be attained by expanding the breadth of measures rebated under the program; however, it may be more effective to focus additional marketing efforts on contractors and increasing general customer awareness of the energy efficiency opportunities as well as available rebates.

4.4 Conclusions and Recommendations

The evaluation team offers the following conclusions and recommendations for the REP Program moving forward:

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

- **Conclusion #1:** When the evaluation team reviewed the program tracking data, we identified 450 records (377 advanced thermostat, 70 advanced power strips, and 3 heat pump water heater records) that had an install date outside of the 2022 program year. Following a review of these records against the 2021 evaluation records, the evaluation team identified four advanced thermostat records and two Tier 1 advanced power strip records that we excluded from the PY2022 analysis due to their inclusion in the previous year's analysis.
  - **Recommendation #1:** Work with the evaluation team during mid-year evaluation to review data and improve data tracking to identify duplicate records across program years. Doing this will help maintain quality assurance of program tracking data.
- **Conclusion #2:** Similar to findings in PY2021, the REP Program requirements around advanced thermostats contributed to program performance being below the goal in PY2022. Notably, while the program team allowed rebates for multiple thermostats purchased per customer, the Ameren Missouri TRM limits thermostat savings to one unit per household.

5. Multifamily Market Rate (MFMR)

This section presents the PY2022 evaluation methodology and results for the MFMR Program. We present additional details on the methodology in Appendix A.

The MFMR Program aims to deliver long-term energy savings and bill reductions to Ameren Missouri customers living in multifamily properties with three or more units. The program targets multifamily property managers and owners and provides a one-stop-shop approach to assist these customers in overcoming barriers to completing comprehensive retrofits. Eligible measures include lighting, refrigerators, advanced thermostats, advanced power strips, domestic hot water, building shell, and HVAC equipment.

Resource Innovations (RI) became the primary implementer of the program in PY2022, taking over implementation from the International Center for Appropriate and Sustainable Technology (ICAST). As part of the program's one-stop-shop approach, RI offers a suite of concierge-style services to assist participants in identifying and executing energy efficiency projects. RI spearheads customer recruitment, assists with the application process, recommends project scopes, estimates incentives, and assists participants in coordinating installations. Customers can contract the installation work to a program-approved Trade Ally, or they can install measures themselves. RI staff also conduct post-installation QA/QC activities, submit final project data to Franklin Energy for invoicing, and provide customers with their rebate at the conclusion of the project.

Franklin Energy serves as the overall administrator of the program and leads the development of marketing collateral (in collaboration with Ameren Missouri and RI), provides engineering oversight, and processes incentive payments. Franklin Energy also facilitates communication between Ameren Missouri and the program implementation team. In this role, Franklin Energy holds regular status updates with Ameren Missouri and is responsible for providing reports on program activity and forecasts of future activity.

5.1 Participation Summary

In PY2022, the program treated 31 premises[20] across 29 projects.[21] These projects resulted in the installations of 3,839 energy-efficient measures as shown in Table 21.

Table 21. PY2022 Multifamily Market Rate Participation Summary

Participation Metrics	Unique Premises	Unique Projects	Measure Count
MFMR Program	31	29	3,839

Note: Unique projects are defined based on the Field Notes variable in the program tracking database.

Table 22 provides the quantity and ex ante savings associated with each measure type delivered to participating customers through the MFMR Program. Advanced thermostats, common area lighting (Lighting Custom BUS), and windows comprised the greatest quantity of measures delivered to property managers and owners. However, advance thermostats, building HVAC (HVAC Legacy Custom BUS), common area lighting, and central air conditioner replacements accounted for the largest share of ex ante gross savings for the Program (together accounting for 69% of ex ante savings).

[20] Given the lack of premise IDs in the program tracking data, the evaluation team estimated the number of unique premises using electric account number.
[21] The implementation team split large projects into phases that appear as separate projects in the tracking data. Therefore, a single participating property could have multiple projects associated with it.

Table 22. PY2022 Multifamily Market Rate Program Participation Summary by Measure Category

Measure Category	Measures		Ex Ante Savings	
	Number	%	MWh	%
Advanced Thermostat	1,071	28%	612	22%
HVAC Legacy Custom BUS	6	0%	477	17%
Lighting Custom BUS	810	21%	470	17%
Central Air Conditioner (CAC)	232	6%	352	13%
Windows Custom	775	20%	211	8%
Heat Pump Water Heater (HPWH)	100	3%	228	8%
Electronically Commutated Motors (ECM)	247	6%	141	5%
Ductless Air Source Heat Pump/Air Conditioner (ASHP/AC)	14	<1%	97	3%
Motor	1	<1%	90	3%
Variable Frequency Drives (VFD)	2	<1%	52	2%
Exit Sign	148	4%	34	1%
Air Source Heat Pump (ASHP)	2	<1%	22	1%
Air Conditioner Tune-Up	47	1%	11	<1%
Lighting RES	90	2%	2	<1%
Lighting Custom RES	288	8%	1	<1%
Filter Alarm	6	<1%	0.475	<1%
Total	**3,839**	**100%**	**2,801**	**100%**

Note: Individual values may not sum to totals due to rounding.

Note: Custom terminology indicates the use of site-specific parameters in the estimation of energy and demand savings from prescriptive measures (i.e., those covered in the TRM), not the installation of measures that require custom impact evaluation approaches.

5.2 Evaluation Methodology

The evaluation team focused almost exclusively on conducting impact evaluation activities to assess the performance of the MFMR Program in PY2022. Table 23 provides an overview of the MFMR Program evaluation activities.

Table 23. PY2022 Evaluation Activities for the Multifamily Market Rate Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in the Fall of PY2022 to understand program staff's perspectives on program performance, implementation, and design changes.
Program Material Review	▪ Reviewed new program materials to inform evaluation activities.
Database Review	▪ Reviewed program database to check that program data were complete.
Engineering Analysis	▪ Verified the deemed assumptions, site-specific inputs, and algorithms used to develop ex ante savings estimates. ▪ Estimated program and measure-level ex post gross impacts using TRM algorithms, deemed savings assumptions, and site-specific parameters where applicable.

5.3 Evaluation Results

5.3.1 Gross Impact Results

This section summarizes gross impact results for the PY2022 MFMR Program. Overall, the MFMR Program was the third largest contributor to the residential portfolio in terms of ex post gross energy and demand savings (6% and 5%, respectively). Table 24 compares first year ex ante and ex post gross savings at the program level. The ex post savings are 94% and 95% of the ex ante savings for energy and peak demand, respectively. As shown, the program achieved 61% of Ameren Missouri's first year gross energy savings goal and 74% of the first year demand savings goal.

Table 24. PY2022 Multifamily Market Rate Gross Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal
First Year Savings					
Energy Savings (MWh)	2,801	93.6%	2,621	4,319	61%
Demand Savings (MW)	1.19	94.6%	1.12	1.52	74%

The evaluation team completed analyses on the following program measures: advanced thermostats (HeatCool), common area lighting (Lighting BUS), common area HVAC equipment replacement (HVAC BUS), central air conditioners and air conditioner tune-ups (Cooling RES), air source heat pumps, dirty filter alarms and electronically commutated motors (HVAC RES), windows and insulation (Building Shell RES), heat pump water heaters (Water Heating RES), motor downsizing and variable frequency drives (Motors BUS), exterior lighting (EXT Lighting BUS), and in-unit lighting (Lighting RES). The remainder of this section summarizes the evaluation team's ex post analysis. We detail all calculation methodology, parameters, and assumptions in this section and source the information in Appendix A.

Table 25 summarizes the total PY2022 MFMR Program ex ante and ex post energy and demand savings and realization rates by enduse.

Table 25. PY2022 Multifamily Market Rate Gross Impacts by Enduse

Enduse	Energy Savings			Demand Savings		
	Ex Ante (MWh)	RR	Ex Post (MWh)	Ex Ante (MW)	Gross RR	Ex Post (MW)
HeatCool	615	83.8%	515	0.187	87.3%	0.163
Lighting BUS	495	98.1%	486	0.095	97.5%	0.093
HVAC BUS	477	100.0%	477	0.261	100.0%	0.261
Cooling RES	363	103.0%	374	0.339	104.7%	0.355
HVAC RES	258	100.0%	258	0.176	62.1%	0.109
Building Shell RES	211	111.1%	234	0.094	123.5%	0.116
Water Heating RES	228	100.0%	228	0.020	100.0%	0.020
Motors BUS	142	25.6%	36	0.013	32.9%	0.004
EXT Lighting BUS	9	100.0%	9	0.002	100.0%	0.002
Lighting RES	3	98.7%	3	0.000	98.7%	0.000
Total	**2,801**	**93.6%**	**2,621**	**1.188**	**94.6%**	**1.124**

Note: Individual values may not sum to totals due to rounding.

Table 26 summarizes the MFMR Program's total PY2022 ex ante and ex post electric energy and demand savings and realization rates by measure category. The gross realization rates of 94% for electric energy savings and 95% for demand savings indicate that the evaluated (ex post) gross savings achieved by the program are close to the program's tracked ex ante savings.

Table 26. PY2022 Multifamily Market Rate Gross Impacts by Measure Category

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Gross RR	Ex Post (MWh)	Ex Ante (MW)	Gross RR	Ex Post (MW)
Advanced Thermostat	612	83.7%	512	0.203	88.3%	0.180
HVAC Legacy Custom BUS	477	100.0%	477	0.261	100.0%	0.261
Lighting Custom BUS	470	95.3%	448	0.090	94.4%	0.085
Central Air Conditioner (CAC)	352	103.1%	363	0.334	103.1%	0.344
Windows Custom	211	111.1%	234	0.094	123.5%	0.116
Heat Pump Water Heater (HPWH)	228	100.0%	228	0.020	100.0%	0.020
Electronically Commutated Motors (ECM)	141	100.0%	141	0.066	100.0%	0.066
Ductless Air Source Heat Pump/Air Conditioner (ASHP/AC)	97	100.0%	97	0.092	27.5%	0.025
Exit Sign	34	137.6%	47	0.007	142.0%	0.009
Variable Frequency Drives (VFD)	52	62.5%	33	0.004	100.0%	0.004
Air Source Heat Pump (ASHP)	22	100.0%	22	0.001	100.0%	0.001
Air Conditioner Tune-Up	11	100.0%	11	0.005	214.1%	0.011
Motor	90	4.2%	4	0.010	5.5%	0.001
Lighting RES	2	98.0%	2	0.000	97.9%	0.000
Lighting Custom RES	1	100.0%	1	0.000	100.1%	0.000
Filter Alarm	0.475	100.0%	0.475	0.000	100.0%	0.000
Total	**2,801**	**93.6%**	**2,621**	**1.188**	**94.6%**	**1.124**

Note: Individual values may not sum to totals due to rounding.

Discrepancies between ex ante savings and ex post savings stem from multiple sources. The following list highlights the largest contributors to differences between ex ante and ex post savings:

- **Advanced Thermostat (22% of ex ante energy and 17% of ex ante demand):** The gross realization rate for advanced thermostats is 84% for energy savings and 88% for demand savings.
  - Ex ante estimates applied deemed savings values for advanced thermostats in accordance with v5.0 of TRM Appendix F. Ex post analysis used customer-specific values for SEER, cooling capacity, and baseline heating conditions found in the program-tracking database, which reduced savings.
- **Lighting Custom BUS (17% of ex ante energy and 8% of ex ante demand):** The gross realization rate for custom business lighting measures is 95% for energy and 94% for demand savings.
  - For four records, the evaluation team identified discrepancies between the program tracking data and project-specific custom workbooks. The ex post analysis replicated the ex ante estimates in the custom workbooks, resulting in increased savings.

- For one record, ex ante calculations used a waste heat factor (WHF) associated with interior lighting for fixtures that are in unconditioned spaces. The ex post analysis used the WHF for the external condition on this measure, which drove energy and demand savings down.
- For one record, ex ante calculations transcribed an incorrect savings number from the project workbook to the program tracking database. The correction of this error in the ex post analysis, led to reduced energy and demand savings.

- **Central Air Conditioner (CAC) (13% of ex ante energy and 28% of ex ante demand):** The gross realization rate for CACs is 103% for both energy and demand savings.
  - Ex ante estimates used TRM inputs from v5.0 of TRM Appendix F. The ex post analysis used the most recent version (v6.0) of Appendix F, which included updated values for cooling capacity and SEER. This increased energy and demand savings.
- **Windows Custom (8% of ex ante energy and 8% of ex ante demand):** The gross realization rate for custom window measures is 111% for energy savings and 123% for demand savings.
  - Ex ante estimates in the project tracking data differed from the project-specific workbooks for all records. The ex post analysis verified the savings in the RAF, which resulted in increased energy and demand savings.
- **Ductless ASHP/AC (3% of ex ante energy and 8% of ex ante demand):** The gross realization rate for ductless ASHP/AC measures is 100% for energy savings and 28% for demand savings.
  - Ex ante demand estimates applied the Coincidence Factor (CF) to total energy savings. The ex post analysis applied the CF to total cooling energy savings in accordance with TRM Appendix F (v6.0) of the TRM, which resulted in lower demand savings.
- **Motor (3% of ex ante energy and 1% of ex ante demand):** The gross realization rate for motor measures is 4% for energy savings and 5% for demand savings.
  - Ex ante estimates used inputs and algorithms that did not reflect the source of savings. The ex post analysis adjusted the following factors to address this issue, causing reductions in both energy and demand savings.
    - Baseline motor load factor: The load requirements for the system have not changed. Assuming the new motor is sized correctly, the previous motor was oversized for the load. We updated the baseline motor load factor to reflect this.
    - Baseline motor efficiency at load factor: The evaluation team corrected the algorithm, changing the baseline motor efficiency from 128% to 73%.
    - HOU: The ex post analysis changed the Hour of Use (HOU) to match the chilled water pump HOU from section 2.8.1 of the Ameren Missouri TRM Appendix H.

5.3.2 Process Results

The MFMR Program aims to assist owners and managers of multifamily properties with identifying and implementing comprehensive energy efficiency projects that result in deep savings and bill reductions for Ameren Missouri customers.

Overall, there were a few changes to the MFMR Program design in PY2022. The most notable change to program design was the shift toward a prescriptive model using deemed baselines to calculate energy savings and customer incentives for projects, rather than site-specific or custom values based on the replaced measures. RI adopted this approach to better facilitate Trade Ally engagement in the program.

Outside of this program change, the MFMR Program experienced difficulties with its project pipeline during PY2022. The initial expectation was that leads from the previous implementer would create a substantial project pipeline while new projects would come in organically as contractors sold the program to their customers. However, few of the legacy implementer's leads resulted in completed projects and contractors were slow to bring in new ones. Furthermore, the change in implementers led to delays in processing projects submitted for payment while RI and Franklin Energy integrated their respective customer relationship management systems and engineering software. Based on that experience, RI adopted a more proactive outreach strategy, and the program team continued to improve operational processes throughout the program year.

Limited product availability also delayed completion on some projects in PY2022. In particular, the program team mentioned that microchip shortages affected the available supply of smart thermostats and furnaces. With supply chain disruptions expected to persist in PY2023, the program team is attempting to develop a pipeline with projects scheduled months in advance so that contractors can have enough time to respond to product shortages.

The program team also commented on rising equipment and labor costs as a possible barrier to program implementation. With cost increases expected to continue in PY2023, the program team plans to evaluate incentive levels and determine if they are sufficient to encourage multifamily property managers and owners to participate.

Complementing the program team's observations about PY2022, the evaluation team offers responses—in Table 27—to the five process evaluation questions required by Missouri Code of State Regulations (CSR) for demand-side process evaluations. Given that the PY2022 evaluation did not include process evaluation activities, the findings here are based largely on process evaluation activities conducted in previous years.

Table 27. Summary of Responses to CSR Process Evaluation Requirements

CSR Required Process Evaluation Questions	Findings
What are the primary market imperfections that are common to the target market segment?	Market imperfections specific to the multifamily sector include (1) the split incentive[22] for in-unit measures between property owners, managers, and residents; (2) a lack of awareness of the potential for saving money and energy through energy efficiency upgrades; (3) costs associated with larger non-lighting measure upgrades; (4) limitations to the knowledgeable staff available to install energy-efficient upgrades; and (5) the time investment to plan, budget, and implement energy efficiency upgrades.

[22] The split incentive occurs when the tenant pays the cost of the electricity use, but the owner is responsible for choices that affect building and equipment efficiency.

CSR Required Process Evaluation Questions	Findings
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes, the target market is appropriately defined as owners, managers and residents of buildings that include three or more units with Ameren Missouri electric service. This program addresses the need for both common area and in-unit upgrades.
Does the mix of enduse measures included in the program appropriately reflect the diversity of enduse energy service needs and existing enduse technologies within the target market segment?	Yes, the program offers measures that cover all major multifamily common area and in-unit enduse needs, including lighting, appliances, space cooling, space heating, ventilation, building shell (e.g., insulation and windows), and water heating. The program team can continue to increase the comprehensiveness of solutions offered to the target market segment by encouraging participation in the one-stop-shop channel.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	The primary recruitment channel is RI's network of relationships with local contractors and larger property management companies. The program also leverages relationships with community-based organizations and trade organizations. This varied approach generates participation from varying customer types in the target market segment.
What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the Program?	One potential strategy to overcome split incentive issues is the promotion of Green Leases.[23] Green Leases are contracts between landlords and a tenant or tenants that negotiate the mutual benefit of installing energy-efficient or green measures in shared buildings. For shared buildings, owners are burdened with green upgrade costs, while tenants benefit from lower operating costs. Without green leases, there is little incentive for owners to make green upgrades to tenant units. Green leases allow both parties financial benefits and incentives, and multifamily building types are ideal buildings for their use. The other market imperfections we outline above are largely targeted by the program's one-stop-shop model. As such, increasing participation and/or the share of projects in the program utilizing those services should help to overcome imperfections, such as lack of awareness and information, project costs, limited staff knowledge, and the time needed to plan efficiency projects more effectively.

