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Ameren Missouri Program Year 2021 Annual EM&V Report

Volume 2: Residential Portfolio Report

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Opinion Dynamics

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1. Executive Summary

This volume of the PY2021 Annual Report presents evaluation results from the Ameren Missouri PY2021 portfolio of residential energy efficiency programs as described in Ameren Missouri's 2019–21 Missouri Energy Efficiency Investment Act (MEEIA) Energy Efficiency Plan. In this document, the evaluation team provides portfolio-level results for PY2021, as well as detailed findings for each program. Results for the business and demand response portfolios are provided in separate volumes.

During PY2021, Ameren Missouri offered seven programs for residential customers. The portfolio of programs included:

- Residential Lighting
- Home Energy Reports (HER)
- Heating, Ventilation, and Air Conditioning (HVAC)
- Energy Efficient Products (EEP)
- Energy Efficient Kits (EEK)
- Multifamily Market Rate (MFMR)
- Residential Appliance Recycling (RAR)
- Pay as You Save (PAYS)[1]

In addition to these seven programs, Ameren Missouri offered two programs targeted specifically to residential customers that meet certain income requirements. As such, this volume also covers the Single Family and Multifamily Income Eligible Programs (SFIE and MFIE, respectively). Finally, in PY2021 Ameren Missouri also provided do-it-yourself kits (DIY Kits) to 2,707 residential income-eligible customers. Collectively, the ten 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. 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 PY2021 evaluation activities and methodologies.
- Chapters 3–11 present evaluation results for the nine residential programs.

1.1 Portfolio Impact Results

At the portfolio level, the PY2021 Ameren Missouri residential programs exceeded their first year energy savings and their first year demand savings goal, achieving 153,321 MWh and 54.37 MW respectively (Table

[1] Note that savings for the PAYS Program are not included in residential portfolio targets and are not applicable to portfolio earnings opportunities for PY2021. As such, we do not present the results of our impact review in this section. For a complete discussion of PAYS impacts see Section 10.

1). Performance related to last year demand savings was mixed with the portfolio exceeding the target for less than 10 and 10–14 EUL targets, but not meeting the 15+ EUL target.[2]

Table 1. PY2021 Residential Portfolio Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Goal/Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	179,950	113%	204,070	75%	153,321	116,246	132%
Demand Savings (MW)	60.92	116%	70.93	77%	54.37	49.40	110%
Last Year Demand Savings							
< 10 EUL (MW)	0.24	1,239%	3.00	76%	2.28	0.77	296%
10–14 EUL (MW)	5.64	87%	4.94	105%	5.17	3.53	146%
15+ EUL (MW)	24.30	89%	21.56	68%	14.65	19.19	76%

Portfolio performance was largely driven by the Residential Lighting, HER, and HVAC programs, which collectively contribute approximately 90% of Ameren Missouri's first year residential savings. As shown in Table 2, the Lighting and HER programs exceeded first year energy and demand savings goals, while the HVAC Program did not. Table 3 shows last year demand savings across the portfolio for all measures with an EUL of less than 10 years, between 11 and 14 years, and 15 or more years. Notably, the Lighting Program drove the high realization rate (1,239%) and strong performance against net savings goals (296%) across the portfolio for the less than 10 EUL class. This was due to a small portion of LEDs sold through the Upstream channel (i.e., sold through brick and mortar retailers) that were installed in business applications with an assumed EUL (six years) that is lower when compared to the assumed EUL for similar LEDs installed in residential spaces (19 years). See Section 3 for additional details.

Table 2. PY2021 Residential Portfolio First Year Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Goal Net	% of Goal
First Year Energy Savings (MWh)							
Lighting	97,062	103%	99,891	64%	63,740	11,238	567%
HER[3]	13,747		37,963		37,963	35,250	108%
HVAC	49,744	94%	46,823	76%	35,534	48,350	73%
REP	8,246	108.8%	8,972	86.1%	7,724	9,800	79%
EEK	5,437	81%	4,420	78%	3,466	4,199	83%
MFMR	3,763	100%	3,780	94%	3,553	4,064	87%
RAR	1,952	114%	2,220	60%	1,341	3,345	40%
Total Residential	**179,950**	**113%**	**204,070**	**75%**	**153,321**	**116,246**	**132%**
First Year Demand Savings (MW)							
Lighting	15.05	103%	15.49	64%	9.88	1.70	581%
HER	6.41		17.69		17.69	16.43	108%

[2] Throughout this volume, we refer to "goals" and "targets." Ameren Missouri's 2019–21 MEEIA Energy Efficiency Plan sets annual first year energy and demand savings goals. In addition, Ameren Missouri developed impact targets that are used to determine Earnings Opportunities.

[3] The 2019–21 MEEIA Energy Efficiency Plan does not include incremental MWh or MW goals for the PY2021 HER Program, but we include goals here based on PY2019 for purposes of comparison.

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Goal Net	% of Goal
HVAC	33.62	97%	32.47	69%	22.50	26.07	86%
REP	3.60	88%	3.18	81%	2.56	2.60	99%
EEK	1.02	84%	0.85	80%	0.68	0.81	84%
MFMR	0.93	101%	0.93	94%	0.88	1.30	67%
RAR	0.30	106%	0.32	55%	0.18	0.48	36%
Total Residential	**60.92**	**116%**	**70.93**	**77%**	**54.37**	**49.40**	**110%**

Table 3. PY2021 Residential Portfolio Last Year Demand Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Target Net	% of Target
< 10 EUL							
Lighting	0.00		2.69	64%	1.71	0.00	0%
HER							
HVAC	0.00		0.00		0.36	0.00	
REP	0.00		0.00		0.04	0.04	
EEK	0.00		0.00		0.01		
MFMR	0.06	1.14	0.07	94%	0.06	0.25	25%
RAR	0.18	1.33	0.25	44%	0.11	0.48	22%
Total Residential	**0.24**	**1,239%**	**3.00**	**76%**	**2.28**	**0.77**	**296%**
10–14 EUL							
Lighting	0.00	0%	0.00		0.00	0.00	0%
HER							
HVAC	0.98	87%	0.85	221%	1.89	0.00	
REP	3.60	88%	3.18	77%	2.44	2.49	98%
EEK	0.74	85%	0.63	90%	0.57	0.76	74%
MFMR	0.26	100%	0.26	94%	0.24	0.28	86%
RAR	0.06	28%	0.02	151%	0.03	0.00	
Total Residential	**5.65**	**87%**	**4.94**	**105%**	**5.17**	**3.53**	**146%**
15+ EUL							
Lighting	15.05	85%	12.79	64%	8.17	1.70	481%
HER							
HVAC	8.31	95%	7.90	72%	5.69	16.71	34%
REP	0.00		0.00		0.08		
EEK	0.28	80%	0.22	46%	0.10	0.05	218%
MFMR	0.61	98%	0.59	94%	0.56	0.73	76%
RAR	0.05	107%	0.05	75%	0.04	0.00	

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Target Net	% of Target
Total Residential	24.30	89%	21.56	68%	14.65	19.19	76%

Among the residential programs in the Low-Income Portfolio, performance against savings goals was also mixed. While the Multifamily Income Eligible (MFIE) Program exceeded its first year energy savings goals, the Single Family Income Eligible (SFIE) Program did not. Neither the MFIE or SFIE Program met its first year demand savings goals (Table 4 and Table 5, respectively). That said, both programs performed well against the average percent of energy savings per property metric established for this MEEIA cycle (i.e., achieving at least 10% savings per property for SFIE and 15% per property for MFIE). In particular, the SFIE Program achieved an average of 14% savings per property while the MFIE Program achieved an average of 21% savings per property.

Table 4. PY2021 Multi Family Income Eligible Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Goal/Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	6,012.12	102%	6,131.86	100%	6,131.86	2,680	229%
Demand Savings (MW)	0.79	119.5%	0.95	100%	0.95	1.20	79%
Last Year Demand Savings							
< 10 EUL (MW)	0.10	191.4%	0.19	100%	0.19	-	-
10–14 EUL(MW)	0.18	101.3%	0.18	100%	0.18	-	-
15+ EUL(MW)	0.32	109.1%	0.35	100%	0.35	1.19	29%

Table 5. PY2021 Single Family Income Eligible Impact Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Goal/Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	3,574	93.3%	3,335	100%	3,335	10,822	31%
Demand Savings (MW)	1.05	97.8%	1.03	100%	1.03	2.47	42%
Last Year Demand Savings							
< 10 EUL	0.17	142.5%	0.24	100%	0.24	0.57	43%
10–14 EUL	0.30	100.6%	0.31	100%	0.31	0.09	341%
15+ EUL	0.39	77.3%	0.30	100%	0.30	1.81	17%

1.2 Key Findings and Recommendations

In the third year of the MEEIA plan cycle, the Ameren Missouri residential portfolio performed well against the plan goals. Additionally, we offer the following key conclusions and recommendations from specific residential programs based on a limited set of process activities. Note that, beginning in PY2022, the Lighting Program will transition to the Low-Income Portfolio. Additionally, the HER, EEK, and RAR programs will discontinue in PY2022. As such, we have focused this conversation on programs for which we completed process evaluation activities (i.e., HVAC and PAYS), and those that will remain in their respective portfolios in PY2022.

1.2.1 Heating, Ventilation, and Air Conditioning Program

- **Key Finding: PY2021 participation was higher in both channels of the HVAC Program when compared to PY2020.** While the Downstream channel saw more growth in absolute terms (for example, 35,475 MWh to 42,201 MWh ex ante savings from PY2020 to PY2021) the Midstream channel experienced increases that by some measures doubled the channel's impact (for example, 209% year to year change from PY2020 to 7,275 MWh ex ante savings). Overall, the ex post net energy savings for the HVAC Program are more than 25% higher than PY2020 savings estimates.
- **Key Finding: Midstream participants are generally satisfied with the program.** Respondents to the midstream participant survey reported being most satisfied with the contractors who install the equipment and with the installation process overall with almost 100% of respondents rating their satisfaction with these two elements as being "somewhat" or "very satisfied."
- **Key Finding: Overall, distributors are happy with the Midstream channel and feel it is running more smoothly in its second year of implementation save for a few challenges.**
  - **Recommendation:** Conduct additional trainings with contractors on (1) the differences between the Downstream and Midstream channels and (2) how to use the different portals. Program staff should also consider whether the Downstream and Midstream channels could be integrated under a single portal to ease the participation process for contractors.

1.2.2 Pay As You Save

- **Key Finding: Customers are very interested in the PAYS Program, but this is not translating into high levels of participation**. While enrollment data suggests a high level of interest in the PAYS Program, it is ultimately reaching fewer customers than intended, particularly for Tier 3 measures that support the deepest savings. Many Tier 2 participants reported they found both the up-front and overall cost of the project prohibitive. The high level of attrition between receipt of Easy Plan (i.e., those that received a set of recommended improvements after receiving an energy assessment) and those that moved forward with plan recommendations suggests that this perception may be generalizable beyond the interviewed participants. At the same time, many Tier 2 participants reported plans to move forward with recommended upgrades outside the PAYS Program, suggesting that they find the recommendations valuable. The PAYS Program is also achieving limited reach among the segments it is uniquely positioned to serve, such as renters and landlords.
  - **Recommendation:** Minimize copays through more precise customer targeting and/or by moving forward with plans to incorporate gas measures. To the extent that copays remain a reality of the PAYS Program, manage expectations through marketing materials, particularly among customer segments that are likely to incur a copay.
  - **Recommendation:** Consider consistently tracking reasons for project abandonment to better understand barriers to Tier 3 participation.
  - **Recommendation:** Consider targeted marketing among renter and landlord populations, including in multifamily residences, since this is one of the primary market imperfections the PAYS Program is positioned to address.
- **Key Finding: While some customers value the financing options associated with the PAYS Program, others who enrolled in PY2021 did not necessarily require or value this component.** PAYS may be attracting some customers who are better suited for other Ameren Missouri offerings (e.g., HVAC Program) and who may be unaware of the central role of financing in the program.

- **Recommendation:** Consider following up with customers who receive an Easy Plan but do not move onto Tier 3 to determine if they are interested in installing the recommended measures without the financing offered by PAYS and direct them to other Ameren Missouri programs.

1.2.3 Multifamily Market Rate

- **Key Finding: The COVID-19 pandemic continued to present significant challenges to the program's model for delivering comprehensive projects.** The program team continued to demonstrate resilience and responsiveness to the circumstances brought about by COVID-19. Program implementers struggled to complete in-unit projects, however, due to occupancy restrictions. Unlike the Multifamily Income Eligible (MFIE) Program, the MFMR Program could not provide relocation incentives to participants to vacate their units. As such, the implementation team had to focus more on common area projects and properties with a portion of already vacant units, as well as deploying virtual assessments and verification processes. Once the COVID-19 restrictions were lifted, project scopes expanded, but delays in project completion due to ramp-up challenges and supply chain issues presented continued hurdles throughout the year. Despite these challenges, the program achieved 87% of its net energy savings goal and 67% of first year demand savings goal. Additionally, the program exceeded its target for demand savings in the 15+ EUL category.
- **Key Finding: The ICAST one-stop-shop program design continued to align with the majority of the best practices for one-stop-shop multifamily programs, including:** (1) offering a single point of contact (SPOC) for project development and technical assistance; (2) a streamlined application process with assistance from a SPOC; (3) comprehensive energy assessments to identify upgrade opportunities; (4) coordination of rebates; (5) assistance with identifying qualified contractors and soliciting, evaluating, and selecting bids; (6) coordination of installations; and (7) QA/QC inspections of each project. Notably, the ICAST team tailors the scope of the one-stop-shop approach to the property manager or owner's needs. In the Market Rate segment, many property managers and owners have established contractor relationships and/or prior knowledge of the incentive process. In these instances, the ICAST team serves as a resource and a guide through the participation process rather than filling the role of a general contractor.
- **Key Finding: The program team implemented a pre-approval process for all projects in 2021, which provided more visibility into Trade Ally projects and presented opportunities to influence project scopes.** In prior program years, the lack of a pre-approval process allowed trade allies to act autonomously from the implementation team. This created challenges for the implementation team when trying to meet savings goals and key performance metrics because trade ally projects were typically limited in scope. Additionally, the implementation team had minimal visibility into the projects until after they were completed. The introduction of the pre-approval process allowed the implementation team an opportunity to influence and alter project scopes early in the process, particularly projects that were limited in scope or did not align with performance targets. This ultimately generated more work for the trade allies and strengthened their trust and allyship to the program.

1.2.4 Multifamily Income-Eligible

- **Key Finding: The COVID-19 pandemic continued to present challenges to the program's model for delivering comprehensive projects, but the successful uptake of relocation incentives mitigated negative impacts to overall program performance.** These incentives, which encouraged participants to temporarily vacate their premises, were a significant factor in the performance of the MFIE Program in 2021. The incentives allowed the implementation team to enter unoccupied units and complete comprehensive projects while adhering to COVID-19 protocols. Once the COVID-19 restrictions were

lifted, the program team was able to leverage the significant pipeline of projects they had developed and demonstrate the full strength of the program; 80% of the total electric-saving measures delivered in PY2021 were installed in the second half of the year. Additionally, the program team nearly tripled the number of premises treated in PY2021 compared to PY2020 and more than doubled the total electric-saving measures installed. As a result, the program achieved 229% of their first year energy savings goals. The program team also and averaged 21% savings per property, exceeding their goal of 18.75%.

- **Key Finding: The program team successfully promoted the co-delivery component in PY2021, spurring high uptake of measures and spending all the allocated budget.** Ameren Missouri Electric partnered with Spire Gas and Ameren Missouri Gas to sponsor the co-delivery offering, which first launched in PY2020. The goal of the offering is to deliver more comprehensive projects to dual-fuel participants in the MFIE Program. Additionally, co-delivery provides efficiencies to customer service; avoiding the need for multiple utilities to engage with the same customer and splitting the cost of dual-fuel measures. The ability to cost split extends the life of program incentive budgets and, in the case of Ameren Missouri Electric, eliminates the financing of gas savings through electric incentive budgets (e.g., fully funding a dual-fuel measure with electric funds). It is important to note, however, that co-delivery does present some implementation challenges. The introduction of gas saving measures to program offerings can divert limited customer budgets towards these measures, which might offer higher savings potential at a property with gas space heating and hot water heating. Any investment in electric saving measures as part of these projects would necessitate including the project in the program team's average percent savings performance metric, which is based on electric energy savings. If electric saving measures only account for a small portion of the project scope, the percent savings metric can be put at risk. As such, the implementation team must balance the delivery of co-delivery measures in such a way that does not jeopardize their performance metrics.

1.2.5 Single Family Income Eligible

- **Key Finding: The Grant Channel had a broader geographic reach in PY2021 when compared to past years and was critical to meeting customer needs in PY2021.** While implementation partners distributed a much smaller number of measures through this channel in PY2021 (90,462) when compared with PY2020 (318,379), the program team built successful relationships with CBOs located outside of St. Louis which allowed Ameren Missouri to reach a much broader geographic area through this channel. As the contactless measure distribution inherent in the design of the Grant Channel was well-suited for serving customers in the midst of the COVID-19 pandemic, the program team was able to exceed their budget for PY2020, leaving less available budget in PY2021. When compared to the number of measures distributed in PY2019 (23,871), the program team has grown the Grants Channel substantially by successfully building partnerships with CBOs throughout Ameren Missouri's service territory.
- **Key Finding: Participation in the Single Family Channel declined in PY2021 (874 participants) compared to PY2020 (1,605) but increased compared to PY2019 (487).** In PY2021 the program offered a full suite of measures to its customers and was able to target high need mobile home customers, a key market segment. Additionally, on average, each participating customer received more measures and deeper savings in PY2021, compared to PY2020 due to the concentrated and comprehensive approach. The program team successfully leveraged the outreach strategy implemented in PY2020 for the Single Family Channel to drive participation through CBOs and housing authorities rather than direct customer outreach. This contributed to building a strong customer

pipeline for PY2021, added efficiency for the program implementation, and allowed the program team to offer customers a comprehensive program scope.

1.3 Cost-Effectiveness Results

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

Table 6 summarizes the cost-effectiveness results for the ten residential programs, including two residential Low-Income Portfolio programs and PAYS. All programs were cost-effective in PY2021 based on the TRC test except Efficient Products, Appliance Recycling, the Single Family Income Eligible and Multifamily Income Eligible Programs, and PAYS.[6] The Single Family Income Eligible and the Multifamily Income Eligible Programs and PAYS were also not cost effective under the UCT, and all programs had RIM results below 1.0.

[4] *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*. October 2001.
[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.

Table 6. Summary of Residential Cost-Effectiveness Results

Program	TRC	UCT	RIM	PCT
Lighting	7.64	5.60	0.50	n/a
HVAC	1.25	1.49	0.48	3.89
HER	3.17	3.17	0.50	n/a
REP	0.99	1.38	0.42	3.41
EE Kits	1.73	2.56	0.46	6.90
MFMR	1.71	1.98	0.50	5.82
RAR	0.95	1.36	0.34	4.76
SFIE	0.65	0.50	0.27	4.50
MFIE	0.64	0.57	0.28	4.32
PAYS	0.68	0.76	0.39	4.08

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

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 residential portfolio evaluation was designed to address several gross impact, net impact, and cost-effectiveness objectives. With the exception of the HVAC and PAYS programs, the evaluation team focused on impact evaluation activities for the PY2021 portfolio. Finally, we have included a fifth category of objectives below focused on responding to the five key research questions stipulated in 20 CSR 4240.22.070(A).[7] The research objectives addressed by the PY2021 residential portfolio evaluations include:

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.

Gross Impact Objectives

- Verify program-tracking data.
- Estimate the first year ex post gross energy (MWh) and demand (MW) savings.
- Estimate last year ex post gross demand savings (MW) savings by EUL category.
- Estimate the percentage of energy savings for all participating properties in each of the residential income-eligible programs (i.e., SFIE and MFIE).

Attribution/Net Impact Objectives

- Estimate the first year ex-post net energy (kWh) and demand (kW) savings.
- Estimate last year ex post net demand (kW) savings, by EUL category.

Cost-Effectiveness

- Assess the cost-effectiveness of each residential program and the residential portfolio as a whole using industry-standard cost-effectiveness tests.

[7] 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.

- Ensure alignment of cost-effectiveness testing assumptions and parameters with the PY2021 business evaluation results, Ameren Missouri's TRM Revisions 5.0, and industry best practices.[8]
- Provide total program benefits, costs, net benefits, and cost-effectiveness testing results.

CSR Mandated Research Questions (20 CSR 4240.22.070(A))

- 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 PY2021 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 7 shows the research activities conducted for each program.

Table 7. Research Activities by Offering

Research Activity	Lighting	HVAC	HER	REP	EEK	MF MR	RAR	PAYS	SF IE	MF IE	DIY Kits
Program Manager and Implementer Interviews	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
Program Material Review	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
Tracking System Review	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
Participant Research											
Participant Survey	-	✓	-	-	-	-	-	✓	-	-	-
Market Partner Surveys/In-Depth Interviews	-	✓	-	-	-	-	-	✓	-	-	-

[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 September 2021 (referred to as "Ameren Missouri TRM"). The referenced TRM versions, updated in September 2021, include Appendix H, Version 3 and Appendix F, Version 5.0, unless otherwise noted.

Research Activity	Lighting	HVAC	HER	REP	EEK	MF MR	RAR	PAYS	SF IE	MF IE	DIY Kits
Gross Impact Analysis											
Database Review	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓
Engineering Analysis	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓
Consumption Analysis	-	-	✓	-	-	-	-	-	-	-	-
Attribution/Net Impact Analysis											
Free Ridership	-	✓	-	-	-	-	-	-	-	-	-
Participant Spillover	-	✓	-	-	-	-	-	-	-	-	-

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 2021. 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 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 PY2021 evaluation cycle—once to support the interim impact analysis completed in August 2021 and once to support the annual impact evaluation in January 2022.[9] 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 that participated in the HVAC and PAYS programs during PY2021. This participant research consisted of quantitative online surveys and in-depth interviews with Ameren Missouri residential customers and property managers/owners who had participated in the programs during PY2021. Topics covered included

- Customer experience with the program;
- Satisfaction with the program overall and different program components;
- Recommendations for program improvement; and

[9] The evaluation team reviewed program tracking data for the HER and PAYS Programs once as neither were included in the interim impact analysis.

- Free ridership (FR) and participant spillover (PSO) for the HVAC Program.

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 C.

2.2.5 Market Partner Research

We conducted market partner research for the HVAC and PAYS Program evaluations. In particular, we conducted in-depth interviews with participating HVAC distributors and contractors who participated in the HVAC Program, along with trade allies that served PAYS participants. Details of the individual data collection activities including areas of exploration, population sizes, sampling approaches, and response rates are presented in the individual program chapters. Final data collection instruments are provided as Appendix C.

2.2.6 Gross Impact Analysis

With the exception of the HER Program, the evaluation team based PY2021 gross impact analyses for the Ameren Missouri residential programs on the Ameren Missouri TRM. Gross impact activities included review of the program-tracking database.

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.
- Last year ex post energy and demand savings reflect baseline adjustments for lighting measures (see additional information below) and 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 savings.
- We present last year ex post demand savings in three EUL categories: less than 10 years, 10–14 years, and 15 years or more.

Database Review and Engineering Analysis

To determine gross impacts associated with the majority of Ameren Missouri's PY2021 programs, we first reviewed the program-tracking database to check that project data was 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 that 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 desk reviews and/or participant survey data.[10]

[10] Ex ante applied Revision 3.1 (dated March of 2020) of the Ameren Missouri 2019-21 MEEIA Energy Efficiency Plan Appendix F – TRM: Residential Measures (referred to as the "Ameren Missouri TRM"). Ex post applied Revision 4.0 (October 2020) of the Ameren Missouri TRM.

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.

2.2.7 Net Impact Analysis

To determine net savings estimates for the PY2021 residential programs, we primarily multiplied gross impact estimates by NTGRs developed during the PY2019 evaluation. For the MFMR Program, however, our team used NTGRs developed based on interviews with participating property managers in PY2020. We developed NTGRs for the HVAC Program based on a PY2021 participant survey and interviews with participating distributors. Additionally, we estimate PY2021 savings for the HER Program through a modeling approach designed to produce net savings and, as such, do not estimate a separate NTGR. Finally, we assume NTGRs of 1.0 for the residential income-eligible programs (i.e., SFIE and MFIE), as is consistent with previous evaluations.

Net-to-Gross Ratio Development

Our PY2021 NTG analyses included consideration of free ridership (FR), participant spillover (PSO), trade ally spillover (TASO), and non-participant spillover (NPSO), depending on program design. We developed estimates of HVAC FR and PSO based on surveys with participants. TASO values for the HVAC Program, and NPSO are based on research conducted through the PY2019 evaluation. NTGRs are calculated as follows:

Equation 1. NTGR

$$NTGR = 1 - FR + PSO + TASO + NPSO$$

Table 8 summarizes, by program, which NTGR components apply to each residential program. The subsections following the table provide more detail on the estimation of FR and PSO.

Table 8. Components of NTGR by Program

NTGR Component	Lighting	HVAC	EEP	EEK	MF MR	RAR
Free Ridership	✓	✓	✓	✓	✓	✓
Participant Spillover	✓	✓	✓	✓	✓	✓
Trade Ally Spillover	-	-	✓	-	-	-
Non-Participant Spillover	✓	✓	✓	✓	✓	-

Free Ridership

Free riders are program participants who would have completed the same energy efficiency upgrade without the program. FR scores represent the percentage of savings that would have been achieved in the absence of the program. FR scores can range from 0% (not a free-rider; the participant would not have completed the project without the program) to 100% (a full free-rider; the participant would have completed the project without the program). FR scores between 0% and 100% represent partial free-riders, i.e., participants who were to some degree influenced by the program to complete the energy efficiency upgrade.

For programs within the residential portfolio, the FR assessment generally consisted of two components:[11]

[11] The evaluation team used modified algorithms for the EEK and RAR programs given their program designs. Additional detail is provided within the program-specific chapters of the report.

- A Program Influence component, based on the participant's perception of the program's influence on the decision to carry out the energy-efficient project; and
- A No-Program component, based on the participant's intention to carry out the energy-efficient project without program funds.

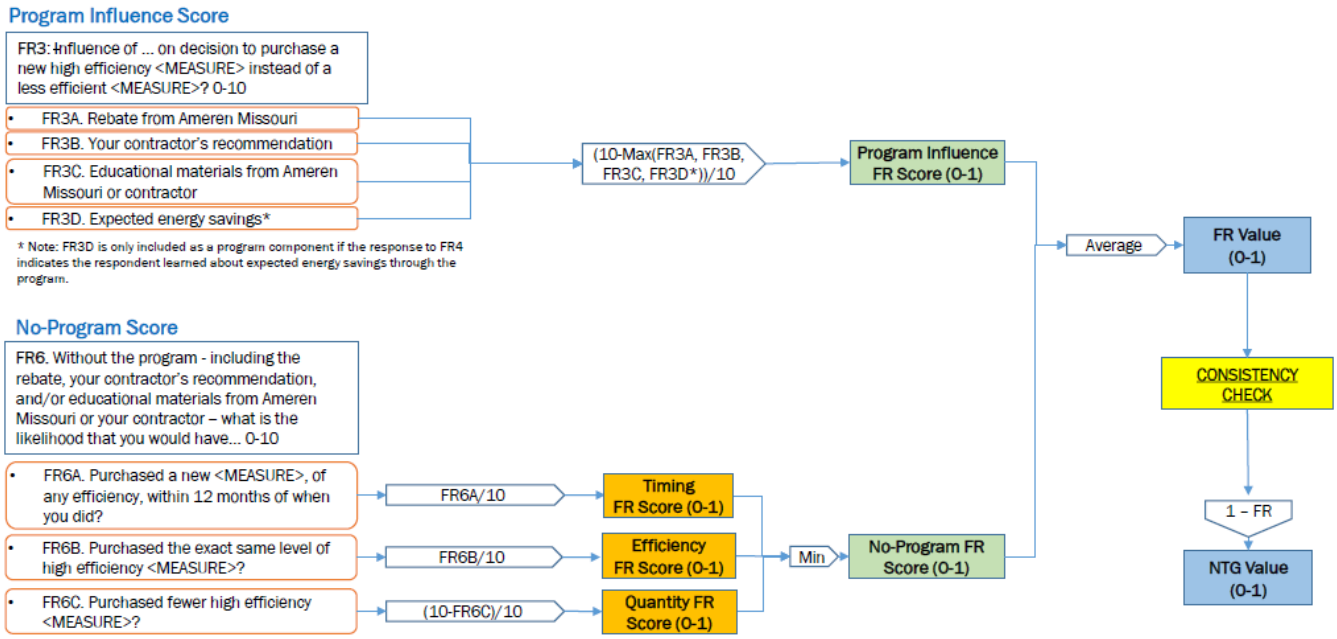
When scored, each component assesses the likelihood of FR on a scale of 0 to 10, with the two scores averaged and for a combined total FR score. FR is the mean of the two components:

Equation 2. Free Ridership

$$Free\ Ridership\ (FR) = Mean(Program\ Influence, No\ Program\ Score)$$

As different and opposing biases potentially affect the two main components, the No-Program component typically indicates higher FR than the Program Influence component. Therefore, combining them decreases the biases. Figure 1 presents a diagram of the respondent-level FR algorithm used for the HVAC, Efficient Products, and Lighting (online component only).

Figure 1. Overview of General Residential Free-Ridership Algorithm



Additional detail on the FR methodology used in the evaluation of the residential portfolio is presented in each of the relevant program chapters.

Participant Spillover

PSO refers to additional energy efficiency upgrades participants made at the time of or after their participation in the residential programs that were influenced by the programs but for which participants did not receive a program incentive. PSO is expressed as a percentage of program savings.

To determine if a survey respondent is eligible for PSO savings, we asked a series of questions about additional energy efficiency installations that they made without receiving an incentive and the degree to which the

program influenced their decision to install the efficient equipment. For example, the Midstream participant survey for the HVAC program included two program influence questions:

a. *Q1. How much did your experience with the Program influence your decision to make these energy efficient improvements on your own? [SCALE 0-10; 0 means "no influence" and 10 means "greatly influenced"]*

b. *Q2. How likely is it you would have made these energy efficiency improvements if you had not received a rebate through the Program? [SCALE 0-10; 0 means "definitely would not" and 10 means "definitely would"]*

To supplement these numeric responses, the survey contains open-ended questions about how the program influenced their decision to make the upgrades and why the participant made the installations without a program incentive. A respondent's additional energy efficiency installations are deemed eligible for PSO if two conditions are met: (1) the Program Influence Factor (see below) is greater than 5.0, and (2) the open-ended responses do not contradict that the installations were eligible for PSO.

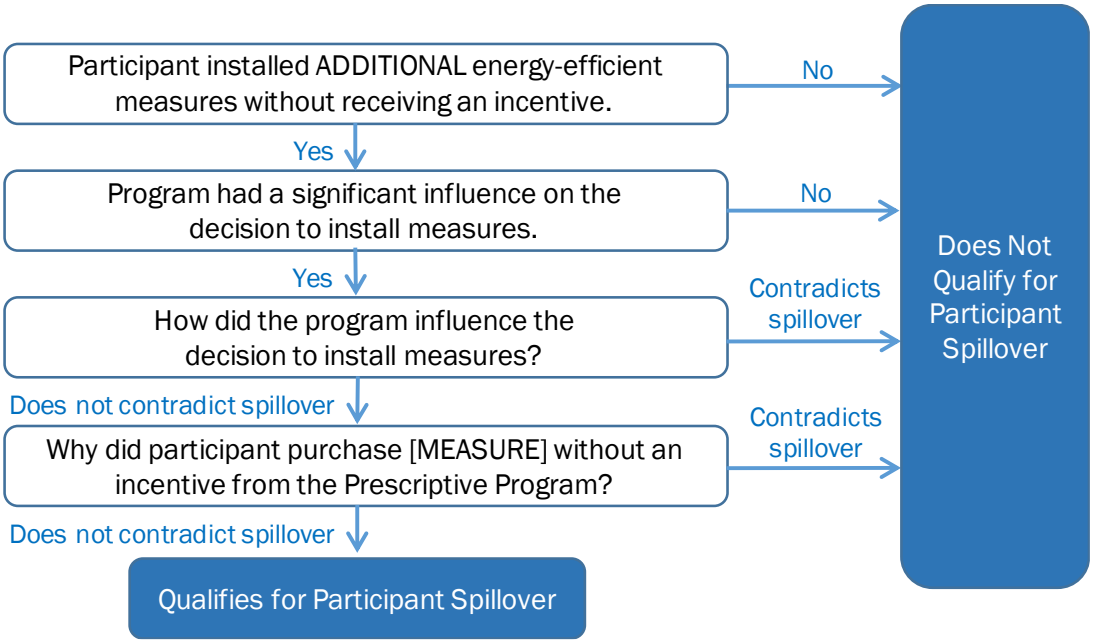
The Program Influence Factor was calculated as follows:

Equation 3. Program Influence Factor

$$\textit{Program Influence Factor} = (Q1\ \text{Response} + (10 - Q2\ \text{Response})) \div 2$$

Figure 2 presents a diagram of the PSO eligibility determination methodology used for this evaluation, including references to question numbers.