5.4 Conclusions and Recommendations

The evaluation team offers the following conclusions and recommendations for the MFMR Program based on the results of the PY2022 evaluation:

- **Conclusion #1:** Consistent with PY2021, the current program tracking database lacks key inputs for calculating ex ante energy and demand savings and that are necessary to verify ex post savings. The missing inputs and additional supporting information are often only available in external documents such as the project-specific or custom workbooks provided by the implementation team. Incorporating these inputs into the tracking database will improve the efficiency of program quality control measures and evaluation and may also positively impact gross realization rates.

[23] Consortium for Building Energy Innovation (CBEI). "Creating an Energy Savings Win-Win for Owners and Tenants." *Split Incentives and Green Leases.* Last modified July 27, 2020. http://www.cbei.psu.edu/split-incentives-and-green-leases/index.html.

- **Recommendation #1:** For projects using site-specific, "custom" parameters, project workbooks include detailed documentation of the development of ex ante estimates. We recommend that the implementation team incorporate more of the key parameters from these workbooks into the program-tracking database given their use in prescriptive algorithms (e.g., cooling capacity, heating capacity, and baseline conditions, which were all provided but not for every record in the database). We also recommend that all custom workbooks going forward include project summaries and information on the sources of energy savings.

- **Conclusion #2:** Ex ante savings estimates for custom business lighting measures all used the common area business lighting CF. Appendix H of the TRM (Versions 4.0) provides additional granularity with separate CFs for indoor lighting, exterior lighting, and 24/7 lighting. Going forward, lighting projects should use the appropriate CF when possible.
  - **Recommendation #2:** We recommend updating the CF values to take into consideration the three different kinds of business lighting: Common Area, Exterior, and 24/7 lighting. This will improve the accuracy of demand savings for each type of lighting.

- **Conclusion #3:** The custom workbooks that program implementers use to estimate ex ante savings for custom HVAC measures, specifically CACs and heat pumps, incorrectly apply the CF to total energy savings to determine demand savings. The TRM specifies that calculations should only apply the CF to the cooling energy savings in order to determine peak summer demand savings. This error led to a large decrease in demand savings in the ex post analysis.
  - **Recommendation #3:** We recommend that the implementation team update the algorithm in the custom workbooks to align with the TRM.

6. Pay As You Save (PAYS)

This chapter summarizes the PY2022 evaluation methodology and results for the Pay As You Save (PAYS®) Program. The PY2022 evaluation of the PAYS Program included both gross impact and process activities, along with an analysis (forthcoming) of participant FR and spillover (SO) for potential prospective application.[24] We present details on the methodologies in Section 6.2, Appendix A, and Appendix C.

The PAYS Program is a tariff on-bill financing offering that launched in PY2021. The program provides a range of energy efficiency measures—including LED lighting, domestic hot water, insulation, air sealing, and HVAC equipment—to residential customers. Program staff deliver some smaller equipment at no cost to customers during an initial home assessment, while installations of other items for qualifying customers are part of more involved retrofits. For these retrofit projects, an on-bill financing incentive design allows participating customers to pay back the cost of energy efficiency projects incrementally through their utility bill in the form of a tariff charge. The tariff charge aspect of the program design means the cost of the project and the payback remains with the premise, not the customer. That is, if the customer moves out of the treated home prior to paying back the cost of the project, the new occupant will pay the remaining balance of the project's cost through their utility bill.

The program design includes an 80/20 rule whereby the structuring of monthly loan payments allows for the expected energy savings to outweigh the project cost, thus resulting in an overall lower monthly utility bill for a participant than before the project. To qualify for a PAYS project, the cost of a measure cannot exceed 80% of the estimated post-upgrade savings over 80% of its expected lifecycle. The remaining 20% of savings must flow to the participant.

The PAYS Program targets residential customers with energy usage higher than expected based on certain housing characteristics and does not target or qualify participants based on income level. Targeted customers receive custom marketing materials, and any interested customer can enroll online. The PAYS Program classifies participation into four tiers:

- **Tier 1:** Once a customer enrolls, the implementer schedules an in-person appointment at the customer's home. During the appointment, an energy advisor conducts a visual inspection of the home, provides more program information, and may provide the participant with direct install measures.
- **Tier 2:** If the home is clear of health and safety issues, and the participant chooses to move forward, the implementer conducts a home assessment in which program staff complete a comprehensive audit and energy assessment. This analysis considers building characteristics and HVAC system specifications and may include direct-air and duct leakage tests.
- **Tier 3:** Program staff enter data from the home assessment into a customized version of the proprietary OptiMiser® modeling software to estimate savings associated with upgrading measures in the home. Participants receive an Easy Plan outlining recommended upgrades. If the project does not meet the program's 80/20 rule on its own, participants get a quote for the copay needed to move forward under program requirements.
- **Tier 4:** For participants who accept the plan, the program team works with a network of registered Trade Allies to install the measures, and the program places a tariff charge on the participant's bill. The implementer conducts quality control remotely for 100% and on-site for 10% of Tier 4 projects.

[24] The results of the FR and SO analyses will be provided in a standalone memorandum.

In addition to on-bill financing, the measures installed are also eligible for any other Ameren Missouri energy efficiency program incentives, and these incentives are automatically applied to the project cost without additional action required from the participant. Franklin Energy administers the program on behalf of Ameren Missouri, and EEtility operates as the program implementer (also referred to as the "implementation team" throughout this section).

6.1 Participation Summary

In PY2022, the PAYS Program completed 991 Tier 1 and 119 Tier 4 projects, as summarized in Table 28. Nearly all participants (94%) received at least one advanced power strip, and slightly less than half (45%) received standard LED lighting measures. Among Tier 4 participants, the vast majority (85%) received an HVAC system, and more than half received smart thermostats (55%) or attic insulation (58%). All Tier 4 participants initially received home assessments and any available Tier 1 direct install measures, but we exclude these customers from the count of total Tier 1 participants to avoid double-counting.

Table 28. PY2021 PAYS Program Participation Summary

Channel	Measure Category	Participants		Units		Ex Ante Energy Savings	
		Count	%	Count	%	MWh	%
Tier 1 Direct Install	Standard LED Lighting	502	45%	2,758	44%	90	9%
	Advanced Power Strip	1,045[a]	94%	1,126	18%	33	3%
	Low-Flow Showerhead	142	13%	176	3%	34	3%
	Bathroom Faucet Aerator	164	15%	295	5%	10	1%
	Kitchen Faucet Aerator	61	5%	68	1%	8	1%
	Water Heater Wrap	5	<1%	7	<1%	1	<1%
	Water Heater Pipe Wrap	204	18%	1,000	16%	5	<1%
Subtotal Tier 1		***991***	***89%***	***5,430***	***86%***	***180***	***18%***
Tier 4 Retrofit	HVAC	101	9%	101	2%	643	63%
	Smart Thermostat	66	6%	66	1%	62	6%
	Attic Insulation	69	6%	69	1%	58	6%
	Air Sealing	44	4%	44	1%	48	5%
	Duct Sealing	14	1%	14	<1%	13	1%
	Specialty LED Lighting	19	2%	558	9%	10	1%
	Tier 1 Measures[b]	N/A	N/A	N/A	N/A	1	<1%
Subtotal Tier 4		***119***	***11%***	***852***	***14%***	***835***	***82%***
Total		**1,110**	**100%**	**6,282**	**100%**	**1,016**	**100%**

[a] Participant count includes Tier 4 participants who received advanced power strips.

[b] Tier 1 measures included in Tier 4 tracking data were excluded to avoid double counting of associated savings.

Note: All Tier 4 participants also received home assessments and any available Tier 1 direct install measures but are excluded from the count of total Tier 1 participants

6.2 Evaluation Methodology

For PY2022, the evaluation team completed a comprehensive gross impact evaluation as well as a process evaluation. The process evaluation focused on understanding differences in program design and delivery from

PY2021 to PY2022 and highlighting key successes and challenges from the second year of the program's implementation. More specifically, key objectives of the process evaluation included the following:

- Characterize the customer experience, i.e., document aspects of the program implementation that went well, those that may be improved in future program years, and customer satisfaction;
- Describe participating contractors' experiences with the program and document any barriers (from the contractor's perspective) to program delivery;
- Explore how availability of financing may contribute to participants' willingness to install deeper savings measures and comprehensive energy efficiency projects;
- Identify potential barriers to increasing participation in the PAYS Program in future years; and
- Answer CSR-mandated research questions under 20 CSR 4240-22.070(A).

The process evaluation relied on interviews with program staff, a review of program materials, a participant survey, interviews with participating trade allies, and a non-participant survey. The impact evaluation relied on a review of program-tracking data, an assignment of appropriate TRM-based savings assumptions for Tier 1 measures, a detailed energy model review for a sample of Tier 4 projects, and development and application of survey-based ISRs. Table 29 provides an overview of the PAYS Program evaluation activities. Following the table, we provide a more detailed summary of key evaluation activities specific to the PAYS Program evaluation (see Chapter 2 for an overarching discussion of evaluation activities common to all residential program evaluations included in this report).

Table 29. PY2022 Evaluation Activities for the PAYS Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews to understand program design, staff's perspective on program implementation, and any changes that occurred throughout PY2022.
Program Material Review	▪ Reviewed program materials to inform evaluation activities.
Participant Survey	▪ Conducted an online survey of PY2022 participants to verify receipt and installation of measures, solicit feedback regarding participation experience, and gather data to inform NTG analysis (forthcoming).
Trade Ally In-Depth Interviews	▪ Completed in-depth interviews with a sample of participating trade allies responsible for installing weatherization and/or HVAC measures.
Non-Participant Survey	▪ Conducted an online survey of non-participants who expressed initial interest in the program to identify reasons why they ultimately decided not to participate.
Gross Impact Analysis	▪ Reviewed program-tracking data for accuracy and completeness. ▪ Assigned Ameren Missouri TRM per-unit savings to develop Tier 1 measure ex post savings. ▪ Updated energy models based on review of available tracking data and detailed project documentation to develop Tier 4 retrofit measure ex post savings. ▪ Developed and assign survey-based ISRs for each measure category.
Prospective Attribution Analysis (Forthcoming)	▪ Conducted participant survey to collect FR and SO inputs. ▪ Develop estimates of FR and SO for prospective application.

Participant Survey

The evaluation team fielded an online survey with PY2022 participants in the PAYS Program (i.e., Tier 1 through 4 participants). Overall, the goals of the participant survey were to:

- Verify measure receipt and installation to develop ISRs;
- Solicit feedback regarding participation experience, including satisfaction with program processes, program-distributed measures, and interactions with program staff and trade allies; and
- Gather information to estimate participant FR and SO for potential prospective application.

The response rate for the participant survey was 38%. Table 30 outlines the disposition summary for the survey; Appendix C provides demographic information for respondents to the participant survey.

Table 30. Participant Survey Disposition Summary

Disposition	Number of Participants
Completed Surveys	391
Partial Complete	31
No Response	616
Bounced E-mail	15
Screened Out	2
Opt-Out	0
Total Participants in Sample	**1,055**

Trade Ally Interviews

The evaluation team conducted in-depth interviews with participating trade allies in PY2022 as a follow-up to the in-depth interviews conducted in PY2021. The goals of the interviews were to:

- Understand participating contractors' overall experiences with the program;
- Collect information on program coordination and implementation; and
- Document program successes and challenges.

In December 2022 and January 2023, we completed interviews with all three active trade allies responsible for Tier 4 retrofit HVAC and/or weatherization installations. The evaluation team offered an incentive of $100 to each interviewee. The interviewed trade allies were responsible for 100% of PAYS retrofit projects completed in PY2022.

Non-Participant Survey

The evaluation team fielded an online survey with customers who, during PY2022, expressed interest in the program by submitting an online PAYS Assessment Form but ultimately did not schedule and complete a home assessment. Overall, the goals of the non-participant survey were to solicit feedback regarding (1) reasons for not participating, (2) likelihood of participation in the future, and (3) the initial program experience, including sources of awareness and preferred modes of communication. The response rate for the non-participant survey was 29%. Table 31 outlines the disposition summary for the non-participant survey; Appendix C provides demographic information for respondents to the non-participant survey.

Table 31. Non-Participant Survey Disposition Summary

Disposition	Number of Participants
Completed Surveys	240
Partial Complete[a]	13
No Response	825
Bounced E-mail	28
Screened Out	105
Opt-Out	0
Total Participants in Sample	**1,211**

[a] Our analysis included partial completes that completed >90% of the survey (n = 4).

Gross Impact Analysis

The PY2022 impact evaluation of the PAYS Program consisted of several steps. We began by reviewing program-tracking data for accuracy and completeness and to confirm it included the necessary level of detail for subsequent components of the analyses. For Tier 1 measures, we reviewed ex ante per-unit savings assumptions and applied appropriate per-unit savings from the Ameren Missouri TRM.[25] For Tier 4 measures, we conducted a comprehensive review of available tracking data and detailed project documentation for a sample of 20 Tier 4 projects. We updated associated OptiMiser models to align with verified measure details, household characteristics, and weather information. Lastly, we developed and applied ISRs based on participant survey responses for each Tier 1 and Tier 4 measure category.

Review of Program-Tracking Data

As a first step in our gross impact analysis, the evaluation team received and reviewed the following program-tracking data reports provided by the program administrator:

- The PAYS Tier 1 program-tracking database includes the following information for participants who completed Tier 1 projects: detailed participant data, installation date, measure quantity, water heating fuel type, HVAC system information, and total energy and demand savings for all Tier 1 measures received by the participant.
- The PAYS Tier 4 program-tracking database includes the following information for participants who completed Tier 4 projects: detailed participant and household data, key participation dates, measure details and quantities, and total energy and demand savings for all Tier 4 and Tier 1 measures received by each Tier 4 participant (i.e., all those who completed a Tier 4 retrofit).
  - This database includes Tier 1 measures already accounted for in the Tier 1 database, sometimes with negative or otherwise unreasonable savings values. To avoid double-counting of Tier 1 measure savings, the evaluation team excluded Tier 1 measures from ex post savings developed for Tier 4 participants.[26]
  - For Tier 4 specialty LED lighting, tracking data included internally inconsistent quantities and savings values that could not be reconciled or disentangled from Tier 1 standard lighting records. For the purposes of the energy model analysis, the evaluation team therefore relied on specialty

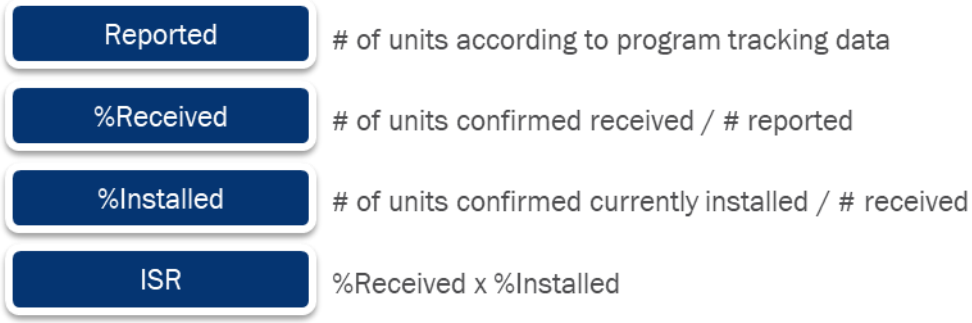
[25] The evaluation team cross-referenced deemed savings from Ameren Missouri TRM Appendix F Revision 6.0 (released October 2022) using PAYS participants' building and incented measure characteristics.
[26] The program team also took steps to avoid double-counting of savings but in a different, less transparent way.

LED quantities included in a supplemental dataset provided by the implementation team, referred to as the Post Retrofit Report.

Survey-Based ISR Development

For both Tier 1 and Tier 4 measures, we relied on participant survey responses to estimate ISRs for the various measure categories. Two sets of survey questions asked respondents to confirm the number of products received and to report the number of those products installed at the time of the survey.[27] We calculated the receipt rate as the number of units the customer received divided by the number appearing in program-tracking data. We calculated the installation rate as the number of units installed at the time of the survey divided by the number received. The ISR is a product of the receipt and installation rates, as shown in Figure 1.

Figure 1. Survey-Based ISR Development



Deemed Savings Analysis for Tier 1 Measures

The Tier 1 analysis began with a review of the program-tracking database to verify that it included the necessary level of detail. We then reviewed all program-tracked ex ante per-unit savings and compared them to values recommended by the Ameren Missouri TRM.[28] We established and assigned appropriate TRM-recommended per-unit savings for each Tier 1 measure category, leveraging actual measure specifications and participant household characteristics (e.g., water heating fuel type) where available in the program-tracking data. We then applied the survey-based ISRs to TRM-based per-unit savings to estimate ex post gross savings for Tier 1 measures.

Energy Model Analysis for Tier 4 Retrofit Measures

The Tier 4 energy model analysis consisted of a desk review of project documentation and a thorough review of modeling files for 20 sampled projects to develop overall realization rates. The implementation team relied on a customized version of a proprietary modeling software called OptiMiser to estimate pre- and post-retrofit energy usage. In preparation for our analysis, we conducted an in-depth interview with implementer and OptiMiser staff familiar with the modeling software and its application.

The evaluation team requested all available project documentation for the sampled projects, which included invoices, equipment spec sheets, photos of baseline and efficient equipment, and OptiMiser modeling files.

[27] Note that for air sealing, duct sealing, and attic insulation, the survey only verified receipt; continued installation is assumed to be 100% for these measures as they are unlikely to be removed.
[28] Note that for ex ante, the TRM version the implementation team applied to the program-tracking data was Revision 5.0 (released September 2021) of the Ameren Missouri 2019–21 MEEIA Energy Efficiency Plan, Appendix F. For ex post, the evaluation team applied the updated Revision 6.0 (released October 2022) of the Ameren Missouri TRM.

Project documentation provided by the implementation team to inform the energy model review included invoices and pre- and post-HVAC installation verification photos for 18 out of 20 projects. Notably, the documentation did not include key items, including verification or additional detail regarding: (1) duct sealing and attic insulation materials, measurements, and photos and (2) blower door test results and CFM reduction values.

We reviewed all these materials and used the information to update model parameters with verified baseline and efficient measure specifications, household characteristics, and weather information for the ex post analysis. We then recalibrated and reran the OptMiser models to calculate ex post savings for each Tier 4 measure category.

Based on revised OptiMiser model outputs, we developed project-level realization rates for each of the sampled projects. We then applied the savings-weighted average of these realization rates as well as the survey-based ISRs to ex ante savings across the entire population of Tier 4 measures to develop ex post gross savings.

6.3 Evaluation Results

6.3.1 Gross Impact Results

This section summarizes gross impact results for the PY2022 PAYS Program. The PAYS Program was the smallest contributor to non-income eligible residential portfolio, representing 2% of portfolio ex post gross energy and demand savings. Table 32 compares first year ex ante and ex post gross savings at the program level. As shown, the program achieved first year ex post gross energy and demand savings of 899 MWh and 0.37 MW, respectively, representing 10% and 9%, respectively, of its gross energy and demand savings goals.

Table 32. PY2022 PAYS Gross Impacts Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal
First Year Savings					
Energy Savings (MWh)	1,016	88.5%	899	8,735	10%
Demand Savings (MW)	0.41	89.4%	0.37	4.07	9%

In PY2022, Tier 4 retrofit measures accounted for 83% of ex post energy savings and 95% of ex post demand savings, with HVAC upgrades alone accounting for a majority of program savings (64% of ex post energy and 74% of ex post demand savings). Among Tier 1 direct install measures, LED lighting represented a majority (58%) of total ex post energy and just over two-thirds (68%) of total ex post demand savings. Table 33 summarizes total ex post savings and realization rates from Tiers 1 and 4 by measure category.

Table 33. PY2022 PAYS Gross Impacts by Channel and Measure Category

Channel	Measure Category	Energy Savings			Demand Savings		
		Ex Ante (MWh)	RR	Ex Post (MWh)	Ex Ante (MW)	RR	Ex Post (MW)
Tier 1 Direct Install	Standard LED Lighting	90	98.2%	88	0.014	98.2%	0.014
	Advanced Power Strip	33	78.2%	26	0.004	78.2%	0.003
	Low-Flow Showerhead	34	58.1%	20	0.003	58.1%	0.002
	Bathroom Faucet Aerator	10	74.0%	8	0.001	74.0%	0.001
	Kitchen Faucet Aerator	8	75.7%	6	0.001	75.7%	0.001

Channel	Measure Category	Energy Savings			Demand Savings		
		Ex Ante (MWh)	RR	Ex Post (MWh)	Ex Ante (MW)	RR	Ex Post (MW)
	Water Heater Wrap	1	100.0%	1	<0.001	100.0%	<0.001
	Water Heater Pipe Wrap	5	90.3%	4	<0.001	90.3%	<0.001
	Subtotal Tier 1	***180***	***84.4%***	***152***	***0.023***	***87.7%***	***0.020***
Tier 4 Retrofit	HVAC	643	90.1%	579	0.300	90.1%	0.270
	Smart Thermostat	62	86.1%	53	0.029	86.1%	0.025
	Attic Insulation	58	88.2%	51	0.027	88.2%	0.024
	Air Sealing	48	88.2%	43	0.023	88.2%	0.020
	Duct Sealing	13	88.2%	12	0.006	88.2%	0.005
	Specialty LED Lighting	10	81.3%	8	0.001	81.3%	0.001
	Subtotal Tier 4	***835***	***89.3%***	***746***	***0.386***	***89.5%***	***0.345***
	Total	**1,016**	**88.5%**	**899**	**0.409**	**89.4%**	**0.365**

Note: Individual values may not sum to totals due to rounding.

As shown in Table 32, the PAYS Program achieved gross realization rates of 88.5% and 89.4% for energy and demand savings, respectively. We made the following adjustments to ex ante savings assumptions. More detailed results are presented in Appendix C.

- **Tier 1 Direct Install (DI) Measures.** Differences between ex ante and ex post savings are driven by two overarching factors: (1) the evaluation team applied Ameren Missouri TRM-recommended assumptions regarding building type and hot water fuel type to develop per-unit savings that reflect information available from the program-tracking database, whereas ex ante savings relied on deemed per-unit savings values from Appendix F Version 5.0 of the Ameren Missouri TRM that did not account for these details; and (2) the evaluation team applied survey-based ISRs developed as part of the current evaluation, whereas ex ante savings relied on deemed per-unit savings values from TRM Appendix F that included ISR assumptions not specific to the PAYS Program. We provide more detailed explanations of these differences below:
  - For 136 water heating measures (9% of water heating measures), the evaluation team changed water heating fuel assumptions to align with Ameren Missouri TRM recommendations based on information included in program tracking data.[29] In contrast, the ex ante savings used deemed per-unit savings from Appendix F of the Ameren Missouri TRM that reflect 100% electric water heating. This difference resulted in a 9% reduction to energy and demand savings for faucet aerators, showerheads, water heater wrap, and water heater pipe wrap.
  - The evaluation team developed and applied measure-specific ISRs as part of this evaluation to estimate ex post gross savings, whereas ex ante savings used deemed per-unit savings from Appendix F of the Ameren Missouri TRM that reflect ISRs from prior research and evaluations of other residential programs. ISRs developed as part of this evaluation ranged from 65% to 100% and are slightly lower than those embedded within ex ante per-unit savings for each Tier 1 measure category except water heater tank and pipe wrap (which the ex post analysis deemed at 100%).

[29] Ameren Missouri TRM Appendix I Version 6.0 stipulates to assume 42% of installations of water heating measures (e.g., faucet aerators, showerheads) are installed in homes with electric water heating when the actual fuel source is unknown. No savings are awarded for measures installed in homes known to have gas water heating.

- **Tier 4 Retrofit Measures.** Differences between ex ante and ex post savings are driven by two overarching factors: (1) the evaluation team reviewed and updated energy models for a sample of projects to correct for inconsistencies between original energy models and available project documentation; and (2) the evaluation team applied survey-based ISRs developed as part of this evaluation, whereas ex ante savings relied on model-based savings that assumed 100% installation rates. We provide more detailed explanations of these differences below:
  - For one project (8% of sampled Tier 4 ex ante energy savings), we updated baseline heating equipment specifications from an electric resistance furnace to an air-source heat pump based on pre-installation photos, which reduced savings substantially and represented the primary driver of the project's 32% savings realization rate.
  - For one project (6% of sampled Tier 4 ex ante energy savings), we updated insulation-related project specifications (e.g., baseline R-values) based on information available in program tracking data, which reduced savings substantially and represented the primary driver of the project's 78% savings realization rate.
  - For 13 projects (65% of sampled Tier 4 ex ante energy savings), we updated weather assumptions, which slightly reduced project-level realization rates in most cases.
  - For 13 projects (63% of sampled Tier 4 ex ante energy savings), we replaced model-based lighting savings (which often included Tier 1 lighting measures) with per-unit savings assumptions from the Ameren Missouri TRM for Tier 4 specialty LEDs only, which slightly reduced savings for each project.

6.3.2 Process Results

This section summarizes the results of the PY2022 process evaluation for the PAYS Program. Key findings are summarized below, and the following subsections provide additional details.

- Program participants generally found the participation process easy and expressed moderate to high levels of satisfaction with key program elements and the program overall, particularly among Tier 3 and Tier 4 participants. The majority of participants felt the same or better about Ameren Missouri after participating and indicated they are likely to recommend the PAYS Program to others.
- Among a minority of participants who expressed dissatisfaction, the most common reasons included lack of communication from program staff or wait times between stages of participation.
- Participants reported that, in certain cases, energy advisors did not install Tier 1 equipment or provide guidance on proper use of advanced power strips, which is likely a key driver of ISRs below 100% and inconsistent use of advanced power strip features. We note that PAYS protocols direct program staff not to move furniture or large electronics to install advanced power strips for liability reasons. Additionally, PAYS protocols dictate that staff should leave Tier 1 measures behind for self-installation should customers make that request. Both of these factors may have contributed to ISRs of less than 100% for Tier 1 measures.
- The majority of Tier 3 participants received their Easy Plans in a timely manner and understood the plan's contents, in part because a program representative nearly always explained it to them. However, half of Tier 3 participants felt PAYS Charge terms were unreasonable, most often based on the required copay amount. Despite this, a majority of Tier 3 participants indicated it was likely they would move forward with a retrofit.

- Customers most commonly learned about the PAYS Program from the Ameren Missouri website and generally would prefer to schedule home energy assessments and learn about future offerings via e-mail.
- The majority of non-participating customers who completed the enrollment process reported that the process was easy, that they were interested in lowering their energy bills, and that they are at least somewhat likely to schedule a PAYS home assessment in the future. Many of these non-participating customers reported that they had not received any follow-up since submitting the online PAYS Assessment Form but remain interested in scheduling a home assessment.
- Trade allies responsible for completing HVAC and weatherization installations reported generally positive program experiences, but pointed to some challenges communicating with the implementation team staff and navigating inconsistencies between Easy Plan recommendations and what they felt was feasible or advisable for a given home.

Participant Experience and Program Satisfaction

Participant Experience

Most PAYS participants found the PAYS Program participation process relatively easy. Approximately 63% of participants indicated they found the process at least somewhat easy. Notably, a significantly higher percentage of Tier 3 and 4 participants found participation easy as compared to Tier 1 and 2 participants (78% of Tier 4, 75% of Tier 3, and 53% of Tier 1/2 found the process at least somewhat easy). Among the minority of respondents who found the participation process at least somewhat difficult (20%), the most common reasons included lack of communication or follow-up from program staff (41%),[30] home energy assessment scheduling issues (25%), long lead times (24%), property barriers that interfered with participation (24%), and lack of knowledge/confusion about the process (9%). In Figure 2 below we provide verbatim responses from participants who responded to the survey that describe some of these more common challenges in more detail.

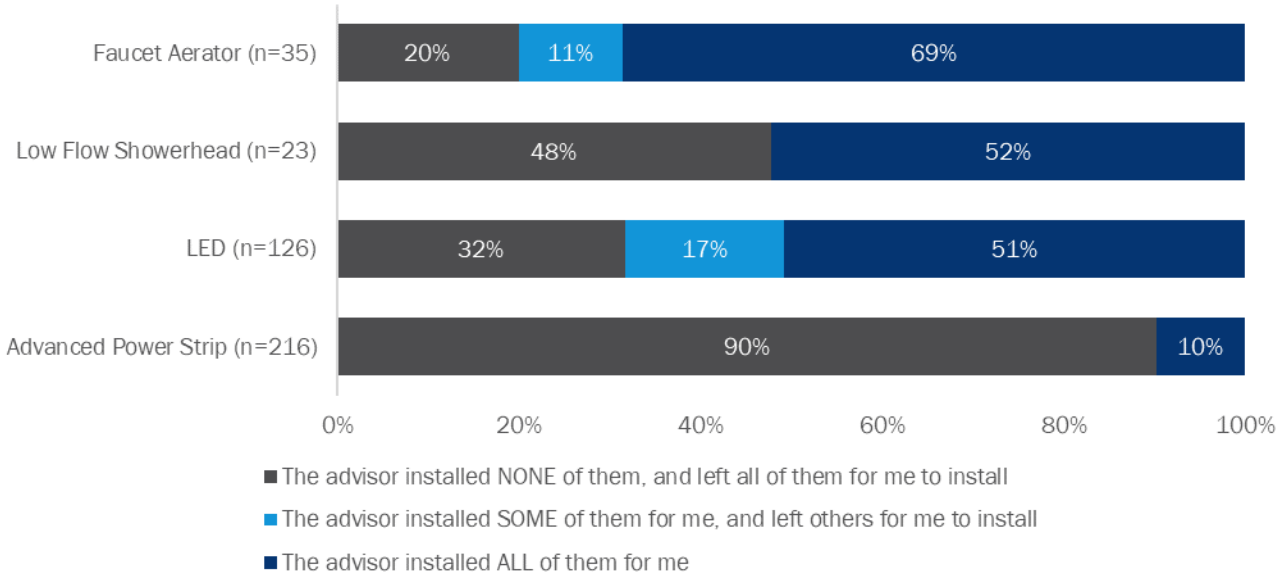
[30] Note that, per in-depth interviews with and documentation provided by the implementation team, PAYS program staff make attempts to contact most Ameren Missouri customers who request follow-up communication related to the PAYS Program.

Figure 2. Participant Difficulties with PAYS Program Process

Lack of Communication /Follow-Up	*"Nothing has been done since the evaluation was completed. I was told someone would contact me within 14 days, no one has. I have called several times and had to leave messages, no return calls."*
Home Energy Assessment Scheduling	*"Scheduling was difficult - I was told to fill out a form and I would get a call back shortly - I did not. I had to call and hound to get the appointment scheduled. It took a long time"*
Long Lead Time	*"It took several months to get a visit and now it has been 5 months and I have received no report as of yet."*
Property Barriers	*"I wasn't eligible to do the [blower door test] due to a leaky window which needs to be replaced, but I don't have the funds available to do so."*
Lack of Knowledge /Confusion	*"Financing options/requirements were not clear. I was under the impression that all charges would be rolled into the electric bill as opposed to a very small percentage of overall cost, making this a less viable solution as I originally thought."*

The survey asked Tier 1 participants whether the energy advisor installed all, some, or none of each measure they received, excluding pipe wrap (see Figure 3). According to respondents, energy advisors installed all units for 69% of faucet aerators recipients and about half of showerhead and LED recipients (52% and 51%, respectively), but for only 10%[31] of participants who received advanced power strip(s). Energy auditors leaving measures for customers to self-install has meaningful implications for participant experience and ISRs (see Section 6.3.1 for ISR results and associated findings).

Figure 3. Measures Installed by Energy Advisor or Left for Participant to Install Through PAYS Program



[31] Note that the PAYS program leaves Tier 1 Direct Install (DI) measures behind upon customer requests. The program team will also not move furniture or large electronics to install advanced power strips for liability reasons.

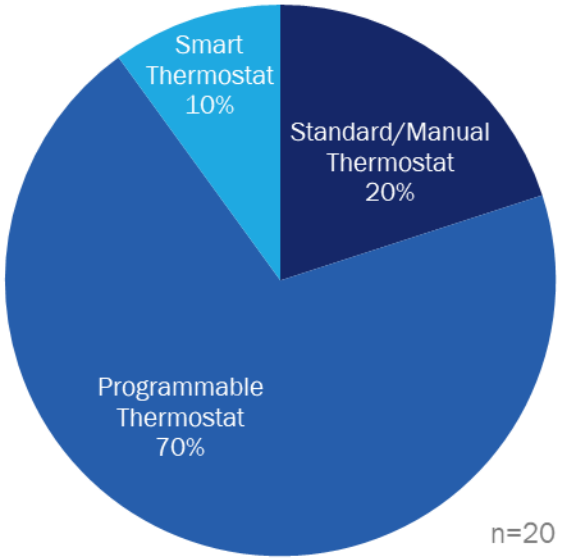
Experience with Advanced Power Strips

Approximately half of advanced power strip recipients indicated they are using them as regular power strips and do not have them set to automatically turn off devices. These participants commonly reported they were not using this feature because they preferred to keep additional devices on even when the main device turns off (39%), the product was confusing/hard to use (36%), the product shut off powered devices when they were still in use (12%), and/or they were not aware of the feature (10%). Participant confusion and hesitancy to take advantage of advanced power strip features could likely be reduced by additional support from energy advisors.

Experience with Smart Thermostats

Given that energy savings from smart thermostats are only achieved when they replace a less efficient thermostat and when users take advantage of energy-saving features, the survey asked participants to confirm what type of thermostat they replaced through the program and how they are using their new smart thermostat. Among the 20 respondents who received smart thermostats through the program, 75% indicated they had set schedules or used other energy-saving smart thermostat features, and 70% reported they had connected it to their homes' Wi-Fi network. As shown in Figure 4, 20% of smart thermostat recipients replaced a standard/manual thermostat, 70% a programmable thermostat, and 10% a previously installed smart thermostat.

Figure 4. Type of Thermostat Replaced with Smart Thermostat Through PAYS Program



Program Satisfaction

Slightly more than half (54%) of participants reported they were at least somewhat satisfied with the program overall, as shown in Figure 5. Twenty-two percent of participants indicated they were somewhat or very dissatisfied with their participation experience. Notably, significantly more Tier 3 and 4 participants than Tier 1 and 2 participants were at least somewhat satisfied with the program overall.