Figure 2. Participant Eligibility for Spillover



For participants that reported qualifying installations through the participant survey, we applied the corresponding measure-level deemed savings estimate in the Ameren Missouri TRM to estimate the spillover measure savings.

It is important to note that the evaluation team did not include spillover savings from the installation of lighting measures given the potential for double counting with the Residential Lighting Program. Many customers do not know they are purchasing program-discounted LEDs, so it is not possible to verify that the LEDs they purchased were not discounted by Ameren Missouri. In addition, the Residential Lighting Program evaluation estimates and claims savings from non-discounted LEDs that were influenced by the Ameren Missouri program.

Non-Participant Spillover (NPSO)

Ameren Missouri has been running energy efficiency programs for many years, and a key component of the residential portfolio has been a marketing and outreach campaign to promote the programs and general energy efficiency awareness among customers. Sustained utility program and general marketing can affect customers' perceptions of their energy usage, and, in some cases, motivate them to take efficiency actions outside of the utility's program. We define NPSO as the energy savings that Ameren Missouri's program marketing activities caused but did not rebate.

As outlined in the PY2021 evaluation plan, we planned to apply the NPSO percentages that we developed in PY2019 (13.7% for MWh and 7.7% MW) to PY2021 ex-post gross savings for four applicable programs: HVAC, REP, RAR, and EEK.

PY2021 NPSO Results

We allocated NPSO to each program based on the relative size of its ex-post gross savings. The specific allocations per program are in Table 9 and Table 10 below. NPSO represented 13.7% of the ex-post gross MWh savings and 7.7% of the ex-post gross MW savings among these programs.

Table 9. NPSO Allocation by Program (MWh)

Program	Ex-Post Gross Savings (MWh)	% Share	NPSO Allocation (MWh)	NPSO as % of Gross Savings
HVAC	46,386	76%	6,355	
REP	7,999	13%	1,096	
EEK	4,420	7%	606	13.7%
RAR	2,220	4%	304	
Total	**61,025**	**100%**	**8,360**	

Table 10. NPSO Allocation by Program (MW)

Program	Ex-Post Gross Savings (MW)	% Share	NPSO Allocation (MW)	NPSO as % of Gross Savings
HVAC	32.17	89%	2.48	
REP	2.95	8%	0.23	
EEK	0.85	2%	0.07	7.7%
RAR	0.32	1%	0.02	
Total	**36.29**	**100%**	**2.79**	

Home Energy Report Consumption Analysis

The evaluation team used a monthly consumption analysis approach to determine impacts from the Home Energy Reports Program. Given the experimental design, the estimated savings are considered net savings. We used treatment and control group monthly billing data to estimate net savings per household over the program period. The net savings are further adjusted using joint savings analysis to ensure that savings are not double-counted between programs. We also compared Uplight's (the program implementer) estimated electric savings to those we developed for this evaluation.

3. Residential Lighting

This section summarizes the PY2021 evaluation methodology and results for the Ameren Missouri Residential Lighting Program. As with other programs in the residential portfolio, we focused on impact evaluation activities in PY2021 for the Residential Lighting Program. Additional details on the methodologies are presented in Appendix A.

3.1 Evaluation Summary

3.1.1 Program Description

The Ameren Missouri Residential Lighting Program is designed to increase sales and awareness of ENERGY STAR® qualified LED lighting products.[12] The target market consists of all residential customers within the Ameren Missouri service territory. Ameren Missouri delivers the Lighting Program through two channels: (1) an Upstream Channel,[13] through retail partners, and (2) through the Ameren Missouri Online Store.

Through its Upstream Channel, the program provides incentives to retail partners to reduce costs and increase sales of qualified energy-efficient LED lighting products. Though the incentives are paid to the retailers, they translate into immediate point-of-purchase discounts for customers when they purchase program-qualified LEDs.[14] The Upstream Channel also trains retail outlet staff to discuss the benefits of efficient lighting and offers in-store marketing materials to increase customer awareness. Additional marketing activities vary from year-to-year but can include lighting clinics and events at retailers, pop-up retail shops, proximity mobile marketing, on-line advertising, co-op advertising, coupons, print, radio, television commercials, billboards, and on-bill messaging.

The Online Store offers Ameren Missouri customers a select assortment of efficient LED lighting products that customers can purchase directly from the site.[15],[16] For the Online Store, the incentives translate to immediate online customer discounts at checkout. In addition to providing all customers access to a streamlined approach for obtaining energy-efficient products, the Online Store also ensures that customers who do not live near a participating retailer have access to discounted LED products.

The Residential Lighting Program design did not change between PY2020 and PY2021, though the program team did begin to scale the program back in PY2021 in anticipation of the program design changes in PY2022. In PY2021, however, both the Online Store and Upstream Channels experienced a decrease in the total volume of bulbs sold. Additionally, beginning in PY2022, the Upstream Channel will be shifting to an income eligible program focusing on thrift stores and discount retailers, and the program will launch a new delivery channel aimed at distributing LEDs through local food banks.

[12] The ENERGY STAR® name and mark are registered trademarks owned by the US EPA.
[13] Ameren Missouri and the implementer refer to this channel as upstream; however, upstream programs typically target manufacturers. This channel of the Lighting Program is really midstream, as the program intervenes with retailers, not manufacturers.
[14] As with most residential midstream/upstream lighting programs across the country, the individual customer purchase of bulbs is not tracked by the program. Instead, the participating retailers provide monthly aggregate data of sales by qualified bulb model to the implementer.
[15] In addition to lighting, the Online Store offers discounted smart thermostats and advanced Tier 1 and Tier 2 power strips. Only the lighting measures are evaluated in this study; the thermostats and power strips are evaluated as part of the Ameren Missouri Residential Efficient Products Program.
[16] The current Online Store lighting main page can be viewed at: https://amerenmissouristore.com/shop/led-bulbs/.

Because the program is delivered via two very different channels, we present results by channel throughout the remainder of this chapter. Additionally, results are generally presented by bulb type (standard, reflector, and specialty) as each type is associated with a different TRM savings value.

3.1.2 Participation Summary

In PY2021, the Upstream Channel incented 2,621,862 individual bulbs from sales across 242 participating retailer stores; the Online Store incented 39,964 bulbs purchased by 2,247 unique Ameren Missouri customers (Table 11). Similar to PY2019 and PY2020, the Upstream Channel dominates the Residential Lighting Program, representing 98.3% of ex ante gross MWh and MW savings.

Table 11. PY2021 Lighting Program Participation Summary by Channel

Channel	Bulbs		Ex Ante Gross Savings			
	Number	%	MWh	%	MW	%
Upstream	2,621,862	98.5%	95,419	98.3%	14.80	98.3%
Online Store	39,964	1.5%	1,642	1.7%	0.25	1.7%
Total	**2,661,826**	**100%**	**97,062**	**100%**	**15.05**	**100%**

The different bulb types incented by both channels include standard, which is a classic A-line bulb, reflector which are directional bulbs, and specialty, which include other bulb shapes such as candelabras or globes. Proportionally, customers purchased similar types of LEDs across channels with standard bulbs dominating sales (Table 12).[17] In the Upstream Channel, 73% of all bulbs sold were standard LEDs compared to 15% reflectors and 12% specialty bulbs (see Table 13). The Online Store sold a similar distribution of bulb types with 71% being standard, 16% reflectors, and 13% specialty bulbs.

Table 12. PY2021 Lighting Program Upstream Channel Participation Summary by Bulb Type

Bulb Type	Stores		Bulbs		Ex Ante Gross Savings			
	Number	%	Number	%	MWh	%	MW	%
Standard	241	44%	1,926,912	73%	68,857	72%	10.68	72%
Reflector	145	27%	381,212	15%	16,214	17%	2.51	17%
Specialty	161	29%	313,738	12%	10,349	11%	1.61	11%
Total	**547**	**100%**	**2,621,862**	**100%**	**95,419**	**100%**	**14.80**	**100%**

Table 13. PY2021 Lighting Program Online Store Channel Participation Summary by Bulb Type

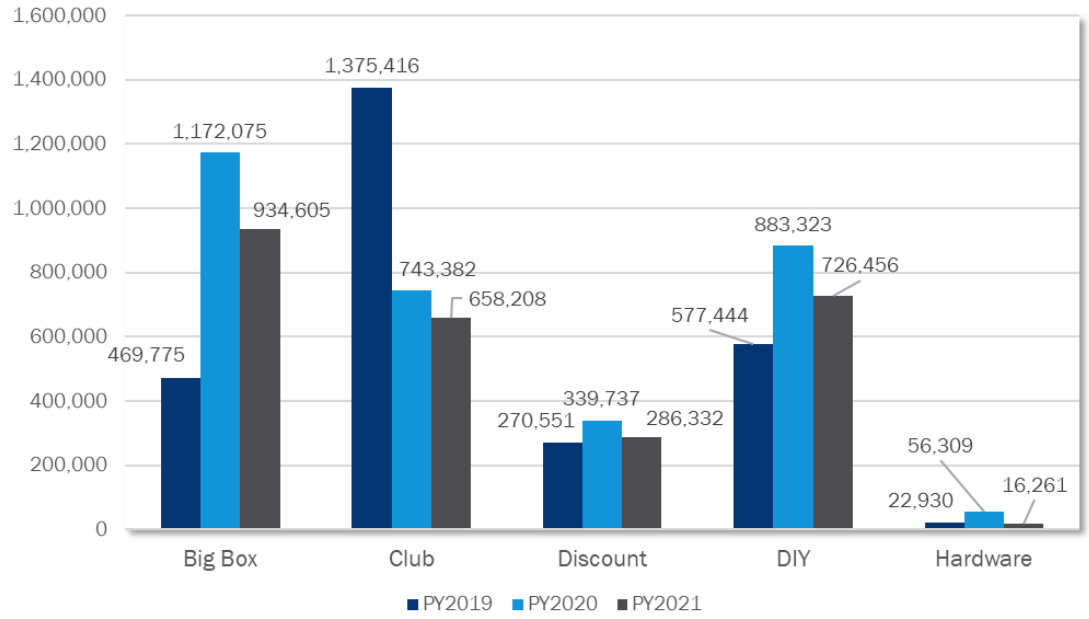
Bulb Type	Customers		Bulbs		Ex Ante Gross Savings			
	Number	%	Number	%	MWh	%	MW	%
Standard	1,946	64%	28,246	71%	1,132	69%	0.18	69%

[17] The Ameren Missouri TRM Appendix I contains two LED measures: (1) 3.5.1 - LED Screw Based Omnidirectional Bulb, and (2) 3.5.2 - LED Specialty Lamp. While there is only a single class for omnidirectional bulbs, specialty bulbs are further broken down into three classes: (1) directional, (2) decorative, or (3) globe. For this evaluation, we refer to three bulb types: (1) standard, (2) reflector, and (3) specialty. Our standard bulb classification aligns entirely with the omnidirectional measure category and our reflector category aligns with the specialty directional bulbs. Our specialty category, however, includes both the decorative and globe TRM classes. We classify bulbs as such based on experience, which has shown notably different market performance and dynamics for globes/candelabras in contrast to directional/reflector bulbs.

Bulb Type	Customers		Bulbs		Ex Ante Gross Savings			
	Number	%	Number	%	MWh	%	MW	%
Reflector	613	20%	6,546	16%	338	21%	0.05	21%
Specialty	480	16%	5,172	13%	172	10%	0.03	10%
Total	**3,039**	**100%**	**39,964**	**100%**	**1,642**	**100%**	**0.25**	**100%**

Because the Upstream Channel accounts for nearly all the program savings (98.3% of ex ante gross MWh), the evaluation team took a deeper look at sales across years and throughout PY2021 to better understand how the channel operated in PY2021. Figure 3 shows Upstream Channel sales by retailer type in PY2019, PY2020 and PY2021. All retailer types sold fewer bulbs in PY2021 than they did in PY2020 with an overall decrease of 17%. Even though Hardware stores only accounted for a small proportion of total Upstream Channel sales, they saw a 71% decrease. Big box, club, and discount stores had more modest decreases in sales volume from PY2020 to PY2021 (20%, 11%, and 16%, respectively).

Figure 3. PY2021 Total Upstream Lighting Sales by Retailer Type

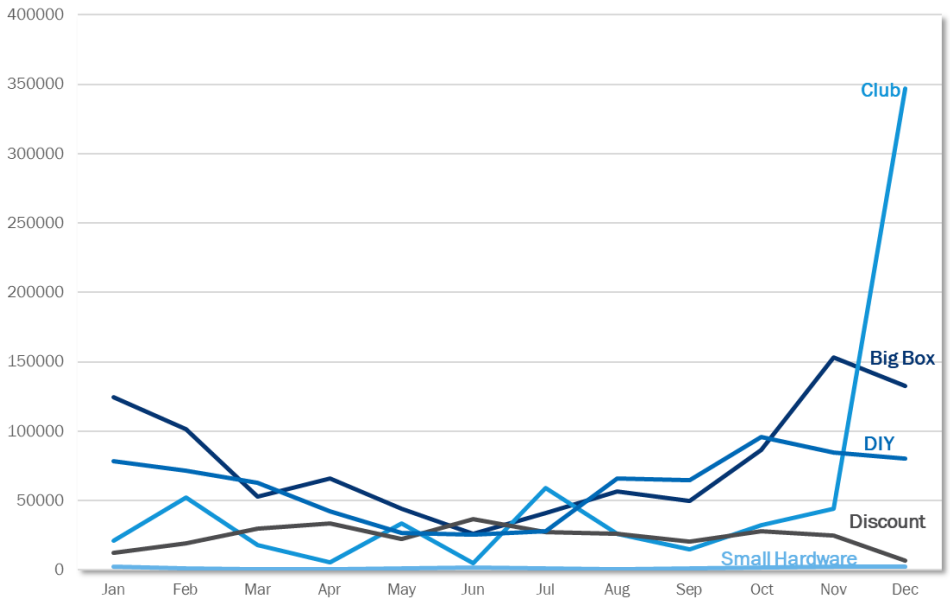


The performance of the program varied throughout the year and across retailer types. Figure 4 shows PY2021 sales by retailer type by month revealing several interesting insights.

- Between November and December, the implementation team conducted a last minute push of 12-pack LEDs to Club stores to boost LED participation, accounting for the uptick in club sales in the below figure.

The decline of big box, DIY and discount store sales in December can be attributed to two factors. First, memorandums (MOU) of understanding were set to end on the last day of December and in the case of some thrift stores, program staff set limits on the MOUs where stores would not be participating in the PY2022 program. Second, several MOUs were not in effect in December because targets and budgets had already been met for the year.

Figure 4. PY2021 Upstream Lighting Sales by Retailer Type Over the 2021 Calendar Year



3.1.3 Key Impact Results

Table 14 presents annual gross and net savings achieved across both channels of the Residential Lighting Program in PY2021. As in previous years, the program vastly exceeded goals for first year energy savings and demand savings as well as last year demand savings. We discuss the factors contributing to these results in Section 3.3.1, Gross Impact Results.

Table 14. PY2021 Lighting Program Impact Summary

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/ Target Net	% of Goal/ Target
First Year Savings							
Energy Savings (MWh)	97,062	102.9%	99,891	63.8%	63,740	11,238	567%
Demand Savings (MW)	15.05	102.9%	15.49	63.8%	9.88	1.70	581%
Last year Demand Savings							
< 10 EUL (MW)	0.00		2.69	63.8%	1.71	0.00	0.00
10-14 EUL (MW)	0.00		0.00		0.00	0.00	0.00
15+ EUL (MW)	15.05	85.0%	12.79	63.8%	8.17	1.70	481%

Overall, the Lighting Program was the largest program in the PY2021 residential portfolio in terms of ex post net savings (42% of portfolio savings). In terms of ex post net demand, the Lighting Program, was the third largest contributor (18% of residential portfolio).

3.1.4 Conclusions and Recommendations

Beginning in PY2022, the Lighting Program will transition to the low-income portfolio and offer discounted or free LEDs through the Community Lighting Program. As PY2021 was the final year of the program in its current design, we do not offer any recommendations for future improvements for the program. However, we do note that the Lighting Program performed well in PY2021, far exceeding its first-year energy, demand, and last year demand savings goals (see Table 14).

To meet the requirements of Missouri Code of State Regulations (CSR) for demand-side process evaluations, we provide responses to the five required process evaluation questions in Table 15. Note that we did not conduct any process evaluation tasks for PY2021, so the findings denoted in the table are largely the same findings we reported in PY2019 and PY2020, with research results drawn from the PY2019 evaluation.

Table 15. 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?	▪ Market imperfections have historically been product availability, customer awareness of energy-efficient lighting options and benefits, and the higher cost of these products. ▪ For PY2019, we found the following: ▪ Product availability is no longer a barrier. LEDs are the most frequently stocked bulb at lighting retailers across all bulb types (i.e., standard, reflector, and specialty). ▪ Customer awareness is a decreasing barrier. The vast majority of customers have LEDs installed in their homes. Two-thirds of customer light sockets also contain either a CFL or an LED. ▪ LEDs still cost more than incandescents, but the price difference has narrowed. ▪ Despite these positive signs of market progress, 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?	▪ The target market for the Residential Lighting Program is all residential customers within Ameren Missouri service territory. ▪ The program targets low-income customers by engaging discount stores that do not typically sell lighting such as St. Vincent De Paul, Salvation Army, Goodwill, and Habitat Restore. These stores tend to serve lower income customers. By bringing low-cost LEDs into these stores, the program attempted to reach customers it may not reach through other participating retailers or programs. ▪ Given the high level of efficient bulb socket saturation among non-low-income customers, the program could benefit from a more targeted design. Truly subdividing the market into low-income versus non-low-income and using tailored program designs for each customer segment would be appropriate.
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 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 that take a standard bulb contain an efficient bulb. A shift in program focus to LED reflector and specialty bulbs, which cost more and lag in use, would be appropriate. An exception is the low-income customer segment, as noted previously. Low-income customers could still use support increasing their use of all efficient bulb types, including standard bulbs.

CSR Required Process Evaluations Questions	Findings
Are the communication channels and delivery mechanisms appropriate for the target market segment?	▪ For the Upstream Channel, the program used in-store and out-of-store marketing. Our PY2019 evaluation found that in-store marketing was the primary driver of sales. Given the nature of the product, marketing at the point-of-purchase is appropriate. ▪ Program implementers added new discount retailers to the program to increase the focus on low-income customers. This was an effective strategy that the program should continue and even expand, if possible. In turn, the program should reduce its emphasis on sales of standard bulbs at non-discount stores. ▪ The Online Store accounted for just over 1% of program sales and savings. With the growing customer reliance on online shopping more generally, the Online Store has unrealized potential. The channel is particularly useful for targeted marketing to underserved customers, which is more difficult to do through the mass market Upstream Channel.
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?	▪ Price is the remaining market imperfection, but much more so for low-income customers. The program should continue its partnerships with low-income retailers that do not traditionally sell lighting and other retailers in low-income neighborhoods. ▪ Customers have been slower to adopt reflector and specialty efficient lighting, in part because the previous products, CFLs, were expensive and did not meet customer expectations. LEDs are a superior product and price has fallen, but LEDs still cost more than incandescent bulbs. The program could do more to increase adoption by focusing program budget on non-standard products.

3.2 Evaluation Methodology

For PY2019, our team conducted a comprehensive process evaluation of the Residential Lighting Program. These efforts included a detailed review of the program logic model, a program material review, Online Store participant surveys, in-store customer intercepts, lighting shelf stocking surveys, price elasticity modeling, and retailer/manufacturer interviews. From the surveys, intercepts, and price elasticity modeling the evaluation team derived key evaluation parameters including in-service rates (ISRs), leakage, residential-business split, participant free ridership (PFR), and participant spillover (PSO). In PY2019 we also conducted a large-scale non-participant survey (n=4,804) to assess non-participant SO (NPSO), among other things.

Because there is no expectation of substantive shifts in any of these parameters in just two years, and to use evaluation resources more efficiently, the evaluation team focused our PY2021 process evaluation efforts on program/implementer interviews and program material reviews. To derive PY2021 gross and net impact results, we applied the PY2019 evaluation-derived key parameters and the appropriate TRM inputs to PY2021 Lighting Program tracking data.[18] The following provides the specific research objectives for the main evaluation efforts.

Gross Impact Analysis

Gross impact-related activities for the PY2021 Residential Lighting Program included review of the program-tracking databases and engineering analysis to estimate ex post gross savings. Key objectives of the PY2021 gross impact analysis included

[18] For this evaluation, we used the Ameren Missouri 2019-21 MEEIA Energy Efficiency Plan Appendix I – TRM: Residential Measures (v5.0 dated 9/15/2021) and Appendix F (v5.0 dated 9/15/2021) (referred to as the "Ameren Missouri TRM").

- Verify program-tracking data;
- Estimate the first year ex post gross energy (MWh) and demand (MW) savings; and
- Estimate last year ex post gross demand (MW) savings, by EUL category.

Net Impact Analysis

Net impact-related activities for the PY2021 Residential Lighting Program included the application of PY2019 evaluation-derived estimates of PFR, PSO, and portfolio-level NPSO to the ex post gross energy (MWh) and demand (MW) savings to derive ex post net MWh and MW. We will also calculate last year ex post net demand savings.

Table 16 provides an overview of the PY2021 Residential Lighting Program evaluation activities.

Table 16. PY2021 Evaluation Activities for the Lighting Program

Task		Description
1	Program Manager and Implementer Interviews	▪ Conducted interviews in October of PY2021 to understand program changes and staff's perspective on program implementation.
2	Program Material Review	▪ Reviewed any new program materials to inform evaluation activities.
3a	Gross Impact Analysis - Database Review	▪ Reviewed program database to check that program data are complete and within range and that program-incented measures meet all program requirements.
3b	Gross Impact Analysis - Engineering Analysis	▪ Estimated overall and measure-level ex post gross impacts using TRM algorithms, deemed savings assumptions, and PY2019 evaluation-derived parameters.
4	Net Impact Analysis	▪ Applied PY2019 evaluation-derived estimates of free ridership, participant spillover, and non-participant spillover to estimate PY2021 net impacts.

3.3 Evaluation Results

The following sections provide the PY2021 Lighting Program gross and net impact findings. We have included additional details regarding the impact evaluation and key inputs in Appendix A.

3.3.1 Gross Impact Results

The evaluation team calculated ex post gross electric and demand savings for both the Upstream and Online Store channels as well as overall. We developed ex post gross savings estimates by examining all measures contained in the program-tracking database and applying algorithms and savings assumptions, including ISRs, leakage, and the proportion of bulbs installed in residential applications based on the appropriate Ameren Missouri TRM.[19]

In PY2021, the Lighting Program achieved 99,891 MWh and 15.49 MW first year gross ex post energy and demand savings, respectively (Table 17). For both first year energy and demand savings, the Lighting Program realized 102.9% of ex ante savings estimates in PY2021. The Lighting Program only realized 85% of ex ante

[19] The primary data collection efforts used to derive the PY2019 results included Online Store customer surveys, in-store shopper intercepts, and sales data modelling. Details of each of these and their combination are provided in Appendix A.

last year demand savings estimates in PY2021. In-store intercepts conducted in PY2019 indicated that about 4% of bulbs purchased through the Upstream Channel were installed in business applications, which have a lower EUL (six years) as compared to residential applications (19 years) due to much higher operating hours. In PY2021, 2.69 MW were associated with the <10 EUL class, decreasing the MW associated with the 15+ class and reducing realization rates.

Table 17. PY2021 Lighting Program Gross Impact Summary

	Ex Ante	Realization Rate	Ex Post
First Year Savings			
Energy Savings (MWh)	97,062	102.9%	99,891
Demand Savings (MW)	15.05	102.9%	15.49
Last Year Demand Savings			
< 10 EUL (MW)	0.00		2.69
10–14 EUL (MW)	0.00		0.00
15+ EUL (MW)	15.05	85.0%	12.79

First year energy and demand savings realization rates differed from 100% primarily due to the implementation team using deemed savings values for each measure included in Appendix F of the Ameren Missouri TRM to estimate ex ante savings, while the evaluation team used a more granular approach to estimating ex post savings outlined in Appendix I of the Ameren Missouri TRM. The two main drivers of differences between ex ante and ex post savings estimates are as follows.

- First, deemed savings values included in Appendix F assume the distribution of bulbs across bulb type, channel, and retailer type based on the PY2019 evaluation. We calculated ex post savings based on the actual distribution across bulb type, channel, and retailer in PY2021. One notable example of this difference in approach is underscored in the realization rate for Upstream reflector bulbs (134.2%). A higher proportion of reflectors were sold through DIY retailers in PY2021 than in PY2019. As our PY2019 evaluation found higher ISRs associated with DIY retailers, this increase in the share of reflectors sold through those retailers contributed to higher ex post savings for this measure category.
- Second, in the PY2021 evaluation, we conducted external research to collect bulb wattage and lumen information at the SKU level (i.e., product-specific level). We then used the researched lumens to calculate base wattage for each SKU using Appendix I of the Ameren Missouri TRM. The deemed savings values provided in Appendix F (used for ex ante savings estimates) assume average base wattages and lumens at a less granular level.

Table 18 shows ex ante and ex post gross savings by bulb-type across the two different channels. The table also shows realization rates for the different bulb types and channels. The highest realization rate (134.2%) was associated with reflector bulbs sold through the Upstream Channel; the lowest (77.9%) was associated with standard bulbs rebated through the Online Store. In general, the realization rates are higher for the Upstream Channel than they are for the Online Store reflecting the effects of the issues presented above.

Table 18. PY2021 Lighting 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)
Upstream	Standard	68,857	93.3%	64,228	10.68	93.3%	9.96
	Reflector	16,214	134.2%	21,757	2.51	134.2%	3.37
	Specialty	10,349	121.1%	12,533	1.61	121.1%	1.94
Online Store	Standard	1,132	80.9%	916	0.18	77.9%	0.14
	Reflector	338	91.7%	310	0.05	88.2%	0.05
	Specialty	172	85.9%	148	0.03	100.0%	0.03
Program Total		**97,062**	**102.9%**	**99,891**	**15.05**	**102.9%**	**15.49**

Table 19 summarizes the total PY2021 last year ex ante and ex post demand savings and realization rates by channel, by bulb type. Upstream reflector bulbs have the highest realization rate (110.5%); Upstream standard bulbs have the lowest (76.9%).

Table 19. PY2021 Lighting Program Annual Last Year Gross Demand Impacts

Channel	Bulb Type	Ex Ante (MW)			Realization Rate	Ex Post (MW)		
		<10	10–14	15+		<10	10–14	15+
Upstream	Standard	0.00	0.00	10.68	76.9%	1.76	0.00	8.21
	Reflector	0.00	0.00	2.51	110.5%	0.59	0.00	2.78
	Specialty	0.00	0.00	1.61	99.8%	0.34	0.00	1.60
Online Store	Standard	0.00	0.00	0.18	77.9%	0.00	0.00	0.14
	Reflector	0.00	0.00	0.05	88.2%	0.00	0.00	0.05
	Specialty	0.00	0.00	0.03	82.7%	0.00	0.00	0.02
Program Total		**0.00**	**0.00**	**15.05**	**85.0%**	**2.69**	**0.00**	**12.79**

3.3.2 Net Impact Results

Net-To-Gross Ratio Results

For PY2021, we used the results of our product level PY2019 net-to-gross ratio (NTGR) analyses to estimate net program impacts. In PY2019, the evaluation team conducted surveys with Online Store participants, in-store intercepts with customers at participating retailers, surveys with non-participants, and price elasticity modeling with the program-tracking data to derive the NTGRs.[20] NTGRs are estimated by store type (discount vs. non-discount) and bulb type for the Upstream Channel and bulb type for the Online Store Channel. For PY2021, the evaluation team re-weighted all applicable values by the distribution of PY2021 ex post gross savings to derive the overall NTGR of 63.8% that Table 20 shows.

[20] Details of the NTGR methodology are available in the Appendix A of the PY2019 report: *Ameren Missouri Program Year 2019 Annual EM&V Report – Volume 2: Residential Portfolio Appendices (June 18, 2020)*

Table 20. PY2021 Lighting Program NTGRs

Channel	Free-Ridership (FR)	Participant Spillover (PSO)	Non-Participant Spillover (NPSO)	Net to Gross Ratio (NTGR)	% of Ex Post Gross Savings
Upstream	43.9%%	0.0%	7.4%	63.5%	98.6%
Online Store	12.9%	1.7%	0.0%	88.8%	1.4%
Program Total	**43.5%**	**0.0%**	**7.3%**	**63.8%**	**100.0%**

Net Impacts

The evaluation team applied the NTGRs to ex post gross energy and demand savings to derive final ex post net impacts for the PY2021 Residential Lighting Program (Table 21). Ex post net energy savings totaled 63,740 MWh and ex post net demand savings totaled 9.88 MW. As noted elsewhere in this section, the vast majority (98.6%) of total ex post net savings is associated with the Upstream Channel; only 1.4% associated with the Online Store.

Table 21. PY2021 Lighting Program Annual First Year Net Impacts

Channel	Energy Savings			Demand Savings		
	Ex Post Gross (MWh)	NTGR	Ex Post Net (MWh)	Ex Post Gross (MW)	NTGR	Ex Post Net (MW)
Upstream	98,517	63.5%	62,519	15.28	63.5%	9.70
Online Store	1,374	88.8%	1,221	0.21	88.8%	0.18
Total	**99,891**	**63.8%**	**63,740**	**15.49**	**63.8%**	**9.88**

Finally, Table 22 shows the last year demand savings (MW) by channel, bulb type, and EUL category. The PY2021 Lighting Program delivered 1.71 MW of <10-year EUL class and 8.17 MW of 15+ year EUL category last year ex post net demand savings.

Table 22. PY2021 Lighting Program Annual Last Year Net Demand Impacts

Channel	Bulb Type	Ex Post Gross (MW)			NTGR	Ex Post Net (MW)		
		<10	10–14	15+		<10	10–14	15+
Upstream	Standard LED	1.76	0.00	8.21	63.5%	1.11	0.00	5.21
	Reflector LED	0.59	0.00	2.78	63.5%	0.38	0.00	1.76
	Specialty LED	0.34	0.00	1.60	63.5%	0.22	0.00	1.02
Online Store	Standard LED	0.00	0.00	0.14	88.8%	0.00	0.00	0.12
	Reflector LED	0.00	0.00	0.05	88.8%	0.00	0.00	0.04
	Specialty LED	0.00	0.00	0.02	88.8%	0.00	0.00	0.02
Total		**2.69**	**0.00**	**12.79**	**63.8%**	**1.71**	**0.00**	**8.17**

4. Home Energy Reports (HER)

This section summarizes the PY2021 evaluation methodology and results for the HER Program. We provide additional details on the methodology used to estimate impacts in Appendix A.

4.1 Evaluation Summary

Ameren Missouri designed the HER Program to promote changes in energy consumption behaviors that result in reduced electricity usage. The target market consists of residential customers in the Ameren Missouri service territory. This program is deployed as a randomized controlled trial (RCT), where customers are randomly assigned to a treatment or control group. HERs provide the treatment customers with a comparison of their energy usage to the usage of similar homes based on home size and location. At the same time, the implementer identifies and maintains a control group of customers who do not receive reports.

The PY2021 HER Program is an ongoing program in its last year of operation in MEEIA Cycle III, with Franklin Energy serving as the residential portfolio implementer and Uplight serving as the day-to-day implementer of the HER Program. Ameren Missouri initiated the program in PY2016 when the program team began to send paper reports to the first wave of treatment group customers.[21] In PY2018, the program team launched a second wave of customers who received paper reports and another that received e-mailed HERs (eHERs) only. In PY2019, a large third wave of customers who received both report types (as long as Ameren Missouri had valid e-mail addresses) were added to the program. In PY2020, Ameren Missouri added a fourth wave of customers who also receive both paper and eHERs if they have an email address on file.

In PY2021, no new waves were added. Uplight sent out four paper HERs, one in February, June, September, and November 2021 to those waves who receive paper reports.[22] Uplight also sent out eHERs every month in 2021, except July and December, to those customers with a valid e-mail on record. Note that the HER Program ended at the conclusion of 2021.

4.1.1 Participation Summary

Table 23 presents participation in the HER Program during PY2021, including the start date and length of time that each wave participated in the HER Program. Note that because the evaluation team relies on an intention-to-treat approach, the number of customers included in the table below reflects the number of treatment and control customers who received at least one bill in PY2021 and does not remove customers who opted out of the program or moved out of the service territory over the year.[23]

[21] Note that Uplight began implementing the HER Program in PY2019 and the previous program cycle was implemented by a different implementation contractor.
[22] As a result of a data issue encountered in June, Uplight did not mail all planned paper HERs that month. Those who did not receive their paper HERs in June received them in the month of October instead.
[23] To estimate program savings, the evaluation team multiplied the annual per household energy savings estimated from the consumption analysis by the number of customers who Ameren Missouri intended to treat. The only exception is for customers who moved out of the service territory; the savings are pro-rated for the number of days the customers resided in their homes before moving.

Table 23. PY2021 HER Participation Summary

Wave	Number of Customers		Start Date	Length of Time in HER Program
	Treatment	Control		
Wave 1	68,401	22,845	August 2016	5 years and 5 months
Wave 2	30,045	8,321	March 2018	3 years and 10 months
Wave 3	132,586	53,192	April 2019	2 years and 9 months
Wave 4	39,426	21,911	April 2020	1 year and 9 months
Total	**270,458**	**106,269**		

4.1.2 Key Impact Results

Table 24 presents the annual savings achieved in PY2021. Note that the contracted electric savings goal for PY2021 is 32,250 MWh. The savings calculated using a consumption analysis are unadjusted net savings since the program framework is an RCT (i.e., incorporates any FR or SO estimates). To arrive at adjusted net savings, the evaluation team calculated an uplift adjustment via a joint savings analysis to ensure any actions taken by participants claimed by other energy efficiency programs were not double-counted. To calculate demand savings, the evaluation team applied a coincidence factor to both the unadjusted and adjusted savings. While the team did not calculate a separate uplift adjustment for demand savings, the adjusted demand savings do reflect the savings uplift as we used adjusted energy savings to estimate adjusted demand savings. The PY2021 HER Program realized 276% of ex ante energy and demand savings and 108% of Ameren Missouri's energy and demand savings goals.

Table 24. PY2021 HER Savings Summary

	Ex Ante Program Savings[a]	Unadjusted Ex Post Net Savings	Uplift Adjustment[b]	Adjusted Ex Post Net Savings	Net Realization Rate	Goal Net[c]	% of Goal
Energy Savings (MWh)	13,747	38,281	317	37,963	276%	35,250	108%
Demand Savings (MW)	6.41	17.84		17.69	276%	16.43	108%

[a] Ex ante savings are based on deemed per participant savings estimates included in the Ameren Missouri TRM Appendix F version 4.0 (dated January 1, 2021).
[b] To arrive at the adjusted ex post net demand savings, the kW savings factor was applied to the adjusted ex post net energy savings. As such, we did not calculate a separate uplift adjustment for demand savings, though adjusted kW savings reflect kWh uplift adjustments.
[c] The 2019–21 MEEIA Energy Efficiency Plan (Revision 5, dated September 15, 2021) does not include incremental MWh or MW goals for the PY2021 HER Program, but we include goals here based on PY2019 for purposes of comparison.

Overall, the HER Program was the second-largest program in the PY2021 residential portfolio, accounting for 23% of ex post net residential portfolio energy savings and 35% of ex post net residential portfolio demand savings.

4.1.3 Key Process Findings

The PY2021 evaluation did not include an assessment of HER Program processes. Findings from a limited set of PY2021 research activities, as well as information from the program-tracking database, however, can help inform the process evaluation requirements for Ameren Missouri's HER Program. Table 25 summarizes responses to the five CSR process evaluation questions.

Table 25. PY2021 CSR Process Questions

CSR Required Process Evaluations Questions	Findings
What are the primary market imperfections that are common to the target market segment?	▪ Though we did not complete a survey for the PY2021 evaluation, PY2019 survey responses from the treatment and control customers indicated they have a general understanding of how behavioral changes lead to reductions in energy usage. One market imperfection common to both customer groups is the lack of a more nuanced awareness of how their actions to reduce energy consumption impact their utility bills. Reports sent through the HER Program are designed to address this market imperfection for treatment customers by providing them with information about energy efficiency program opportunities and recommendations to modify behaviors to reduce energy consumption in their homes.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	▪ The target market segment is appropriately defined. The program sends paper and/or email HERs to treatment customers who received these forms of treatment in previous years, with Wave 1 receiving HERs over the longest period of time. Ameren Missouri did not add any waves of customers to this program in PY2021, as this is the last year of operation for the HERs Program.
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 main form of treatment for customers is the paper and/or electronic HER. The HERs reflect the diversity of enduse energy service needs of residential homes—the target market. They include information related to the last 13 months of electric consumption, including load that is disaggregated by home area, as well as comparisons of monthly energy usage to similar homes. Reports also include customized tips aimed at modifying behavior related to the installation of LED lighting to replace less efficient lighting, installing programmable or advanced thermostats, and adjusting the way customers operate their washers/dryers, dishwashers, and HVAC equipment. In addition, HERs include information about applicable energy efficiency rebate programs that may lead customers to retrofit aging inefficient equipment.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	▪ The communication channels and delivery mechanisms are appropriate for the target market. Based on the PY2019 participant survey, the majority of respondents were satisfied with the way they receive HERs, and with the information they contained. Additionally, the HERs made customers aware of the energy efficiency programs Ameren Missouri offers. ▪ Ameren Missouri also operates an additional communication channel for this program—an online portal that provides similar information as the HERs, but on a continual basis. These forms of communication are used to inform customers about how much energy they use as well as about equipment upgrade opportunities and behavioral changes they can make to reduce electricity usage.
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 PY2021 evaluation did not include process research designed to answer this question. The PY2019 evaluation provided the following recommendation: ▪ HERs increased awareness of energy saving opportunities. Treatment customers were more likely to be aware of energy savings opportunities compared to control customers (64% compared to 53%). However, a higher percentage of treatment customers reported feeling like they do not have control over the amount of household energy that is used relative to control customers. Since treatment customers receive HERs, Ameren Missouri should consider providing information about how much energy various enduses and behavioral changes are projected to save for the average home. One potential way to communicate this is to monetize the energy savings so that treatment customers gain some understanding of how much money they can save by replacing old equipment and/or making changes to how they use energy.

4.1.4 Conclusions and Recommendations

The evaluation team offers the following conclusion for the HER Program moving forward:

- The HER Program performed well in PY2021, far exceeding ex ante savings estimates (276% realization rate) and performing well compared to net savings goals (108% of goals). On average, participants across all four waves saved 142 kWh per household annually. Wave 2 participants realized the highest average energy savings per household annually (294 kWh), when compared to participants in other waves, and also had the highest pre-period average daily energy consumption (58 kWh). By contrast, Wave 4 participants realized the lowest average energy savings per household (64 kWh) and had the lowest pre-period average daily consumption (32 kWh). It is not uncommon for HERs participants to experience lower treatment effects during their first full year of treatment.

4.2 Evaluation Methodology

The evaluation team performed both impact and process evaluation activities to assess the performance of the HER Program in PY2021. In addition to the overarching research objectives outlined for the residential portfolio, the evaluation team explored the following HER Program-specific objectives:

- Confirm treatment and control groups in each wave are equivalent
- Estimate unadjusted and adjusted ex post net energy and demand savings
- Provide evaluation results that can be used to improve the design and implementation of the HER Program

Table 26 provides an overview of the HER Program evaluation activities. Following the table, we outline program-specific aspects of key evaluation methodologies.

Table 26. PY2021 Evaluation Activities for the HER Program

Task		Description
1	Program Manager and Implementer Interviews	▪ Conduct interviews in Q3 of PY2021 to understand program changes and staff perspectives on program implementation.
2	Consumption/Net Impact Analysis	▪ Conduct equivalency analysis for all waves to check if treatment and control customer groups are equivalent in terms of average daily consumption of electricity. ▪ Conduct consumption analysis to quantify the changes in energy use among the treatment and control groups and arrive at unadjusted PY2021 net impacts. ▪ Determine savings from participation in other Ameren Missouri residential programs through a joint savings analysis. ▪ Remove double counted savings from unadjusted net impacts and estimate adjusted PY2021 net impacts.
3	Reporting	▪ Develop the draft and final annual reports.

4.2.1 Equivalency Analysis

The evaluation team performed an equivalency analysis to ensure that the treatment and control groups for each of the four waves participating in the HER Program in PY2021 were equivalent in terms of energy consumption (see Table 27). The equivalency analysis included all treatment and control customers who received at least one bill in PY2021 and those customers/observations that were present in the data after it

was cleaned. We compared average daily consumption (ADC) of electricity between treatment and control groups during their pre-participation periods to assess whether these groups were equivalent before cleaning billing data to ensure quality and completeness. Because we rely on an intent-to-treat (ITT) approach, we used the population of treatment and control customers in this equivalency analysis. We found that the two groups were equivalent for each of the waves. We used consumption data for the year prior to program participation to calculate ADC for each wave.

We provide detailed results showing the equivalency of the treatment and control groups for all waves in Appendix A.

Table 27. Pre-Participation Average Daily Consumption of HER Program Treatment and Control Groups

Wave	Treatment (Pre-Participation) Consumption	Control (Pre-Participation) Consumption
Wave 1	47.05	46.91
Wave 2	64.69	64.78
Wave 3	41.24	41.17
Wave 4	33.20	33.28

4.2.2 Consumption Analysis

The evaluation team performed a consumption analysis to assess any changes in energy consumption as a result of receiving HERs using an intent-to-treat (ITT) approach.[24] We conducted a statistical analysis of monthly electric billing data for all Ameren Missouri customers who received a HER (the treatment group) and a randomly selected group of customers who did not receive a HER (the control group). The inclusion of a control group in the program design ensures the statistical model controls for exogenous factors and robustly isolates the treatment effect. Consistent with evaluation best practices, we tested several model specifications and selected the one with the best fit. The selected model is a Lagged Dependent Variable model, which uses pre-period average seasonal consumption for each customer to control for customer-specific effects. We present further details about the consumption analysis in Appendix A.

4.2.3 Demand Reductions

We calculated demand impacts based on the Ameren Missouri TRM, which applies a peak adjustment factor to modeled energy savings results. The factor value used to arrive at PY2021 HER demand savings is 0.0004660805 kW.[25]

4.2.4 Joint Savings Analysis

The evaluation team also determined whether the Ameren Missouri HER Program generated participation uplift in PY2021—that is, an increase in participation in other energy efficiency programs in PY2021 as a result of the Ameren Missouri HER Program. To complete this joint savings analysis, we calculated whether more treatment than control group customers participated in other residential energy efficiency programs after

[24] An ITT approach estimates the impacts of the initiative for a group of customers the initiative intended to treat, (i.e., customers AIC intended to receive HERs or eHERs). An alternative approach is the average treatment effect of the treated (ATT), which estimates the impacts of the initiative for the group of customers who received HERs and/or eHERs. These approaches differ in the number of customers used in the analysis.

[25] Revision 4 (dated January 1, 2021) of the Ameren Missouri 2019–21 MEEIA Energy Efficiency Plan Appendix F – Deemed Savings Table, Home Energy Report Deemed Table (referred to as the "Ameren Missouri TRM").

receiving HERs. We cross-referenced the HER Program database—both treatment and control groups—with the databases of other residential energy efficiency programs offered by Ameren Missouri in PY2021, including:

- Appliance Recycling
- Efficient Products
- Peak Time Savings
- Single Family Income Eligible (SFIE)
- Multifamily Income Eligible (MFIE)
- Multifamily Market Rate (MFMR)
- Heating, Ventilation, and Air Conditioning
- Online Retail Lighting
- DIY Kits

To estimate participation uplift, we calculated the number of customers who participated in both the HER program and other energy efficiency programs in PY2021. To ensure participation in other programs was attributable solely to the HER Program, we calculated participation uplift using a post-only difference estimator and tested the results for statistical significance. To do so, we identified the total number of treatment and control customers who participated in an Ameren Missouri energy efficiency program in PY2021. Any statistically significant positive difference between the treatment and control population is the net participation due to the HER Program.

4.3 Evaluation Results

In the remainder of this section, we present the results of the impact evaluation.

4.3.1 Net Unadjusted Impact Results

The evaluation team estimated unadjusted annual net savings using a consumption analysis (see Section 4.2). Unadjusted annual net savings are the savings derived from the consumption analysis and include savings from other energy efficiency programs in which treatment customers participated in PY2021. The PY2021 HER Program achieved 38,281 MWh and 18 MW in ex post unadjusted net savings (see Table 28 through Table 30).

Table 28. PY2021 HER Program Unadjusted Ex Post Net Annual Savings

Savings	Number of Customers Treated in PY2021	Unadjusted Net Savings (% per household)[a]	Unadjusted Net Savings (per household)[b]	Unadjusted Net Program Savings[b]
Energy Savings (MWh)	270,458	0.95%	0.142	38,281
Demand Savings (MW)			.00006597	17.84

Note: The unadjusted net savings per household (% and kWh) are weighted averages across the four waves.
[a] Demand savings rely on a demand savings factor applied to energy savings; consequently, we do not present ex post net demand savings as a percentage per household.
[b] Totals may not sum due to rounding.

Table 29. PY2021 HER Program Unadjusted Ex Post Net Annual Electric Energy Savings by Wave

Wave	Number of Customers Treated in PY2021	Unadjusted Net Savings (% per household)	Unadjusted Net Savings (kWh per household)	Unadjusted Net Program Savings (MWh)
Wave 1	68,401	0.96%	156.4	10,695
Wave 2	30,045	1.40%	294.1	8,837
Wave 3	132,586	0.96%	122.5	16,236
Wave 4	39,426	0.55%	63.7	2,513

Table 30. PY2021 HER Program Unadjusted Ex Post Net Annual Electric Demand Savings by Wave

Wave	Number of Customers Treated in PY2019	Unadjusted Net Savings (% per household)[a]	Unadjusted Net Savings (kW per household)	Unadjusted Net Program Savings (MW)[b]
Wave 1	68,401		0.07	4.98
Wave 2	30,045		0.13	4.12
Wave 3	132,586		0.06	7.57
Wave 4	39,426		0.03	1.17

[a] Demand savings rely on a demand savings factor applied to energy savings; consequently, we do not present net demand savings as a percentage per household.
[b] Totals may not sum due to rounding.

4.3.2 Joint Savings Analysis

We considered energy savings that resulted from energy-efficient actions taken through other Ameren Missouri residential energy efficiency programs in our joint savings analysis. While we would expect a base rate of participation in these programs from both the treatment and control groups, it is possible that the HER Program resulted in an increase, or "uplift," in participation in other Ameren Missouri residential energy efficiency initiatives among the members of the treatment group by promoting these programs to treated customers.

Table 31 presents a summary of the participation uplift for the Ameren Missouri residential programs that were active during PY2021. The evaluation team found a statistically significant difference in program participation between treatment and control customers for the HVAC, Lighting Online Store, and Residential Appliance Recycling, programs. As such, the evaluation team deducted approximately 317 MWh of unadjusted energy savings due to this analysis, which represents approximately 1% of the program's unadjusted ex post net energy savings.

Table 31. PY2021 HER Program Savings Uplift Results

Savings	PY2021 Savings Uplift	
	Savings	%[a]
Energy Savings (MWh)	317	1%
Demand Savings (MW)[b]		

[a] The savings uplift percentage is a percentage of the program unadjusted savings.

[b] Since a demand savings factor is applied to the estimate of energy savings, the evaluation team does not use the joint savings analysis to estimate demand savings uplift. Instead, we apply the demand savings factor to the adjusted ex post net energy savings to arrive at the adjusted ex post net demand savings for the program.

4.3.3 Net Adjusted Impact Results

The total PY2021 adjusted net impacts for the HER Program were 37,963 MWh and 17.69 MW, which reflect the results of the joint savings analysis (Table 32). Table 33 and Table 33 present the ex post adjusted net impacts for each of the waves in PY2021.

Table 32. PY2021 HER Program Adjusted Annual Net Annual Savings

Savings	Unadjusted Net Program Savings	Savings Uplift[a]	Final Adjusted Net Program Savings
Energy Savings (MWh)	38,281	314	37,963
Demand Savings (MW)	17.84		17.69

Note: Savings in the table above are rounded.

[a] Because the demand savings rely on a demand savings factor applied to energy savings, we do not present savings uplift for demand savings and instead apply the kW peak factor ratio to the final adjusted net program energy savings.

Table 33. PY2021 HER Program Adjusted Annual Net Electric Energy Savings by Wave

Wave	Unadjusted Net Program Savings (MWh)	Savings Uplift (MWh)	Final Adjusted Net Program Savings (MWh)
Wave 1	10,695	46	10,648
Wave 2	8,837	15	8,822
Wave 3	16,236	233	16,003
Wave 4	2,513	23	2,490
Total	**38,281**	**317**	**37,963**

Note: Savings in the table above are rounded.

Table 34. PY2021 HER Program Adjusted Net Electric Demand Savings by Wave

Wave	Unadjusted Net Program Savings (MW)	Savings Uplift (MW)[a]	Final Adjusted Net Program Savings (MW)
Wave 1	4.98		4.96
Wave 2	4.12		4.11
Wave 3	7.57		7.46
Wave 4	1.17		1.16
Total	**17.84**		**17.69**

Note: Savings in the table above are rounded.

[a] Because the demand savings rely on a demand savings factor applied to energy savings, we do not present savings uplift for demand savings and instead apply the kW peak factor ratio to the final adjusted net program energy savings for each wave.

5. Heating Ventilation and Air Conditioning (HVAC)

This section summarizes the evaluation results and methodology for the PY2021 Ameren Missouri Residential Heating, Ventilation, and Air Conditioning Program, referred to here as the HVAC Program. For PY2021, the evaluation team conducted detailed process and impact evaluations. Details on the methodologies are presented in Section 5.2 and Appendix A.

5.1 Evaluation Summary

5.1.1 Program Description

The Ameren Missouri Residential HVAC Program obtains energy and demand savings by incenting the installation of energy-efficient central air conditioning (CAC), heat pump (HP), and advanced thermostat measures.[26] The HVAC Program target market is single family and multifamily residential homeowners within the Ameren Missouri service territory.

The HVAC Program consists of two channels: Downstream and Midstream. In the Downstream channel, contractors submit the rebate application on the customer's behalf then the customer may choose to either have the rebate sent directly to them or applied as an instant incentive on their invoice from the contractor. In contrast, with the Midstream channel, the contractors complete the applications, but the incentives are paid to the distributors who then 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 specific line item on the contractor's receipt to the customers.[27]

The goal of the Midstream channel is to incent 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 rate at which super-efficient units make it into the market and resultantly, their availability. Ideally, this approach will accelerate market transformation.

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

[26] Note that for the sake of brevity we refer to "heat pumps" or "HPs" in general throughout much of this chapter. The HVAC Program HP category actually includes air source heat pumps (ASHPs), ground source heat pumps (GSHPs), and ductless mini split heat pumps (DMSHPs).

[27] Regardless of how the rebate gets split between the distributor and contractor, a minimum amount is required to make it to the enduse customer.

opportunities, and a public relations tool kit. The result of these combined efforts is that customers are more aware of the HVAC Program than any other Ameren Missouri program in the Residential Portfolio.[28]

In PY2021, the HVAC Program began providing additional marketing training to contractors to market their services in conjunction with the program and covered 50% of marketing costs. The program also raised the total amount of marketing costs covered from $1,500 to $2,500 in the beginning of PY2021.

[28] Based on a PY2019 non-participant survey (*n*=4,804), where 60% of respondents indicated they were aware of the HVAC Program; Appliance Recycling was the program with second highest level of respondent awareness, but was only recognized by 41% of respondents.

5.1.2 Participation Summary

The HVAC Program participation increased significantly in PY2021. In particular, over the course of PY2021, 15,734 unique customers completed 15,976 HVAC projects through the Downstream channel (Table 35), an increase in the number of both participants and projects from PY2020 of 18%. Through the Midstream channel, 2,130 unique customers completed 2,188 HVAC projects in PY2021, an increase in participants and projects of 103% and 105%, respectively.

Table 35. PY2021 HVAC Participation Summary

Enduse	Participants		Projects		Measures		Ex Ante Gross Savings	
	Number	%[A]	Number	%	Number	%	MWh	%
Downstream								
CAC	13,225	84.1%	13,372	83.7%	14,051	69.9%	27,590	65.0%
ASHP	1,493	9.5%	1,502	9.4%	1,575	7.8%	12,199	28.7%
Advanced Thermostat	3,951	25.1%	4,021	25.2%	4,297	21.4%	1,627	3.8%
GSHP	142	0.9%	146	0.9%	184	0.9%	1,048	2.5%
DMSHP	5	0.03%	5	0.03%	5	0.02%	5	0.01%
Downstream Total	15,734		15,976		20,112	100%	42,469	100%
Midstream								
ASHP	362	17.0%	365	16.7%	386	10.8%	3,509	48.2%
CAC	1,440	67.6%	1,454	66.5%	1,526	42.7%	2,868	39.4%
Advanced Thermostat	1,232	57.8%	1,239	56.6%	1,309	36.6%	514	7.1%
DMSHP	333	15.6%	340	15.5%	353	9.9%	384	5.3%
Midstream Total	2,130		2,188		3,574	100%	7,275	100%

[A] Percentages may not sum to 100 because some customers participated in both channels and some customers conducted multiple projects.

5.1.3 Key Impact Results

Table 36 presents the PY2021 HVAC Program first year and last year energy and demand savings, inclusive of both the Downstream and Midstream channels, by the following measure EUL categories: < 10 years, 10–14 years, and 15+years.

Table 36. PY2021 HVAC Program Savings Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR[A]	Ex Post Net	Target Net	% of Target
First-Year Savings							
Energy Savings (MWh)	49,744	94.1%	46,823	75.9%	35,534	48,350	73%
Demand Savings (MW)	33.62	96.6%	32.47	69.3%	22.50	26.07	86%
Last-Year Demand Savings							
< 10 EUL			0.00		0.36	0.00	
10–14 EUL	0.98	86.6%	0.85	221.3%	1.89	0.00	
15+ EUL	8.31	95.0%	7.90	72.1%	5.69	16.71	34%

[A] Net-to-gross ratios may exceed 100% due to spillover.

Overall, the HVAC Program was the third largest program in the PY2021 residential portfolio in terms of ex post net savings (23% of Residential Portfolio savings) and the largest in terms of ex post net demand (41% of Residential Portfolio).

In PY2021, the HVAC Program increased ex post net savings and ex ante savings when compared to PY2020. This increase in savings coincides with increased participation, as well as the number of projects and measures completed through the program.

5.1.4 Key Process Findings

For PY2021, the evaluation team focused its process research on the Midstream channel. Key findings include:

- **Most distributors reported that program sales have increased from PY2020 to PY2021 despite hurdles faced due to supply chain issues and price increases.** Distributors attributed increased sales of high efficiency units to high customer demand. They attributed high customer demand to an increase in customers being at home and caring about their heating and cooling systems more since they were at home most of the time. The incentive was a secondary driver in sales as they mentioned it helped to offset price increases that occurred throughout the year. An increase in program sales is also supported by impact findings showing an increase in program participation, measures, and savings from PY2020 to PY2021.
- **The program is working well from the customer perspective.** The vast majority of respondents (94%) who participated in the Midstream channel of the HVAC program (n=198) were "somewhat" or "very" satisfied with their experience overall. These respondents were even more satisfied with the contractor who installed their equipment, with 96% of respondents rating their satisfaction as "somewhat" or "very" satisfied.
- **Distributors are satisfied with the way the Midstream channel is functioning, save for a few implementation hurdles.** Individual distributors identified administrative challenges they encountered with the HVAC Program. These challenges, which are discussed further in Section 5.3, may warrant

review by program staff to determine whether there is a systematic issue that needs to be addressed (e.g., lack of specificity in application rejection e-mails and challenges using the program portal). Additionally, two distributors mentioned confusion among some contractors about the two channels of the HVAC Program and which portal to use for each offering.

To meet the requirements of Missouri Code of State Regulations (CSR) for demand-side process evaluations, we provide responses to the five required process evaluation questions in Table 37.[29] Given the targeted process research conducted in PY2021, the majority of findings presented below are from the PY2020 evaluation.

Table 37. 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 imperfections include the high upfront cost of high efficiency HVAC equipment and a lack of customer awareness regarding the benefits of such systems (i.e., energy and utility bill savings). Contractors play an important role in addressing these market imperfections by educating customers and promoting program incentives to make the high efficiency equipment affordable alternatives to standard efficiency equipment. Midstream research conducted for PY2020 suggested, however, that there is an organic segmentation to the customer population that warrants consideration. Different segments of customers face different barriers and the importance of the certain barriers can vary by customer. For example, customers of higher sociodemographic attainment do not encounter the same barriers as customers whose income is too high to qualify as a low-income customer, but are nonetheless unable to afford the initial costs of an energy-efficient system upgrade. While the former may easily be a candidate for *super*-efficient equipment, the latter is not really a candidate for *any* equipment, regardless of efficiency level. Another customer segment may be able to bear the cost of higher efficiency equipment but might not be able overcome the additional cost barrier associated with super-efficient equipment. While each of these different segments of customer face the same general barriers, the significance and importance of the different barriers certainly varies.
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 due to their operating condition. Our research in PY2020 suggests the target market segment should be revised to incorporate the added complexity that the addition of the Midstream channel revealed. There are at least three customer segments that fall under the program-described target market but, particularly the first two, are not always served by the program. First, there are low-income customers who qualify for the CommunitySavers® Program. Though the program was changed in PY2020 to address challenges posed by the COVID-19 pandemic,

[29] The Missouri Code of State Regulations (20 CSR 4240.22(8), formerly 4 CSR 240-22.070(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.

CSR Required Process Evaluations Questions	Findings
	these customers would typically be the target of the CommunitySavers® Program and not the HVAC Program. Second, are customers who have incomes that exceed the criteria for low-income, but are still unable to overcome the cost barrier of upgrading to an energy-efficient system. Though savings opportunities surely exist with this segment, accessing them will likely require alternative program designs. The third and final customer segment includes those who are willing to make energy-efficient HVAC upgrades but can only overcome the cost barrier of these upgrades with rebates. The COVID-19 pandemic continued to impact the accessibility of the HVAC Program for all customer segments as the cost of equipment increased across all efficiency levels. Supply chain disruptions and inflation in 2021 triggered price increases of approximately 20% across all equipment incented in the Midstream and Downstream channels. Nonetheless, the program experienced significant growth from PY2020 to PY2021.
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 offers incentives for heating and cooling equipment at various efficiency levels. The HVAC Program also correctly accounts for market and federal code changes. The program requirement that the existing unit cannot exceed 12 SEER will change for PY2022. The new 13.99 SEER limit should enable more customers to access the program and incented technologies.
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. In PY2020, a majority of participants reported having first heard about the program through contractors. Marketing materials such as e-mails, newsletters, bill inserts, the Ameren Missouri website, home energy reports, and mass media advertising also contributed 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?	Leverage the insights that arose with the introduction of the Midstream Channel. Acknowledge that the contractors operating in each channel are different, and much of this is likely based on the sociodemographic attainment of their targeted customer base. Segment the HVAC customer population to ensure that the program design and messaging are in alignment with the unique set of barriers and needs faced by the different segments.

5.1.5 Conclusions and Recommendations

The evaluation team offers the following conclusions and recommendations for the HVAC Program based on the results of the PY2021 evaluation:

- **Conclusion #1**: PY2021 participation was higher in both channels of the HVAC Program when compared to PY2020. While the Downstream channel saw more growth in absolute terms (for example, 35,475 MWh to 42,469 MWh ex ante savings from PY2020 to PY2021) the Midstream program experienced increases that by some measures doubled the channel's impact (for example,

209% year to year change from PY2020 to 7,275 MWh ex ante savings). Overall, the ex post net energy savings for the HVAC Program are 25% higher than PY2020 savings estimates.

- **Conclusion #2**: Midstream participants are generally satisfied with the program. Respondents to the midstream participant survey reported being most satisfied with the contractors who install the equipment and with the installation process overall with almost 100% of respondents rating their satisfaction with these two elements as being "somewhat" or "very satisfied."
- **Conclusion #3**: Overall, distributors are happy with the Midstream channel and feel it is running more smoothly in its second year of implementation save for a few challenges.
  - **Recommendation**: Conduct additional trainings with contractors on (1) the differences between the Downstream and Midstream channels and (2) how to use the different portals. Program staff should also consider whether the Downstream and Midstream channels could be integrated under a single portal to ease the participation process for contractors.

5.2 Evaluation Methodology

The evaluation team performed both impact and process evaluation activities to assess the performance of the PY2021 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;
- Measure customer satisfaction with program processes and motivations for participating; and
- Provide evaluation results that can be used to improve the design and implementation of the HVAC Program.

Table 38 provides an overview of the HVAC Program evaluation activities. Following the table, we outline program-specific aspects of key evaluation methodologies.

Table 38. PY2021 Evaluation Activities for the HVAC Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conduct interviews to assess changes in program design and implementation from PY2021, key program successes and challenges, program performance, and evaluation priorities.
Program Material Review	▪ Review all program materials to inform evaluation activities.
Tracking System Review	▪ Review implementer's tracking system to ensure that data required for the evaluation is being collected.
Midstream Participant Survey	▪ Collect data to inform gross impact analysis (e.g., verify installation and early replacement), NTG (i.e., free ridership and participant spillover), and yield process-related insights.
Participating Distributor Interviews	▪ Collect data to inform NTG (i.e., distributor free ridership and participant spillover) and yield Midstream channel process-related insights.
Database Review	▪ Review program database to check that program data are complete and that program-installed measures meet all program requirements.
Engineering Analysis	▪ Verify that ex ante savings use correct deemed savings values. ▪ Estimate overall and measure-level ex post gross impacts using TRM algorithms, deemed savings assumptions, and evaluation-estimated parameters.

Evaluation Activity	Description
Attribution/Net Impact Analysis	▪ Develop estimates of free ridership and participant spillover. ▪ Apply portfolio-level non-participant spillover. ▪ Estimate PY2021 net impacts.

Participant Survey

The evaluation team fielded a Midstream participant survey for the PY2021 evaluation from mid-December 2021 to mid-January 2022. Overall, the goals of the participant survey were to:

- Verify measure installation to develop ISRs;
- Measure participant satisfaction with program processes, the installed HVAC measures, contractor interactions, and program informational materials;
- Estimate participant FR and SO for Midstream participants.

The response rate for the Midstream participant survey was 15%. The disposition summary for the survey is outlined below in Table 39.