Figure 5. Overall PAYS Program Participant Satisfaction

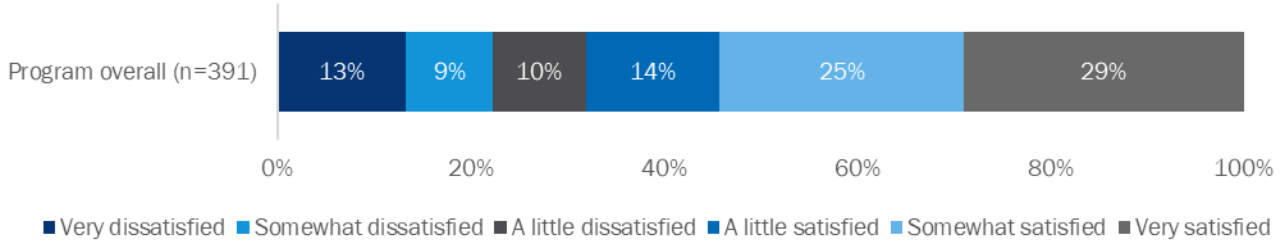
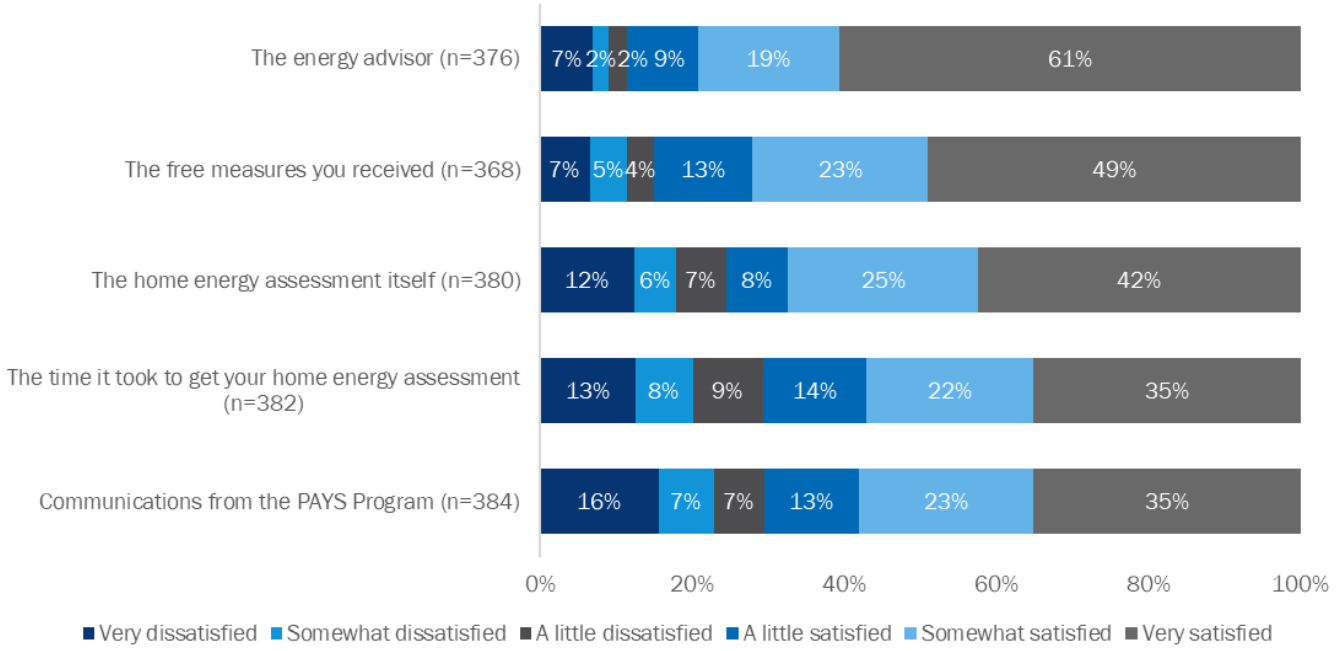


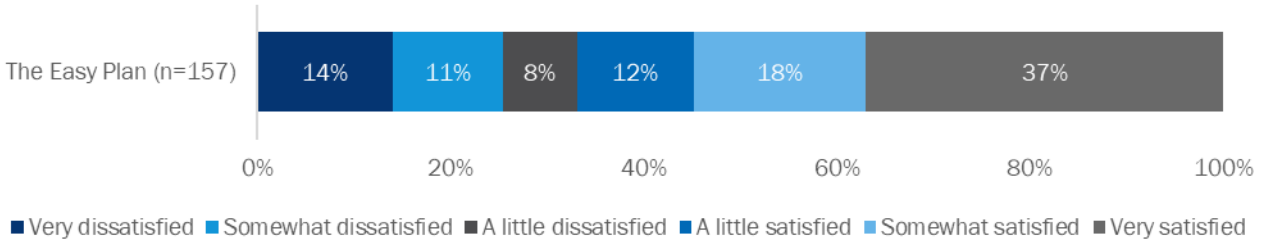
Figure 6 summarizes satisfaction ratings for individual program components. Of the program components relevant to all participants regardless of tier, respondents were most satisfied with the energy advisor and the free measures they received (80% and 72%, respectively, were at least somewhat satisfied with each of these components, respectively). Somewhat fewer respondents reported they were at least somewhat satisfied with the time it took to get their home energy assessment and the communications from the PAYS program (57% and 58%, respectively). Significantly more Tier 3 and 4 participants than Tier 1 and 2 participants expressed some type of satisfaction with nearly every component in Figure 6.

Figure 6. Participant Satisfaction with Program Components Relevant to All Tiers



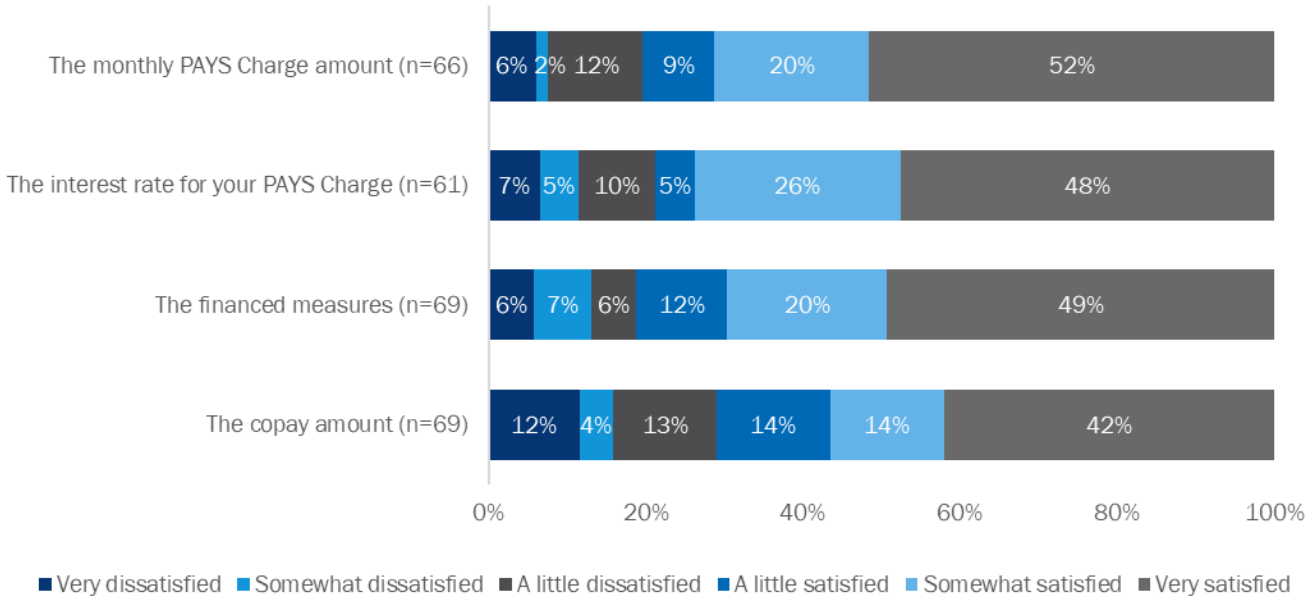
A majority of participants (55%) were at least satisfied with the Easy Plan, as shown in Figure 7.

Figure 7. Easy Plan Participant Satisfaction



We also asked Tier 4 participants to rate their satisfaction with Tier 4-specific program components. Among these respondents, Of Tier 4 participants, 72% were at least somewhat satisfied with PAYS Charge amount, 74% were as least somewhat satisfied with PAYS Charge interest rate, and 69% were at least somewhat satisfied with the financed measures. Slightly over half (56%) of Tier 4 participants reported they were at least somewhat satisfied with the copay amount, as seen in Figure 8.

Figure 8. Participant Satisfaction with Tier 4 Program Components



Reasons for Dissatisfaction

While satisfaction levels were generally high for the program overall and for various individual program components, some respondents expressed dissatisfaction and cited the following reasons:

- Among the 22% of respondents who expressed dissatisfaction with the program overall, the most common reasons included the program not being worthwhile or in line with expectations (37%) and communication from program staff (29%).
- Among those who were dissatisfied with the amount of time it took to schedule a home energy

assessment, more than three-quarters (78%) reported the process took months.

- Those dissatisfied with the home energy assessment itself often reported the assessment was unhelpful or not in-depth enough (33%), they were unable to complete an assessment due to structural property barriers (27%), and/or the energy auditor lacked knowledge/did not provide recommendations (24%).
  - *"The audit…was not comprehensive. The auditor incorrectly evaluated the existing insulation in the home…and was unable to answer basic questions of how the PAYS program works."*
- Those dissatisfied with the energy auditor commonly reported the energy auditor did not appear qualified/knowledgeable (37%), did not provide them with any home recommendations/explanations (26%), and/or did not complete the assessment (18%).
  - *"The assessment was done incorrectly. I was given a proposal for adding insulation and had it scheduled. When I took off work to meet the installers, they came back and told us we do not need insulation."*
  - *"The auditor just went around the house, [providing] no explanations. The auditor said it would all come out in writing."*
  - *"I was told because I had an unfinished bathroom that I could not complete the process."*
- Those dissatisfied with the free measures they received commonly reported the energy auditor did not explain the measures (25%), the measures were not practical (20%), the measures were low quality (15%), and/or they did not need the measures (15%).
  - *"I gave away the advanced power strips because I didn't understand how they worked. They didn't come with any instructions."*
  - *"The measures did not offer a practical solution to our heating and cooling issues."*
- Those dissatisfied with communications from the PAYS Program commonly reported an overall lack of communication from program staff (69%) and/or communication came after a long wait (17%).
  - *"If you want any information or communication, you have to be the one to reach out…and being told that it's a waiting process or that they don't know when an advisor will reach out to discuss things."*
- Those dissatisfied with the Easy Plan mainly cited the upfront cost as the reason for their dissatisfaction (63%).
  - *"The proposed improvements were more expensive than if I just had a contractor do them without using the program."*
- The few participants dissatisfied with the Tier 4 program components cited concerns with the PAYS Charge terms, specifically the upfront payment being too high and the payment period being too long.

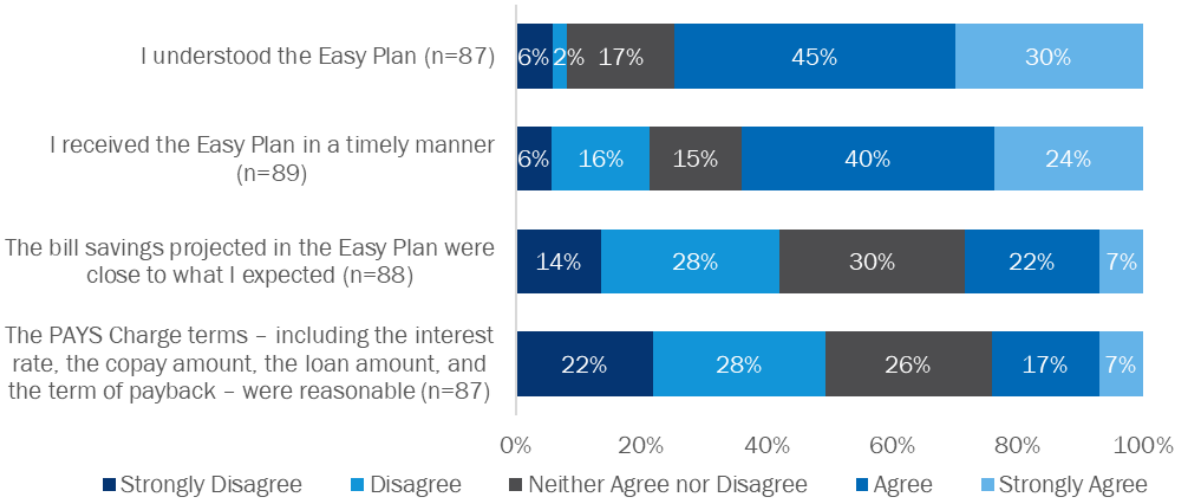
Perceptions of Ameren Missouri and Likeliness to Recommend Program

Participants generally reported the program had neutral or positive impacts on their perception of Ameren Missouri and are likely to recommend the PAYS Program to others. After participating in the PAYS Program, 44% of participants felt more favorable towards Ameren Missouri, 38% felt the same, and 18% felt less favorable towards Ameren Missouri. Nearly two-thirds of participants (63%) were at least somewhat likely to recommend the PAYS Program to others, including 25% who have already done so, 20% who were very likely, and 17% who were somewhat likely to do so, while 24% said they were not at all likely to recommend the program.

Easy Plan and Likelihood to Participate in Tier 4

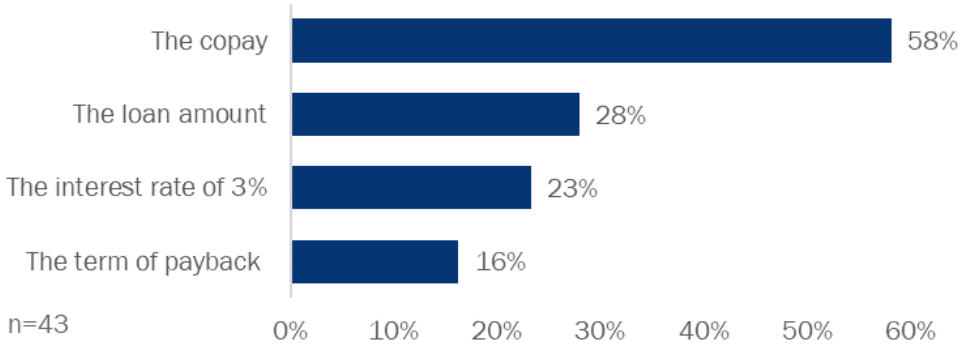
We asked Tier 3 participants to rate their agreement with a series of statements about the program and its processes. We found strong levels of agreement that participants understood the Easy Plan (75% agreed or strongly agreed) and that they received the Plan in a timely manner (64%, agreed or strongly agreed). Notably, among those who agreed or strongly agreed that they understood the Easy Plan, 93% reported their program representative explained the Easy Plan to them. Nearly one-third of participants (28%) felt that the projected bill savings were close to what they expected, with 24% feeling that the PAYS Charge terms were reasonable, as shown in Figure 9.

Figure 9. Participant Experience with PAYS Easy Plan Components



Among the Tier 3 participants who felt the project savings did not align with their expectations, 70% indicated the projected savings were lower than they expected while 30% indicated the projected savings were higher than they expected. Among those who felt PAYS Charge terms were unreasonable, 58% found the copay unreasonable, 28% took issue with the loan amount, 23% would have preferred an interest rate lower than 3%, and 16% would have preferred a different payback term, as shown in Figure 10.

Figure 10. Specific Charge Terms Identified as Unreasonable by Dissatisfied Participants



Note: Percentages do not sum to 100% as some respondents provided multiple responses.

For participants who found each charge term unreasonable, we asked what they felt would be a reasonable copay, loan amount, and interest rate. Of the 10 participants who found the copay unreasonable and provided valid responses, the average copay amount suggested was $650. Of the six participants who found the loan unreasonable and provided valid responses, the average loan amount suggested was $4,417. Of the nine participants who found the interest rate of 3% unreasonable and provided valid responses, six indicated the maximum interest rate they would be willing to accept was 0%.

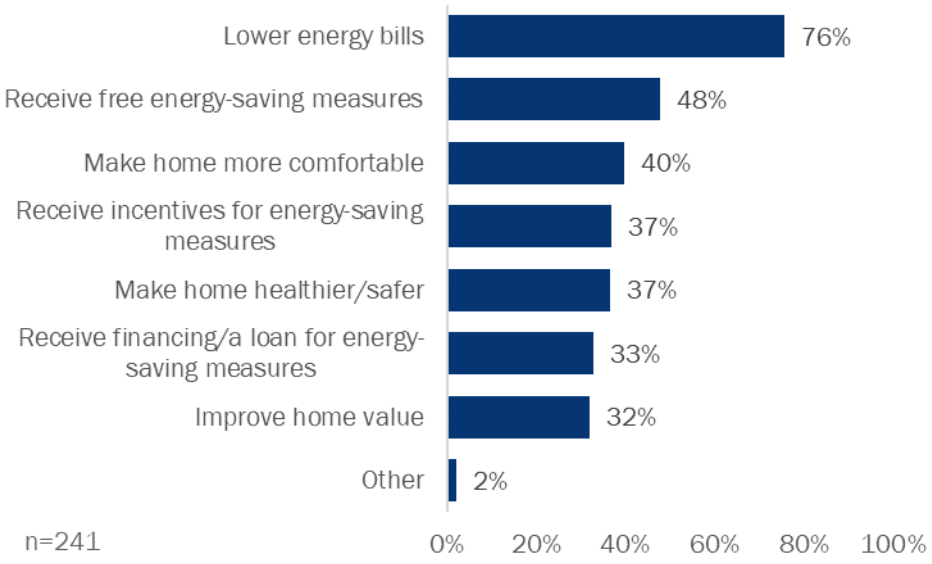
When asked about their likelihood to pursue Easy Plan recommendations in the future, 61% of Tier 3 participants indicated they were at least somewhat likely to move forward with the recommended energy efficiency update (i.e. complete a Tier 4 retrofit project). Only 22% were not at all likely to move forward with the updates. The most common reasons participants cited for being unlikely to move forward with updates were the upfront costs (57%) and the perceived insignificant savings potential (22%).

Non-Participant Experience

Enrollment Motivations

Customers who submitted a PAYS Assessment Form but never received an initial home assessment reported a wide array of motivations for enrolling. By far the most common motivation was lowering their energy bills (76%), followed by receiving free energy-saving measures (48%), making their home more comfortable (40%), receiving incentives for energy-saving measures (37%), and making their home healthier/safer (37%). Figure 11 summarizes the enrollment motivations cited by customers.

Figure 11. Motivations for Completing PAYS Assessment Form

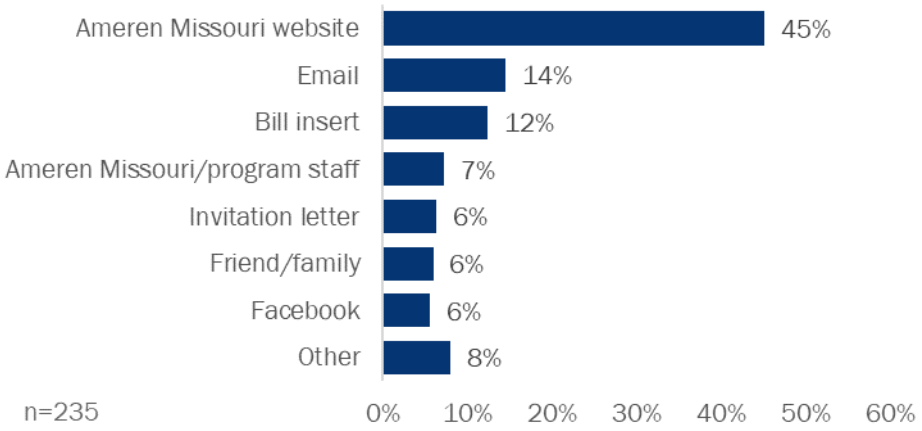


Note: Percentages do not sum to 100% as some respondents provided multiple responses.

Sources of Program Awareness

Program staff leveraged a variety of strategies to market the PAYS Program. To assess the effectiveness of these strategies, the non-participant survey asked customers who enrolled in the PAYS Program offering (but never received an initial home assessment) how they initially learned about the program. The most commonly reported source of awareness was the Ameren Missouri website (45%), followed by e-mail outreach (14%) and bill inserts (12%), as shown in Figure 12.

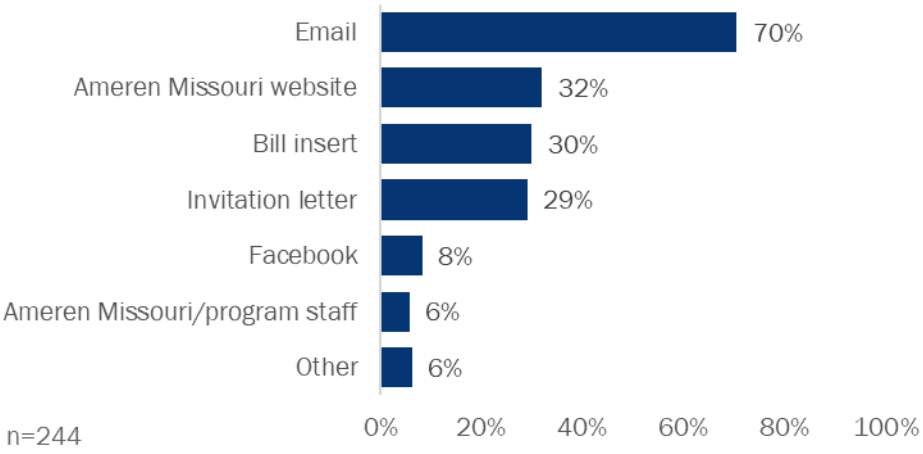
Figure 12. Non-Participants Sources of Program Awareness



Note: Percentages do not sum to 100% as some respondents provided multiple responses.

Only 40% of those who enrolled but have yet to participate consider themselves at least somewhat familiar with the PAYS Program. When asked how they would like to receive information about similar Ameren Missouri offerings in the future, the most common response was e-mail (70%), followed by the Ameren Missouri website (32%), bill insert (30%), and invitation letter (29%), as shown in Figure 13.

Figure 13. Non-Participant Future Communication Preferences



Note: Percentages do not sum to 100% as some respondents provided multiple responses.

Barriers to Participation

The majority (88%) of non-participants felt the online PAYS Assessment Form was at least somewhat easy to complete suggesting the form itself is not a major barrier to participation. Of the eight who felt the form was at least a little difficult, four pointed to it being too complex or lengthy.

Approximately 53% of non-participants indicated they were at least slightly dissatisfied with their limited program experience, and just 28% were at least somewhat satisfied with program communications. Those dissatisfied with communication from the program commonly reported having received no communication since completing the online PAYS Assessment Form (76%) or having reached out to the program but received no response (10%). Among non-participants who submitted a PAYS Assessment Form, only 37% reported receiving a follow-up email and 16% reported receiving a phone call from PAYS program staff to schedule their home energy assessment. While we note that PAYS program staff attempt to contact most customers interested in participating, these findings suggest there are many potential PAYS Program participants who have submitted a PAYS Assessment Form and are awaiting outreach from program staff to schedule their home assessment.

Of those who received a phone call but did not end up scheduling a home assessment, 59% indicated the available times offered to them did not work with their schedule, and 30% were told they were ineligible. Of the nine non-participants that scheduled a home energy assessment but did not complete it, five cited personal reasons, two were told they were ineligible, one experienced a scheduling issue, and one pursued financial assistance through other means.

The majority of non-participants indicated that, given the choice, they would prefer to schedule an assessment via email (74%), while a smaller portion would prefer to schedule via phone or mail (18% and 8%, respectively). Given the large percentage of interested customers who applied but reported having yet to receive follow-up communication to schedule, there are likely opportunities to improve upon follow-up communications and scheduling processes.

Likelihood of Future Participation

The majority (87%) of non-participants indicated they are at least somewhat likely to schedule a PAYS Program home energy assessment in the future, and only 5% said they were not at all likely to schedule an assessment. The most common reasons for not moving forward with an assessment in the future include perceived costs associated with participating (26%), lack of communication from program staff (22%), and perceived complexity of the process (21%).

Trade Ally Experience

We spoke to representatives from each of the three trade allies responsible for installing HVAC and weatherization equipment. Two of the three trade allies conduct both HVAC and weatherization installations, and one exclusively handles HVAC equipment. Trade allies receive notification from the implementation team when an Easy Plan is approved so that trade ally staff can engage the participant and coordinate installation of associated equipment.

Overall Program Experience

Trade allies generally reported positive experiences with the PAYS Program in 2022. Trade allies pointed to increased participation as the overarching program success in PY2022, as well as the addition of gas measures which better aligns the program with customer demand in Ameren Missouri's service territory. One trade ally also noted that there seems to be increased awareness of the PAYS Program among customers

relative to PY2021, which likely contributed to participation increases. Despite some program staffing changes, two of the three trade allies provided positive feedback regarding communication with program staff and with the process of resolving issues. For example, one trade ally noted the following:

> *"I think it has gone very well. I think we communicate very well back and forth with all the workers through the PAYS Program. And whenever I've had issues, they are pretty quick to get any issues corrected. I feel like everything has gone well and smoothly. We have great communication."*

Two trade allies expressed particular appreciation for the PAYS Program generating customers for them and reported that, with the addition of gas measures, the projects they have completed through the PAYS Program in PY2022 were slightly larger, which translated to increased sales for their companies. One trade ally did report some difficulty with the change order process and suggested that the addition of gas measures did not generate more sales or projects for their company. The same trade ally also reported difficulty coordinating and communicating with program staff.

All three trade allies reported interest in continuing to work with the PAYS Program and in working with Ameren Missouri to continue streamlining and improving the program's design and implementation.

Program Design and Implementation Changes in 2022

All three PAYS Program trade allies pointed to the addition of gas measures via SPIRE as a positive change to overall program operations from PY2021, as it allows them to meet demand for gas furnaces. However, two trade allies reported they have yet to see this change result in substantive increases to participation levels.

Trade allies expressed some frustration with a perceived lack of knowledge among PAYS Program staff or energy advisors, particularly in terms of selecting weatherization measures that are appropriate for customers in Ameren's Missouri service territory. Trade allies found that some scopes of work included recommendations that are not appropriate or applicable, or missed ones that may be more appropriate. Trade allies suggested these instances can have negative effects on customer experiences in the program or result in missed opportunities.

> *"When PAYS went at this originally and it was all electric, they had no idea the market we have which is mostly gas furnaces and electric ACs…I think [that knowledge] is the issue…They can't accurately explain things to the homeowner."*

> *"The weatherization program feels like they are on the right track but from our experience, the recommendations that we make with homeowners, their program could probably be revamped slightly to be custom to the area they are serving. What works in Arizona might not work in Missouri."*

> *"One big example is that PAYS Program does not consider basements as part of the conditioned space in the home. That is a falsity in this area. That might be true in other parts of the country…but they are missing a big meaningful opportunity for weatherization improvements by ignoring basements."*

Coordination and Communication with Program Staff

Two of the three trade allies reported challenges in coordinating and communicating with implementer staff, pointing to a lack of communication around project assignments and communication breakdowns with some implementation team members. These trade allies reported difficulty reaching implementer staff in charge of

fieldwork and change orders and said they did not receive notification when projects were assigned to them, which could cause delays and negative customer experiences. They also noted that some implementer staff were difficult to work with and could sometimes be adversarial:

> *"I think there are some [implementer staff] that are very adversarial with our contractors…Some kind of internal review process of their own team and how it is contributing to the mission of the program would be a good idea."*

Barriers and Implementation Challenges

Trade allies named a lack of training for implementer field staff, delays in receiving payment, and increasing equipment costs as the key challenges they faced in PY2022:

- All three trade allies reported the lack of training among implementer field staff conducting energy audits resulted in incorrect or inaccurate scopes of work and required change orders, which they felt was a laborious process and had negative implications for customer perceptions of the program and trust in both trade ally and program staff.
- Trade allies also pointed to excessively long windows between the start of a project and receiving payment. With some projects taking months to complete, they often had to shoulder equipment, labor, and other operating costs, which presented a challenge for smaller companies. One trade ally explained that while larger companies may be able to shoulder the costs, smaller companies may not have the resources to do so, which may result in fewer projects being completed.
- Largely due to inflation, equipment costs increased over the course of 2022, as did the cost of labor and transportation. Trade allies expressed difficulty navigating unpredictable cost increases that sometimes resulted in their having to cover the difference when pricing changes occurred after project approval.

> *"The pricing is always a challenge…Over the course of the last two and a half years, we have seen over 35% increases in the cost of equipment alone…Where we used to see annual price increases, we are seeing quarterly price increases. The program is not designed to keep up with that [frequency of change]. That has been a challenge. [And also increased cost of] labor, insurance, gas, everything across the board."*

CSR Mandated Research Questions

To meet the requirements of the Missouri Code of State Regulations (CSR) for demand-side process evaluations, we provide responses to the five required process evaluation questions in Table 34.[32]

Table 34. Summary of Responses to CSR Process Evaluation Requirements

CSR-Required Process Evaluations Questions	Findings
What are the primary market imperfections that are common to the target market segment?	▪ At a high level, the primary market imperfection that the program addresses is the high cost of energy efficiency home upgrades. Financing plays an important role in addressing this market imperfection by offsetting the upfront cost and ensuring manageable payments over time.

[32] The Missouri Code of State Regulations (20 CSR 4240.22.070(A)) requires that demand-side programs operating as part of a utility's preferred resource plan are subject to ongoing process and impact evaluations that meet certain criteria, including the process evaluation questions presented in this section. Please note, the reference for this CSR was previously 4 CSR 240-22.070(8).

CSR-Required Process Evaluations Questions	Findings
	▪ Another market imperfection the program seeks to alleviate is split incentives. By tying the program cost to the premises rather than the participant, the program is designed to include renters that may not have been willing to make an investment in a temporary home previously. It also entices landlords who may have been unwilling to incur the cost of equipment upgrades that would provide cost savings for their tenants.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	▪ The PAYS Program's target algorithms are proprietary, but the target market segment includes customers with single-family and multifamily residential homes that have higher usage than the housing characteristics would suggest. Only homes expected to have the required savings potential receive targeted marketing materials. ▪ There is no income requirement for the target market segment. As the program is intended to have no up-front cost, however, it is well-positioned to serve moderate-income customers who do not qualify for low-income incentives but would be unable to afford the up-front costs of weatherization and HVAC upgrades.
Does the mix of enduse measures included in the program appropriately reflect the diversity of enduse energy service needs and existing enduse technologies within the target market segment?	▪ The PAYS Program includes a mix of enduse measures that are customized based on the needs of each home. Upgrades include LED lighting, domestic hot water, insulation, HVAC, and air sealing measures, among others. ▪ The addition of natural gas-derived technologies for PY2022 reflect an improvement from PY2021 to better reflect the diversity of the energy needs within the target market segment.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	▪ The program uses a targeted marketing approach with "good fit" customers based on high energy usage and property characteristics. Targeted customers receive a home energy report as the primary marketing approach. ▪ Customers most often learned of the program via the Ameren Missouri website, but the vast majority suggested they would prefer to receive program information and communications via email.
What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the Program?	▪ The implementation team should prioritize consistent and timely communication with customers at each stage of participation and maintain regular communication with trade ally staff to minimize customer wait times and maximize participation levels and participant satisfaction. ▪ Implementer staff can also consistently install all provided equipment and educate customers about proper use of items like advanced power strips or smart thermostats that require proper setup to achieve their savings potential.

6.3.3 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following conclusions and recommendations for the PAYS Program moving forward:

- **Conclusion #1:** We identified several gaps and inconsistencies in program-tracking databases provided for Tier 4 projects. First, Tier 4 program-tracking data included Tier 1 measures despite those measures already being included with claimed savings in the Tier 1 program-tracking data. The program team avoided double-counting savings for those measures by adjusting Tier 4 savings to only include the difference between modeled savings and TRM savings. Second, the data reflected inconsistent information regarding both Tier 1 and Tier 4 LED lighting that frequently did not

distinguish between types of light bulbs or provided internally-inconsistent information about lighting measures included for a given project.

- **Recommendation:** Apply a consistent and transparent savings approach for each Tier 4 measure category (e.g., TRM-based per-unit savings for specialty LED lighting, and model-based savings for other Tier 4 measures to capture interactive effects).

- **Conclusion #2:** Program participants generally expressed moderate to high levels of satisfaction with the program overall, and with key program elements, including the equipment they received, ease of participation processes, and clarity of Easy Plan contents.
- **Conclusion #3:** Customers, including participants and non-participants, as well as trade allies, point to communication challenges when attempting to coordinate with implementer staff. Many customers who completed the online PAYS Assessment Form are highly interested in participating but reported not receiving follow-up communication to schedule a home assessment. Those who did receive a home assessment often reported waiting long periods both to schedule their assessment and to receive an Easy Plan following the assessment.
  - **Recommendation:** We note that PAYS staff make an effort to contact most Ameren Missouri customers interested in participating in the program. However, as both non-participants and participants reported communication issues, we recommend the implementation team consider additional communication methods (e.g., direct mail) and adjustments to their follow-up communication processes. We also recommend proactively communicating expected timelines and wait times to customers at each stage of participation.
  - **Recommendation:** Maintain regular communication with trade ally staff and prioritize addressing issues they raise regarding retrofit project execution, particularly those that may prevent initiated projects from being completed.
- **Conclusion #4:** Participants often reported that the energy advisor did not directly install Tier 1 measures or show them how to properly set up advanced power strips, which are likely key drivers of (1) ISRs below 100% for Tier 1 measures and (2) advanced power strip recipients often reporting they were unsure how to use the product's features. We note that PAYS staff are instructed to defer to customers who prefer to self-install Tier 1 measures, and not to move furniture or large electronics to install advanced power strips.
  - **Recommendation:** If energy advisors are unable to plug-in the advanced power strips at the time of the visit, based on specific circumstances or customer preferences, they should at a minimum provide clear explanations of the features and verbal or written guidance on how to set them up properly.
- **Conclusion #5:** Some Trade Allies reported challenges associated with shouldering the cost of projects while awaiting project closeout and payment, which sometimes occurs months after the work begins. This can be especially challenging for smaller trade ally companies, given the increasing costs of equipment, labor, and operation in general.
  - **Recommendation:** Regular and timely engagement with trade allies will help ensure project scopes are aligned with current labor and material costs. Program staff may also consider introducing a payment system that allows trade allies to recoup some project expenses before the project is fully closed out.

7. Multifamily Income Eligible (MFIE)

This section presents the PY2022 evaluation methodology and results for the Multifamily Income Eligible (MFIE) Program. We present additional details on the methodology in Appendix A.

The MFIE Program, known to customers as the CommunitySavers® Multifamily Program, aims to deliver long-term energy savings and bill-reduction opportunities to income eligible Ameren Missouri customers living in multifamily properties. The program targets income eligible multifamily property managers and owners and provides a one-stop-shop approach to assist these customers in overcoming barriers to completing comprehensive retrofits. Eligible measures include lighting, advanced thermostats, advanced power strips, domestic hot water, building shell, and HVAC upgrades.

The target market for the MFIE Program includes owners and managers of multifamily properties with three or more units and high proportions of low-income residents. Approved participants must meet one of the following income requirements:

- They reside in a federal, state, or local subsidized housing property and fall within that program's income guidelines.
- They reside in nonsubsidized housing and provide proof of income levels at or below 80% of area median income (AMI).
- They reside in a census tract where at least 85% of customers are at or below 80% of AMI.

Properties with a mix of qualifying and nonqualifying tenants can qualify the entire property if at least 50% of the tenants meet the income eligibility requirements.

Resource Innovations (RI) became the primary implementer of the MFIE Program in PY2022, taking over implementation from the International Center for Appropriate and Sustainable Technology (ICAST). As with the MFMR Program, the MFIE Program uses a one-stop-shop delivery model in which RI offers a suite of concierge-style services to assist participants in identifying and executing energy efficiency projects. RI spearheads customer recruitment, assists with the application process, and provides oversight of participating Service Providers, who conduct energy use assessments to identify potential energy efficiency improvements and ultimately install the agreed upon measures. RI staff also conduct post-installation QA/QC activities, submit final project data to Franklin Energy for invoicing, and provide customers with their rebate at the conclusion of the project.

Franklin Energy serves as the overall administrator of the program and leads the development of marketing collateral (in collaboration with Ameren Missouri and RI), provides engineering oversight, and processes incentive payments. Franklin Energy also facilitates communication between Ameren Missouri and the program implementation teams. In this role, Franklin Energy holds regular status updates with Ameren Missouri and is responsible for providing reports on program activity and forecasts of future activity.

7.1 Participation Summary

In PY2022, the program treated 147 premises[33] across 91 projects.[34] These projects resulted in the installations of 44,153 energy-efficient measures, as shown in Table 35.

Table 35. PY2022 Multifamily Income Eligible Participation Summary

Participation Metrics	Unique Premises	Unique Projects	Measure Count
MFIE Program	147	91	44,153

Table 36 provides the quantity of each measure type delivered to participating customers through the MFIE Program. In-unit lighting, common area lighting, and advanced thermostats accounted for the greatest quantity of measures delivered to property managers and owners. However, air source heat pumps (ASHP), common area lighting, and central air conditioners made the greatest contributions to ex ante energy savings.