Table 39. Participant Survey Disposition Summary

Disposition	Midstream
Completed Surveys	198
Partial Complete	64
No Response	1,067
Screened Out	3
Bounced E-mail	64
Opt-Out	0
Total Participants in Sample	**1,431**

Distributor In-Depth Interviews

The evaluation team conducted in-depth interviews with a sample of distributors participating in the Midstream channel in PY2021. A total of 19 unique distributors participated in the Midstream channel of the PY2021 HVAC Program. Because of the small population size, we purposively sampled, targeting the distributors who sold the most equipment through the Midstream channel to ensure we captured those who represented the bulk of program sales and savings. The goals of these interviews were to

- Support the estimation of distributor FR associated with the program;
- Gather feedback on program requirements, processes, and design, including satisfaction with program components such as trainings and marketing; and
- Yield insights regarding the future of the Ameren Missouri HVAC market.

The evaluation team offered an incentive of $100 to every distributor who completed the interview. Ultimately, we completed five interviews with a set of distributors representing 91% of total Midstream channel ex post gross savings.

Impact Analysis

Gross Impact Analysis

The gross impact analysis consisted of a program-tracking database review to identify database errors and duplicate records, as well as to ensure that the implementer-applied savings algorithms and assumptions as outlined in the appropriate version of the Ameren Missouri TRM and Appendix F deemed savings tables.[30] Additionally, the evaluation team developed measure-level ISRs from the participant surveys, which were applied to ex ante gross savings in the process of computing ex post gross savings. Ultimately, to determine ex post gross energy and demand savings, the evaluation team computed savings for each measure using the engineering equations and assumptions shown in Appendix A. We applied the deemed 85%/15% ER/ROF ratio to measure categories where the ex ante ER percentage (based on the implementer's classification of failed versus operational compressors) was greater than 85%, which includes CACs and DMSHPs.[31]

Measure Verification

We used the PY2021 participant surveys to develop ISRs for the Midstream channel of the HVAC Program at the measure level. Using the same methodology as the PY2020 survey, we first asked program participants if they recalled receiving the rebate(s) for the program-record measure(s). If they did, we than asked how many of their respective HVAC units were currently installed. We calculated ISRs by dividing the number of HVAC units currently installed by the total number of equipment reported in the program-tracking database. The ISRs used for the PY2021 evaluation are shown in Section 5.3.2; details of the development of the ISRs are provide in Appendix A.

Attribution/Net Impact Analysis

The PY2021 net-to-gross ratios (NTGRs) for the HVAC Program's Downstream channel were developed in PY2020. Since the participant survey was only conducted among Midstream participants, the NTG analysis and ratios outlined below are only for the Midstream channel.

The Midstream channel's NTGR includes channel specific PFR and PSO derived from the PY2021 participant surveys. Because of the nature of the Midstream channel and significant role of the distributors, it also includes distributor FR (DFR) derived from the PY2021 distributor interviews. Note that for the Midstream channel, the evaluation team did not estimate distributor SO.[32]

In PY2020, the evaluation team in consultation with regulatory stakeholders in Missouri established an 80%/20% weighting of PFR/DFR respectively and we have applied the same weighting ratio for the PY2021 Midstream NTGR, which is computed as follows:

Equation 4. PY2021 Midstream HVAC NTGR Calculations

$$Midstream\ NTGR_{2020} = 1 - (PFR_{Mid.2020} * 80\%) + (DFR_{Mid.2020} * 20\%) + PSO_{Mid.2020}$$

Non-Participant SO (NPSO) is also applied at the program level to derive the final net electricity and demand savings. The NPSO rates applied to PY2021 were originally derived from a large-scale (n=4,804) non-

[30] Note that for ex ante, the TRM version applied to the program-tracking data was Revision 4.0 (released October 2020) of the Ameren Missouri 2019–21 MEEIA Energy Efficiency Plan Appendix F. For ex post, the evaluation team applied the updated Revision 5.0 (released September 2021) of the Ameren Missouri TRM.

[31] As part of the PY2020 settlement agreement, the ER/ROF ratio was deemed at the lesser of 85%/15% (ER/ROF) split or actual year-end results from the program-tracking data, where "lesser of" refers to the ER value.

[32] Since contractors initiate the Midstream application, the main avenue for distributor SO would be distributors selling 18+ SEER units to non-participating contractors who then install units into eligible customers' homes. This type of SO is captured in the NPSO values that the evaluation team estimated for PY2019, which are applied to the PY2020 results as noted above.

participant survey conducted as part of the PY2019 evaluation. For PY2021, we use the PY2019 NPSO rates and re-weighted them to account for the PY2021 ex post gross savings distribution across measures and channels. In the end, the overall program NTGR is:

Equation 5. PY2021 HVAC Program NTGR Calculations

$$Mean(Downstream\ NTGR_{2020},\ Midstream\ NTGR_{2020}) + NPSO_{Down.2019}$$

Details of how each of the elements of the NTGRs are computed are included in Appendix A.

5.3 Evaluation Results

5.3.1 Process Results

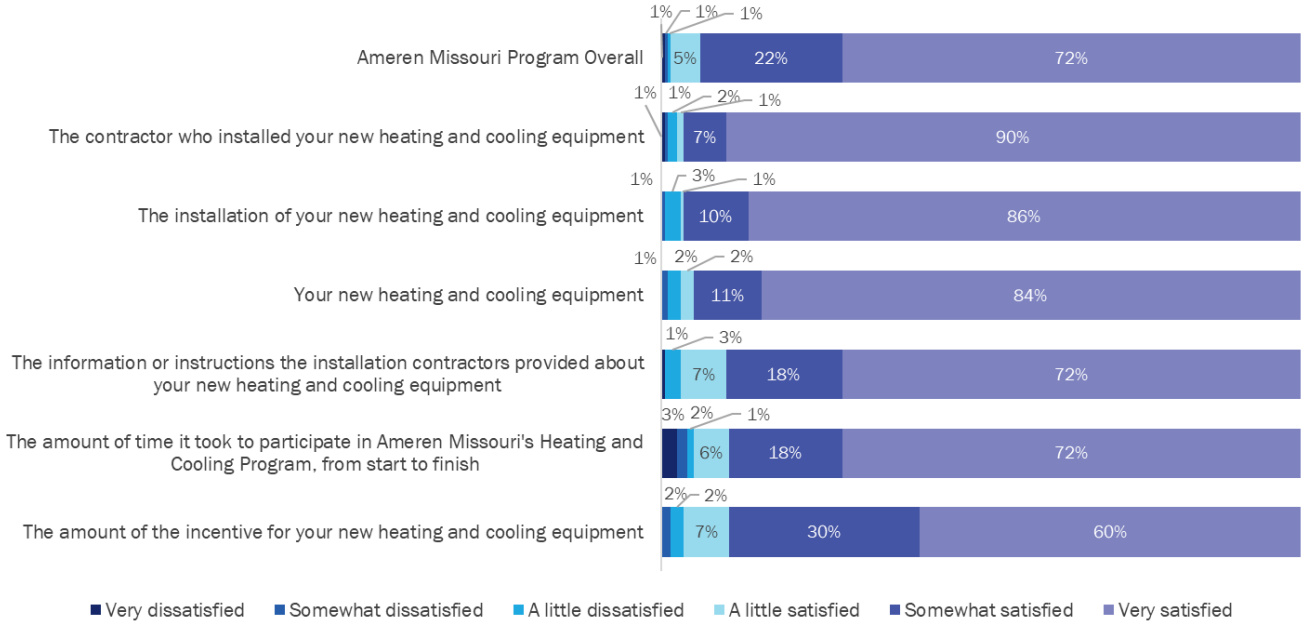
Program Satisfaction

Midstream participants are highly satisfied with all components of the HVAC Program as well as the HVAC Program overall. They are the most satisfied with the contractor who installed their equipment.

Of the 198 customers we surveyed, most respondents expressed high levels of satisfaction with all elements of the HVAC Program as shown in Figure 5. The highest rated elements of the program were the installation process and the contractor who installed the equipment with 96.5% of respondents rating their satisfaction as being "somewhat" or "very satisfied" for both elements. The lowest rated elements of the program were the instant incentive amount received and the amount of time it took to participate in the program, with 89.4% of respondents rating their satisfaction as "somewhat" or "very satisfied" for both elements.

The rates of satisfaction have trended down slightly compared to Midstream participants in PY2020; however, with respondents rating their satisfaction an average of 4% less across all aspects of the program in PY2021. The greatest decrease in satisfaction was seen in the amount of the instant incentive provided to participants. Since incentives did not change between PY2020 and PY2021, this may be due to rising prices due to supply chain shortages and inflation, which has caused an increase in the cost of heating and cooling units across efficiency levels. Regardless, all elements of the program were still rated very highly by respondents indicating the program is performing well in its second year of implementation from a participant perspective. Additionally, all respondents reported it was either "somewhat" or "very likely" they would recommend the HVAC Program to others (78%) or that they had already recommended it to others (18%).

Figure 5. Respondent Satisfaction with Program Components (n=198)



A vast majority of Midstream participants found the HVAC Program to be "somewhat" or "very easy" to participate in and over half of participants thought of Ameren Missouri more favorably after they had participated in the program.

90% of respondents rated their experience participating in the HVAC Program as being "somewhat" or "very easy," as shown in Figure 6. Additionally, after participating, over half of respondents said they felt more favorable towards Ameren Missouri (58%). Some respondents who felt that it was difficult to participate in the program, however, noted that it took a long time for them to receive their incentive, despite the fact that it should have been instant (n=6).

Figure 6. Midstream channel Ease of Participation

Distributor Process Results

Distributor Characterization

All five distributors we interviewed had participated in the Midstream channel since its launch in March 2020. Two distributors identified as manufacturer-owned distributors while the other three were independent HVAC equipment distributors that distribute multiple brands of equipment. All five distributors had at least one physical location in Missouri with three having more than three locations. The five distributors that we interviewed represented 91% of ex post program savings.

Program Operation

Distributors are mostly satisfied with the implementation of the Midstream HVAC Program and its offerings.

All five distributors we spoke with felt the program was running smoothly from their perspective. Two distributors mentioned participation was easier than in PY2020, which they attribute to having another year of experience with the Midstream channel. In particular, they noted that since their territory managers had more experience promoting and selling units that qualify for the Midstream channel, their sales of program qualifying units had increased. One distributor said the following regarding PY2021 program performance:

"I think it's great because as it is driving attention and thought to much higher efficiency systems such as 17, or really I should say 18 and higher systems, and that suits us well, which makes it really nice. And I think it helps us sell high-end product…"

Distributors reported the main advantage of program participation was the ability to offer higher efficiency equipment with the higher incentive amount. Due to rising costs, however, they expressed that the incentive should increase as well.

Three out of five distributors said a main advantage of participating in the program was the higher incentive level provided for the 18+ SEER equipment. Given 18+ SEER equipment can be cost prohibitive for some customers, the distributors indicated the incentive makes selling the higher efficiency systems easier for contractors. These distributors also noted, however, that costs are increasing due to supply chain issues and inflation. They expressed worry that their sales of higher efficiency units will trend down as prices increase.

Two distributors mentioned that the program should raise the incentive amount to offset price increases to continue to incent customers to purchase higher efficiency units.

"The objective of these programs is to pay a portion of the incremental cost, right? Well, when you've gone up 30% on equipment and probably 50% on labor on these things, and you're talking, in the past, let's say a 16 SEER piece of equipment costs $10,000, and now it's $15,000, but the incentive level has stayed the same, what's the motivation factor?"

Despite price increases and supply chain shortages, distributors reported that the percentage of program-qualifying sales has increased from PY2020 to PY2021.

While two distributors stated the incentive level for program qualifying units should be higher to account for rising costs, four out of five distributors reported their sales of program-qualifying equipment have increased from PY2020 to PY2021. Additionally, three out of five distributors reported they had onboarded additional dealers into the program, which contributed to the overall increase of sales. Two distributors also mentioned that people being at home more due to the COVID-19 pandemic has driven interest in higher efficiency HVAC units.

Distributors mentioned different administrative issues as the main disadvantage of participating in the Midstream channel. However, none of the individual administrative concerns reported were mentioned universally by the distributors.

Four out of five distributors identified specific issues with the administrative side of the program:

- **Application portal.** Some contractors struggled to input information into the application portal and called distributors for help. One distributor mentioned that contractors get confused when submitting applications through the different channels. Another distributor reported that contractors were confused as to why there were two different portals for the Midstream and Downstream channels and why their incentive was coming from Ameren Missouri for 17 SEER and below equipment, but from the distributor for 18+ SEER equipment. Both of these distributors felt that additional training or resources on the program portal was needed for contractors and distributors.
- **Clarity of error e-mails**. One distributor felt bounce back e-mails received from the online portal after a faulty application was submitted could more clearly outline the problem with the application. They mentioned that if the problem were listed in the subject line of the e-mail or more obvious in the body of the e-mail, it would be easier to resolve the issue.
- **Administrative burden.** Two distributors felt there was too much administrative burden placed on them. One of these distributors noted they felt there was too much paperwork for the contractor and distributor to do and wished the process was more streamlined for both parties. Another distributor mentioned they felt the task of processing incentives was an unnecessary one for them to undertake and should be handled by the program implementation staff.

Training

The majority of distributors are highly satisfied with the HVAC Program trainings that Ameren Missouri conducts.

Three distributors rated the training provided to them by the HVAC program staff as being a 9 or 10 on a scale from 0 to 10 where 0 was "extremely dissatisfied" and 10 was "extremely satisfied." These three distributors reported that trainings always provide them with good information about the program, as well as how to properly fill out applications and correct errors. They also highlighted that program staff are very responsive and patient when answering questions about the program. The other two distributors did not participate or did not recall participating in any Ameren Missouri trainings and consequently, were unable to comment. One likely explanation for this could be that these distributors sent their program administrators or territory managers to the training.

Distributors were unable to conduct technical trainings to contractors due to the ongoing COVID-19 pandemic, which limited their ability to train contractors on installations for high efficiency systems.

Although technical trainings are not a part of the HVAC Program, they contribute to the ability of contractors to upsell units to customers and install high efficiency systems. These trainings typically cover how to install specific equipment and involve a lot of hands-on learning, which is not feasible via virtual trainings. One distributor noted they tried to conduct a couple of virtual training sessions on more professional development topics, but the virtual trainings were not as effective as in-person trainings had been previously.

One distributor also mentioned that approximately 10% of the contractors they work with do not participate in the program because they have not embraced learning about the higher efficiency equipment. This distributor noted these contractors don't feel that filling out the application to receive the incentive is worth it, so they don't offer the incentives through the program. While this is a small percentage of contractors, it is important

to note there is still an education barrier for some contractors who feel they don't want to spend the time or resources learning how to install higher efficiency equipment. Additional outreach and education among this subsection of contractors would be necessary in order to provide them with the resources and skills to participate in the HVAC Program.

Distributor Stocking and Sales Strategies

We asked the distributors about the various sales strategies they implemented to sell 18+ SEER units in PY2021. The majority of distributors used a few key sales strategies that were largely unchanged since PY2020. The most mentioned sales strategies include:

- **Encouraging contractors to purchase 18+ SEER units.** All five distributors emphasized that they always upsell contractors to higher efficiency units with or without the program. They mentioned that encouraging contractors to purchase high efficiency units using the good, better, best model is a staple selling strategy. Two distributors mentioned that their sales increased in the second year of program implementation because dealers and contractors realized how easy it was to participate in the program. One distributor reported that a calculator enabling contractors to see the expected return on investment for a given SEER rating and housing scenario would be especially helpful in upselling contractors and customers to higher efficiency units.

"As we talk about this, if there is one giant hole in our industry that would help people sell more, it would be a reliable SEER rating savings calculator that people could rely on, and you guys [Ameren Missouri] could even have out on your website and host it there for dealers to go out and use."

- **Educating contractors on the benefit of higher efficiency systems.** Distributors conduct technical and sales trainings with contractors to ensure their units are being installed correctly, and to educate them on the technology so they can upsell the higher efficiency models effectively. One distributor also mentioned that a large part of their training revolves around the contractor not making assumptions about what the homeowner wants and always providing homeowners with a good, better, best recommendation.
- **Emphasizing homeowner comfort.** Multiple distributors also mentioned that their selling strategy has included a focus on home comfort in PY2020 and PY2021. Due to the number of people now at home for majority of the day due to the COVID-19 pandemic, consumers are investing more in their HVAC systems. This trend is consistent from our findings in PY2020 that more customers were interested in replacing their HVAC systems to keep up with the summer cooling and winter heating seasons. As one distributor put it:

"I mean it's a focus on comfort. I mean, honestly, the pandemic put a really strong emphasis on people all of a sudden caring about their comfort in their home. I mean, that can't be ignored."

Impacts of COVID-19, Supply Chain Shortages, and Price Increases

Distributors reported that they were heavily impacted by supply chain shortages and equipment price increases throughout PY2021. Participation in the program was strong despite these issues.

- The COVID-19 pandemic affected the distributors in multiple ways in PY2021 and consequently distributors adapted their business operations. All five distributors reported the total price increase across residential HVAC equipment was at least 20% in PY2021. They all also reported experiencing challenges receiving equipment due to supply chain problems. Distributors reported that both issues combined caused some of their territory managers to sell-down equipment efficiency levels, which

required them to sell less-efficient equipment either because they did not have higher efficiency stock on hand or the upfront cost was too high for the customer. One distributor anticipated the shortage early and was able to overstock early in 2021 to compensate for supply chain issues. The other four distributors were more heavily impacted by the supply chain shortages and price increases and the demand for equipment exceeded their supply. Stocking issues were also a major barrier that affected distributors' ability to sell units using the good, better, best sales strategy. As one distributor shared,

"I mean, if you wanted an AHRI-matched system and you were not one of our premier dealers or whatnot, then you're looking at eight to 12 weeks to get that product. So basically, dealers, whatever they could get their hands on is what they were installing. In no way in 2021 was the dealer going in and offering a good, better, best alternative. It was, hey, here's the only thing we've got, so."

5.3.2 Gross Impact Results

Measure Verification

As part of our evaluation, we calculated ISRs for each measure based on responses to the participant survey (Table 40). The ISR values for all measures are 99.7%.

Table 40. PY2021 HVAC ISR Results

Measure Category	ISR
CAC	100.0%
HPs (ASHPs, GSHP, DMSHP)	100.0%
Advanced Thermostats	99.2%
Overall Program	**99.7%**

Gross Impact Results

As presented in Table 41, the PY2021 HVAC Program achieved 46,823 MWh and 32.47 MW in ex post gross savings, representing a 94.1% energy and 96.6% demand savings realization rate.

Table 41. PY2021 HVAC Program Annual Savings

	Ex Ante Gross	Gross RR	Ex Post Gross
First Year Savings			
Energy Savings (MWh)	49,744	94.1%	46,823
Demand Savings (MW)	33.62	96.6%	32.47
Last Year Demand Savings			
< 10 EUL	0.00		0.00
10–14 EUL	0.98	86.6%	0.85
15+ EUL	8.31	95.0%	7.90

Table 42 summarizes the total PY2021 HVAC Program ex ante and ex post energy (MWh) and demand (MW) savings and realization rates by channel and measure. The Downstream channel accounting for the vast majority (83%) of ex post gross energy savings, down from 91% in PY2020. CACs continue to provide the majority of the program's ex post gross energy savings (63%, up from 56% in PY2020), followed by ASHPs (30%, down from 32% in PY2020). The remaining measures make up the other 7% of program ex post gross energy savings.

Table 42. PY2021 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						
CAC	27,590	94.2%	25,982	26.14	94.2%	24.62
ASHP	12,199	87.1%	10,625	2.59	90.5%	2.34
Advanced Thermostat	1,627	82.9%	1,348	0.75	86.8%	0.65
GSHP	1,048	100.0%	1,047	0.34	115.3%	0.39
DMSHP	5	130.6%	7	0.00	116.6%	0.00
Downstream Total	**42,469**	**91.9%**	**39,009**	**29.82**	**93.9%**	**28.01**
Midstream Channel						
CAC	2,868	124.5%	3,571	2.72	124.5%	3.38
ASHP	3,509	94.1%	3,302	0.73	99.1%	0.73
Advanced Thermostat	514	81.2%	417	0.23	86.0%	0.20
DMSHP	384	136.4%	524	0.11	135.7%	0.15
Midstream Total	**7,275**	**107.4%**	**7,814**	**3.79**	**117.6%**	**4.46**
Total	**49,744**	**94.1%**	**46,823**	**33.62**	**96.6%**	**32.47**

Table 43 summarizes the HVAC Program's total PY2021 last year ex ante and ex post electric demand savings and realization rates by channel and measure. Last year demand savings are lower than first year demand savings due to baseline shifts, which occur after six years for ER, CAC, and HP measures. CAC measures continue to contribute the majority of (78%) of last year ex post gross savings (64% Downstream, 13% Midstream), followed by Advanced Thermostat (10% overall, 7% Downstream, 2% Midstream). ASHP, GSHPs, and DMSHPs make up the remaining 13% of ex post gross savings.

Table 43. PY2021 HVAC Program Last Year Gross Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)				Gross Realization Rate	Ex Post Gross Savings (MW)			
	<10 EUL	10–14 EUL	15+ EUL	Total		<10 EUL	10–14 EUL	15+ EUL	Total
Downstream Channel									
CAC	0.00	0.00	6.10	6.10	92.4%	0.00	0.00	5.64	5.64
ASHP	0.00	0.00	0.55	0.55	87.2%	0.00	0.00	0.48	0.48
Advanced Thermostat	0.00	0.75	0.00	0.75	86.8%	0.00	0.65	0.00	0.65
GSHP	0.00	0.00	0.27	0.27	100.4%	0.00	0.00	0.27	0.27
DMSHP	0.00	0.00	0.00	0.00	91.5%	0.00	0.00	0.00	0.00
Downstream Total	**0.00**	**0.75**	**6.91**	**7.67**	**91.8%**	**0.00**	**0.65**	**6.38**	**7.04**
Midstream Channel									
CAC	0.00	0.00	1.03	1.03	111.4%	0.00	0.00	1.15	1.15
ASHP	0.00	0.00	0.29	0.29	91.4%	0.00	0.00	0.27	0.27
Advanced Thermostat	0.00	0.23	0.00	0.23	86.0%	0.00	0.20	0.00	0.20
DMSHP	0.00	0.00	0.08	0.08	126.6%	0.00	0.00	0.10	0.10
Midstream Total	**0.00**	**0.23**	**1.40**	**1.63**	**105.0%**	**0.00**	**0.20**	**1.51**	**1.71**

Measure Category	Ex Ante Gross Savings (MW)				Gross Realization Rate	Ex Post Gross Savings (MW)			
	<10 EUL	10–14 EUL	15+ EUL	Total		<10 EUL	10–14 EUL	15+ EUL	Total
Total	0.00	0.98	8.31	9.30	94.1%	0.00	0.85	7.90	8.75

Reasons for Discrepancies

We detail the discrepancies that drive the electric energy and demand realization rates for the PY2021 HVAC Program below. While realization rates for measures differ by channel, we discuss the Downstream and Midstream channels together because differences are driven by the same overarching themes.

- **Central Air Conditioners (CAC):**
  - Ex post applied the 85/15 ER split for this measure as the split was 86.9% in the tracking data. Without applying the 85/15 split, the kWh and kW RRs would have been 100.9%.
  - Ex post applied the first year desk review realization rate of 98.3%.
- **Air Source Heat Pumps (ASHP):**
  - Application of the first year desk review realization rate of 90.2% accounts for most of the discrepancy. Without this RR, the first year kWh RR would be 98.3% and the first year kW RR would be 102.5%.
  - The kW RR is slightly higher because cooling kWh has an RR of 102.5% whereas heating kWh has an RR of 97.2%. Differences in capacity are the main reasons for these RRs.
  - Ex post did not apply the 85/15 ER split for this measure as the split was 83.1% in the tracking data.
- **Ground Source Heat Pumps (GSHP):**
  - Overall energy savings realization matched between ex ante and ex post despite ex ante having applied defaults from Appendix F whereas ex post analysis applied actual tracked equipment data to determine appropriate values. The kWh RR for cooling was 86% whereas heating kWh RR was 109%.
  - Ex post did not apply the 85/15 ER split for this measure as the split was 75.8% in the tracking data.
- **Advanced Thermostats:**
  - Ex ante claimed 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 savings. When calculating ex post, the evaluation team only awarded savings for one thermostat per household (identified as unique electric account numbers). As a result, 487 thermostats (9% of Downstream thermostats and 8% of Midstream thermostats) received zero ex post savings. This decreased energy and demand savings.
  - The ex post analysis applied actual tracked equipment data to determine appropriate savings values for each thermostat whereas ex ante applied defaults from Appendix F. The ex post analysis used the field "Thermostat Controlling Unit" to determine whether the thermostat controls a heat pump or a CAC unit with either gas or electric heat. Where the controlled unit was unknown, we used data on the primary heating equipment and/or the water heater fuel type. For many of these measures, ex ante assumed unknown heating equipment type, applying the Version 4.0 Appendix

F default of 16% electric heating. This discrepancy drives lower ex post electric energy and demand savings. Additionally, for participants who also installed a new CAC or HP, the ex post analysis applied the SEER value of the new equipment, decreasing verified energy and demand savings.

- Ex ante referenced Appendix F Version 3.2 for all Midstream thermostats and Appendix F Version 4.0 for all Downstream thermostats. Ex post referenced Appendix F Version 5.0. This resulted in differences in the SEER, cooling capacity, FossilHeat, and ElectricHeat for unknown existing heating and cooling equipment, and led to an overall increase in energy and demand savings.
- Ex post applied the PY2021 ISR of 99.2%.

- **Ductless Mini-Split Heat Pumps (DMSHP):**
  - The difference in ex ante and ex post is driven by differences between actual values used in the ex post analysis versus values from Ameren Missouri TRM Version 4.0 used in the ex ante analysis. Both heating and cooling savings yield higher savings in ex post mainly due to higher actual capacities and higher actual efficiency ratings (both SEER and HSPF) of the new equipment.
  - Ex post applied the 85/15 ER split for this measure as the split was 92.4% in the tracking data. Since 82% of DMSHPs were installed in new construction settings (to which the 85/15 ER split does not apply), however, applying the split had a minimal impact on RRs.

5.3.3 Net Impact Results

Net-To-Gross Ratio Results

For PY2021, the evaluation team conducted surveys with Midstream channel participants to estimate PFR and PSO at the channel by enduse levels. We also conducted in-depth interviews with Midstream distributors, which were used to estimate DFR. TASO was not recomputed for PY2021, and instead, the evaluation team applied PY2019 TASO values as was the same in PY2020. A survey was not conducted with Downstream channel participants for PY2021 but instead used the results from the PY2020 Downstream channel surveys and the PY2020 NTGRs. Table 44 shows the components of the NTGRs used for the PY2021 HVAC Program evaluation. Details on the methods used to compute the various elements of the NTGRs is provided in Appendix A.

Table 44. PY2021 HVAC Program NTGRs by channel by Enduse

Measure/Enduse	Participant Free Ridership (PFR)	Distributor Free Ridership (DFR)	Participant Spillover (PSO)	Trade Ally Spillover (TASO)	Net-to-Gross Ratio (NTGR)
Downstream					
CACs	39.5%		0.6%	0.3%	61.4%
ASHP	37.0%				63.9%
GSHP					
DMSHP					
Advanced Thermostats	29.6%		0.6%		71.3%
Downstream Total	**38.2%**		**0.6%**	**0.3%**	**62.7%**
Midstream [A]					
CACs	40.5%	45.0%	0.26%		58.9%

Measure/Enduse	Participant Free Ridership (PFR)	Distributor Free Ridership (DFR)	Participant Spillover (PSO)	Trade Ally Spillover (TASO)	Net-to-Gross Ratio (NTGR)
ASHP	37.1%				61.6%
DMSHP					
Advanced Thermostats	31.5%				68.8%
Midstream Total	**38.4%**	**45.0%**	**0.26%**		**60.7%**

[A] The evaluation team developed FR estimates for midstream measures through a weighted average of PFR (80% weight) and DFR (20% weight).

Based on results from the participant survey, we identified six respondents who had installed measures that qualified for PSO. Our engineering analysis of SO measures for these participants yielded total spillover savings of 1,985 kWh for the midstream channel (see Table 45).

Table 45. HVAC Program Participant Spillover Measures and Savings

Channel	Spillover Measure	Number of Unique Participants	Total kWh
Midstream	Air Purifier	1	579
	Air Sealing	1	62
	Clothes Washer	4	396
	Dehumidifier	1	204
	Dishwasher	4	57
	Insulation	2	40
	Low-Flow Faucet Aerator	2	87
	Low-Flow Showerhead	2	159
	Refrigerator	5	234
	Tier 2 APS	1	152
	Windows	1	15
	Total	**6**	**1,985**

Dividing the estimated total SO in our sample for (1,985 kWh for the Midstream channel) by total program ex post gross savings of the overall participant sample for each channel (771,017 kWh for the midstream channel) yields a SO rate of 0.26% for the midstream channel, as shown in Equation 6.

Equation 6. PY2021 HVAC Program Midstream Channel Participant Spillover Rate

$$PSO\ \%_{Energy} = \frac{Total\ participant\ sample\ SO\ (kWh)}{Total\ participant\ sample\ savings\ (\mathrm{kWh})} = \frac{1{,}985\ kWh}{771{,}017\ \mathrm{kWh}} = 0.26\%$$

Net Impacts

The evaluation team applied the PY2021 NTGRs to ex post gross energy (MWh) and demand (MW) savings to determine ex post net energy (MWh) and demand (MW) impacts for the PY2021 HVAC Program. Table 46 and

Table 47 present the net impacts for the PY2021 HVAC Program. NTGRs expressed here are not applied NTGRs but an expression of the average NTGR by dividing net savings by gross savings.

Table 46. PY2021 HVAC Program Annual First Year Net Impacts

Measure Category	Energy Savings			Demand Savings		
	Ex Post Gross (MWh)	NTGR[33]	Ex Post Net (MWh)	Ex Post Gross (MW)	NTGR[33]	Ex Post Net (MW)
Downstream Channel						
CAC	25,982	61.4%	15,955	24.62	61.4%	15.12
ASHP	10,625	63.9%	6,785	2.34	63.9%	1.49
Advanced Thermostat	1,348	71.3%	960	0.65	71.3%	0.47
GSHP	1,047	63.9%	669	0.39	63.9%	0.25
DMSHP	7	63.9%	4	0.00	63.9%	0.00
Non-Participant Spillover			5,344			2.16
Downstream Total	**39,009**	**76.2%**	**29,717**	**28.01**	**69.6%**	**19.49**
Midstream Channel						
CAC	3,571	58.9%	2,103	3.38	58.9%	1.99
ASHP	3,302	61.6%	2,034	0.73	61.6%	0.45
Advanced Thermostat	417	68.8%	287	0.20	68.8%	0.14
DMSHP	524	61.6%	323	0.15	61.6%	0.09
Non-Participant Spillover			1,071			0.34
Midstream Total	**7.814**	**74.5%**	**5,818**	**4.46**	**67.6%**	**3.01**
Total	**46,823**	**75.9%**	**35,534**	**32.47**	**69.3%**	**22.50**

[33] Total NTGR values are higher than all individual NTGRs at the measure level for both channels and the overall total. This is because Non-Participant Spillover is included in NTGR calculations at the channel and overall levels, but not at the measure level.

Table 47. PY2021 HVAC Program Annual Last Year Net Demand Impacts

Measure Category	Ex Post Gross Savings (MW)				NTGR	Ex Post Net Savings (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Downstream Channel									
CAC	0.00	0.00	5.64	5.64	61.4%	0.00	0.00	3.46	3.46
ASHP	0.00	0.00	0.48	0.48	63.9%	0.00	0.00	0.31	0.31
Advanced Thermostat	0.00	0.65	0.00	0.65	71.3%	0.00	0.47	0.00	0.47
GSHP	0.00	0.00	0.27	0.27	63.9%	0.00	0.00	0.17	0.17
DMSHP	0.00	0.00	0.00	0.00	63.9%	0.00	0.00	0.00	0.00
Non-Participant Spillover						0.31	1.11	0.74	2.16
Midstream Channel									
Downstream Total	**0.00**	**0.65**	**6.38**	**7.04**	**93.2%**	**0.31**	**1.57**	**4.67**	**6.56**
CAC	0.00	0.00	1.15	1.15	58.9%	0.00	0.00	0.68	0.68
ASHP	0.00	0.00	0.27	0.27	61.6%	0.00	0.00	0.16	0.16
Advanced Thermostat	0.00	0.20	0.00	0.20	68.8%	0.00	0.14	0.00	0.14
DMSHP	0.00	0.00	0.10	0.10	61.6%	0.00	0.00	0.06	0.06
Non-Participant Spillover						0.05	0.18	0.12	0.34
Midstream Total	**0.00**	**0.20**	**1.51**	**1.71**	**80.7%**	**0.05**	**0.31**	**1.02**	**1.38**
Total	**0.00**	**0.85**	**7.90**	**8.75**	**90.8%**	**0.36**	**1.89**	**5.69**	**7.94**

6. Residential Efficient Products (REP)

This section summarizes the PY2021 evaluation methodology and results for the Residential Efficient Products (REP) Program. The PY2021 evaluation only included impact evaluation activities as a detailed process evaluation was conducted as part of the PY2019 evaluation. Additional details on the methodologies are presented in Appendix A.

6.1 Evaluation Summary

6.1.1 Program Description

The REP Program is designed to raise 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 residential customers to save energy cost-effectively. The target market consists of all residential customers within the Ameren Missouri service territory.

The REP Program is designed to be an umbrella program, incorporating various program partners, products, and program delivery strategies. The REP is also intended to be flexible. 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 PY2021, Ameren Missouri offered rebates for four measures through the program: advanced thermostats, power strips, pool pumps, and heat pump water heaters. The incentive levels and program requirements are summarized in Table 48.

Table 48. PY11 Measures Offered Through the Residential Efficient Products Program

Measure	Rebate Offered
Advanced Thermostats[34]	$50 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
Variable Speed and Multi-Speed Pool Pumps	$200 rebate per unit; limited to two pool pumps per residential electric account
Heat Pump Water Heaters	$350 rebate per unit; limited to two rebates per residential electric account

As in past years, the REP Program used two delivery channels in PY2021; however, the Online Store channel is the path that almost all participating Ameren Missouri customers use:

[34] Note that while customers could purchase more than one thermostat and *ex ante* savings reflect this, the Ameren Missouri TRM 2019–21 MEEIA Plan (Revision 5.0, September 2021) 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. 59, emphasis added). As such, only one thermostat per customer account number is included in *ex post* savings computations. As a result, a total of 2,774 advanced thermostats present in the program-tracking data were excluded from ex post computations.

- **Online Store:** Advanced thermostats and power strips are sold directly to customers through Ameren Missouri's Online Store where the rebates are applied immediately at checkout.[35],[36]
- **Mail-in Channel:** Customers can purchase program-qualified thermostats,[37] heat pump water heaters, and pool pumps anywhere and then submit a rebate application via mail-in or e-mail.

Over the course of PY2021, REP Program staff implemented a number of program changes compared to PY2020. To bolster participation across Ameren Missouri's portfolio, program staff started using the Online Store Channel to offer bundled packages with the Peak Time Savings Program that included an additional $50 incentive for participants who signed up for the Peak Time Savings Program through the Online Store. Specific to program marketing and promotion, staff introduced a "New Mover Campaign" including cross marketing of LED bulbs targeted at first time Online Store users. Finally, as another added benefit for potential participants, the program began offering free Emerson thermostats through a partnership with Emerson and utilized press releases and social media influencers to increase program participation and media attention.

The COVID-19 pandemic also continued to affect the REP Program in PY2021. Between challenges getting field staff into participating stores to conduct various implementation activities and shipping delays, which had an impact on the customer experience and product delivery timelines, program staff had to remain flexible and responsive to changing circumstances over the course of the year.

6.1.2 Participation Summary

The vast majority of PY2021 program activity is associated with the Online Store channel (92% of participants and measures). The Online Store channel served the most participants, sold the most measures, and generated the greatest ex ante gross savings for the REP Program. In all, the Online Store accounted for more than three-quarters (77%) of PY2021 REP Program ex ante gross savings; the remaining savings, comprising less than one-quarter (23%) of the total, were associated with mail-in rebates (Table 49).

Table 49. PY2021 REP Program Participation Summary by Channel

Channel	Participants		Measures		Ex Ante Savings	
	Number	%	Number	%	MWh	%
Online Store	16,292[a]	92%	20,438	92%	6,374	77%
Mail-in	1,526	9%	1,672	8%	1,872	23%
Total	**17,768[b]**	**100%[c]**	**22,110**	**100%**	**8,246**	**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 (17,768) is less than the sum of the number of participants across both channels (17,818) because 50 participants (defined by unique electric account numbers) purchased products from more than one channel.

[c] Totals may not sum due to rounding.

Looking at the various measures rebated through each channel in PY2021, advanced thermostats were the most popular product that the REP Program offered (87% of all measures sold through the Online Store; 56% of all measures from the Mail-in Channel, or 84% of all REP Program measures combined) (Table 50). Tier 1

[35] In addition to advanced thermostats and power strips, the Online Store offers discounts on LEDs. However, LEDs are evaluated as part of the Residential Lighting Program evaluation. The store also sells some connected home products without a discount, which are not included in this evaluation.

[36] The current Online Store main page can be viewed here: https://amerenmissouristore.com/.

[37] PY2020 was the first year thermostats were rebated through the Mail-in Channel. They were only rebated through the Online Store prior to PY2020.

power strips were the next most popular measure (12% of all REP Program measures), followed by pool pumps (3% of all REP Program measures). The least common measures were heat pump water heaters (1% of all REP Program measures) and Tier 2 power strips (<1% of all REP Program measures). Accordingly, the bulk of ex ante gross MWh program savings (80%) came from sales of advanced thermostats, while pool pumps accounted for 14% and heat pump water heaters 5%. The power strips accounted for relatively small proportions of ex ante gross MWh savings—Tier 1 2%; Tier 2 <1%.

Table 50. PY2021 REP Program Participation Summary by Measure

Channel	Measure	Participants		Measures		Ex Ante Savings	
		Number	%	Number	%	MWh	%
Online Store	Advanced Thermostats	15,617	86%	17,738	80%	6,212	75%
	Tier 1 Power Strips	991	5%	2,599	12%	146	2%
	Tier 2 Power Strips	81	0%	101	0%	15	0%
Mail-in	Advanced Thermostats	816	4%	936	4%	322	4%
	Heat Pump Water Heaters	171	1%	176	1%	401	5%
	Pool Pumps	552	3%	560	3%	1,150	14%
Total		**18,228[a]**	**100%[b]**	**22,110**	**100%**	**8,246**	**100%**

[a] The total number of participants shown in the table (18,228) is more than the sum of the number of unique participants across channels and measures (17,768) because 460 participants (defined by unique electric account numbers) purchased products from more than one end-use.

[b] Totals may not sum due to rounding.

6.1.3 Key Impact Results

Table 51 presents the REP Program annual savings achieved in PY2021. As shown, the program achieved 79% of Ameren Missouri's net energy savings goal and 99% of the net demand savings goal. We discuss some of the factors contributing to the goal shortfalls in Section 6.3.1.

Table 51. PY2021 REP Program Savings Summary

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	8,246	108.8%	8,972	86.1%	7,724	9,800	79%
Demand Savings (MW)	3.60	88.3%	3.18	80.6%	2.56	2.60	99%
Last Year Demand Savings							
< 10 EUL (MW)	0.00		0.00		0.04	0.04	
10–14 EUL (MW)	3.60	88.3%	3.18	76.8%	2.44	2.49	98%
15+ EUL (MW)	0.00		0.00		0.08		

Overall, the REP Program was the fourth-largest program in the PY2021 residential portfolio in terms of both ex post net savings (5% of residential portfolio) and ex post net demand (5% of residential portfolio).

6.1.4 Conclusions and Recommendations

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

- **Conclusion #1:** Consistent with PY2020, the REP Program requirements around advanced thermostats contributed to program performance being below the goal. In particular, while the program allowed rebates for multiple thermostats purchased per customer, the Ameren Missouri TRM limits thermostat savings to one unit per household.
- **Conclusion #2:** Also consistent with PY2020, for almost all measures ex ante assumptions around measure installation were incorrectly applied based on the Ameren Missouri TRM Appendix F. More specifically, for almost all measures, a 100% ISR was applied to the program-tracking data when the TRM prescribed lower ISRs based on past evaluations. Additionally, ex ante savings estimates were based on Ameren Missouri TRM Appendix F (v4.0) while ex post savings are based on TRM Appendix F (v5.0).
  - **Recommendation #2:** Ensure the appropriate TRM parameters are applied to program-tracking data.

To meet the requirements of Missouri CSR for demand-side process evaluations, we respond to the five required process evaluation questions in Table 52.[38] Note that we did not conduct any process evaluation tasks for PY2021, so the findings denoted in the table are largely the same findings we reported in the previous year.

Table 52. 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 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 that 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 either 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. Other market imperfections are measure-specific and generally apply to the market potential: ▪ Only 4% of homes in the Ameren Missouri service territory have inground pools. Thus, the market for pool pumps is very limited, and the product selection is largely driven by contractor recommendations. ▪ 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

[38] 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
	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. When the measure mix is considered (heat pump water heaters, pool pumps, and advanced thermostats), however, the actual market is predominantly homeowners. That said, virtually all residences (even rentals) could benefit from Tier 1 or Tier 2 advanced power strips. Some measures, like pool pumps, should be targeted at residences with pools, but no further subdivision seems needed.
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 five measures: (1) advanced thermostats, (2) Tier 1 power strips, (3) Tier 2 power strips, (4) heat pump water heaters, and (5) pool pumps. When one considers the diversity of energy-consuming items in the typical residence (the target market), a very wide range of other enduse measures appear potentially applicable to the REP Program. Of course, cost-effectiveness and overlap with other programs needs to be considered. ENERGY STAR®[39] room air conditioners, air purifiers, and dehumidifiers were included when developing targets/goals in 2018, so they may be good candidates for measure expansion.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	In PY2020, program marketing activities included TV/radio ads, social media ads, paid search optimization, e-mail campaigns, including rebate information on energy statements or Home Energy Reports, and location-based ads and promotions. In PY2019, most participants who purchased products through the Online Store reported learning about the program through direct communication from Ameren Missouri or the Ameren Missouri website. Mass marketing does not appear to have been that effective. Customers who purchased pool pumps and heat pump water heaters were more likely to learn about the program through a contractor than other communication channels. Increasing outreach to contactors to increase their involvement with the program could increase participation for these measures.
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, focusing additional marketing efforts on contractors, and increasing general customer awareness of the energy efficiency opportunities as well as available rebates.

6.2 Evaluation Methodology

For PY2021, the Opinion Dynamics team focused its efforts on an impact evaluation having completed detailed process and impact evaluations of the REP Program in PY2019. Table 53 provides an overview of the PY2021 REP Program evaluation activities. Following the table, we outline program-specific aspects of key evaluation methodologies.

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

Table 53. PY2020 Evaluation Activities for the REP Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conduct interviews in Q3 of PY2021 to understand program staff's perspective on program implementation.
Program Material Review	▪ Review new program materials to inform evaluation activities.
Gross Impact Analysis – Database Review	▪ Review program database to check that program data are complete and that program-installed measures meet all program requirements.
Gross Impact Analysis – Engineering Analysis	▪ Verify that ex ante savings use the correct deemed savings values. ▪ Estimate overall and measure-level ex post gross impacts using TRM algorithms, deemed savings assumptions, and PY2019 evaluation-estimated parameters.
Net Impact Analysis	▪ Apply PY2019 evaluation-derived estimates of free ridership, participant spillover, and non-participant spillover to estimate PY2021 net impacts.
Reporting	▪ Develop the draft and final annual reports.

Impact Analysis

Gross Impact Analysis

Gross impact-related activities for the PY2021 REP Program included review of the program-tracking databases and engineering analysis to estimate ex post gross savings. ISRs derived from the PY2019 evaluation were applied to PY2021 ex ante savings as part of the computation of ex post gross savings. Key objectives of the PY2021 gross impact analysis include:

- Verify program-tracking data;
- Estimate the first year ex post gross energy (MWh) and demand (MW) savings; and
- Estimate last year ex post demand (MW) savings, by EUL category.

Net Impact Analysis

Net impact-related activities for the PY2021 REP Program included the application of PY2019 evaluation-derived estimates of FR, PSO, and portfolio-level NPSO to the ex post gross energy (MWh) and demand (MW) savings to derive ex post net MWh and MW. We also calculated last year ex post net demand savings.

6.3 Evaluation Results

The following sections provide the PY2021 REP Program gross and net impact findings. Additional details regarding the impact evaluation are included in Appendix A.

6.3.1 Gross Impact Results

For PY2021, the evaluation team used participant survey derived ISRs from the PY2019 evaluation (see Table 54). Note that no Tier 1 power strips were sold through the program in PY2019, so we rely on the PY2019 Tier 2 power strip ISR for PY2021. Also, advanced thermostats were not rebated through the Mail-in Channel in PY2019, so we rely on the Online Store ISR for PY2021. The overall total ISR (97.5%) is weighted for PY2021 based on this year's ex post gross savings by measure.

Table 54. PY2021 REP Program ISRs by Measure

Channel	Measure	ISR
Online Store	Advanced Thermostats	98.8%
	Tier 1 Power Strips	93.8%[a]
	Tier 2 Power Strips	93.8%
Mail-in	Advanced Thermostats	98.8%[b]
	Heat Pump Water Heaters	100.0%
	Pool Pumps	100.0%
	Total	**97.5%**

[a] No Tier 1 power strips were sold through the Online Store in the PY2019 REP Program. For PY2021, we assumed the same ISR as Tier 2 power strips.
[b] For PY2019, advanced thermostats were not rebated through the Mail-in Channel. For PY2021, we assume the same ISR as advanced thermostats sold through the Online Store.

The PY2021 REP Program achieved 8,972 MWh and 3.18 MW of ex post gross savings, resulting in 108.8% and 88.3% realization rates, respectively (Table 55).

Table 55. PY2021 REP Gross Impact Summary

	Ex Ante	Realization Rate	Ex Post
First Year Savings			
Energy Savings (MWh)	8,246	108.8%	8,972
Demand Savings (MW)	3.60	88.3%	3.18
Last Year Demand Savings			
< 10 EUL (MW)	0.00		0.00
10–14 EUL (MW)a	3.60	88.3%	3.18
15+ EUL (MW)	0.00		0.00

[a] All program measures offered in PY2021 have a measure life between 10–14 years (13 years for heat pump water heaters; 10 years for the remainder of the measures).

Table 56 shows the ex post gross savings and realization rates by channel and measure. The realization rates range from a high of 116.5% for advanced thermostats rebated through the Mail-in Channel to 98.6% for Tier 1 Power Strips through the online store Channel.

Table 56. PY2021 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	6,212	110.9%	6,887	3.11	87.0%	2.71
	Tier 1 Power Strips	146	98.6%	144	0.02	98.6%	0.02
	Tier 2 Power Strips	15	99.9%	15	0.00	99.9%	0.00
Mail-in	Advanced Thermostats	322	116.5%	375	0.16	90.1%	0.15
	Heat Pump Water Heaters	401	100.0%	401	0.04	100.0%	0.04
	Pool Pumps	1,150	100.0%	1,150	0.27	100.0%	0.27
Total		8,246	108.8%	8,972	3.60	88.3%	3.18

Table 57 summarizes the total PY2021 last year ex ante and ex post electric demand savings and realization rates by channel, by measure, by EUL class. Advanced thermostats contribute the majority of the REP Program's ex post gross demand savings (85% Online Store; 5% Mail-in) followed by pool pumps (9%), heat pump water heaters (1%), and Tier 1 and Tier 2 power strips (both <1%).

Table 57. PY2021 REP Program Annual Last-Year Gross Demand Impacts

Channel	Measure Category	Ex Ante (MW) Total				Gross Realization Rate	Ex Post (MW) Total			
		<10	10–14[a]	15+	Total		<10	10–14[a]	15+	Total
Online Store	Advanced Thermostats	0.00	3.11	0.00	3.11	87.0%	0.00	2.71	0.00	2.71
	Tier 1 Power Strips	0.00	0.02	0.00	0.02	98.6%	0.00	0.02	0.00	0.02
	Tier 2 Power Strips	0.00	0.00	0.00	0.00	99.9%	0.00	0.00	0.00	0.00
Mail-in	Advanced Thermostats	0.00	0.16	0.00	0.16	90.1%	0.00	0.15	0.00	0.15
	Heat Pump Water Heaters	0.00	0.04	0.00	0.04	100.0%	0.00	0.04	0.00	0.04
	Pool Pumps	0.00	0.27	0.00	0.27	100.0%	0.00	0.27	0.00	0.27
Total		**0.00**	**3.60**	**0.00**	**3.60**	**88.3%**	**0.00**	**3.18**	**0.00**	**3.18**

[a] All measures offered in PY2021 have a measure life between 10–14 years (13 years for heat pump water heaters; 10 years for all other measures).

Below we detail the key reasons, by channel and measure, for realization rates discrepancies.

- **Online Store and Mail-in: Advanced Thermostats.** The gross realization rate for advanced thermostats through the Online Store is 110.9% for electric energy and 87.0% for demand while the gross realization rate for advanced thermostats through the Mail-in Channel was 116.5% for electric energy and 90.1% for electric demand.
  - For measures with unknown heating equipment, ex ante applied the Appendix F (v4.0) default, which assumes 16% of homes have electric heating equipment and 84% have gas heating equipment. The evaluation team applied weighted average assumptions based on PY2021 records with known heating equipment type (31% of homes have electric heating equipment and

69% have gas heating equipment). This affected 80.0% of Online Store thermostat records and all Mail-in records, and was the primary driver of discrepancies between ex ante and ex post energy savings.

- There was an update in Appendix F (v5.0) to the SEER and cooling capacity assumptions for advanced thermostats. While ex ante correctly applied the SEER (13.55) and cooling capacity (13,552 Btu/hr) from the old version of Appendix F (v4.0), ex post applied the updated SEER (13.0) and cooling capacity (13,000 Btu/hr) from Appendix F (v5.0). This resulted in increased electric energy and electric demand savings.
- Ex ante claimed 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 savings. When calculating ex post, the evaluation team only awarded savings for one thermostat per household (identified as unique electric account numbers). As a result, 2,739 online store thermostats (11.8% of ex ante gross MWh) and 35 mail-in thermostats (0.1% of ex ante gross MWh) received zero ex post savings. This decreased electric energy and electric demand for advanced thermostats.
- Appendix F (v4.0) updated the ISR for advanced thermostats from 100% to 98.8%. While ex ante correctly applied an older version of Appendix F (v3.1), the evaluation team relied on inputs from the most recent version (v5.0), overall increasing ex post savings.

6.3.2 Net Impact Results

Net-To-Gross Ratio Results

For PY2021, we applied product level NTGRs developed in PY2019 to estimate net program impacts. In PY2019, the evaluation team surveyed 1,063 total REP Program participants to develop product-level FR and PSO scores. The values are re-weighted by the distribution of PY2021 product-level ex post gross savings to derive the overall NTGR of 73.0% as shown in Table 58.

Table 58. PY2021 REP Program NTGRs

Channel	Measure/Enduse	Free Ridership (FR)	Participant Spillover (PSO)	NTGR (1-FR+PSO)
Online Store	Advanced Thermostats	29.3%	2.8%	73.5%
	Tier 1 Power Strips[a]	16.6%	2.8%	86.2%
	Tier 2 Power Strips	16.6%	2.8%	86.2%
Mail-in	Advanced Thermostats[b]	29.3%	2.8%	73.5%
	Heat Pump Water Heaters	40.4%	2.8%	62.4%
	Pool Pumps	35.6%	2.8%	67.2%
Total		**29.8%**	**2.8%**	**73.0%**

[a] No Tier 1 power strips were sold through the Online Store in the PY2019 REP Program. For PY2021 we assumed the same FR and PSO values as tier 2 power strips.
[b] For PY2019, advanced thermostats were not rebated through the Mail-in Channel. For PY2021 we assume the same FR and PSO values as advanced thermostats sold through the Online Store.

Net Impacts

The evaluation team applied the product-level PY2019 NTGRs as well as the portfolio-wide energy NPSO rate of 13.7% and the demand NPSO of 7.7% to ex post gross savings values to determine net impacts for the PY2021 REP Program (see Table 59). Overall, the PY2021 REP Program delivered a total of 7,724 MWh of ex post net energy savings and 2.56 MW of ex post net demand savings when incorporating NPSO.

Table 59. PY2021 REP Program Annual First Year Net Energy and Demand Savings

Channel	Measure Category	Energy Savings			Demand Savings		
		Ex Post Gross (MWh)	NTGR	Ex Post Net (MWh)	Ex Post Gross (MW)	NTGR	Ex Post Net (MW)
Online Store	Advanced Thermostats	6,887	73.5%	5,059	2.71	73.5%	1.99
	Tier 1 Power Strips[a]	144	86.2%	124	0.02	86.2%	0.01
	Tier 2 Power Strips	15	86.2%	13	0.00	86.2%	0.00
Mail-in	Pool Pumps	1,150	67.2%	773	0.27	67.2%	0.18
	Advanced Thermostats[b]	375	73.5%	275	0.15	73.5%	0.11
	Heat Pump Water Heaters	401	62.4%	250	0.04	62.4%	0.02
Non-Participant Spillover				1,229			0.24
Total		**8,972**	**86.1%**	**7,724**	**3.18**	**80.6%**	**2.56**

[a] No Tier 1 power strips were sold through the Online Store in the PY2019 REP Program. For PY2021 we assumed the same NTGR value as Tier 2 power strips.

[b] For PY2019, advanced thermostats were not rebated through the Mail-in Channel. For PY2021 we assume the same NTGR value as advanced thermostats sold through the Online Store.

Finally, Table 60 shows the last year demand savings by channel, by measure, by EUL class. The PY2021 REP Program delivered 2.44 MW of 10–14 year last year ex post net demand savings when incorporating NPSO.

Table 60. PY2020 REP Program Annual Last Year Net Demand Impacts

Channel	Measure Category	Ex Post Gross (MW)				NTGR	Ex Post Net (MW)			
		<10	10–14[a]	15+	Total		<10	10–14[a]	15+	Total
Online Store	Advanced Thermostats	0.00	2.71	0.00	2.71	73.5%	0.00	1.99	0.00	1.99
	Tier 1 Power Strips[b]	0.00	0.02	0.00	0.02	86.2%	0.00	0.01	0.00	0.01
	Tier 2 Power Strips	0.00	0.00	0.00	0.00	86.2%	0.00	0.00	0.00	0.00
Mail-in	Advanced Thermostats[c]	0.00	0.15	0.00	0.15	73.5%	0.00	0.11	0.00	0.11
	Heat Pump Water Heaters	0.00	0.04	0.00	0.04	62.4%	0.00	0.02	0.00	0.02
	Pool Pumps	0.00	0.27	0.00	0.27	67.2%	0.00	0.03	0.00	0.03
Non-Participant Spillover							0.04	0.13	0.08	0.24
Total		**0.00**	**3.18**	**0.00**	**3.18**	**80.6%**	**0.04**	**2.44**	**0.08**	**2.56**

[a] All measures offered in PY2021 have a measure life between 10–14 years (13 years for heat pump water heaters; 10 years for all other measures).

[b] No Tier 1 power strips were sold through the Online Store in the PY2019 REP Program. For PY2021 we assumed the same NTGR value as Tier 2 power strips.

[c] For PY2019, advanced thermostats were not rebated through the Mail-in Channel. For PY2021 we assume the same NTGR value as advanced thermostats sold through the Online Store.

7. Energy Efficiency Kits (EEK)

This section summarizes the PY2021 evaluation methodology and results for the Energy Efficiency Kits (EEK) Program.

7.1 Evaluation Summary

The EEK Program is designed to increase customer awareness of the benefits of high-efficiency products, educate residential customers about energy consumption in their homes, and offer information, products, and services to residential customers to encourage cost-effective energy savings. The target market includes all residential customers within the Ameren Missouri service territory. Each kit includes LED light bulbs, hot water pipe wrap, low-flow showerheads, and faucet aerators.

The EEK Program provides energy efficiency measures to Ameren Missouri residential customers by distributing kits and educational materials to schools located in Ameren's service territory. In past years, the program implementation team targeted sixth grade students, but in PY2021 Ameren Missouri expanded the offering to additional grades and faculty members.[40] The program design includes a combination of classroom activities with projects in the home aimed to encourage the installation of energy-efficient products included in each kit.

We note that the EEK Program will be discontinued at the end of PY2021.

7.1.1 Participation Summary

In PY2021, 210 schools participated in the EEK Program. In total, 23,454 kits were shipped to these schools; however, the implementation team tracked 38 classrooms that were unable to distribute their 2,756 kits to students. Table 61 provides a summary of the total kits initially shipped to schools, and Table 62 includes a summary of the kits that were actually distributed to students. In total, 88% of the kits shipped in PY2021 reached customers by the end of the year.

Table 61. PY2021 EEK Program Reported Participation Summary

Measure Category	Participants (Schools)		Work Orders [a]		Measures		Ex Ante Savings	
	Number	%	Number	%	Number	%	MWh	%
Pipe Insulation [b]	210	100%	385	100%	133,428	35%	231	4%
LED Lighting [c]	210	100%	385	100%	93,996	24%	2,107	34%
Bathroom Faucet Aerator	210	100%	385	100%	44,431	12%	149	2%
Kitchen Faucet Aerator	210	100%	385	100%	44,431	12%	720	12%
Low-Flow Showerheads	210	100%	385	100%	44,431	12%	1,694	27%
Dirty Filter Alarm	210	100%	385	100%	23,454	6%	1,268	21%

[a] The Work Order is a unique ID assigned to each class within a school in which kits are distributed. Each teacher can have multiple Work Orders, one for each class where they distribute kits. Therefore, individual schools and teachers can have multiple Work Orders. For the Holiday Kits, a Work Order was unique at the business unit level. For one organization, kits were distributed at three different locations. Therefore, there are three Work Orders associated with that organization; the other organization had a single Work Order.

[b] Measure quantity represents total footage of pipe insulation at three feet per kit.

[40] Program staff ensured this expansion did not result in duplicate participation among students.

[c] Kits with LEDs include four bulbs per kit.

Table 62. PY2021 EEK Program Verified Participant Summary

Measure Category	Schools Delivered to Customers		Work Orders [a] Delivered to Customers		Total Ex Ante Measures	Delivered Measures in 2021
	Number	%	Number	%		
Pipe Insulation [b]	199	95%	347	90%	133,428	117,045
LED Lighting [c]	199	95%	347	90%	93,996	82,972
Bathroom Faucet Aerator	199	95%	347	90%	44,431	38,970
Kitchen Faucet Aerator	199	95%	347	90%	44,431	38,970
Low-Flow Showerheads	199	95%	347	90%	44,431	38,970
Dirty Filter Alarm	199	95%	347	90%	23,454	20,698

[a] The Work Order is a unique ID assigned to each class within a school in which kits are distributed. Each teacher can have multiple Work Orders, one for each class where they distribute kits. Therefore, individual schools and teachers can have multiple Work Orders.

7.1.2 Key Impact Results

The EEK Program offers six measures to participants. Program implementation staff use measure-specific equations and inputs sourced from the Ameren Missouri TRM v5.0 to estimate ex ante savings. As the EEK Program will be discontinued following PY2021, the evaluation team took a streamlined approach to estimating ex post gross impacts for the program. We applied the gross measure-level realization rates from the PY2020 evaluation to PY2021 tracking data to estimate gross savings and applied measure-level NTGRs developed through a PY2019 participant survey to estimate net savings.[41] As shown in Table 63, the program achieved 83% of Ameren Missouri's net energy savings goal for the EEK Program in PY2021.

Table 63. PY2021 EEK Program Impact Summary Impact

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	5,437	81.3%	4,420	78.4%	3,466	4,199	83%
Demand Savings (MW)	1.02	83.6%	0.85	79.8%	0.68	0.81	84%
Last Year Demand Savings							
< 10 EUL	0.00		0.00		0.01	0.00	
10–14 EUL	0.74	84.9%	0.63	90.1%	0.57	0.76	74%
15+ EUL	0.28	80.4%	0.22	46.4%	0.10	0.05	218%

Overall, the EEK Program was the fifth-largest program in the PY2021 residential portfolio, accounting for 2% of ex post net residential portfolio energy savings and 1% of ex post net residential portfolio demand savings.

[41] As documented in detail in the **Impact Methodology** section, the evaluation team determined that the characteristics of the Holiday Kits offering was more akin to kits distributed through the Appliance Recycling Program. Therefore, for measures distributed through the Holiday Kits offering, the evaluation team applied realization rates and NTGRs from the Appliance Recycling Program.

7.1.3 Key Process Findings

As a key part of the PY2021 evaluation, we explored a set of evaluation questions required by the Missouri Code of State Regulations (CSR) for demand-side process evaluations. Table 64 includes our responses for each question.

Table 64. 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 the program addresses are the lack of consumer awareness about and/or the reluctance to purchase the energy-saving kit items. The program addresses these two barriers by providing the kit items free of charge and educating the students (and, indirectly, household members) about the energy-saving potential of installing the items. All potential housing stock characteristics may be included in kit product distribution due to the program being offered to all students in a participating classroom. The 2019 residential baseline study results indicate shrinking opportunity for the standard LEDs included in the kit. Nearly 70% of light sockets in Ameren Missouri's service territory that take a standard bulb contain an efficient bulb (either CFL or LED). LEDs also had higher FR than other kit measures, suggesting that many families were already using LEDs and would purchase them on their own. Faucet flow rate data from the baseline study indicate somewhat more opportunity for high-efficiency faucet aerators (39% of customers have aerators with flow rates greater than 2.2 GPM).
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes. The program targets residential customers with children in middle school. The intent is to increase awareness of energy efficiency and Ameren Missouri's energy efficiency programs and achieve energy savings through the installation of kit items.
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. Since existing residential customer technologies can vary widely in age, make, model, and pre-existing efficiencies, kit programs must carefully weigh the cost of included items and the potential for the items not to be installed by the customer. Results from the PY2019 participant survey indicated the following measure in-service rates: at least one LED bulb (88%), hot water pipe insulation (56%), showerhead (54%), bathroom faucet aerator (48%), furnace filter whistle (44%), and kitchen faucet aerator (40%).
Are the communication channels and delivery mechanisms appropriate for the target market segment?	Yes, though adjustments could be made to better align the program with teachers' unique needs. The program provides teachers with teaching materials, student education worksheets, the kit materials, and installation instructions. Further, in PY2021, program staff provided specific digital instructions and take-home materials to aid in delivering the program's educational content.
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?	Based on responses to the PY2019 participant survey, some participating teachers/parents would appreciate an opt-in system, which could reduce waste and increase adoption rates—i.e., only providing kits to students whose parents opt-into the program.

7.2 Evaluation Methodology

The evaluation team limited research efforts for the EEK Program to impact evaluation activities in PY2021. We explored the following EEK-specific objectives:

- Verify program tracking data
- Estimate the first-year ex post gross and net energy (kWh) and demand (kW) savings
- Estimate last-year ex post gross and net demand (kW) savings, by EUL category

Table 65 provides an overview of the EEK Program evaluation activities we employed to address these research objectives. Following the table, we provide details on the impact methodology we used to estimate the gross and net savings for the program.

Table 65. PY2021 Evaluation Activities for the EEK Program

Evaluation Activity	Description
Program Material and Data Review	▪ Reviewed program-tracking data and available program materials to inform evaluation activities.
Gross Impact Analysis	▪ Reviewed program database to check that program data are complete and that program-installed measures meet all program requirements. ▪ Analyzed the program database to determine the kits distributed in 2021. ▪ Estimated ex post gross impacts using PY2020 realization rates.
Net Impact Analysis	▪ Applied PY2019 evaluation-derived estimates of free ridership, participant spillover, and non-participant spillover to estimate PY2021 net impacts.