Table 36. PY2022 Multifamily Income Eligible Program Participation Summary by Measure Category

Measure Category	Quantity	Ex Ante Savings	
		MWh	%
Air Source Heat Pump	419	5,130	42%
Common Area Lighting	7,216	2,450	20%
Central Air Conditioner (CAC)	648	1,882	16%
Advanced Thermostat	1,909	819	7%
Electronically Commutated Motor	788	467	4%
Filter Alarm	1,483	263	2%
Showerhead	627	146	1%
In-Unit Lighting	28,620	397	3%
Air Conditioner Tune-Up	577	137	1%
Exterior Lighting	88	134	1%
Advanced Power Strips	790	120	1%
Faucet Aerator	821	72	1%
Ceiling Insulation	6	25	<1%
Building Shell RES	61	26	<1%
Programmable Thermostat	99	20	<1%
Air Sealing	1	1	<1%
Total[a]	**44,153**	**12,086**	**100%**

[a] Individual values may not sum to totals due to rounding.

[33] Given the lack of premise IDs in the program-tracking data, the evaluation team estimated the number of unique premises using electric account numbers.

[34] The implementation team split large projects into phases that appear as separate projects in the tracking data. Therefore, a single participating property could have multiple projects associated with it. Additionally, these project counts reflect the number of projects that produced electric energy savings; there were additional projects, delivered through the co-delivery component of the program, that only produced gas savings.

7.2 Evaluation Methodology

The PY2022 evaluation focused on estimating energy and demand savings impacts to assess the performance of the MFIE Program. Table 37 provides an overview of the MFIE Program evaluation activities.

Table 37. PY2022 Evaluation Activities for the Multifamily Income Eligible Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in Fall PY2022 to understand program staff perspectives on program performance implementation and design changes.
Program Material Review	▪ Reviewed program materials to inform evaluation activities.
Database Review	▪ Reviewed program database to check that program data were complete.
Engineering Analysis	▪ Verified the deemed assumptions, site-specific inputs, and algorithms used to develop ex ante savings estimates. ▪ Reviewed analysis workbooks for a sample of custom projects (i.e., those using site-specific inputs to estimate savings). ▪ Estimated program and measure-level ex post gross impacts using TRM algorithms, deemed savings assumptions, and site-specific parameters where applicable.
Net Impact Analysis	▪ Estimated PY2022 net impacts.

Gross Impact Analysis

The PY2022 program-tracking database included two types of measures: (1) prescriptive measures identified with specific TRM IDs and (2) "custom" measures identified only in terms of their enduse but without any additional measure-specific information.[35] For prescriptive measures, the engineering analysis included a review of ex ante values and development of ex post values, using TRM algorithms, deemed savings assumptions, and available site-specific parameters for the population of measures. For custom measures, on the other hand, the program-tracking database did not contain information sufficient to verify ex ante savings; this information was only available in project-specific custom workbooks. Given the large number of custom projects in PY2022, we took a sample-based approach, as we describe below.

Analysis of Custom Projects

The PY2022 program-tracking database included 114 MFIE custom projects[36] with electric measures.[37] We conducted custom reviews for a random sample, stratified by enduse, of 26 of these projects. We selected the sampling approach and sample sizes based on the number, type, and size of custom projects, targeting 10% relative precision at the 90% confidence level (90/10), where possible. Table 38 summarizes the sample for the custom reviews.

[35] While the program-tracking data refer to these measures as "custom," they are TRM-based measures that use a mix of custom and TRM-based inputs to develop ex ante savings.
[36] For sampling purposes, we defined projects based on the "fieldnotes" and enduse variables in the program-tracking database. Using this approach, if one project as defined by the project name in "fieldnotes" had three enduses, each enduse was counted as a project. For this reason, the project counts presented here differ from those in Section 7.1.
[37] An additional two custom projects only included gas measures; we excluded these from this analysis.

Table 38. Multifamily Income Eligible Program Custom Project Sampling Summary

Enduse	Total Ex Ante Custom Energy Savings (MWh)	Number of Custom Projects[a]	
		Population	Project Reviews
HVAC	6,952	64	8
Business Lighting	2,164	24	8
Residential Lighting	377	23	10
Building Shell[b]	26	3	--
Total	**9,519**	**114**	**26**

[a] For sampling purposes, we defined projects based on the "fieldnotes" and enduse variables in the program-tracking database. Using this approach, if one project as defined by the project name in "fieldnotes" had three enduses, each enduse was counted as a project.

[b] Given the small contribution of building shell measures to MFIE custom savings, we applied a default realization rate of 100% for these measures.

The custom reviews consisted of a desk review of the workbooks provided by the program implementer. The main purpose of the reviews was to verify that the ex ante analysis correctly reflected the installed measures, including equipment types and quantities, efficiencies, baseline assumptions, and other information needed to estimate gross energy and demand savings. Based on the information provided in the workbooks, we developed project-level ex post savings estimates. We aggregated the project-level results to the enduse level by applying weights that reflect (1) the relative size of each project within the sample and (2) the probability of each project to be sampled.[38] We then used the enduse-level realization rates to adjust the ex ante savings for the population of custom projects.

Average Percent Energy Savings Metric

The evaluation team followed guidance originally outlined in the 2019-2021 MEEIA Energy Efficiency Plan to estimate the average percent energy savings per property for the MFIE Program in PY2022. We calculated the two key inputs for calculating the metric, including evaluated energy savings and total billed energy consumption for the 12-month period prior to participation (pre-period consumption). These items enable calculation of the average percent energy savings per property metric by dividing the program's total ex post energy savings by the total pre-period consumption for all the properties served during the program year.

To calculate pre-period consumption, we used information collected from Ameren Missouri's customer billing data and from PY2022 program-tracking data. The evaluation team reviewed all datasets for accuracy and completeness. Each data source is described below.

- **Program Tracking Data:** Franklin Energy provided the evaluation team with participant tracking files for the MFIE program that included all PY2022 program participants through December 2022. These files contained unique customer identifiers, contact information, participation date, measures installed, and ex ante savings. Franklin Energy also provided a list of non-participating premises from properties treated through the MFIE Program.
- **Customer Billing Data:** Ameren Missouri provided historic electric billing data for all electric customers through December 2022. The billing data included account number, premise number, meter number, billing dates, and usage values.

[38] We sampled in two waves, at mid-year and at year-end.

As the first analysis step, we used the program-tracking data and the list of non-participating MFIE premises to compile the full list of unique premises associated with properties treated through the MFIE program in PY2022. We dropped any premises associated with projects initiated in PY2021 and only kept premises associated with projects initiated and completed in PY2022. We then requested total electric consumption data from Ameren Missouri for each premise for the 12 months prior to the month the property was treated.

7.3 Evaluation Results

7.3.1 Gross Impact Results

This section summarizes gross impact results for the PY2022 MFIE Program. The MFIE was the largest program amongst residential programs in the Low-Income Portfolio in terms of ex post gross energy and demand savings (76% of energy and 77% of demand). Table 39 compares first year ex ante and ex post gross savings at the program level. The ex post savings are 93% and 39% of the ex ante savings for energy and peak demand, respectively. As shown, the program achieved 115% of Ameren Missouri's first year gross energy savings goal and 88% of the first year demand savings goal.

Table 39. PY2022 Multifamily Income Eligible Gross Impact Summary

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross	Goal Gross	% of Goal
First Year Savings					
Energy Savings (MWh)	12,086	93.1%	11,247	9,754	115%
Demand Savings (MW)	7.34	39.3%	2.88	3.29	88%

The evaluation team completed analyses of savings associated with the following measure categories: residential and common area HVAC (HVAC RES, HVAC BUS); in-unit, common area, and exterior lighting (Lighting RES, Lighting BUS, EXT Lighting BUS); advanced and programmable thermostats (heatcool); residential water heating (Water heating RES); HVAC tune-ups and other system improvements (Cooling RES, Heating RES); miscellaneous efficient equipment (Miscellaneous RES), and building shell improvements (Building Shell RES).

Table 40 summarizes the total PY2022 MFIE Program ex ante and ex post energy and demand savings and realization rates by enduse. The gross realization rate of about 93% for electric energy savings indicates that the evaluated (ex post) gross energy savings achieved by the program are close to the program's tracked ex ante savings. However, the gross realization rate of 39% for demand savings indicates that the ex post gross demand savings are far from the tracked ex ante demand savings.

Table 40. PY2022 Multifamily Income Eligible Gross Impacts by Enduse

Enduse	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Realization Rate[b]	Ex Post (MWh)	Ex Ante (MW)	Realization Rate[b]	Ex Post (MW)
HVAC RES	7,196	95.0%	6,839	5.74	25.7%	1.48
Lighting BUS	2,357	97.3%	2,294	0.45	97.7%	0.44
heatcool	839	90.2%	757	0.36	106.8%	0.39
Cooling RES	567	84.1%	477	0.54	84.1%	0.45
EXT Lighting BUS	227	100.0%	227	0.03	99.4%	0.03

Enduse	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Realization Rate[b]	Ex Post (MWh)	Ex Ante (MW)	Realization Rate[b]	Ex Post (MW)
Water Heating RES	217	102.9%	223	0.02	102.9%	0.02
Lighting RES	397	36.6%	145	0.06	36.6%	0.02
Miscellaneous RES	120	101.3%	122	0.01	101.3%	0.01
HVAC BUS	103	96.3%	99	0.10	13.0%	0.01
Building Shell RES	51	103.9%	53	0.03	103.2%	0.03
Heating RES	12	96.3%	12	0.01	96.3%	0.01
Total[a]	**12,086**	**93.1%**	**11,247**	**7.34**	**39.3%**	**2.88**

[a] Individual values may not sum to totals due to rounding.

[b] In some cases, dividing ex post by ex ante (as presented in the table) will not produce the realization rates presented due to rounding.

Table 41 summarizes the MFIE Program's total PY2022 first year ex ante and ex post electric energy and demand savings and realization rates by measure category.

Table 41. PY2022 Multifamily Income Eligible Electric Energy and Demand Savings by Measure Category

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Gross Realization Rate[b]	Ex Post (MWh)	Ex Ante (MW)	Gross Realization Rate[b]	Ex Post (MW)
Air Source Heat Pump (ASHP)	5,130	96.3%	4,941	4.86	12.2%	0.59
Common Area Lighting	2,450	97.5%	2,388	0.45	97.7%	0.44
Central Air Conditioner (CAC)	1,882	92.3%	1,736	1.05	89.4%	0.94
Advanced Thermostat	819	90.0%	737	0.34	107.2%	0.37
Electronically Commutated Motor (ECM)	467	98.1%	458	0.22	98.1%	0.21
Filter Alarm	263	57.9%	152	0.12	57.9%	0.07
Showerhead	146	100.0%	146	0.01	100.0%	0.01
In-Unit Lighting	397	36.6%	145	0.06	36.6%	0.02
AC Tune-Up	137	101.4%	139	0.13	101.4%	0.13
Exterior Lighting	134	99.4%	133	0.03	99.4%	0.03
Advanced Power Strips	120	101.3%	122	0.01	101.3%	0.01
Faucet Aerator	72	108.6%	78	0.01	108.6%	0.01
Ceiling Insulation	25	108.0%	27	0.01	108.2%	0.01
Building Shell RES	26	100.0%	26	0.02	100.0%	0.02
Programmable Thermostat	20	100.0%	20	0.02	100.0%	0.02
Air Sealing	1	99.4%	1	0.00	99.3%	0.00
Total[a]	**12,086**	**93.1%**	**11,247**	**7.34**	**39.3%**	**2.88**

[a] Individual values may not sum to totals due to rounding.

[b] In some cases, dividing ex post by ex ante (as presented in the table) will not produce the realization rates presented due to rounding.

Custom Analysis Results

While the tables in the previous section include the results from all projects, Table 42 presents the results of the gross savings analysis for the 26 sampled custom projects. Realization rates for the various measure categories ranged from 34.4% to 99.4% for energy and from 12.2% to 99.4% for demand.

Table 42. Multifamily Income Eligible Program Impact Results for Sampled Custom Projects

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Gross Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Gross Realization Rate [a]	Ex Post (MW)
HVAC						
ASHP	1,003.16	96.3%	966.25	0.950	12.2%	0.116
CAC	96.00	96.3%	92.47	0.091	96.3%	0.088
ECM	49.73	96.3%	47.90	0.023	96.3%	0.022
Business Lighting	810.03	99.4%	804.80	0.154	99.4%	0.153
Residential Lighting	303.79	34.4%	104.36	0.045	34.4%	0.016

[a] In some cases, dividing ex post by ex ante (as presented in the table) will not produce the realization rates presented due to rounding.

As outlined in the Section 7.2, we used the enduse-level realization rates to adjust the ex ante savings for the population of custom projects. We include a description of the drivers of variances between ex ante and ex post energy and demand savings in the following section.

Explanation of Discrepancies

Discrepancies between ex ante savings that the program team calculated and ex post savings that the evaluation team calculated are primarily driven by updates to parameter values and algorithms in the most recent TRM (Appendix F, version 6.0, updated October 2022), the use of participant-specific information from the program-tracking data rather than TRM default values, and the identification of errors in sampled custom workbooks.

Below, we describe the key drivers of differences between ex ante and ex post savings for measure categories that individually contributed more than 3% of MFIE program ex ante savings.

- **Air Source Heat Pump (42% of ex ante energy and 66% of ex ante demand savings):** The gross realization rate for ASHPs is 96.3% for energy savings and 12.2% for demand savings. We made one significant ex post update that impacted demand savings:
  - Among the "custom" measures analyzed as part of the ex post analysis, the evaluation team noticed that ex ante estimates used an incorrect algorithm to derive demand savings, applying the Coincidence Factor (CF) to total energy savings rather than to cooling savings specifically. While identified through a review of sampled projects, the evaluation team verified that the incorrect algorithm was used for all heat pumps in the population, and as such, corrected this at the population level rather than through the sample. The correction of the algorithm in the ex post analysis resulted in a large decrease in demand savings.
- **Common Area Lighting (20% of ex ante energy and 6% of ex ante demand savings):** The gross realization rate for business lighting (i.e., common area lighting) is 97.5% for energy savings and 97.7% for demand savings. Explanations for discrepancies include the following:

- Ex ante estimates applied deemed values for fixture/lamp wattage from the TRM to calculate savings. The ex post analysis used customer-specific values from the program-tracking data where possible, resulting in a decrease in both energy and demand savings.
- Ex ante estimates applied deemed savings values from Appendix F of the v5.0 TRM. Ex post analysis applied v6.0 of Appendix F, which included a new algorithm to calculate savings for common area lighting that includes new inputs (e.g., an interactive factor for kW) that led to decreased energy and demand savings.

- **Central Air Conditioner (16% of ex ante energy and 14% of ex ante demand savings):** The gross realization rate for central air conditioners is 92.3% for energy savings and 89.4% for demand savings. The discrepancies and ex post adjustments include the following:
  - Ex ante estimates applied the measure-specific existing SEER values from the TRM to calculate savings for early replacement CAC records. The ex post analysis, in alignment with the methods outlined in the TRM, used a derated SEER value that represents the degradation of existing equipment performance with age. In cases where the program-tracking data did not include the age of existing equipment, the ex post analysis used a default value of 12 years. This decreased energy and demand savings.
  - Ex ante estimates used v5.0 of Appendix F from the TRM. The ex post analysis used v6.0 of Appendix F and the updated parameter values for SEERexist and SEERefficient, among others. This led to reductions in both energy and demand savings.
  - Ex ante estimates applied deemed savings values from the TRM. Ex post analysis used existing and efficient equipment capacity and SEER values from project tracking data where possible. This led to decreases in energy and demand savings.
  - Among the "custom" measures we analyzed as part of the ex post analysis (65% of records for this offering), the evaluation team found that ex ante estimates did not put a maximum on the derating age for SEERexist as dictated by the TRM. The ex post analysis used the maximum age for derating—30 years—outlined in the TRM as a cutoff when the age of the existing system is greater than 30 years. This resulted in lower energy and demand savings for all CAC measures.
- **Advanced Thermostat (7% of ex ante energy and 5% of ex ante demand savings):** The gross realization rate for advanced thermostats is 90% for energy savings and 107.2% for demand savings.
  - Ex ante estimates were based on deemed savings values from TRM Appendix F. The ex post analysis used actual cooling and heating capacities and efficiencies from the program-tracking data where possible. This decreased saving for both energy and demand.
  - Ex ante estimates used v5.0 of Appendix F from the TRM. Ex post analysis used v6.0 of Appendix F, which defines parameters specifically developed for income eligible programs providing advanced thermostats. Overall, this decreased the savings for energy and demand on some records and increased the savings for energy and demand on other records.
- **In-Unit Lighting (3% of ex ante energy and 1% of ex ante demand savings):** The gross realization rate for residential lighting is 36.6% for energy and demand savings.
  - Per the 2022 stipulation agreement, all income eligible programs should use a CFL baseline (i.e., 45 lumens per watt). For a small number of prescriptive records (n = 4), the base wattage was much higher than the prescribed baseline wattage outlined in the TRM and stipulation agreement. As a result, the evaluation team used the TRM deemed values for those measures as the more realistic options. This decreased energy and demand savings.

- Among the "custom" in-unit lighting measures analyzed as part of the ex post analysis, the evaluation team found that ex ante estimates used the existing fixture as the baseline as opposed to the 45 Lumens per Watt CFL baseline prescribed by the 2022 stipulation agreement when calculating residential energy and demand savings. In developing ex post calculations, we updated the baseline accordingly which subsequently reduced energy and demand savings for these measures.

Average Percent Energy Savings Metric

An additional performance metric for the PY2022 MFIE Program is the average percent energy savings per participating property. The use of this performance metric is meant to encourage the pursuit of deeper savings per property and to provide a holistic assessment of the program's impact. The program team has a target of achieving an average 15% energy savings per property across the program. Table 43 summarizes the key inputs to calculating the average percent energy savings according to 2019–21 MEEIA Energy Efficiency Plan guidance. We calculated average percent energy savings per property as total ex post energy savings divided by the total billed energy consumption at participating properties. Ex post savings—which are based on engineering approaches using the Ameren Missouri TRM and desk reviews—equate to 41% of the recorded baseline energy use. These results are largely attributable to the high incidence of HVAC measures and indicate that the program team was successful in delivering comprehensive projects to participants.