Impact Methodology

To estimate PY2021 impacts for the EEK Program, Opinion Dynamics applied the measure-level gross realization rates and NTGRs from the PY2020 evaluation to the PY2021 tracking data to estimate gross and net savings. Table 66 includes the realization rates and NTGRs applied to each measure.

Table 66. EEK Measure-Level Realization Rates and Net-to-Gross Ratios – School Kits

Measure	Realization Rate (%)	NTGR
Hot Water Pipe Insulation	82%	0.723
LED 10W	80%	0.364
Bathroom Faucet Aerator	64%	0.819
Kitchen Faucet Aerator	59%	0.842
Low-Flow Showerheads	89%	0.715
Dirty Filter Alarm	87%	0.886

7.3 Evaluation Results

In the remainder of this section, we present the results of the impact evaluation.

7.3.1 Gross Impact Results

The PY2021 EEK Program achieved 4,420 MWh and 0.85 MW in ex post gross savings (Table 67).

Table 67. PY2021 EEK Program Gross Impact Summary

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross
First Year Savings			
Energy Savings (MWh)	5,437	81.3%	4,420
Demand Savings (MW)	1.02	83.6%	0.85
Last Year Demand Savings			
< 10 EUL	0.00		0.00
10–14 EUL	0.74	84.9%	0.63
15+ EUL	0.28	80.4%	0.22

To determine the ex post savings shown above, the evaluation team applied the measure-level gross realization rates from the PY2020 evaluation to the PY2021 tracking data to estimate ex post gross energy and demand savings. At the measure-level, ex post gross realization rates for energy and demand savings ranged from 59% to 89% in PY2020 (see Table 68 and Table 69).

Table 68. PY2021 EEK Program Annual First Year Gross Impacts

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Gross Realization Rate	Ex post (MWh)	Ex Ante (MW)	Gross Realization Rate	Ex Post (MW)
Dirty Filter Alarm	1,118	87.2%	975	0.52	87.2%	0.45
LED Lighting	1,858	80.4%	1,493	0.28	80.4%	0.22
Bathroom Faucet Aerator	131	64.0%	84	0.01	64.0%	0.01
Kitchen Faucet Aerator	633	59.1%	374	0.06	59.1%	0.03
Low-Flow Showerheads	1,494	88.9%	1,328	0.13	88.9%	0.12
Hot Water Pipe Insulation	204	81.9%	167	0.02	81.9%	0.01
Total or Weighted Average	**5,437**	**81.3%**	**4,420**	**1.02**	**83.6%**	**0.85**

Table 69. PY2021 EEK Program Annual Last Year Gross Demand Impacts

Measure Category	Ex Ante Gross Savings (MW)				Gross Realization Rate	Ex Post Gross Savings (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Dirty Filter Alarm	0.00	0.52	0.00	0.52	87.2%	0.00	0.45	0.00	0.45
LED Lighting	0.00	0.00	0.28	0.28	80.4%	0.00	0.00	0.22	0.22
Bathroom Faucet Aerator	0.00	0.01	0.00	0.01	64.0%	0.00	0.01	0.00	0.01
Kitchen Faucet Aerator	0.00	0.06	0.00	0.06	59.1%	0.00	0.03	0.00	0.03
Low-Flow Showerheads	0.00	0.13	0.00	0.13	88.9%	0.00	0.12	0.00	0.12
Hot Water Pipe Insulation	0.00	0.02	0.00	0.02	81.9%	0.00	0.01	0.00	0.01

Measure Category	Ex Ante Gross Savings (MW)				Gross Realization Rate	Ex Post Gross Savings (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Total or Weighted Average	0.00	0.74	0.28	1.02	83.6%	0.00	0.63	0.22	0.85

7.3.2 Net Impact Results

Net-To-Gross Ratio Results

The evaluation team relied on NTGR values developed through surveys conducted in PY2019 for the PY2021 EEK products (Table 70).

Table 70. PY2021 EEK Program Net-to-Gross Ratios

Measure/Enduse	Free Ridership (FR)	Participant Spillover (PSO)	NTGR (1-FR+PSO)
LED Lighting	63.64%		36.36%
Low-Flow Showerheads	32.02%	3.47%	71.46%
Dirty Filter Alarm	14.83%	3.47%	88.65%
Kitchen Faucet Aerators	19.22%	3.47%	84.25%
Hot Water Pipe Insulation	31.16%	3.47%	72.31%
Bathroom Faucet Aerators	21.55%	3.47%	81.92%

Source: Ameren Missouri Program Year 2019 Annual EM&V Report. Volume 2: Residential Portfolio Report

Net Impacts

The evaluation team applied the researched NTGRs to determine net impacts for the EEK Program for PY2021. In 2021, the EEK Program saved 3,466 MWh of net energy and 0.68 MW of net demand (Table 71 and Table 72).

Table 71. PY2021 EEK Program Annual First Year Net Impacts

Measure Category	Energy Savings			Demand Savings		
	Ex Post Gross Savings (MWh)	NTGR	Ex Post Net Savings (MWh)	Ex Post Gross (MW)	NTGR	Ex Post Net (MW)
Dirty Filter Alarm	975	88.6%	864	0.45	88.6%	0.40
LED Lighting	1,493	36.4%	543	0.22	36.4%	0.08
Bathroom Faucet Aerator	84	81.9%	69	0.01	81.9%	0.01
Kitchen Faucet Aerator	374	84.2%	315	0.03	84.2%	0.03
Low-Flow Showerheads	1,328	71.5%	949	0.12	71.5%	0.08
Hot Water Pipe Insulation	167	72.3%	121	0.01	72.3%	0.01
Non-Participant Spillover			606			0.07
Total or Weighted Average	**4,420**	**78.4%**	**3,466**	**0.85**	**79.8%**	**0.68**

Table 72. PY2021 EEK Program Annual Last Year Net Demand Impacts

Measure Category	Ex post Gross Savings (MW)				NTGR	Ex post Net Savings (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Dirty Filter Alarm	0.00	0.45	0.00	0.45	88.6%	0.00	0.40	0.00	0.40
LED Lighting	0.00	0.00	0.22	0.22	36.4%	0.00	0.00	0.08	0.08
Bathroom Faucet Aerator	0.00	0.01	0.00	0.01	81.9%	0.00	0.01	0.00	0.01
Kitchen Faucet Aerator	0.00	0.03	0.00	0.03	84.2%	0.00	0.03	0.00	0.03
Low-Flow Showerheads	0.00	0.12	0.00	0.12	71.5%	0.00	0.08	0.00	0.08
Hot Water Pipe Insulation	0.00	0.01	0.00	0.01	72.3%	0.00	0.01	0.00	0.01
Non-Participant Spillover						0.01	0.03	0.02	0.07
Total or Weighted Average	**0.00**	**0.63**	**0.22**	**0.85**	**79.8%**	**0.01**	**0.57**	**0.10**	**0.68**

8. Multifamily Market Rate (MFMR)

This section presents the PY2021 evaluation summary, methodology, and results for the MFMR Program. Additional details on the methodology are presented in Appendix A.

8.1 Evaluation Summary

The MFMR Program is designed 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.

The International Center for Appropriate and Sustainable Technology (ICAST) is the primary implementer of the program. As part of the one-stop-shop approach, ICAST offers a suite of concierge-style services to assist participants in identifying and executing energy efficiency projects. ICAST Energy Advisors spearhead customer recruitment, assist with the application process, conduct energy assessments, recommend custom project scopes, estimate incentives, and assist participants in coordinating installations. Customers can contract the installation work to outside vendors, or they can work with ICAST's operations team. For projects that are limited to direct-install measures, ICAST has a group of subcontractors who complete the work. ICAST 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.

As part of the one-stop-shop approach to promote deeper savings, ICAST also implements a custom—rather than prescriptive—approach to recommending upgrades, calculating ex ante site savings, and providing customer incentives. Using this approach, ICAST calculates most measure savings and incentives against site-specific baselines. Eligible measures include lighting, advanced thermostats, domestic hot water, building shell, and HVAC measures.

Franklin Energy serves as the overall administrator of the program and leads the development of marketing collateral (in collaboration with Ameren Missouri and ICAST), 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.

Ameren Missouri continued to implement COVID-19 restrictions in PY2021 to limit health risks for program staff and participants. These restrictions included prohibiting work in occupied units which spurred implementation changes such as offering virtual energy assessments and inspections, as well as focusing installations on common areas and vacant units. Restrictions were eventually lifted in July 2021 and the implementation team returned to their original strategy. Despite having to manage the COVID restrictions for much of the year, the program team still achieved 3,553 MWh of net electric savings in PY2021.

8.1.1 Participation Summary

In PY2021, the program treated 2,749 premises across 20 projects.[42] These projects resulted in the installations of 40,169 energy-efficient measures (Table 73). This is a notable increase compared to PY2020, where the program team delivered 27,012 measures to 1,664 unique premises across 19 unique projects.

[42] The implementation team split large projects into phases that are reflected as separate projects in the tracking data. Therefore, a single participating property could have multiple projects associated with it.

The primary driver of the increase in savings in PY2021 compared to PY2020 is the growth in building shell, residential lighting, and business lighting installations.

Table 73. PY2021 Multifamily Market Rate Program Participation Summary by Measure

Enduse	Unique Premises		Measures		Ex Ante Savings	
	Number	%	Number	%	MWh	%
Lighting RES	2,271	83%	19,177	48%	482	13%
Water Heating RES	1,308	48%	3,750	9%	704	19%
HeatCool	926	34%	928	2%	757	20%
Building Shell RES	473	17%	13,911[a]	35%	514	14%
HVAC RES	59	2%	124	<1%	393	10%
Lighting BUS	21	1%	1,971	5%	694	18%
EXT Lighting BUS	12	<1%	303	1%	106	3%
Motors BUS	1	<1%	1	<1%	2	<1%
Cooling BUS	1	<1%	2	<1%	3	<1%
HVAC BUS	1	<1%	2	<1%	107	3%
Total	**2,749**	**100%**	**40,169**	**100%**	**3,763**	**100%**

[a] Measure quantity reported in square feet

8.1.2 Key Impact Results

Table 74 presents annual gross and net electric energy and demand savings achieved in PY2021 The ex post savings are 100% and 101% of the ex ante savings for energy and peak demand, respectively. As shown, the program achieved 87% of Ameren Missouri's first year net energy savings goal and 67% of the first year demand savings goal.[43]

Table 74. PY2021 Multifamily Market Rate Program Savings Summary

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/ Target Net	% of Goal/ Target
First Year Savings							
Energy Savings (MWh)	3,763	100%	3,780	94%	3,553	4,064	87%
Demand Savings (MW)	0.93	101%	0.93	94%	0.88	1.30	67%
Last Year Demand Savings							
< 10 EUL (MW)	0.06	114%	0.07	94%	0.06	0.25	25%
10–14 EUL (MW)	0.26	100%	0.26	94%	0.24	0.28	86%
15+ EUL (MW)	0.61	98%	0.59	94%	0.56	0.73	76%

8.1.3 Key Process Findings

The PY2021 evaluation did not include an in-depth assessment of MFMR Program processes. Findings from interviews with program staff, as well as information from the program-tracking database, however, helped

[43] Note that the evaluation team expects impacts for the MFMR Program to change between the draft and final evaluation reports due to corrections made by the implementation team that they were unable to reconcile in time to process PY2021 ex post impacts for this evaluation.

inform the process evaluation requirements for Ameren Missouri's MFMR Program. Below, we summarize key findings from these activities. Additionally, Table 75 summarizes responses to the five CSR process evaluation questions.

Key process findings from the PY2021 MFMR Program include:

- **The COVID-19 pandemic continued to present significant challenges to the program's model for delivering comprehensive projects.** The program team continued to demonstrate resilience and responsiveness to the circumstances brought about by COVID-19. Program implementers struggled to complete in-unit projects, however, due to occupancy restrictions. Unlike the Multifamily Income Eligible (MFIE) Program, the MFMR Program could not provide relocation incentives to participants to vacate their units. As such, the implementation team had to focus more on common area projects and properties with a portion of already vacant units, as well as deploying virtual assessments and verification processes. Once the COVID-19 restrictions were lifted, project scopes expanded, but delays in project completion due to ramp-up challenges and supply chain issues presented continued hurdles throughout the year. Despite these challenges, the program achieved 87% of its net energy savings goal and 67% of first year demand savings goal.
- **The ICAST one-stop-shop program design continued to align with the majority of the best practices for one-stop-shop multifamily programs, including:** (1) offering a single point of contact (SPOC) for project development and technical assistance; (2) a streamlined application process with assistance from a SPOC; (3) comprehensive energy assessments to identify upgrade opportunities; (4) coordination of rebates; (5) assistance with identifying qualified contractors and soliciting, evaluating, and selecting bids; (6) coordination of installations; and (7) QA/QC inspections of each project. Notably, the ICAST team tailors the scope of the one-stop-shop approach to the property manager or owner's needs. In the Market Rate segment, many property managers and owners have established contractor relationships and/or prior knowledge of the incentive process. In these instances, the ICAST team serves as a resource and a guide through the participation process rather than filling the role of a general contractor.
- **The program team implemented a pre-approval process for all projects in 2021, which provided more visibility into Trade Ally projects and presented opportunities to influence project scopes.** In prior program years, the lack of a pre-approval process allowed trade allies to act autonomously from the implementation team. This created challenges for the implementation team when trying to meet savings goals and key performance metrics because trade ally projects were typically limited in scope. Additionally, the implementation team had minimal visibility into the projects until after they were completed. The introduction of the pre-approval process allowed the implementation team an opportunity to influence and alter project scopes early in the process, particularly projects that were limited in scope or did not align with performance targets. This ultimately generated more work for the trade allies and strengthened their trust and allyship to the program.

Table 75. 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?	Market imperfections specific to the multifamily sector include (1) the split incentive[44] for in-unit measures between property owners, managers, and residents; (2) awareness of the potential for saving money and energy through energy efficiency upgrades; (3) costs associated with larger non-lighting measure 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. 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. While COVID-19 impacted the range of projects that could be completed in PY2021, as well as the measures that could be installed as part of those projects, the implementation team delivered a comprehensive set of solutions to the target market segment through the one-stop-shop model. The tracking data indicates that 65% of measures were installed in tenant units and 35% were installed in common areas or exterior locations in PY2021. 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 program uses a mix of communication channels including traditional channels such as e-mail blasts and distribution of collateral at industry events. The primary recruitment channel used is ICAST's network of existing relationships with larger property ownership and management companies. The program also leverages more tailored outreach to smaller scale property owners. 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.[45] Green Leases are contracts between landlords and tenant(s) 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 are designed to allow both parties financial benefits and incentives, and multifamily building types are ideal buildings for their use. The other market imperfections 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.

[44] 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.

[45] 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.

8.1.4 Conclusions and Recommendations

The evaluation team offers the following conclusions and recommendations for the MFMR Program based on the results of the PY2021 evaluation:

- **Conclusion #1:** Similar to PY2020, the current program tracking database does not include all the project data and inputs used to calculate ex ante energy and demand savings. Some detailed project data and other key information is only available in the project-specific Rebate Approval Forms ("RAFs"). Incorporating more information into the tracking database will improve the ability to track program activity and improve the efficiency of evaluation and other quality control measures.
  - **Recommendation #1:** We understand that the MFMR Program will be transitioning to a more prescriptive approach in PY2022. We recommend that program implementation staff incorporate all key parameters for prescriptive algorithms into the program-tracking database (e.g., existing thermostat type, leakage rate, and baseline wattage, which are currently included in the RAFs, but not in the database). For custom measures that might reference methods or assumptions outside the Ameren Missouri TRM, we recommend documenting the savings estimation methods and any key parameter assumptions used to estimate savings, including associated sources and/or justification when project-specific data or other customized methods are not available or used.
- **Conclusion #2**: The program completed 1,108 window replacements in PY2021, accounting for about 2.8% of all measure installations and 12.5% of ex post energy savings. The Ameren Missouri TRM does not currently include an algorithm to estimate savings for window replacements. As such, implementation staff applied an algorithm from the 2017 Missouri Statewide Commercial TRM and used site-specific parameters to calculate ex ante savings.
  - **Recommendation #2:** Assuming window replacements will continue to be a focus for the program in PY2022 and beyond, we recommend adding this measure to the Ameren Missouri TRM, along with standard assumptions for key parameters, given the program's transition to a more prescriptive model.
- **Conclusion #3:** Most discrepancies between ex ante and ex post savings are due to differences in the ISRs applied in the analyses. The evaluation team applied the ISRs outlined in Appendix F of the Ameren Missouri TRM in the ex post analysis. The ex ante analysis appeared to include a variety of ISRs from undocumented sources. We note that the current implementation model allows for the application of site-specific parameters in savings calculations, where available. It is unclear whether the implementation team was applying installation verification rates established through QA/QC visits as ISRs. If this is the case, we note that ISRs are not appropriate for site-specific values because ISRs are researched values that represent a combination of installation rates, equipment failures, and customer removal rates.
  - **Recommendation #3**: The program team should rely on the ISRs documented in Appendix F of the Ameren Missouri TRM in ex ante savings calculations.

8.2 Evaluation Methodology

The evaluation team performed both impact and process evaluation activities to assess the performance of the MFMR Program in PY2021. In addition to the overarching research objectives outlined for the Residential portfolio, the evaluation team explored the following MFMR Program-specific objectives:

- Obtain information on program design and planned implementation with a focus on differences from PY2020;

- Understand program staff and implementer perceptions, experiences, and expected program impacts;
- Characterize program participation with respect to the number and characteristics of participants and installed measures;
- Verify program-tracking data;
- Estimate the first year ex post gross and net energy (kWh) and demand (kW) savings; and
- Estimate last year ex post gross and net demand (kW) savings, by EUL category.

Table 76 provides an overview of the MFMR Program evaluation activities. Following the table, we outline program-specific aspects of key evaluation methodologies.

Table 76. PY2021 Evaluation Activities for the Multifamily Market Rate Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in the Fall of PY2021 to understand program staff's perspective 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 at 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.
Net Impact Analysis	▪ Applied PY2020 estimates of free ridership and participant spillover. ▪ Estimated PY2021 net impacts.

8.3 Evaluation Results

8.3.1 Process Results

The MFMR Program is designed to provide one-stop-shop services 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. To achieve this result, the program design includes various participation pathways, associated market actors, and points of intervention to meet customer's needs. The evaluation team provided detailed documentation of the nuanced program design and implementation strategy, as well as the customer participation experience, in the PY2020 Residential Portfolio Report. The following sections include a summary of PY2021 program design changes, challenges the program team experienced delivering the program, and impacts these challenges had on program performance.

Program Design Changes

COVID-19 restrictions implemented in PY2020 persisted into PY2021 for much of the year. These restrictions prevented program staff from entering occupied units. Similar to 2020, program staff attempted to drive program performance forward by focusing on common area work and vacant units. Additionally, program staff continued to leverage other tactics introduced in 2020 to reduce contact with customers, including offering virtual installation verifications and QA/QC inspections, and conducting real-time QA/QC inspections whenever possible. The COVID-19 restrictions were eventually lifted at the end of July, allowing the program team to resume the original design and implementation strategy.

In addition to the COVID-19 restrictions, the program team implemented several other design changes. The most impactful of which was the implementation of a pre-approval requirement for all program incentives. This requirement was critical in reducing potential risk from trade ally projects and allowing the program team to monitor program performance and activity more accurately. In prior program years, the lack of a pre-approval process allowed trade allies to act almost entirely autonomously from the program team. This created challenges for program staff as they tried to track program activity toward meeting savings goals and other performance metrics. The implementation team had minimal visibility into trade ally projects until after they were completed. Additionally, these projects were often limited in scope, so introduction of the pre-approval process allowed the implementation team an opportunity to influence projects early in the process and encourage more comprehensive scopes. This ultimately generated more work for the trade allies and strengthened their trust and allyship to the program. It also allowed the program team to have more insight into the project pipeline and monitor incentive budgets more effectively.

Lastly, program staff added new program requirements, such as burn hour requirements for certain lighting replacements, and publicized already existing requirements, such as per property incentive caps. These requirements were previously listed in the fine print of program participation agreements, but program staff sought to make these requirements more visible with the goal of creating more transparency about program eligibility and participation requirements.

Implementation Challenges

The limitation of project scopes to common areas and unoccupied units for much of the year directly impacted the measure mix and, by extension, the savings profile of completed projects. As illustrated in Table 74, the MFMR Program has unique performance targets for different levels of savings persistence (i.e., lifetimes). In a typical implementation environment, the MFMR Program design is aptly suited to meet these performance targets. The comprehensive approach of offering measures in both common areas and tenant units, as well as measures spanning several key enduses, allows program teams to scope projects that include a variety of measures and would deliver a blend of persisting savings. The ability of program staff to fully leverage this approach was inhibited, however, by the COVID-19 restrictions. Common area measures have distinctly different operating profiles than in-unit measures and these operating profiles have a direct impact on the lifetime of the measure. For example, LED lighting that is installed in a lobby is likely to be in-use for more hours a day than LED lighting installed in a bedroom. As a result, a light bulb installed in a lobby would likely have a shorter measure life than one installed in a tenant unit. Since most of the projects completed early in the year were limited to common area measures, this directly impacted the implementation team's ability to meet the program performance targets, specifically in the 10–14 and 15+ EUL categories.

In addition to limiting project scopes, the COVID-19 restrictions also delayed project timelines for property owners or managers that elected to hold out until they could receive the full services of the program. This led to a precipitous increase in program activity when the COVID-19 restrictions were lifted mid-year. Many projects closed at the very end of the year, resulting in a "hockey stick" pattern to project completions. These project completion delays were exacerbated by other challenges, as well. Following the lifting of the restrictions, the program team had to update program documentation and protocols, and gain approval, before they could return to the original program implementation strategy. In addition, it took time to re-engage with property managers who were previously interested in participating. Some property managers and owners had already re-allocated the funds they had earmarked for the MFMR Program to other projects, while others still had reservations about having program staff enter occupied units due to the persistence of the pandemic. Lastly, the supply chain disruptions resulting from the pandemic caused delays in procuring equipment, which further extended project timelines. All these factors led to delays in project completions and extended the ramp-up period to the return of the full program offering.

Program Performance

Despite the challenges introduced by the COVID-19 restrictions, the program achieved 87% of first year energy savings goals. Program staff reported that the introduction of the pre-approval process was helpful in allowing staff to influence project scopes early in the process to effectively balance the interests of the customer and the trade ally with program performance targets. This process required strong partnership and collaboration with the trade allies, which was fostered by discussions prompted through the pre-approval process. Program staff also reported that the program's incentive structure, which offers larger incentives for HVAC and other non-direct install measures, helped drive the uptake of longer-lived measures by effectively reducing the customer cost of these targeted measures. This is apparent in the number of HVAC and building shell measures delivered in PY2021. However, as previously mentioned, the limitations introduced by the COVID-19 restrictions directly impacted the program team's ability to deliver comprehensive projects for much of the year and inhibited their ability to develop project scopes specifically tailored to meet the program's demand savings targets. As a result, the program team struggled to drive demand savings in the various EUL categories; achieving 25%, 86%, and 76% of demand savings targets in the <10, 10-14, and 15+ categories.

Lastly, the one-stop-shop approach continued to serve as an attractive offering to customers. Program staff reported that property owners and managers appreciate this approach because program staff are there to help participants through every step of the participation process. In addition, for projects where ICAST served as the general contractor, they broke projects up into several phases, which helped drive program spend earlier in the year and allowed contractors and customers to get paid sooner, which made all involved parties more comfortable amid long project timelines.

8.3.2 Gross Impact Results

As presented in Table 77, the PY2021 MFMR Program achieved 3,780 MWh and 0.93 MW in ex post gross savings, resulting in realization rates of 100% and 101%, respectively.

Table 77. PY2021 Multifamily Market Rate Gross Impact Summary

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross
First Year Savings			
Energy Savings (MWh)	3,763	100%	3,780
Demand Savings (MW)	0.93	101%	0.93
Last Year Demand Savings			
< 10 EUL (MW)	0.06	114%	0.07
10–14 EUL (MW)	0.26	100%	0.26
15+ EUL (MW)	0.61	98%	0.59

The evaluation team completed analysis on the following program measures: common area lighting (Lighting BUS), in-unit lighting (Lighting RES), exterior lighting (EXT Lighting BUS), advanced thermostats and programmable thermostats (HeatCool), bathroom and kitchen faucet aerators and showerheads (Water Heating RES), windows and insulation (Building Shell RES), air source heat pumps and electronically commutated motors (HVAC RES), central air conditioners (Cooling BUS), HVAC controls (HVAC BUS), and pool pumps (Motors RES). The remainder of this section summarizes the evaluation team's ex post analysis. All calculation methodology, parameters, and assumptions are detailed in this section and sourced in Appendix

A. Table 78 summarizes the total PY2021 MFMR Program ex ante and ex post energy savings and realization rates by enduse.

Table 78. PY2021 Multifamily Market Rate Annual First Year Gross Impacts by Enduse

Enduse	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Gross Realization Rate	Ex Post (MW)
HeatCool	757	100%	757	0.15	100%	0.15
Water Heating RES	704	96%	680	0.06	96%	0.06
Lighting BUS	694	108%	747	0.13	108%	0.14
Lighting RES	482	96%	464	0.07	96%	0.07
Building Shell RES	514	100%	514	0.40	100%	0.40
HVAC RES	393	101%	397	0.05	105%	0.05
EXT Lighting BUS	106	102%	108	0.00	102%	0.00
HVAC BUS	107	100%	107	0.05	100%	0.05
Cooling BUS	3	100%	3	0.00	100%	0.00
Motors BUS	2	100%	2	0.00	100%	0.00
Total	**3,763**	**100%**	**3,780**	**0.93**	**101%**	**0.93**

Table 79 summarizes the MFMR Program's total PY2021 last year ex ante and ex post electric demand savings and realization rates by enduse and EUL class. The total ex post last year demand savings are 99% of the ex ante last year demand savings.

Table 79. PY2021 Multifamily Market Rate Program Annual Last Year Gross Demand Impacts by Enduse

Enduse	Ex Ante (MW)				Realization Rate	Ex Post (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Building Shell RES	0.00	0.00	0.40	0.40	100%	0.00	0.00	0.40	0.40
HeatCool	0.00	0.15	0.00	0.15	100%	0.00	0.15	0.00	0.15
Lighting BUS	0.06	0.04	0.03	0.13	108%	0.06	0.04	0.04	0.14
Lighting RES	0.00	0.00	0.07	0.07	96%	0.00	0.00	0.07	0.07
Water Heating RES	0.00	0.06	0.00	0.06	96%	0.00	0.06	0.00	0.06
HVAC BUS	0.00	0.00	0.05	0.05	100%	0.00	0.00	0.05	0.05
HVAC RES	0.00	0.00	0.05	0.05	76%	0.01	0.00	0.03	0.04
EXT Lighting BUS	0.00	0.00	0.00	0.00	102%	0.00	0.00	0.00	0.00
Cooling BUS	0.00	0.00	0.00	0.00	100%	0.00	0.00	0.00	0.00
Motors BUS	0.00	0.00	0.00	0.00	100%	0.00	0.00	0.00	0.00
Total	**0.06**	**0.26**	**0.61**	**0.92**	**99%**	**0.07**	**0.26**	**0.59**	**0.92**

Table 80 summarizes the MFMR Program's total PY2021 ex ante and ex post electric energy and demand savings and realization rates by measure category. The gross realization rates of 100% for electric energy savings and 101% for demand savings indicate the evaluated (ex post) gross savings achieved by the program are very similar to the program's tracked ex ante savings.

Table 80. PY2021 Multifamily Market Rate Electric Energy and Demand Savings by Measure Category

Measure Category	Quantity	Energy Savings			Demand Savings		
		Ex Ante (MWh)	Gross Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Gross Realization Rate	Ex Post (MW)
Advanced Thermostat	903	745	100%	745	0.14	100%	0.14
Business Lighting	1,971	694	108%	747	0.13	108%	0.14
In-Unit Lighting	19,177	482	96%	464	0.07	96%	0.07
Low-Flow Showerhead	1,259	466	95%	442	0.04	95%	0.04
Windows	1,108	472	100%	472	0.38	100%	0.38
Air Source Heat Pump	99	378	101%	382	0.04	106%	0.04
Low-Flow Faucet Aerator	2,491	238	100%	238	0.02	100%	0.02
Exterior Business Lighting	303	106	102%	108	0.00	102%	0.00
HVAC Controls	2	107	100%	107	0.05	100%	0.05
Ceiling Insulation	12,803	42	100%	42	0.02	100%	0.02
Electronically Commutated Motor	25	15	100%	15	0.01	100%	0.01
Programmable Thermostat	25	13	100%	13	0.01	100%	0.01
Central Air Conditioner	2	3	100%	3	0.00	100%	0.00
Pool Pump	1	2	100%	2	0.00	100%	0.00
Total	**40,169**	**3,763**	**100%**	**3,780**	**0.93**	**101%**	**0.93**

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:

- **Low-Flow Showerhead:** The gross realization rate for low-flow showerheads is 95% for both energy and demand savings.
  - Ex ante calculations applied an ISR of 100% for 601 showerhead records (57% of records) and an ISR of 89% for 462 records (43% of records). The evaluation team applied an ISR of 91% in ex post calculations, in accordance with the most recent version (v5.0) of Appendix F in the TRM. This reduced savings.
- **Air Source Heat Pump**: The gross realization rate for air source heat pumps is 101% for energy and 106% for demand savings.
  - Ex ante calculations applied site-specific existing SEER values to calculate savings for early replacement air source heat pumps. The evaluation team, in alignment with the methods outlined in the Ameren Missouri TRM, de-rated the existing SEER value for early replacement heat pumps by the age of the existing equipment, or otherwise by a default of 12 years, to account for the degradation of the performance of the existing equipment over time. This increased energy and demand savings.
  - For all time-of-sale (TOS) records, ex ante calculations assumed that the heating capacity was equal to the tracked cooling capacity, despite the fact that heating capacity was also tracked. The evaluation team applied the tracked heating and cooling capacities where appropriate. This increased energy savings. Additionally, ex ante calculations used a SEER of 8.69 for the baseline efficiency for all TOS records, which is indicative of an existing SEER value. Ex post calculations

applied code-compliant baseline SEER values from Appendix F v5.0 of the TRM. This reduced savings.

- **Lighting RES:** The gross realization rate for residential lighting measures is 96% for both energy and demand savings.
  - Ex ante calculations applied various ISRs (e.g., 93.12%, 96.18%, 100%) from unknown sources to 3,186 residential lighting records (90% of records). The evaluation team applied an ISR of 95.12% to all records in accordance with the most recent version (v5.0) of Appendix F of the TRM. This reduced savings.
- **Lighting BUS:** The gross realization rate for business lighting measures is 108% for both energy and demand savings.
  - For 34 records (76% of records), ex ante calculations applied the waste heat factor (WHF) and hours-of-use (HOU) assumptions for interior business lighting measures from the Business Deemed Savings Table in Appendix F v5.0 of the TRM. In most cases, the evaluation team applied the non-residential values for WHF and HOU from the MFMR Deemed Table in Appendix F v5.0 of the TRM. However, we adjusted the HOU applied in ex post calculations for interior lighting measures that are always on or only on at night. These HOU adjustments matched the values applied in the ex ante calculations. These updates increased both energy and demand savings.
  - Ex ante calculations applied ISRs from unknown sources (e.g., 94.0% and 97.6%) for four business lighting records (9% of records). The evaluation team applied an ISR of 100% in accordance with the most recent version (v5.0) of Appendix F of the TRM. This increased energy and demand savings.
- **EXT Lighting BUS**: The gross realization rate for exterior business lighting measures is 102% for both energy and demand savings.
  - Ex ante calculations applied ISRs from unknown sources (e.g., 97.0% and 97.6%) for two exterior business lighting records (17% of records). The evaluation team applied an ISR of 100% in accordance with the most recent version (v5.0) of Appendix F of the TRM. This increased savings.
- **Electronically Commutated Motors:** The gross realization rate for electronically commutated motors is 100% for both energy and demand savings. However, the evaluation team applied a different measure life in the ex post analysis than the program team applied in the ex ante analysis.
  - Ex ante calculations applied a measure life of 18 years for electronically commutated motors (ECMs). Ex post calculations applied a measure life of six years, representative of the remaining life of the existing equipment and in accordance with the Code of Federal Regulations that became effective in July 2019.

Additionally, several program-tracking data errors resulted in very small discrepancies at the measure level but did not have an impact on gross realization rates.

Net Impact Results

Net-To-Gross Ratio Results

The evaluation team relied on NTGR values from PY2020 for the PY2021 net savings estimations. No new research was conducted in PY2021. Table 81 presents the PY2021 MFMR Program NTGR, derived from the results of our PY2020 NTG analysis.

Table 81. PY2021 Multifamily Market Rate Program NTGR

Program	Free Ridership (FR)	Participant Spillover (PSO)	NTGR (1-FR+PSO)
MFMR Program	0.06	0.00	0.94

Net Impacts

In 2021, the MFMR Program saved 3,553 MWh and 0.88 MW of net energy and demand (Table 82).

Table 82. PY2021 Multifamily Market Rate Net Savings Summary

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/ Target Net	% of Goal/ Target
First Year Savings							
Energy Savings (MWh)	3,763	100%	3,780	94%	3,553	4,064	87%
Demand Savings (MW)	0.93	101%	0.93	94%	0.88	1.30	67%
Last Year Demand Savings							
< 10 EUL	*0.06*	*114%*	*0.07*	94%	*0.06*	*0.25*	*25%*
10–14 EUL	*0.26*	*100%*	*0.26*	94%	*0.24*	*0.28*	*86%*
15+ EUL	*0.61*	*98%*	*0.59*	94%	*0.56*	*0.73*	*76%*

Table 83 and Table 84 present the net impacts for the PY2021 MFMR Program by enduse and by EUL class.

Table 83. PY2021 Multifamily Market Rate Annual First Year Net Impacts by Enduse

Enduse	Energy Savings			Demand Savings		
	Ex post Gross Savings (MWh)	NTGR	Ex post Net Savings (MWh)	Ex post Gross Savings (MW)	NTGR	Ex post Net (MW)
HeatCool	757	94%	712	0.15	94%	0.14
Lighting BUS	747	94%	702	0.14	94%	0.13
Water Heating RES	680	94%	639	0.06	94%	0.06
Lighting RES	464	94%	436	0.07	94%	0.07
Building Shell RES	514	94%	483	0.40	94%	0.38
HVAC RES	397	94%	373	0.05	94%	0.05
EXT Lighting BUS	108	94%	102	0.00	94%	0.00
HVAC BUS	107	94%	101	0.05	94%	0.05
Cooling BUS	3	94%	3	0.00	94%	0.00
Motors BUS	2	94%	2	0.00	94%	0.00
Total	**3,780**	**94%**	**3,553**	**0.93**	**94%**	**0.88**

Table 84 shows the last year demand savings by measure by EUL class. The PY2021 MFMR Program delivered 0.86 MW of total last year ex post net demand savings.

Table 84. PY2021 Multifamily Market Rate Last Year Net Demand Impacts by Enduse

Enduse	Ex Post Gross Savings (MW)				NTGR	Ex Post Net Savings (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Building Shell RES	0.00	0.00	0.40	0.40	94%	0.00	0.00	0.38	0.38
HeatCool	0.00	0.15	0.00	0.15	94%	0.00	0.14	0.00	0.14
Lighting BUS	0.06	0.04	0.04	0.14	94%	0.06	0.04	0.04	0.13
Lighting RES	0.00	0.00	0.07	0.07	94%	0.00	0.00	0.06	0.07
Water Heating RES	0.00	0.06	0.00	0.06	94%	0.00	0.06	0.00	0.06
HVAC BUS	0.00	0.00	0.05	0.05	94%	0.00	0.00	0.05	0.05
HVAC RES	0.01	0.00	0.03	0.04	94%	0.01	0.00	0.03	0.03
EXT Lighting BUS	0.00	0.00	0.00	0.00	94%	0.00	0.00	0.00	0.00
Cooling BUS	0.00	0.00	0.00	0.00	94%	0.00	0.00	0.00	0.00
Motors BUS	0.00	0.00	0.00	0.00	94%	0.00	0.00	0.00	0.00
Total	**0.07**	**0.26**	**0.59**	**0.92**	**94%**	**0.06**	**0.24**	**0.56**	**0.86**

9. Appliance Recycling (RAR)

This section summarizes the PY2021 evaluation methodology and results for the Residential Appliance Recycling Program (RAR).

9.1 Evaluation Summary

The primary goal of the RAR Program is to promote the retirement and recycling of inefficient refrigerators, freezers, dehumidifiers, and room air conditioners from households by offering turn-in incentives and free pick-up services for operational equipment. The focus of the program is on refrigerators and freezers, but the program includes pick-up of working dehumidifiers and room air conditioners with the pick-up of a larger appliance.

The program also provides participants with energy-efficient kits containing LED lamps and domestic hot water measures, such as faucet aerators and low-flow showerheads. Ameren Missouri outsources program implementation to a turnkey service provider that manages processes from eligibility verification to proper disposal or recycling of turned-in appliances, as well as contributions to developing and implementing the program's marketing strategy. The program emphasizes the savings associated with retiring older, less efficient appliances as well as the benefits of proper disposal/recycling of those appliances.

Additionally, in PY2021, the program team introduced a limited-time Holiday Kits offering. Participation in the RAR program was lower than expected in PY2021 due to COVID-19 related program design changes. As a result, the program team had excess kits at the end of the year. The program team partnered with Emerson Electric and Kidsmart—two businesses in Ameren Missouri's service territory—to distribute energy efficiency kits to employees for the holidays. Recipients received the same installation instructions provided through the primary RAR channel.

We note that the RAR Program will be discontinued at the end of PY2021.

9.1.1 Participation Summary

In PY2021, a total of 1,948 unique customers recycled appliances through the Ameren Missouri RAR Program. All of these customers received energy efficiency kits, as well.[46] Table 85 shows the total number of recycled appliances and kit measures distributed.

Table 85. PY2021 Appliance Recycling Program Participation Summary

Measure Category	Participants		Measures		Ex Ante Savings	
	Number	%	Number	%	MWh	%
LED Lighting [a]	1,948	100%	7,824	30.3%	231	14.1%
Hot Water Pipe Insulation [b]	1,948	100%	5,868	22.8%	15	0.9%
Low-Flow Showerheads	1,948	100%	1,956	7.6%	53	3.3%
Dirty Filter Alarm	1,948	100%	1,956	7.6%	30	1.8%
Kitchen Faucet Aerator	1,948	100%	1,956	7.6%	25	1.5%
Bathroom Faucet Aerator	1,948	100%	1,956	7.6%	5	0.3%
Refrigerator Recycling (post-1990)	1,563	80.2%	1,624	6.3%	844	51.6%

[46] Eight participants received two energy efficiency kits.

Measure Category	Participants		Measures		Ex Ante Savings	
	Number	%	Number	%	MWh	%
Freezer Recycling	236	12.1%	244	0.9%	202	12.3%
Refrigerator Recycling (pre-1990)	205	10.5%	208	0.8%	212	13.0%
Dehumidifier Recycling	41	2.1%	47	0.2%	7	0.4%
Room Air Conditioner Recycling	32	1.6%	41	0.2%	12	0.8%

[a] Kits with LEDs include four bulbs per kit.
[b] Measure quantity represents total footage of pipe insulation at three feet per kit.

As noted above, Ameren Missouri also partnered with two local St. Louis employers to offer energy efficiency kits to their employees through the RAR Program. In total 1,210 participants received 13,310 energy efficiency measures through the kits. Table 86 shows the total number of participants who received kits by both local employers, and the ex ante savings for this offering associated with each.

Table 86. Holiday Kits Employer Participation

Organization	Participants		Measures		Ex Ante Savings	
	Number	%	Number	%	MWh	%
Emerson Electric	960	79%	10,560	79%	249	79%
Kidsmart	250	21%	2,750	21%	65	21%

9.1.2 Key Impact Results

The RAR Program implementers used a mix of regression-based and prescriptive algorithms to calculate PY2021 ex ante gross savings.[47] The methodology and equations can be found in the Ameren Missouri TRM v5.0. As the RAR Program will be discontinued following PY2021, the evaluation team took a streamlined approach to estimating ex post gross impacts for the program. We applied the gross measure-level realization rates from the PY2020 evaluation to PY2021 tracking data to estimate gross savings and applied measure-level NTGRs developed through a PY2019 participant survey to estimate net savings. Table 87 presents annual savings achieved in PY2021. As shown, the program achieved 40% of Ameren Missouri's net energy savings goal for RAR.

Table 87. PY2021 Appliance Recycling Program Impacts Summary

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/ Net	% of Goal/ Target
First Year Savings							
Energy Savings (MWh)	1,952	113.7%	2,220	60.4%	1,341	3,345	40%
Demand Savings (MW)	0.30	105.8%	0.32	55.3%	0.18	0.48	36%
Last Year Demand Savings							
< 10 EUL (MW)	0.18	132.9%	0.25	43.9%	0.11	0.48	22%
10–14 EUL (MW)	0.06	27.7%	0.02	150.7%	0.03	0	
15+ EUL (MW)	0.05	106.8%	0.05	75.3%	0.04	0	

[47] The refrigerator and freezer recycling calculations are regression-based, while the room air conditioner recycling, dehumidifier recycling, and kit measure calculations rely on prescriptive algorithms and assumptions.

Overall, the RAR Program was the seventh-largest program in the PY2021 Residential portfolio, accounting for 0.9% of ex post net residential portfolio energy savings and 0.3% of ex post net Residential portfolio demand savings.

9.1.3 Key Process Findings

As a key part of the PY2021 evaluation, we explored a set of evaluation questions required by the Missouri Code of State Regulations (CSR) for demand-side process evaluations. Table 88 includes our findings for each question:

Table 88. 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 imperfection the program addresses is residential customers' low impetus to remove old, inefficient refrigerators and freezers from the grid. Often customers will keep a spare refrigerator or freezer for secondary use or dispose of it in a way that it continues to be used as opposed to disposing of the appliance permanently.
Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	Yes. The evaluation team conducted a residential baseline study in 2019 that found that 37% of residents have a secondary refrigerator, an additional 8% have a third refrigerator, and 39% report the presence of a stand-alone freezer.[48] This indicates ample opportunity to achieve savings by removing these additional appliances from the grid. Participant survey responses indicate 29% of recycled appliances were primary units, which, in the absence of the program, a customer might retain for secondary use. Regarding appliance age, baseline data indicates that there are very few existing appliances of vintages earlier than 1990 (1% of primary refrigerators, 10% of secondary refrigerators, and 12% of secondary freezers). Participant survey data indicate that 36% of recycled units were manufactured earlier than 1990. Thus, the program is successfully motivating the recycling of these units.
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 allows refrigerators or freezers to be recycled, along with window air conditioners and/or dehumidifiers. In PY2021, 4% of recycled appliances were dehumidifiers and room air conditioners, demonstrating there is a small market for these additional measures to be recycled. During the PY2019 RAR participant survey, customers did not mention requests for additional measures to be included in the program.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	Yes. Ameren Missouri primarily advertises this program through bill inserts and direct e-mail campaigns. Based on PY2019 RAR participant survey responses, physical collateral is the primary mechanism through which responding participants reported hearing about the program.
What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select	Ameren Missouri can annually revisit program assumptions regarding the percent of equipment in residential use that was manufactured prior to 1990, the percent of equipment recycled that is primary vs. secondary, and the size of freezers recycled through the program.

[48] The evaluation team conducted a survey with 1,395 residential customers between July 31 and August 24, 2019, and in-home audits with a subsample of 120 baseline survey respondents between August 14 and September 25, 2019.

CSR Required Process Evaluations Questions	Findings
enduses/measure groups included in the Program?	

9.2 Evaluation Methodology

The evaluation team limited research efforts for the RAR Program to impact evaluation activities in PY2021. We explored the following RAR-specific objectives:

- Verify program-tracking data
- Estimate the first year ex post gross and net energy (kWh) and demand (kW) savings
- Estimate last year ex post gross and net demand (kW) savings, by EUL category

Table 89 provides an overview of the RAR Program evaluation activities we employed to address these research objectives. Following the table, we provide details on the impact methodology we used to estimate the gross and net savings for the program

Table 89. PY2021 Evaluation Activities for the Residential Appliance Recycling Program

Evaluation Activity	Description
Holiday Kits Program Staff Interview	▪ Conducted an interview with Ameren Missouri and Franklin staff at the end of PY2021 to understand the details of the Holiday Kits offering and other program-tracking data-related items.
Program Material Review	▪ Reviewed available program materials to inform evaluation activities.
Gross Impact Analysis	▪ Reviewed program database to check that program data are complete and program-installed measures meet all program requirements. ▪ Analyzed the program database to determine the measures recycling and distributed in 2021. ▪ Estimated ex post gross impacts using PY2020 realization rates.
Net Impact Analysis	▪ Applied PY2019 evaluation-derived estimates of free ridership, participant spillover, and non-participant spillover to estimate PY2021 net impacts.

Impact Methodology

To estimate PY2021 impacts for the RAR Program, including the Holiday Kits, Opinion Dynamics applied the measure-level gross realization rates and NTGRs from the PY2020 evaluation to the PY2021 tracking data to estimate gross and net savings. Table 90 includes the realization rates and NTGRs applied to each measure.

Table 90. Appliance Recycling Measure-Level Realization Rates and Net-to-Gross Ratios

Measure	Realization Rate (%)	NTGR
Hot Water Pipe Insulation	63%	0.671
LED 10W	107%	0.598
Bathroom Faucet Aerator	26%	0.795
Kitchen Faucet Aerator	24%	0.797
Low-Flow Showerheads	32%	0.732
Dirty Filter Alarm	25%	0.854

9.3 Evaluation Results

In the remainder of this section, we present the results of the impact evaluation.

9.3.1 Gross Impact Results

Gross Impact Results

Table 91 presents the RAR Program's annual savings achieved in PY2021; 2,220 MWh and 0.32 MW in ex post gross savings.

Table 91. PY2021 Appliance Recycling Program Gross Impact Summary

	Ex Ante	Realization Rate	Ex post
First Year Savings			
Energy Savings (MWh)	1,952	113.7%	2,220
Demand Savings (MW)	0.30	105.8%	0.32
Last Year Demand Savings			
< 10 EUL (MW)	0.18	132.9%	0.25
10–14 EUL (MW)	0.06	27.7%	0.02
15+ EUL (MW)	0.05	106.8%	0.05

To determine the ex post savings shown above, the evaluation team applied the measure-level gross realization rates from the PY2020 evaluation to the PY2021 tracking data to estimate ex post gross energy and demand savings. At the measure-level, ex post realization rates for energy and demand savings ranged from 24% to 154% in PY2020 (Table 92 and Table 93).

Table 92. PY2021 Appliance Recycling Program Annual 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)
Dirty Filter Alarm	30	25.0%	7	0.01	25.0%	0.00
Dehumidifier Recycling	7	100.0%	7	0.00	100.0%	0.00
Room Air Conditioner Recycling	12	100.0%	12	0.01	100.0%	0.01
Freezer Recycling	202	92.6%	187	0.03	92.6%	0.03
Refrigerator Recycling (pre-1990)	212	115.4%	245	0.03	115.4%	0.03
Refrigerator Recycling (post-1990)	844	154.4%	1,304	0.11	154.4%	0.17
LED Lighting	231	106.8%	246	0.03	106.8%	0.04
Bathroom Faucet Aerator	5	25.9%	1	0.00	25.9%	0.00
Kitchen Faucet Aerator	25	24.3%	6	0.00	24.3%	0.00
Low-Flow Showerheads	53	32.1%	17	0.00	32.1%	0.00
Hot Water Pipe Insulation	15	63.2%	10	0.00	63.2%	0.00
Appliance Recycling Total	*1,637*	*124.8%*	*2,043*	*0.24*	*119.7%*	*0.29*
Dirty Filter Alarm	65	25.0%	16	0.03	25.0%	0.01

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Realization Rate	Ex Post (MW)
LED Lighting	107	106.8%	115	0.02	106.8%	0.02
Bathroom Faucet Aerator	7	25.9%	2	0.00	25.9%	0.00
Kitchen Faucet Aerator	36	24.3%	9	0.00	24.3%	0.00
Low-Flow Showerheads	87	32.1%	28	0.01	32.1%	0.00
Hot Water Pipe Insulation	12	63.2%	7	0.00	63.2%	0.00
Holiday Kits Total	*314*	*56.3%*	*177*	*0.06*	*48.8%*	*0.03*
Total	**1,952**	**113.7%**	**2,220**	**0.30**	**105.8%**	**0.32**

Table 93. PY2021 Residential Appliance Recycling Program Annual Last Year Gross Demand Impacts

Measure Category	Ex Ante Gross Savings (MW)[a]				Gross Realization Rate	Ex post Gross Savings (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Dirty Filter Alarm	0.00	0.01	0.00	0.01	25.0%	0.00	0.00	0.00	0.00
Dehumidifier Recycling	0.00	0.00	0.00	0.00	100.0%	0.00	0.00	0.00	0.00
Room Air Conditioner Recycling	0.01	0.00	0.00	0.01	100.0%	0.01	0.00	0.00	0.01
Freezer Recycling	0.03	0.00	0.00	0.03	92.6%	0.03	0.00	0.00	0.03
Refrigerator Recycling (pre-1990)	0.03	0.00	0.00	0.03	115.4%	0.03	0.00	0.00	0.03
Refrigerator Recycling (post-1990)	0.11	0.00	0.00	0.11	154.4%	0.17	0.00	0.00	0.17
LED Lighting	0.00	0.00	0.03	0.03	106.8%	0.00	0.00	0.04	0.04
Bathroom Faucet Aerator	0.00	0.00	0.00	0.00	25.9%	0.00	0.00	0.00	0.00
Kitchen Faucet Aerator	0.00	0.00	0.00	0.00	24.3%	0.00	0.00	0.00	0.00
Low-Flow Showerheads	0.00	0.00	0.00	0.00	32.1%	0.00	0.00	0.00	0.00
Hot Water Pipe Insulation	0.00	0.00	0.00	0.00	63.2%	0.00	0.00	0.00	0.00
Appliance Recycling Total	*0.18*	*0.02*	*0.03*	*0.24*	*119.7%*	*0.25*	*0.01*	*0.04*	*0.29*
Dirty Filter Alarm	0.00	0.03	0.00	0.03	25.0%	0.00	0.01	0.00	0.01
LED Lighting	0.00	0.00	0.02	0.02	106.8%	0.00	0.00	0.02	0.02
Bathroom Faucet Aerator	0.00	0.00	0.00	0.00	25.9%	0.00	0.00	0.00	0.00
Kitchen Faucet Aerator	0.00	0.00	0.00	0.00	24.3%	0.00	0.00	0.00	0.00
Low-Flow Showerheads	0.00	0.01	0.00	0.01	32.1%	0.00	0.00	0.00	0.00
Hot Water Pipe Insulation	0.00	0.00	0.00	0.00	63.2%	0.00	0.00	0.00	0.00
Holiday Kits Total	*0.00*	*0.04*	*0.02*	*0.06*	*48.8%*	*0.00*	*0.01*	*0.02*	*0.03*
Total	**0.18**	**0.06**	**0.05**	**0.30**	**105.8%**	**0.25**	**0.02**	**0.05**	**0.32**

[a] Some values are too small to be shown in this table in megawatts, values do exist in kilowatts.

9.3.2 Net Impact Results

Net-To-Gross Ratio Results

The evaluation team relied on NTGR values from PY2019 for PY2021 net savings estimations. No new research was conducted in PY2021. Table 94 presents the results of our NTG analysis from PY2019.

Table 94. PY2021 Residential Appliance Recycling Program Measure-Level Net-to-Gross Ratio

Measure Category	Measure-Level Respondents	Free Ridership (FR)	Participant Spillover (PSO)	NTGR (1-FR+PSO)
Freezer	46	58.1%	4.4%	46.9%
Refrigerator	143	62.6%	4.4%	42.3%
Room Air Conditioners and Dehumidifiers (Ex Post Savings Weighted Appliance Value)		61.3%	4.4%	43.6%
Bathroom Faucet Aerators	149	21.6%	1.2%	79.6%
Dirty Filter Alarm	149	15.7%	1.2%	85.5%
Kitchen Faucet Aerators	149	21.4%	1.2%	79.8%
LED Light Bulbs	86	40.2%	0.0%	59.8%
Low-Flow Showerheads	149	28.0%	1.2%	73.2%
Pipe Insulation (Hot Water)	149	34.1%	1.2%	67.1%

Source: Ameren Missouri Program Year 2019 Annual EM&V Report. Volume 2: Residential Portfolio Report

Net Impacts

The evaluation team applied the 2019 NTGRs to determine net impacts for the PY2021 RAR Program. In 2021, the RAR Program saved 1,341 MWh of net energy and 0.18 MW of net demand (Table 95 and Table 96).

Table 95. PY2021 Residential Appliance Recycling Program Annual First Year Net Impacts

Measure Category	Energy Savings			Demand Savings		
	Ex post Gross Savings (MWh)	NTGR	Ex post Net Savings (MWh)	Ex post Gross Savings (MW)	NTGR	Ex post Net (MW)
Dirty Filter Alarm	7	85.4%	6	0.00	85.4%	0.00
Dehumidifier Recycling	7	43.1%	3	0.00	43.1%	0.00
Room Air Conditioner Recycling	12	43.1%	5	0.01	43.1%	0.01
Freezer Recycling	187	46.4%	87	0.03	46.4%	0.01
Refrigerator Recycling (pre-1990)	245	41.8%	102	0.03	41.8%	0.01
Refrigerator Recycling (post-1990)	1,304	41.8%	545	0.17	41.8%	0.07
LED Lighting	246	59.8%	147	0.04	59.8%	0.02
Bathroom Faucet Aerator	1	79.5%	1	0.00	79.5%	0.00
Kitchen Faucet Aerator	6	79.7%	5	0.00	79.7%	0.00
Low-Flow Showerheads	17	73.2%	13	0.00	73.2%	0.00

Measure Category	Energy Savings			Demand Savings		
	Ex post Gross Savings (MWh)	NTGR	Ex post Net Savings (MWh)	Ex post Gross Savings (MW)	NTGR	Ex post Net (MW)
Hot Water Pipe Insulation	10	67.1%	6	0.00	67.1%	0.00
Appliance Recycling Total	*2,043*	*45.1%*	*921*	*0.29*	*45.5%*	*0.13*
Dirty Filter Alarm	16	85.4%	14	0.01	85.4%	0.01
LED Lighting	115	59.8%	69	0.02	59.8%	0.01
Bathroom Faucet Aerator	2	79.5%	2	0.00	79.5%	0.00
Kitchen Faucet Aerator	9	79.7%	7	0.00	79.7%	0.00
Low-Flow Showerheads	28	73.2%	20	0.00	73.2%	0.00
Hot Water Pipe Insulation	7	67.1%	5	0.00	67.1%	0.00
Holiday Kits Total	*177*	*65.7%*	*116*	*0.03*	*68.5%*	*0.02*
Non-Participant Spillover			304			0.02
Total or Weighted Average	**2,220**	**60.4%**	**1,341**	**0.32**	**55.3%**	**0.18**

Table 96. PY2021 Residential Appliance Recycling Program Last Year Net Demand Impacts

Measure/Enduse	Ex Post Gross Savings (MW)				NTGR	Ex Post Net Savings (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Dirty Filter Alarm	0.00	0.00	0.00	0.00	85.4%	0.00	0.00	0.00	0.00
Dehumidifier Recycling	0.00	0.00	0.00	0.00	43.1%	0.00	0.00	0.00	0.00
Room Air Conditioner Recycling	0.01	0.00	0.00	0.01	43.1%	0.01	0.00	0.00	0.01
Freezer Recycling	0.03	0.00	0.00	0.03	46.4%	0.01	0.00	0.00	0.01
Refrigerator Recycling (pre-1990)	0.03	0.00	0.00	0.03	41.8%	0.01	0.00	0.00	0.01
Refrigerator Recycling (post-1990)	0.17	0.00	0.00	0.17	41.8%	0.07	0.00	0.00	0.07
LED Lighting	0.00	0.00	0.04	0.04	59.8%	0.00	0.00	0.02	0.02
Bathroom Faucet Aerator	0.00	0.00	0.00	0.00	79.5%	0.00	0.00	0.00	0.00
Kitchen Faucet Aerator	0.00	0.00	0.00	0.00	79.7%	0.00	0.00	0.00	0.00
Low-Flow Showerheads	0.00	0.00	0.00	0.00	73.2%	0.00	0.00	0.00	0.00
Hot Water Pipe Insulation	0.00	0.00	0.00	0.00	67.1%	0.00	0.00	0.00	0.00
Appliance Recycling Total	*0.25*	*0.01*	*0.04*	*0.29*	*45.5%*	*0.10*	*0.01*	*0.02*	*0.13*
Dirty Filter Alarm	0.00	0.01	0.00	0.01	85.4%	0.00	0.01	0.00	0.01
LED Lighting	0.00	0.00	0.02	0.02	59.8%	0.00	0.00	0.01	0.01
Bathroom Faucet Aerator	0.00	0.00	0.00	0.00	79.5%	0.00	0.00	0.00	0.00
Kitchen Faucet Aerator	0.00	0.00	0.00	0.00	79.7%	0.00	0.00	0.00	0.00
Low-Flow Showerheads	0.00	0.00	0.00	0.00	73.2%	0.00	0.00	0.00	0.00
Hot Water Pipe Insulation	0.00	0.00	0.00	0.00	67.1%	0.00	0.00	0.00	0.00
Holiday Kits Total	*0.00*	*0.01*	*0.02*	*0.03*	*68.5%*	*0.00*	*0.01*	*0.01*	*0.02*
Non-Participant Spillover						0.00	0.01	0.01	0.02
Total or Weighted Average	**0.25**	**0.02**	**0.05**	**0.32**	**55.3%**	**0.11**	**0.03**	**0.04**	**0.18**

10. Pay As You Save (PAYS)

This section summarizes the PY2021 evaluation methodology and results for Ameren Missouri's Pay as You Save (PAYS) Program. Additional details on the methodologies are presented in Appendix A. Data collection instruments are included in Appendix C.

10.1 Evaluation Summary

10.1.1 Program Description

The PAYS program is a tariff on-bill financing offering that launched in PY2021. The program provides packages of energy efficiency measures, among them LEDs, domestic hot water, insulation, air sealing, and HVAC, to residential customers. The 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 pay back remains with the premises, 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 monthly loan payments are structured to allow for the expected energy savings to outweigh the project cost, thus resulting in an overall lower monthly utility bill for participants 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 anticipated given 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. Participation in the PAYS Program is classified into three tiers.

- **Tier 1:** Once enrolled, the implementer schedules an in-person appointment at the customer's home. At the appointment, a data collector conducts a visual inspection of the home, provides more information about the program, and may provide the participant with direct install measures.
- **Tier 2:** If the home lacks health and safety issues and the participant chooses to move forward, the implementer conducts a home assessment where a data collector completes an energy analysis of the home, considering building characteristics, HVAC system specifications, and direct air and duct leakage tests.
- **Tier 3:** The data from the home assessment is entered into a proprietary version of OptiMiser modeling software to estimate savings associated with upgrading measures in the home. Participants receive an Easy Plan outlining recommended upgrades and, if the project does not meet the program's 80/20 rule on its own, are quoted a copay needed to move forward under program requirements. For participants who accept the plan, the program team then works with a network of trade allies to install the measures, and a tariff charge is placed on the participant's bill. The implementer conducts quality control remotely for 100% and on-site for 10% of Tier 3 projects.

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.

10.1.2 Participation Summary

In PY2021, the PAYS Program completed 548 Tier 1 projects, 350 Tier 2 projects, and 75 Tier 3 projects, as summarized in Table 97. Overall, about half of those customers who expressed an interest by enrolling online scheduled a home inspection and received direct install measures. Most interested customers did not achieve the deep savings associated with Tier 3 measures, as they chose not to move forward with a home assessment and Easy Plan or elected not to install the recommended measures with financing through the PAYS Program. Ultimately, 7% of the initial enrolled customers installed Tier 3 measures in PY2021. At the end of PY2021, 66 projects were closed out, with the tariff charge applied to the participant's bill.

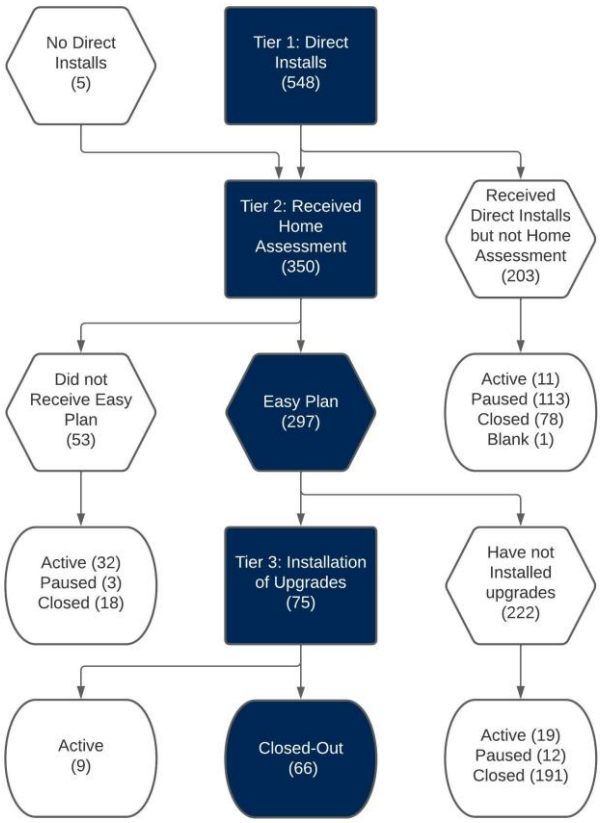
Table 97. PY2021 PAYS Program Participation Summary

Project Status	Total Count	% of Enrolled	% Completing Previous Step
Enrolled[a]	1,048	100%	100%
Tier 1: Visual Inspection of Home and Receipt of Direct Installs[b]	550	52%	52%
Tier 2: Completed Home Assessment	350	33%	64%
Received Easy Plan[c]	297	28%	85%
Tier 3: Complete Installs	75	7%	25%
Closed Projects	66	6%	88%

[a] Two records were identified that had a direct install date, but no enrollment date; they are included in enrollment count.
[b] In the case of discrepancies between the Home Assessment and Direct Install Reports provided by the implementer, we defaulted to the Direct Install Report.
[c] Customers who received an Easy Plan in 2022 were counted as Tier 2 participants with an "active" status for the purposes of PY2021 evaluation. Additionally, one customer who received an easy plan in 2021 but a home assessment in 2022 was counted as enrolled but not a Tier 2 participant in PY2021.

Figure 7 demonstrates the path participants take through the PAYS Program, with the expected participant path shaded in blue. This visual representation of the customer journey through the PAYS Program highlights that customers attrit at key decision points in the process. The largest proportion of attrition occurs after customers receive their Easy Plan, which is a key stage when customers need to make two decisions: (1) Whether to do all, some, or none of the recommended upgrades and whether to finance recommended upgrades through an on-bill tariff model. As part of this evaluation, we conducted research with partial participants who received an Easy Plan did not complete a Tier 3 PAYS project to better understand the reasons for their decision not to move forward. Findings from this research are covered in Section 10.3.1 of this report. The second largest attrition occurs when customers enroll online but do not follow-through with scheduling an in-person home assessment. In addition, there are participants at each stage of the process whose projects remain active or are paused, suggesting that a portion of the projects were started but not completed in PY2021, and may still be completed in the future.

Figure 7. Customer Participation Flow Chart



In PY2021, nearly all Tier 3 participants were homeowners, and none of them lived in multifamily homes. Most participants' primary heating fuel was electric. Of closed-out Tier 3 projects, 70% required a copay to meet the 80/20 rule, with an average copay of $2,912. Additional characteristics of Tier 3 participants with closed projects (n=66) are summarized in Table 98.