Table 43. PY2022 Multifamily Income Eligible Program Average Energy Savings Per Property

Metric	Value
Ex post gross energy savings (kWh) [A]	6,380,176
Total billed pre-participation energy consumption (kWh) [B]	15,615,727
Average percent energy savings per property [A/B]	41%

7.3.2 Process Results

The MFIE Program aims to provide one-stop-shop services to assist owners and managers of income eligible multifamily properties with identifying and implementing comprehensive energy efficiency projects that result in deep savings and bill reductions for Ameren Missouri customers.

Overall, there were few program design changes in PY2022. The most notable change to program design was the shift toward a prescriptive model using deemed baselines to calculate energy savings and customer incentives for projects, rather than site-specific or custom values based on the replaced measures. RI adopted this approach to gain efficiencies in program delivery.

Outside of that program change, the MFIE program team faced implementation challenges similar to the those documented for the MFMR Program. First, the MFIE Program experienced difficulties with its project pipeline during PY2022. The program team expected a significant pipeline of project leads heading into PY2022, but few leads developed by the prior implementer resulted in completed projects. Furthermore, the change in implementers led to delays in processing projects submitted for payment while RI and Franklin Energy integrated their respective customer relationship management systems and engineering software. As the program team improved operational processes, project submissions increased.

Second, limited product availability delayed completion of some projects. In particular, the program team mentioned that microchip shortages affected the available supply of smart thermostats and furnaces. With supply chain disruptions expected to persist in PY2023, the program team is working to develop a pipeline

where projects are scheduled months in advance so that contractors have enough time to respond to product shortages.

Finally, the MFIE program team also noted rising equipment and labor costs as a possible barrier to program implementation. With cost increases expected to continue in PY2023, the program team plans to evaluate incentive levels and determine if they are sufficient to encourage multifamily property managers and owners to participate.

Complementing the program team's observations about PY2022, the evaluation team offers responses to the five process evaluation questions required by Missouri Code of State Regulations (CSR) for demand-side process evaluations in Table 44. Given that the PY2022 evaluation did not include process evaluation activities, the findings here are based largely on process evaluation activities conducted in previous years.

Table 44. Summary of Responses to CSR Process Evaluation Requirements

CSR Required Process Evaluation Questions	Findings
What are the primary market imperfections that are common to the target market segment?	Market imperfections specific to the multifamily sector include (1) the split incentive for in-unit measures between property owners, managers, and residents:[a] (2) a lack of awareness about the potential for saving money and energy through energy efficiency upgrades; (3) costs associated with energy efficiency upgrades; (4) knowledgeable staff available to install energy-efficient upgrades; and (5) the time investment to plan, budget, and implement energy efficiency upgrades.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes, the target market is appropriately defined as a building including three or more units with Ameren Missouri electric service and located in an area where most residents have an annual income at or below 80% of AMI. This program also addresses multifamily property needs for both common area and in-unit upgrades.
Does the mix of enduse measures included in the program appropriately reflect the diversity of enduse energy service needs and existing enduse technologies within the target market segment?	Yes, the program offers measures that cover all major multifamily common area and in-unit enduse needs, including lighting, appliances, space cooling, space heating, building shell (e.g., insulation and windows), and water heating. The program team can continue to increase the comprehensiveness of solutions offered to the target market segment by encouraging participation in the one-stop-shop channel.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	The primary recruitment channel is RI's network of relationships with local contractors and larger property management companies. The program also leverages relationships with community-based organizations and trade organizations. This varied approach generates participation from varying customer types in the target market segment.
What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the Program?	One potential strategy to overcome split incentive issues is the promotion of Green Leases.[c] Green Leases are contracts between landlords and a tenant or tenants that negotiate the mutual benefit of installing energy-efficient or green measures in shared buildings. For shared buildings, owners are burdened with green upgrade costs, while tenants benefit from lower operating costs. Without green leases, there is little incentive for owners to make green upgrades to tenant units. Green leases allow both parties financial benefits and incentives, and multifamily building types are ideal buildings for their use.

CSR Required Process Evaluation Questions	Findings
	The other market imperfections we outlined above are largely targeted by the program's one-stop-shop model. As such, increasing participation and/or the share of projects in the program utilizing those services should help to overcome imperfections, such as lack of awareness and information, project costs, limited staff knowledge, and the time needed to plan efficiency projects more effectively.

[a] The split incentive occurs when the tenant pays the cost of the electricity use, but the owner is responsible for choices that affect building and equipment efficiency.

[b] This represents a minimum because some properties that did not receive both common area and in-unit installations in PY2021, could have had phases of their projects completed in previous years.

[c] Consortium for Building Energy Innovation (CBEI). "Creating an Energy Savings Win-Win for Owners and Tenants." *Split Incentives and Green Leases.* Last modified July 27, 2020. http://www.cbei.psu.edu/split-incentives-and-green-leases/index.html.

7.4 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers key conclusions and recommendations for the MFIE Program moving forward:

- **Conclusion #1:** The ex post gross demand savings for the program are 39% of the ex ante gross demand savings, indicating that the tracked ex ante savings significantly overestimate the program's demand savings. The discrepancy between ex ante and ex post energy savings is driven primarily by the use of an incorrect algorithm to calculate demand savings for central air conditioners and heat pumps. In particular, for these custom HVAC measures, ex ante estimates incorrectly applied the Coincidence Factor (CF) to the total energy savings to determine demand savings. The TRM states that the CF should only be applied to the cooling energy savings in order to determine peak summer demand savings.
  - **Recommendation #1:** Update the algorithm used in custom workbooks to comply with the TRM and calculate demand savings by applying the CF to the cooling energy savings rather than the total energy savings.
- **Conclusion #2:** Consistent with PY2021, the current program-tracking database lacks key inputs for calculating ex ante energy and demand savings and that are necessary to verify ex post savings. The missing inputs and additional supporting information are often only available in external documents such as the project-specific or custom workbooks provided by the implementation team. Incorporating these inputs into the tracking database will improve the efficiency of program quality control measures and evaluation and may also positively impact gross realization rates.
  - **Recommendation #2:** For projects using site-specific, "custom" parameters, project workbooks include detailed documentation of the development of ex ante estimates. We recommend that the implementation team incorporate more of the key parameters from these workbooks into the program-tracking database given their use in prescriptive algorithms (e.g., cooling capacity, heating capacity, and baseline conditions, which were all provided but not for every record in the database). We also recommend that all custom workbooks going forward include project summaries and information on the sources of energy savings.
- **Conclusion #3:** While the implementation team has continued to make improvements to the accuracy and completeness of program-tracking data since PY2019, the evaluation team identified several discrepancies in the PY2022 tracking data between the gross savings, quantities, and incentives reported in the tracking database versus project-specific custom workbooks.

- **Recommendation #3:** The implementation team should continue to improve QA/QC data checks to ensure consistency between data sources and fields.

8. Community Lighting

This chapter summarizes the PY2022 evaluation methodology and results for the Community Lighting Program. The PY2022 evaluation of the Community Lighting Program included an engineering analysis to develop gross energy and demand savings estimates. We present additional details on the methodology in Appendix A.

The Community Lighting Program provides deeply discounted or free LEDs through two separate channels. The Upstream Channel offers point-of-purchase discounts on select standard and specialty LEDs sold at participating discount retail locations within specific income eligible ZIP codes that are in Ameren Missouri service territory. The Food Bank Channel distributes four-packs of standard LEDs to partnering food pantry locations throughout Ameren Missouri service territory and is not based on income eligible ZIP codes. The food pantries then distribute the packs at no cost to their clientele.

8.1 Participation Summary

In PY2022, the Community Lighting Program distributed 517,160 LED bulbs, claiming 2,625 MWh and 0.41 MW in ex ante energy and demand savings, respectively. The Upstream Channel incented 229,064 bulbs sold at 50 participating discount retailer locations, while the Food Bank Channel distributed 288,096 bulbs across 56 participating food pantry locations. The Upstream Channel accounted for slightly less than half of program savings, representing 48% of ex ante gross MWh and MW savings, while the Food Bank Channel accounted for 52% of ex ante gross MWh and MW savings. Standard LEDs accounted for 88% of all units distributed through the Community Lighting Program, making up 73% of Upstream Channel sales and 100% of Food Bank Channel–distributed products. Table 45 summarizes participation and ex ante savings by channel and bulb type.

Table 45. PY2022 Lighting Program Detailed Participation Summary by Channel and Bulb Type

Bulb Type	Store/Food Bank Locations		Bulbs		Ex Ante Gross Savings			
	Count	%	Units	%	MWh	%	MW	%
Upstream Channel								
Standard	50	47%	167,840	32%	849	32%	0.13	32%
Reflector	14	13%	27,016	5%	262	10%	0.04	10%
Specialty	16	15%	34,208	7%	161	6%	0.02	6%
Subtotal	*50*	*47%*	*229,064*	*44%*	*1,271*	*48%*	*0.20*	*48%*
Food Bank Channel								
Standard	56	53%	288,096	56%	1,354	52%	0.21	52%
Subtotal	*56*	*53%*	*288,096*	*56%*	*1,354*	*52%*	*0.21*	*52%*
Total	**106**	**100%**	**517,160**	**100%**	**2,625**	**100%**	**0.41**	**100%**

Note: The numbers of Upstream Channel store locations selling different bulb types do not sum to the total number of participating stores because some stores sold multiple types of bulbs.

The number of bulbs sold each month varied substantially over the course of the year, surging in June with sales of nearly 40,000 units and again toward the end of the calendar year, with sales of over 40,000 units in December. These surges in sales were primarily driven by standard lighting products. Figure 14 shows PY2022 sales by month for the Upstream Channel[39].

Figure 14. PY2022 Upstream Lighting Sales Over the 2022 Calendar Year

8.2 Evaluation Methodology

For PY2022, our team focused on gross impact evaluation efforts, supplemented by program staff interviews and program material review. Our impact evaluation included review of the program-tracking databases and an engineering analysis to estimate ex post gross savings by applying appropriate TRM-recommended assumptions based on information available from PY2022 Community Lighting Program tracking data.

We began the PY2022 impact analysis by reviewing program-tracking data to verify that it included the necessary level of detail and was free of any significant inconsistencies. We then calculated ex post gross savings using Ameren Missouri TRM algorithms and deemed savings assumptions.

We conducted interviews with program administration and implementation staff in the third quarter of 2022. The objectives of these interviews were to understand the program design, any changes that occurred throughout the year, and program staff's perspective on program implementation.

Table 46 provides an overview of the PY2022 evaluation activities for the Community Lighting Program.

Table 46. PY2022 Evaluation Activities for the Community Lighting Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in October 2022 to understand program design, challenges throughout the year, and implementation staff's perspective lon implementation of the program.
Program Material Review	▪ Reviewed program materials to understand program design changes relative to PY2021.

[39] Because the Food Bank Channel delivered drop shipments on a less frequent basis to participating food pantries for distribution, the Channel's participation is not tracked on a monthly basis so is not included.

Evaluation Activity	Description
Engineering Analysis	▪ Reviewed program-tracking data to verify inclusion of necessary level of detail and absence of significant inconsistencies. ▪ Developed ex post savings by applying appropriate TRM-recommended algorithms and parameters based on product information included in program-tracking data.

8.3 Evaluation Results

8.3.1 Gross Impact Results

This section summarizes gross impact results for the PY2022 Community Lighting Program. Overall, the Community Lighting Program represented 16% of ex post gross energy and 10% of ex post gross demand savings amongst residential programs in the Low-Income Portfolio. The program realized ex post gross energy and demand savings of 2,425 MWh and 0.38 MW, respectively. This represents 429% of ex post gross energy savings targets and 470% of ex post gross demand savings targets. Table 47 presents overall first year ex ante and ex post gross savings and targets for PY2022.

Table 47. PY2022 Community Lighting Gross Impacts

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal
First Year Savings					
Energy Savings (MWh)	2,625	92.4%	2,425	565	429%
Demand Savings (MW)	0.41	92.4%	0.38	0.08	470%

Note: Gross RR values shown here are based on unrounded savings values.

The evaluation team completed analyses for standard bulbs provided through both the Upstream and Food Bank channels, along with reflector and specialty bulbs offered through the Upstream Channel. As indicated in section 8.1, standard bulbs represented the largest share of program activity, accounting for 80% of ex post energy and demand savings across both channels. Table 48 presents ex post gross energy and demand savings by channel and bulb type.

Table 48. PY2022 Community Lighting Gross Impacts by Channel and Bulb Type

Bulb Type	Ex Ante		Ex Post		Gross RR	
	kWh	kW	kWh	kW	kWh	kW
Upstream Channel						
Standard	848,838	132	747,538	116	88.1%	88.1%
Reflector	261,515	41	335,229	52	128.2%	128.2%
Specialty	160,778	25	158,821	25	98.8%	98.8%
Food Bank Channel						
Standard	1,354,051	210	1,183,060	184	87.4%	87.4%
Total	**2,625,182**	**407**	**2,424,647**	**376**	**92.4%**	**92.4%**

Note: Individual values may not sum to totals due to rounding.

The Community Lighting Program realized 92.4% of gross ex ante energy and demand savings in PY2022. Based on our engineering analysis, we attribute differences between ex ante and ex post gross savings to the following factors:

- **Differences in LED wattage assumptions.** To calculate ex post gross energy and demand savings, we applied product-specific LED wattages available from program-tracking data. Ex ante savings relied on deemed per-unit savings values from Appendix F of the Ameren Missouri TRM, which embedded a less granular blended average of LED wattages. This difference in LED wattage assumptions resulted in a decrease in ex post energy and demand savings for standard bulbs, an increase for reflector bulbs, and a decrease for specialty bulbs relative to ex ante savings estimates.
- **Differences in in-service rate (ISR) assumptions.** To calculate ex post gross energy and demand savings, we applied ISRs of 88%, 90%, and 93% for standard, reflector, and specialty products, respectively, based on Ameren Missouri TRM recommendations. Ex ante savings relied on deemed per-unit savings values from Appendix F of the Ameren Missouri TRM, which embedded a less granular blended average ISR of 88.6% for all bulb types. This difference in ISR resulted in a decrease in ex post energy and demand savings for standard bulbs, an increase for reflector bulbs, and an increase for specialty bulbs relative to ex ante savings estimates.

8.3.2 Process Results

Note that, similar to other residential programs, the evaluation team completed no process evaluation tasks as part of the PY2022 Community Lighting Program evaluation. However, unlike other residential programs, we did not complete process research related to the Community Lighting Program in prior evaluations as PY2022 marks the first year of the Program's implementation. As such, we included responses to the required CSR process questions in Table 49 below based on our review of program materials, our interviews with program staff, and our previous evaluation work and market research related to Ameren Missouri's market rate Residential Lighting Program that operated between PY2019 and PY2021.

Table 49. Summary of Responses to CSR Process Evaluation Requirements

CSR Required Process Evaluation Questions	Findings
What are the primary market imperfections that are common to the target market segment?	While LEDs are now broadly available in the residential lighting market, the higher price of LEDs continues to remain one challenge to increasing adoption amongst income-eligible populations. Based on evaluations and other market research conducted in previous years, we understand that customer use of efficient bulbs varies by household income and use case (i.e., socket type). Lower-income customers have lower LED penetration and efficient bulb saturation than other customers. Low-income customers are also more likely to purchase the lowest cost bulb rather than consider factors like energy efficiency. Sockets that take a standard bulb also have greater efficient bulb saturation than reflector or specialty sockets.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes, the target market is appropriately defined as income-qualified individuals located in communities with large portion of income-eligible customer within Ameren Missouri service territory. This program addresses multiple incomes levels through both channels of the Program.

CSR Required Process Evaluation Questions	Findings
Does the mix of enduse measures included in the program appropriately reflect the diversity of enduse energy service needs and existing enduse technologies within the target market segment?	Standard bulbs are the most commonly used bulb in customer homes and have long been the focus of the now discontinued Residential Lighting Program. This focus made sense when socket saturation of efficient bulbs was low across all use cases. In our PY2019 evaluation, we found that 70% of light sockets in market rate households that take a standard bulb contain an efficient bulb. However, as noted previously, we understand that adoption of standard LED bulbs is less prevalent amongst income eligible populations. As such, the mix of standard, reflector, and specialty bulb types still makes sense to offer to this population of Ameren Missouri residential customers.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	Yes, for the upstream channel, the implementation team uses a combination of in-store and out of store marketing materials. In the PY2019 evaluation of the market rate Residential Lighting Program, we found that in-store marketing was the most effective mechanism for driving sales of efficient bulbs. We expect that discount retailers and thrift stores are a more targeted delivery mechanism for reaching income-qualified segments of the market. Further, providing free LEDs through partnerships with foodbanks within Ameren Missouri's service territory is an effective means of reaching a specific portion of the income-eligible segment; likely those in greater need of this type of assistance in lowering their energy burden.
What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the Program?	The higher price of LEDs continues to be the largest market barrier to increasing adoption amongst income-eligible populations. The program team should continue to expand partnerships with discount retailers and thrift stores within Ameren Missouri's service territory and expand distribution through local food banks. Additionally, the program team might consider expanding the food bank channel to include other community partners. Finally, the program team might consider expanding the program offerings to include additional bulb types (e.g., in PY2023 the program team will offer LED night lights through the food bank channel).

8.4 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following conclusions and recommendations for the Community Lighting Program:

- **Conclusion #1:** In its first year of implementation, the Community Lighting Program effectively maintained an income eligible–focused portion of the Residential Lighting Program while also introducing the new Food Bank Channel, dramatically exceeding savings targets set for PY2022.
- **Conclusion #2:** The evaluation team applied product-specific LED wattages and bulb-type-specific ISRs from the Ameren Missouri TRM to calculate ex post energy and demand savings, whereas program-tracked ex ante savings relied on an outdated blended average LED wattage and ISR assumptions embedded within per-unit savings provided by Appendix F of the Ameren Missouri TRM.
  - **Recommendation:** To improve the accuracy of ex ante savings and better align with Ameren Missouri TRM recommendations, the implementation team should consider using actual LED wattages and bulb type–specific ISRs to calculate ex ante savings.

9. Single Family Income Eligible (SFIE)

This section summarizes the PY2022 evaluation methodology and results for the Residential Single Family Income Eligible (SFIE) Program. We present additional details on the methodology in Appendix A.

The Single Family Income Eligible (SFIE) Program, known to customers as the CommunitySavers® Single Family Program, aims to provide whole-home energy efficiency upgrades to income-eligible Ameren Missouri customers living in single family properties, including mobile homes and duplexes.[40] The Program focuses on providing income-eligible customers with a free walkthrough home energy assessment, direct installation of low-cost energy efficiency measures, and installation of home weatherization measures (including minor repairs needed to install these measures), along with information about behavioral improvements and other Ameren Missouri programs. The implementation team primarily recruits participants through partnerships with large housing organizations and trusted community groups.

As part of the SFIE Program, Ameren Missouri also provides grant funding to community-based organizations (CBOs) for the provision of energy efficiency measures. In PY2022, grant funding was provided by the SFIE Program to a single CBO as part of the Cool Down St. Louis event. As part of these efforts, eligible customers received window air conditioners and LED light bulbs.

From a program implementation perspective, the roles and responsibilities of Franklin Energy and Resource Innovations (RI) largely remained the same as in PY2021. RI serves as the program implementer, leading customer recruitment efforts, managing sub-contractors, collecting program-tracking data, and transferring data to Franklin Energy. Franklin Energy serves as the program administrator, reviewing the data submissions and savings calculations, batching invoices, and processing incentives. Franklin Energy also aggregates program-tracking data and provides regular reports on program activity to Ameren Missouri. For grant funding activities, Franklin Energy works closely with Ameren Missouri to administer and implement the offerings.

9.1 Participation Summary

The program team treated 540 participants through the Single Family Channel in PY2022, which accounted for 93% of program ex ante savings. The Grant Channel accounted for the remaining 7% of program ex ante savings. Across both channels the program team and their CBO partner distributed a total of 11,295 measures. Table 50 presents participation in the SFIE Program during PY2022 by channel.

Table 50. PY2022 Single Family Income Eligible Program Participation Summary

Program Component	Participants		Measures[b]		Ex Ante Savings	
	Number[a]	%	Number	%	MWh	%
Single Family	540	100%	7,395	65%	1,034	93%
Grant			3,900	35%	76	7%
Total	**540**	**100%**	**11,295**	**100%**	**1,110**	**100%**

Note: CBOs that distribute measures through the Grant Channel do not track individual participants.
[a] Includes nine participants with zero ex ante savings. These participants only received energy assessments and/or gas-only measures for which the program does not claim savings.
[b] The program provided 1,102 gas only and 497 other non-energy savings measures (e.g., health and safety measures etc.) to participating customers through the Single Family Channel.

[40] In PY2020, Ameren Missouri approved the treatment of one to four-family homes through this program.

9.2 Evaluation Methodology

The evaluation team focused on impact evaluation activities in PY2022 to assess the performance of the SFIE Program. Table 51 provides an overview of the SFIE evaluation activities.

Table 51.. PY2022 Evaluation Activities for the Single Family Income Eligible Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in the fall of PY2022 to understand program staff's perspective on program performance.
Program Material Review	▪ Reviewed available program materials to inform evaluation activities.
Tracking System Review	▪ Reviewed the tracking system to ensure the implementer was collecting the data required to support evaluation efforts.
Engineering Analysis	▪ Verified that ex ante savings used correct TRM values and algorithms. ▪ Estimated overall and measure-level ex post gross impacts using TRM algorithms, deemed savings assumptions, and program-tracking data.

9.3 Evaluation Results

9.3.1 Gross Impact Results

This section summarizes gross impact results for the PY2022 SFIE Program. Overall, the SFIE Program was the smallest program amongst residential programs in the PY2022 Low-Income Portfolio, accounting for 7% of ex post gross Low-Income Portfolio energy savings.

As presented in Table 52, the PY2022 SFIE Program achieved 1,056 MWh and 0.48 MW in ex post gross first year savings, resulting in 95% and 98% realization rates, respectively.

Table 52. PY2022 Single Family Income Eligible Gross Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	Goal Gross	% of Goal
First Year Savings					
Energy Savings (MWh)	1,110	95.1%	1,056	1,622	65%
Demand Savings (MW)	0.49	97.7%	0.48	0.59	81%

Table 53 shows the ex ante, ex post, and gross realization rates for first year electric energy and demand savings, by measure in descending order of ex post savings. Realization rates for most of the measures are close to 100% as reflected in the overall program realization rates of 95% and 98% but range from 91.8% for lighting to 108.8% for ECM Auto Fan. Air Source Heat Pump (ASHP) measures account for the largest portion of ex ante energy savings (513 MWh, 46%) with a gross realization rate of about 92.1%. Central Air Conditioner measures account for the next largest share of ex ante savings (192 MWh, 17%), the ECM Auto Fan control measure is third highest (87 MWh, 8%), and Room Air Conditioner (AC) is the next largest measure (72 MWh, 6%). All other measures are individually less than 5% of program savings, and together account for only about 22% of ex ante program energy savings.

Table 53. PY2022 Single Family Income Eligible Annual First Year Gross Impacts

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	RR	Ex Post (MWh)	Ex Ante (MW)	RR	Ex Post (MW)
Air Source Heat Pump	513	92.1%	472	0.08	102.7%	0.08
Central Air Conditioner	192	93.1%	179	0.18	93.1%	0.17
ECM Auto Fan	87	108.8%	94	0.04	108.8%	0.04
Room Air Conditioner	72	98.8%	71	0.07	98.8%	0.07
Learning Thermostat	40	95.8%	39	0.03	95.7%	0.03
Programmable Thermostat	37	97.3%	36	0.03	97.1%	0.03
Ceiling Insulation	32	96.3%	31	0.01	96.6%	0.01
Refrigerator	29	100.0%	29	0.00	100.0%	0.00
Tune-Up	28	95.4%	27	0.02	96.7%	0.02
Lighting	25	91.8%	23	0.00	91.8%	0.00
Advanced Power Strips	17	100.0%	17	0.00	100.0%	0.00
Filter Alarm	17	100.0%	17	0.01	100.0%	0.01
Air Sealing	13	102.3%	14	0.01	102.2%	0.01
Low Flow Showerhead	6	102.5%	6	0.00	102.5%	0.00
Low Flow Faucet Aerator	2	93.7%	2	0.00	93.7%	0.00
Duct Sealing	0	97.6%	0	0.00	97.6%	0.00
Pipe Insulation	0	99.9%	0	0.00	99.8%	0.00
Total	**1,110**	**95.1%**	**1,056**	**0.49**	**97.7%**	**0.48**

Note: Individual values may not sum to totals due to rounding.

Discrepancies between ex ante savings calculated by the program team and ex post savings calculated by the evaluation team are primarily driven by updates to parameter values in the most recent TRM (Appendix F version 6.0 updated October 2022),and the use of participant-specific information from the program tracking data when available instead of TRM default values.

Below, we describe the key drivers of differences between ex ante and ex post savings for measures that individually contributed more than 5% of SFIE program ex ante savings.

- **Air Source Heat Pump (46% of ex ante energy savings and 16% of ex ante demand savings)**: The gross realization rate for ASHPs is 92.1% for energy and 102.7% for demand savings. The discrepancies and the ex post adjustments include:
  - Ex ante savings estimates were based on an average default TRM savings value, even though the tracking data contained actual installed unit characteristics including cooling and heating efficiencies and capacities for most claims. For the ex post analysis, we applied the installed SEER and cooling/heating capacity values from the program tracking data. This resulted in lower energy and demand savings.
  - The majority of ASHP installations were claimed as early replacement (ER). The estimation of ER savings requires a baseline SEER value based on the actual age of the in-situ equipment. Equipment age was not populated in the tracking data, yet almost half of the records had baseline SEER values less than 10 SEER and as low as 6 SEER, despite the fact that the 10 SEER minimum

efficiency requirement is more than 30 years old. Given equipment age was missing and more reasonable baseline efficiencies are warranted for these records, we followed the TRM which allows 8 SEER as the lowest baseline value. For ex post savings calculations, this baseline SEER value was further derated by a default of 12 years, since equipment age was missing. Baseline heating efficiency was never populated so default values were used. This resulted in higher energy and demand savings.

- For a number of records, the tracked heating capacities were unreasonable. Typically, heating capacity is about the same or slightly less than cooling capacity, but for a significant number of records, the heating capacity was 25% or greater than the cooling capacity. For these records, we set the heating capacity equal to the cooling capacity. The reason for this potential data entry error was not readily apparent, but the need for a correction was clear.
- Program tracking data included information on building type, but ex ante savings estimates incorrectly used energy savings for single family measures as a default for multifamily residences. The ex post analysis updated measure codes and savings for multifamily installations. This adjustment generally decreased savings but had an insignificant overall impact since the majority of ASHP installations were in single family homes (which includes mobile homes).

- **Central Air Conditioner (17% of ex ante energy savings and 37% of ex ante demand savings)**: The gross realization rate for central air conditioners is 93.1% for both energy and demand savings. We made several significant ex post updates:
  - The ex ante savings estimates were based on an average default TRM savings value from Appendix F Version 5.0 for all measures and failed to incorporate any tracked project-specific information such as the equipment capacity and efficiency. The evaluation team applied actual SEER and cooling capacity values from the program tracking data in the ex post analysis, and these changes account for the majority of the savings impacts. In addition, we corrected a handful of cooling capacity data entry errors, for example 30,000 (kBtuh) was entered as 3,000.
  - Similar to ASHPs, the majority of central air conditioner installations were claimed as early replacement (ER). The estimation of ER savings requires a baseline SEER value that is based on the actual age of the in-situ equipment. Equipment age was not populated in the tracking data, yet a number of records had baseline SEER values less than 10 SEER and as low as 4 SEER despite the fact that the 10 SEER minimum efficiency requirement is more than 30 years old. Given equipment age was missing and more reasonable baseline efficiencies are stipulated by TRM for these records, we followed the TRM which allows 8 SEER as the lowest baseline value. This updated baseline SEER value was further derated by a default of 12 years since the age of the existing equipment was missing.
  - Program tracking data included information on building type, but ex ante savings estimates incorrectly used energy savings for single family measures as a default for multifamily residences. The ex post analysis updated measure codes and savings for multifamily installations. This adjustment generally decreased savings but had an insignificant overall impact since the majority of records were in single family homes (which includes mobile homes).
- **ECM Auto Fan (8% of ex ante energy savings and 8% of ex ante demand savings)**: This measure is the retrofit of an efficient electronically commutated motor (ECM) on a residential air conditioner / furnace

blower motor. The gross realization rate for ECM auto fan retrofit is 108.8% for both energy and demand savings. We made the following minor ex post updates:

- Ex ante estimates used TRM Appendix F Version 5.0 default values for the percentages of homes with new Air Source Heat Pump and percentage of homes with new Central Air Conditioners. Ex post analysis uses the "New ASHP" and "New Central Air Conditioning" field values from the program tracking data when populated. This accounts for 100% of discrepancy.

- **Room Air Conditioner (6% of ex ante energy savings and 14% of ex ante demand savings)**: The gross realization rate for room air conditioners ROF is 98.8% for both energy and demand savings. We made the following minor ex post updates:
  - Ex ante estimates were based on an average default TRM savings value, even though the tracking data contained actual unit cooling capacities for most claims. For the ex post analysis, we applied the installed cooling capacity values from the program tracking data.
  - Program tracking data included information on building type, but ex ante savings estimates incorrectly used energy savings for single family measures as a default for multifamily residences. The ex post analysis updated measure codes and savings for multifamily installations. This adjustment generally decreased savings but had an insignificant overall impact since the majority of records were in single family homes (which includes mobile homes).

9.3.2 Process Results

Overall, the design and implementation of the SFIE Program remained consistent with PY2021 in terms of implementation team roles and responsibilities, as well as the implementation model. The most notable development related to program design and implementation was the program team's decision not to resume direct customer outreach in PY2022, instead continuing to increase its emphasis on recruiting participants through community partnerships. This program year had been the first available opportunity to resume neighborhood canvassing after it was paused in PY2020 due to COVID-19 restrictions.[41] However, the program team determined that an outreach strategy based on community partnerships was more effective at overcoming key barriers to participation than direct canvassing and mail. By working with community organizations who were trusted sources of information, the program team determined it was better able to inform income-eligible customers about the SFIE Program and convince them that participation really *was* free. That said, while the program team saw its community-based outreach strategy as more effective overall, it acknowledged community partners often have limited resources and may periodically experience difficulties scheduling and coordinating with participants.

In terms of challenges, the program team did encounter issues related to equipment sourcing in PY2022. In particular, the program had difficulty acquiring refrigerators throughout the program year. While this did not present a barrier to customer participation, it did limit the range of measures available through the program.

Complementing the program team's observations about PY2022, the evaluation team offers responses to the five process evaluation questions required by Missouri Code of State Regulations (CSR) [42] for demand-side

[41] Even though COVID-19 restrictions were lifted in September 2021, the implementation team had limited funds to resume direct customer outreach in PY2021. This was the result of the program team choosing to overspend its PY2020 budget to serve high-need customers, which reduced the PY2021 budget allocated to the implementation team.

[42] The Missouri Code of State Regulations (20 CSR 4240.22.070(A)) requires that demand-side programs operating as part of a utility's preferred resource plan are subject to ongoing process and impact evaluations that meet certain criteria, including the process evaluation questions presented in this section. Please note, the reference for this CSR was previously 4 CSR 240-22.070(8). As of September 2019, the CSR was moved to the location cited above.

process evaluations in Table 54. The findings summarized here are based largely on process evaluation activities conducted in previous years.

Table 54. Summary of Responses to CSR Process Evaluation Requirements

CSR Required Process Evaluations Questions	Findings
What are the primary market imperfections that are common to the target market segment?	Income-eligible households face multiple barriers to investing in energy efficiency either through Ameren Missouri programs or outside of them. Market imperfections include: ▪ the high upfront cost of energy-efficient products relative to household capital and available credit, even when taking into account traditional utility program incentives, ▪ lack of access to traditional forms of information about energy efficiency programs, ▪ housing stock that may need health and safety improvements, which can preclude efficiency upgrades unless these issues are addressed first, and ▪ split incentives between property owners and renters, for those who rent their home.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Ameren Missouri has defined the target customer market as occupants of single family housing who live in areas where most residents have an annual income at or below 80% of AMI. This criterion is aligned with income-eligible program eligibility requirements in other states and should not be merged with any other income-based market segments. Additionally, the program targets specific housing stock subsegments (e.g., single family and mobile homes). This helps to target community and measure selection, as well as audits and measure installation assumptions, but the program team should consider that the program is set up to serve one type of housing at a time.
Does the mix of enduses measures included in the program appropriately reflect the diversity of enduses energy service needs and existing enduses technologies within the target market segment?	The baseline study of residential Ameren Missouri customers completed in PY2019 shows that income-eligible households tend to have lower-efficiency products in their home compared to their non-income-eligible counterparts, including lighting. These results are consistent with findings from around the United States. The program's mix of enduses measures appropriately reflects these needs. The program offers measures that cover major single family and mobile home energy-saving needs, including building envelope, HVAC and thermostats, refrigeration, lighting, domestic hot water, and plug load measures. Additionally, the program cross-promotes opportunities for additional savings through the Ameren Missouri HVAC Program.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	The program team's communication and delivery channels are appropriate to the target market segment. Staff use a variety of community-centric approaches to promote the program, including through housing organizations with large property portfolios, community groups, and mobile home park owners; holding meet-and-greet events with community leaders in popular community gathering places like restaurants; and working with Ameren Missouri to identify community non-profit organizations serving income-eligible areas that could distribute efficient products to their constituents. These approaches are appropriate for the target market segment because they work around traditional time, geographic, and other barriers to learning about energy efficiency and the availability of utility-sponsored programs.

CSR Required Process Evaluations Questions	Findings
What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select enduses/measure groups included in the Program?	The program team can increase the rate of customer acceptance by continuing to expand the network of participating CBOs. This collaborative work with community partners offers the opportunity to engage with many Ameren Missouri customers across the service territory. The distribution and installation arms offer opportunities for participants to install measures across a range of enduses.

9.4 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following conclusions and recommendations for the SFIE Program moving forward:

- **Conclusion #1:** The ex post gross savings for the program are 95.1% of the ex ante gross energy savings and 97.7% of the ex ante gross demand savings (Table 52), indicating that the tracked ex ante savings slightly underestimate the program's energy and demand savings. The discrepancy between ex ante and ex post savings is driven by two issues: (1) the ex ante savings are based on Appendix F Version 5.0 of the Ameren Missouri TRM, updated September 2021, and the ex post savings are based on the more recent Version 6.0 of Appendix F, updated October 2022; and (2) ex ante savings did not incorporate project-specific data when available, instead relying on Appendix F deemed per-unit savings values for all measures.
  - **Recommendation #1:** Update ex ante savings algorithms to use actual tracked parameter values (such as equipment capacities and efficiencies) to calculate ex ante savings wherever possible. At a minimum, ensure the TRM Appendix F measure reference IDs assigned to measures accurately represent the other information collected for that record, including housing type, delivery method (direct install or kit), and existing equipment and fuel type.
  - **Recommendation #2:** For early replacement ASHP and Central Air Conditioner measures, update the default minimum baseline SEER value to 10 SEER for ex ante savings claims and update the TRM accordingly to at least 10 SEER which has been effective since 1992. In addition, early replacement claims should require and record in the tracking data the actual age of the replaced equipment. The absence of equipment age will be assumed to mean that the equipment is replace-on-failure rather than an actual early replacement scenario. For a sense of the impact of this adjustment on savings: Using a 10 SEER baseline instead of 8 SEER, which was used for this year's ex post analysis would change the ASHP realization rate from 92% to 89% and the Central Air Conditioner realization rate from 93% to 85%
  - **Recommendation #3:** For ASHPs, investigate the source of space heating capacity discrepancies and provide a tracking data quality control check to flag heating capacities that deviate significantly from the cooling capacity. On a similar note for Central Air Conditioners, provide a quality control check to check cooling capacities for data entry errors by doing a range check based on typical sizes.

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