Table 98. Tier 3 Participant Summary

Characteristic	Number of Tier 3 Participants	Percent of Tier 3 Participants
Primary Heating Fuel		
Electric	49	74%
Gas	17	26%
Owner/Renter Status		
Owner	65	98%
Renter	1	2%
Copay Details		
Not Required	20	30%
Required	46	70%
Average Amount (when required)	$2,912	

Additional information on PY2021 PAYS participants is provided in Appendix A.

10.1.3 Key Impact Findings

Table 99 represents the annual savings reported for PY2021 across Tier 1 direct install measures and Tier 3 projects. The table shows ex ante savings and adjusted ex ante savings, which reflect corrections to reporting errors. The ex ante values for Tier 1 measures are deemed, whereas ex ante values for Tier 3 measures are project-specific and custom calculated using the OptiMiser software. Since the evaluation team did not complete a full impact evaluation for this new program, we do not report evaluated ex post savings for PY2021. Appendix A includes additional analysis of the measure-level savings associated with the PAYS program, including re-calculated values, where appropriate.

Table 99. PY2021 PAYS Program Impact Summary

Tier	Participants	Total Ex Ante Gross Savings (kWh)	Total Ex Ante Gross Savings (kW)	Average Ex Ante Gross Savings per Project (kWh)	Average Ex Ante Gross Savings per Project (kW)
Ex Ante Savings					
Tier 1[a]	550	125,115	210.21	227	0.38
Tier 3[b]	66	545,370	62.26	8,263	0.94
Total (As Reported)		**670,485**	**272.46**		
Adjusted Ex Ante Savings[c]					
Tier 1[a]	550	125,115	15.64	227	0.03
Tier 3[b]	66	545,370	62.26	8,263	0.94
Total (As Reported with Corrections)		**670,485**	**77.90**		

[a] Includes Tier 1 from the Direct Install Report for Tier 1-only participants plus Tier 1 measure savings from the Post Retrofit report for Tier 3 participants.
[b] Tier 3 measure savings as reported in the Post Retrofit Report.
[c] The evaluation team adjusted savings for one data entry error that significantly overstated the Direct Install kW savings.

Table 100. PY2021 PAYS Program Savings Compared to Targets[a]

Savings Metric	Adjusted Ex Ante Gross[b]	Target	% Target Achieved
Electric Savings (MWh)	670	4,367	15%
Demand Savings (MW)	0.08	2.04	4%

[a] PY2021 PAYS targets are not included in residential or portfolio totals and do not apply to portfolio targets or earnings opportunity in PY2021: Ameren Missouri 2019-21 MEEIA Energy Efficiency Plan, Appendix A – Portfolio and Program Summary.

[b] Adjusted Ex Ante includes a correction to one data entry error that significantly overstated the Direct Install kW savings.

In PY2021, the PAYS Program goal was to provide $5 million in financing to eligible customers. Table 101 summarizes the program's performance against this goal.

Table 101. PY2021 PAYS Performance Against Financing Goal

Metric	Value
Financing Target	$5,000,000
Financing Provided	$334,778
% Target Achieved	7%

Key impact findings from the PY2021 PAYS Program evaluation include:

Program-Tracking Data

- The Direct Install Report includes aggregated Tier 1 savings for each participant and does not report savings by Tier 1 measure type. This reporting approach made it difficult to determine and assess the energy and demand savings claimed for each direct install measure type.
- The evaluation team observed several program-tracking issues that program staff should address to improve the accuracy of ex ante savings estimates. They include:
  - The Direct Install Report included a data entry error that overstated Tier 1 measure kW savings by about 1334%. The evaluation team corrected this error in the "adjusted ex ante savings" reported in the tables above.
  - Both the Direct Install Report and the Post Retrofit Report included quantities and energy and demand savings for Tier 1 measures installed for Tier 3 participants. Measure quantities for these participants matched between reports in all but six instances. There are inconsistencies in the reported savings at the participant level; however, caused by differing measure-level deemed savings values used in the Direct Install and Post Retrofit reports.
  - The evaluation team noted two participants for which the Direct Install Report showed Tier 1 measure(s) installed but reports no savings.
  - The Post Retrofit Report does not include energy or demand savings for water heater pipe wrap measures.
- The reported ex ante savings for Tier 1 direct install measures used deemed savings values consistent with the Ameren Missouri TRM for a majority, but not all, of the Tier 1 measures and participants. Although measure-level savings were not reported for Tier 1 measures in the Direct Install Report, the evaluation team was able to determine that a range of energy and demand savings values were used for several Tier 1 measures. When the evaluation team recalculated Tier 1 savings using the Ameren Missouri TRM deemed savings values, the recalculated energy and demand savings were 97% and 98% of the adjusted ex ante savings, respectively.
- The deemed ex ante savings value for direct install smart strip measures matches the Ameren Missouri TRM deemed savings value for Tier 1 advanced power strips installed in a home office. Savings for advanced power strips may be higher for Tier 2 advanced power strips as well as advanced power strips controlling home entertainment systems.[49] Through documentation provided by the program team, the evaluation team learned advanced power strips can be installed in either an entertainment system or office setup. The program team should record the type and location of advanced power

[49] Here we refer to smart strip model tiers rather than measure tiers associated with the PAYS Program specifically. Tier 2 advanced power strips have a countdown period and sensor to monitor usage of the connected electronic devices. If the sensor does not detect activity or motion during the countdown period, or the device is turned off, the electronics plugged into the smart strip will automatically shut off to save additional energy.

strips installed for PAYS and consider updating the deemed savings value(s) for this direct install measure.

Ex Ante Savings Estimates

- For the PY2021 PAYS Program, the adjusted ex ante savings for Tier 1 measures (for 548 unique participants) comprised about 20% of the total adjusted ex ante savings, and the Tier 3 measures (for 66 unique participants) accounted for 80% of the total PAYS adjusted ex ante savings.
- The most common Tier 1 direct install measure was advanced power strips, which 97% of Tier 1 participants received. Most Tier 1 direct install measures were distributed far less frequently; however, and LEDs and advanced power strips were the only measure types received by more than 20% of Tier 1 participants.
- The reported Tier 3 savings ranged from 6% to 51% (average 29%) of the estimated baseline whole home consumption for homes with electric heat and range from 1% to 31% (average 16%) for homes with natural gas heating.
- The reported Tier 3 savings ranged from 13% to 127% (average 68%) of the estimated baseline total HVAC consumption for homes with electric heat and range from 1% to 101% (average 34%) for homes with natural gas heat. For 11 participants, the estimated Tier 3 savings exceeded the estimated total baseline HVAC consumption, suggesting the reported Tier 3 savings may be overstated.
- The reported total Tier 3 savings were similar to the energy savings calculated using TRM algorithms with a static baseline. The Tier 3 measures are highly interactive; however, and failure to account for those interactions can result in overstated savings. The total reported Tier 3 savings were higher than the TRM algorithms with an adjusted baseline to account for interactively, suggesting the modeled savings may be overstated.

10.1.4 Key Process Findings

Key process findings from the PY2021 PAYS Program evaluation are detailed below.

Participant Experience

- Tier 2 participants who received an Easy Plan but did not proceed to Tier 3 were generally very satisfied with aspects of the program in which they participated, including the home assessment and direct install measures.
- Although these participants did not move forward with their Easy Plan, many have made, or plan to make, some portion of the recommended upgrades outside of the program, suggesting that many find the recommendations valuable in informing their energy upgrades.
  - Over half of respondents were dissatisfied with the recommendations in their Easy Plan; however, citing they felt the recommendations were incomprehensive or that they received varied from recommendations received from other contractors.
- Although Tier 2 participants mentioned the opportunity to save energy and finance upgrades as key features that initially attracted them to the PAYS program, satisfaction with financing options and the expected energy savings were low.
  - Tier 2 participants most frequently reported that the copay and overall cost of the installs prevented them from choosing to complete Tier 3 upgrades. Ninety-four percent of Tier 2

participants who received an Easy Plan but did not proceed with installation in PY2021 (n=222) had projects that required a copay to proceed, with an average copay amount of $3,877.

- Some participants reported that they would have to finance their copay to participate, while others did not find value in the financing service and would prefer to pay for the whole project up front.
- Additionally, participants reported that the projected energy savings were insufficient to motivate them to complete the project, particularly given the higher-than-expected copays.

Trade Ally Experience

- Trade allies reported high overall satisfaction with Ameren Missouri and were satisfied with the training provided for the PAYS Program, as well as the scheduling workflows.
- Some trade allies provided feedback that recommendations could be better tailored to local building stock and heating sources and that they would like to have the ability to weigh-in on recommendations.
  - Trade allies reported they could provide participants with more complete service if the PAYS Program were to allow for gas measure installs. This would save the participant money by allowing them to complete comprehensive installs in one project rather than two.
  - Trade allies believed that recommendations do not always maximize savings for participants, both due to the lack of gas measures and non-comprehensive recommendations.
- Trade allies reported a lag time in payment, which is a burden to trade allies and could prove to be a barrier for some moving forward. Most trade allies reported that the PAYS Program made up a small portion of their work and that the volume of projects they received was lower than expected.

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 102.[50]

Table 102. 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. ▪ 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 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.

[50] 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
	▪ 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. ▪ Our PY2021 interviews found the targeted marketing was not performing as expected. As a result, the program team was considering introducing an additional mass marketing strategy with modified messaging. Rather than advertising the PAYS Program as having "no upfront cost," it would state that PAYS could help to "offset your upgrade." This would extend the target market to customers that could afford a copay to meet the 80/20 rule rather than just trying to target customers that would qualify with little to no upfront cost.
Does the mix of derive measures included in the program appropriately reflect the diversity of derive energy service needs and existing derive technologies within the target market segment?	▪ The PAYS program includes a mix of derive measures that are customized based on the needs of each home. The upgrades include the installation of LEDs, domestic hot water, insulation, HVAC, and air sealing measures, among others. ▪ In our interviews we found the lack of natural gas-derived technologies in the program did not reflect the diversity of the energy needs within the target market segment. Given the prevalence of gas heating in Ameren Missouri territory, the program could benefit from including natural gas-derived technologies. We note that in PY2021, serving natural gas customers was not allowed based on the tariff that the PAYS Program was operating under and that Ameren Missouri staff indicated this is being planned for future years.
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.
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?	▪ Given the high prevalence of gas heat in Missouri and the importance of HVAC savings in qualifying projects under PAYS 80/20 savings rules, the program should consider gas co-delivery to maximize eligibility and associated savings. ▪ After addressing this issue, the program would be positioned to implement targeted marketing strategies among renters/landlords and moderate-income residents who the PAYS Program is situated to serve.

10.1.5 Conclusions and Recommendations

- **Conclusion:** The PAYS Program demonstrates the potential to generate substantial savings for participants who install Tier 3 upgrades. Savings projections for Tier 1 measures are generally consistent with the Ameren Missouri TRM and, on average, are about 1% of participants' whole home annual consumption. Savings projections for Tier 3 measures are significant and represent, on average, a 25% reduction in whole home annual consumption. Estimated savings for Tier 3 projects are generally reasonable on average but may be too high or low in certain cases.
  - **Recommendation:** Ensure Tier 1 direct install measure savings associated with Tier 3 projects are not double-counted. Both the Direct Install and Post Retrofit reports include Tier 1 savings for customers who participated in both the Tier 1 and Tier 3 levels. A simple sum of the savings in these two reports would duplicate savings for these Tier 1 measures.

- **Recommendation:** Ensure that modeled savings account for interactive effects among Tier 3 weatherization and HVAC measures. For example, the implementer should consider reviewing cases where projected savings exceed 40% of baseline consumption to ensure accuracy.

- **Conclusion:** Program-tracking data is generally complete, although there are opportunities to make reporting more comprehensive and consistent to ensure accurate reporting of ex ante savings.
  - **Recommendation:** The program team should apply a consistent and transparent savings approach for Tier 1 measures (e.g., deemed for Tier 1 participants and modeled for Tier 3 participants to capture interactive effects, deemed for all participants). Where deemed savings are used, the savings should be consistent for Tier 1 and Tier 3 participants and consistent with the Ameren Missouri TRM. Savings should generally be reported by measure rather than project.
  - **Recommendation:** Consider adding an Ameren Missouri TRM section specifically for PAYS direct install measures to document the deemed savings values for Tier 1 measures.
  - **Recommendation:** Ensure savings are claimed for all installed measures, and record details about advanced power strip type and location to enable claiming accurate and maximum savings.

- **Conclusion:** While enrollment data suggests a high level of interest in the PAYS Program, it is ultimately reaching fewer customers than intended, particularly for Tier 3 measures that support the deepest savings. Many Tier 2 participants reported they found both the up-front and overall cost of the project prohibitive. The high level of attrition between receipt of Easy Plan and Tier 3 installations suggests that this perception may be generalizable beyond the interviewed participants. At the same time, many Tier 2 participants reported plans to move forward with recommended upgrades outside the PAYS Program, suggesting that they find the recommendations valuable. The PAYS Program is also achieving limited reach among the segments it is uniquely positioned to serve, such as renters and landlords.
  - **Recommendation:** Minimize copays through more precise customer targeting and/or by moving forward with plans to incorporate gas measures. To the extent that copays remain a reality of the PAYS Program, manage expectations through marketing materials, particularly among customer segments that are likely to incur a copay.
  - **Recommendation:** Consider consistently tracking reasons for project abandonment to better understand barriers to Tier 3 participation.
  - **Recommendation:** Consider targeted marketing among renter and landlord populations, including in multifamily residences, since this is one of the primary market imperfections that the PAYS Program is positioned to address.

- **Conclusion:** While some customers value the financing options associated with the PAYS Program, others who enrolled in PY2021 did not necessarily require or value this component. PAYS may be attracting some customers who are better suited for other Ameren Missouri offerings (e.g., Heating and Cooling Program) and who may be unaware of the central role of financing in the program.
  - **Recommendation:** Consider following up with customers who receive an Easy Plan but do not move onto Tier 3 to determine if they are interested in installing the recommended measures without the financing offered by PAYS and direct them to other Ameren Missouri programs.

10.2 Evaluation Methodology

Given that PY2021 is the first year of the program's implementation, evaluation efforts focused on completing a comprehensive review of program processes and a high-level impact review. Activities included process research, reviewing program-tracking data and systems, and assessing the program team's impact estimation

approach and the associated ex ante savings for consistency and reasonableness. In addition to the overarching research objectives outlined for the Residential Portfolio, the evaluation team explored the following PAYS Program-specific objectives:

- Characterizing the participant experience by documenting aspects of the program implementation that went well, those that may be improved in future program years, and participant satisfaction
- Describing participating trade allies' experiences with the program and documenting any barriers (from the trade allies' perspectives) to program delivery
- Exploring how availability of financing may contribute to participants' willingness to install deeper savings measures and comprehensive energy efficiency projects
- Reviewing program-tracking data for accuracy and completeness
- Assessing the program team's impact estimation approach and the associated ex ante savings for consistency and reasonableness.

Table 103 provides an overview of the PAYS Program evaluation activities. Following the table, we outline program-specific aspects of key evaluation methodologies.

Table 103. PY2021 Evaluation Activities for the PAYS Program

Evaluation Activity		Description
1	Program Manager and Implementer Interviews	▪ Conduct interviews to understand program design, staff's perspective on program implementation, and any changes that occurred throughout PY2021. ▪ Probe to identify early program successes, challenges, and program performance.
2	Program Material Review	▪ Review program materials to inform evaluation activities.
3	Participant Interviews	▪ Complete 12 interviews with PY2021 participants that did not proceed with recommended upgrades to explore drivers, barriers, participant experiences with the program, and satisfaction.
4	Trade Ally In-Depth Interviews	▪ Complete in-depth interviews with a sample of participating trade allies.
5	Impact Review	▪ Review program-tracking data for accuracy and completeness. ▪ Assess the reasonableness of reported ex ante savings and consistency with the Ameren Missouri TRM, where appropriate.

10.2.1 Participant Interviews

The evaluation team conducted participant interviews late in 2021 for the PY2021 evaluation. Interviews were conducted with Tier 2 participants who received an Easy Plan, outlining recommended upgrades and copay amounts, but did not move forward with installing the recommended upgrades, according to program-tracking data. This segment of participants was targeted to provide input on the experience with the home assessment and Easy Plan, drivers of participation, and importantly, barriers to proceeding with the upgrades. The evaluation team offered an incentive of $20 to those who completed the phone interview. In all, we completed 12 participant interviews. Findings on participant experience, motivations, and barriers resulting from these interviews provide Ameren Missouri with early feedback that can help them to improve program implementation and increase Tier 3 participation levels in future years.

Overall, the Tier 2 participant interviews were intended to achieve the following goals:

- Understand and assess program processes
- Explore experiences with the aspects of the program in which the customer participated:
  - Home assessment enrollment and schedule
  - Home assessment and direct installs
  - Easy Plan receipt and review
- Measure participant satisfaction with program offerings and processes
- Explore the role of financing in participants' consideration of installing comprehensive retrofits
- Identify reasons participants did not move forward with the recommended changes

10.2.2 Trade Ally Interviews

The evaluation team conducted in-depth interviews with participating trade allies. We worked with the program team to obtain a list of participating trade allies. A total of three trade allies had completed at least one project and were still active in the PAYS program when interviews were conducted in late 2021. The evaluation team offered an incentive of $150 to those who completed the phone interview. In all, we completed three trade ally interviews. The interviewed trade allies were responsible for 100% of the PAYS projects that had been closed out at the time of the interviews.[51]

The goals of these interviews were to

- Assess trade ally satisfaction and experience with program components such as training and marketing;
- Highlight both challenges and successes in delivering the program to Ameren Missouri participants in its first year; and
- Identify opportunities to improve the PAYS program in future years, from the perspective of participating trade allies.
- Table 104 summarizes the specialties of PAYS trade allies that were interviewed as part of this task.

Table 104. Trade Ally In-Depth Interviews Completed Summary

Trade Ally Type	Trade Allies Interviewed	Total Active Trade Ally Population
Weatherization	0	0
HVAC	1	1
Weatherization and HVAC	2	2
Total	**3**	**3**

[51] As of the end of PY2021, we identified two additional trade allies in the project database. One trade ally had never closed out a project and the other was new to the PAYS program, having joined very late in 2021.

10.2.3 Impact Analysis

The PAYS impact analysis for PY2021 consisted of a review of the program-tracking data and ex ante savings estimates. We also worked with the PAYS team to understand and assess the methods and models used to estimate measure-level and project savings.

Assessment of Savings Estimation Approach

Through interviews with program staff and implementers, the evaluation team obtained an understanding of the models used by the PAYS team to recommend measures, estimate savings, and ultimately qualify projects to move forward with or without a copay. Although the evaluation team could not review individual model inputs or algorithms due to their proprietary nature, we received an informational overview of the software used by the program team and gathered information from the program team on the types of inputs the model uses.

Review of Program-Tracking Data

The evaluation team reviewed program-tracking data reports for completeness and accuracy. We reviewed three reports: Direct Install Report, Post Retrofit Report, and Key Assessment Data Report. These reports include data collected on participant and household characteristics, key equipment characteristics, implemented Tier 1 and Tier 3 savings measures, and ex ante savings. We also compared program-tracking data and reported savings across reports for consistency within the PAYS Program data reports.

We did not review detailed home assessment reports for participants or any of the energy models used to estimate Tier 3 measure savings.

Assessment of Ex Ante Estimated Savings

We also reviewed the PY2021 program data reports to understand the reported ex ante savings for each measure and/or participant and to assess the ex ante savings for reasonableness. In our review, we considered multiple factors including

- Per-unit deemed savings values for Tier 1 direct install measures, compared to Ameren Missouri TRM deemed savings values for comparable measures;
- Measure-level savings estimates for Tier 3 measures, compared to Ameren Missouri TRM calculations for comparable measures;
- Per-project projected savings for Tier 3 measures, based on available data including (1) baseline whole home electricity consumption data, (2) baseline characteristics of home and systems, collected through the home assessment, and (3) characteristics of installed measures; and
- Measure-level contribution to project-level and program-level savings.

Because both the Direct Install and Post Retrofit reports reported Tier 1 measure savings for Tier 3 participants, the evaluation team calculated the total savings from Tier 1 measures as the sum of Tier 1 savings from the Direct Install Report for Tier 1-only participants and the sum of Tier 1 savings from the Post Retrofit Report for the Tier 3 participants.

- For Tier 3 projects, our analysis included only those projects that were closed out in PY2021. We did not calculate ex post savings as part of this analysis. We did compare reported ex ante savings

estimates to expected values using TRM-based methods; however, and these methods and findings are detailed further in Appendix A.

10.3 Evaluation Results

10.3.1 Process Results

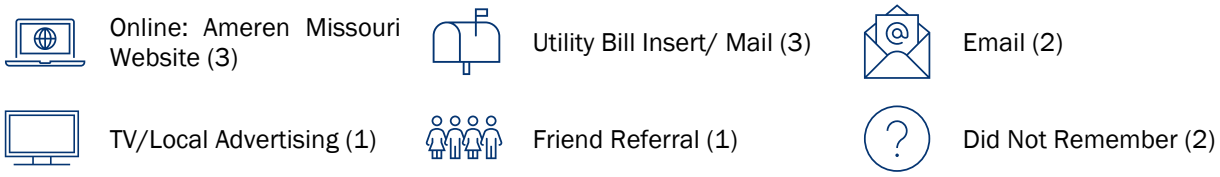
Participant Process Evaluation Results

This section details findings from interviews with Tier 2 PAYS Program participants who received an Easy Plan but chose not to move forward with Tier 3 upgrades.

Program Awareness and Participation

The implementer used a variety of strategies to engage PAYS participants. In PY2021, participants most commonly reported learning about the program through the Ameren Missouri website and mail outreach, suggesting that Tier 2 participants were about equally likely to enroll because of targeted and mass marketing efforts. Figure 8 summarizes how interviewed participants learned about the program.

Figure 8. PAYS Sources of Awareness



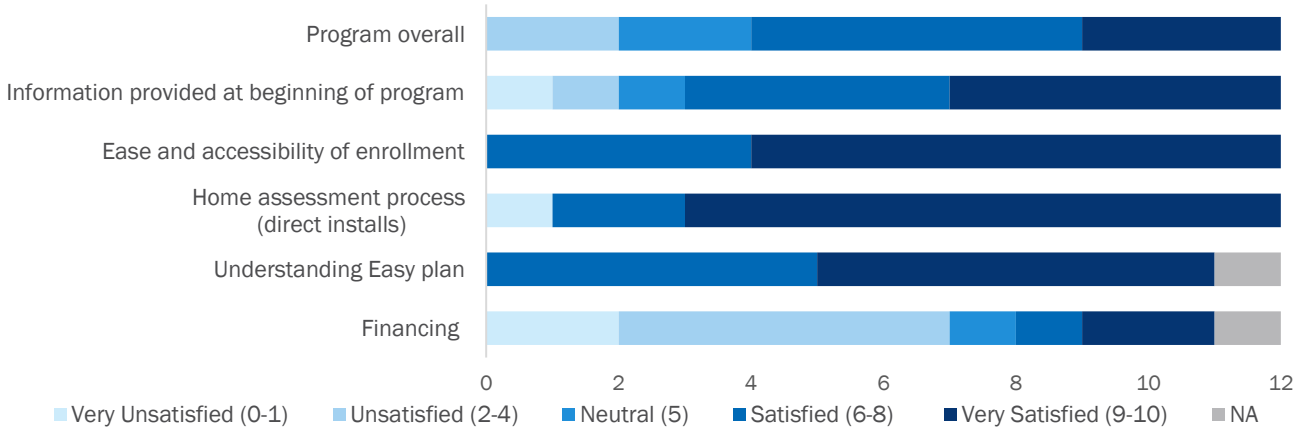
The most commonly reported reasons for signing up for a home assessment were to reduce electricity bills (5 of 12) and the opportunity to upgrade appliances and systems in the home (4 of 12). Additionally, two participants reported they were motivated to enroll because they received materials that identified their home as the least efficient home in their neighborhood. Other motivations included wanting to identify energy savings and improve temperature control. Participants identified the top three most attractive aspects of the PAYS Program specifically were the opportunity to finance the upgrades, to realize financial savings, and to identify changes they could make in their home to save energy. Participants stated there were no aspects of the program description that made them less interested.

In general, participants reported that the steps of the program were well explained. Only one participant responded that the steps were not at all explained, highlighting that they did not understand that financing was a requirement and wished they had more information. When asked about potential improvements, multiple participants suggested improvements in communication related to the copay. One participant felt that the marketing was misleading given the up-front cost associated with their project, while another desired a better understanding of the potential copay associated with completing a PAYS project.

Participant Experience and Program Satisfaction

Overall, most participants were relatively satisfied with the program, with two-thirds of participants reporting an overall satisfaction rating of 7 or above (out of 10). Participant satisfaction with the different facets of the program is represented in Figure 9. In general, participants were most satisfied with the ease and accessibility of the enrollment form (average 8.9/10), the home assessment process (average 8.5/10), and their understanding of the Easy Plan (average 8.5/10). By far, participants were least satisfied with the financing associated with PAYS (average 4.2/10).

Figure 9. Participant Satisfaction the PAYS Program and Components (n=12)



Direct Installs and Home Assessment

All participants reported having a generally positive experience with the home assessment process. Of the participants who remembered the home assessment enrollment form (10 of 12), none identified any aspect that could be improved. In general, participants reported that the scheduling process was straightforward and easy. A few participants reported needing to reschedule their appointment, but none reported COVID-19 having any impact on their willingness to schedule.

Participants were satisfied with the direct installs they received, but use of the measures varied by participant and measure type. Most participants reported that the data collector installed the measures during the time of the home assessment. One participant said they would have preferred to have the measures installed but the data collector left them to be installed by the participant.

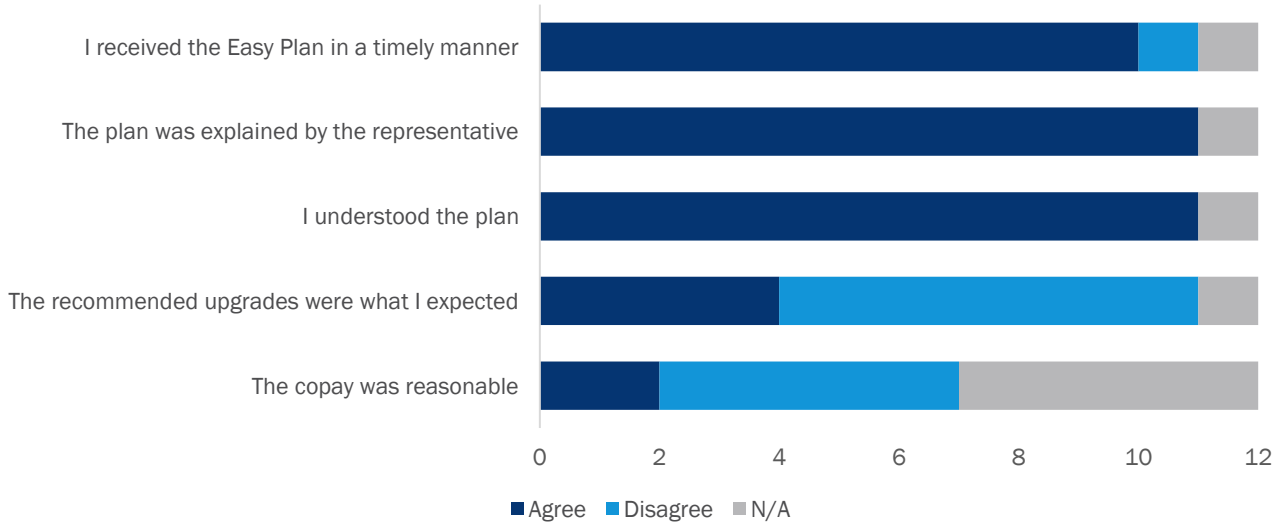
Participants stated that the home assessment itself went smoothly and that involvement on their end was minimal. Some reported answering questions about the home, while others noted that they helped move furniture, but in general, the home assessment was a pleasant, hands-off experience for the participants. A couple of participants reported being very interested in the process and that the home assessment was a great learning experience, adding credibility to the program. Another participant recommended the data collector provide more information during the assessment, such as on-site recommendations, suggesting that the educational component of the home assessment could be leveraged even further. No barriers to completing the assessment were reported. One interviewee had to seal an attic entrance to complete the assessment; however, the data collector waited for the repair and completed the assessment the same day.

Easy Plan

While the interviews focused on participants who received an Easy Plan according to program-tracking data, one respondent stated that they did not recall receiving it. Among the remaining participants, all reported that the plan was explained by the representative and that they understood it. In general, participants felt that the plan was received in a timely manner, although one participant was dissatisfied, and reported that it took a few weeks to receive their Easy Plan, when they were hoping to receive it in a few days.

Satisfaction with the Easy Plan dropped off significantly when it came to the recommended upgrades and cost. Over half of the interviewed individuals reported that the recommended upgrades were not what they expected. For example, one participant was surprised that no upgrades were recommended for their windows, while another received a different recommendation than previous trade allies had provided to them. In addition, of the interviewed participants whose projects required a copay (n=7), most (5 of 7) of the participants felt that it was unreasonable. Participant perspectives on aspects of the Easy Plan are included in Figure 10.

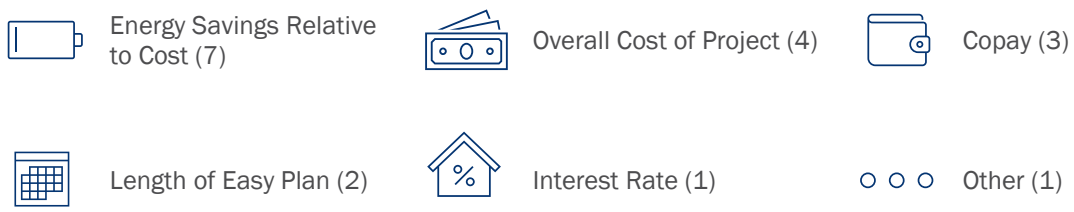
Figure 10. Participant Experience with PAYS Easy Plan (n=12)



Barriers to Tier 3 Participation

A key focus of the interviews was understanding barriers that led to Tier 2 participants' decisions not to move forward with the Easy Plan. One barrier identified was the overall project cost. Seven of twelve participants did not feel that the level of energy savings they were projected to realize was worth the cost of the project. Four participants reported that the cost of the project was over-priced and that they could replace the system, or pay someone else to replace the system, for less, with one participant stating that the implementer provided "astronomical bids." Figure 11 summarizes participant barriers to moving forward.

Figure 11. Barriers to Tier 3 Participation



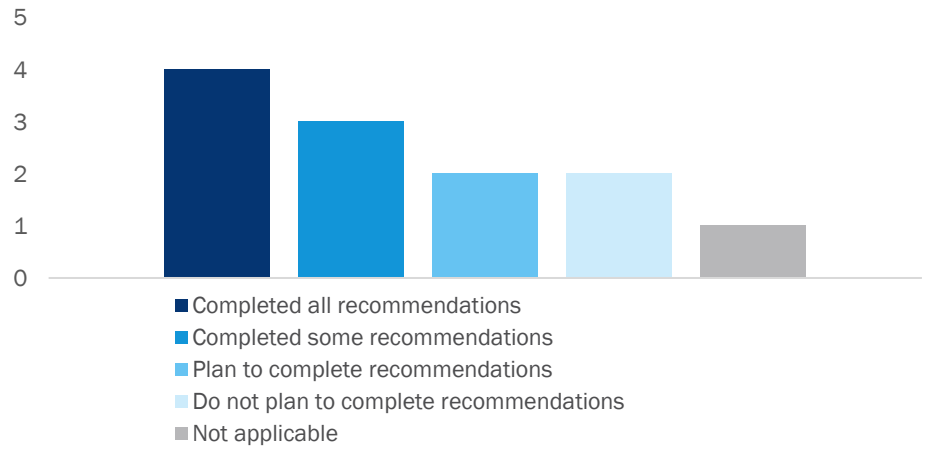
Note: Participants could identify multiple barriers to moving forward with their project.

The copay was also identified by three participants as a significant barrier to participation. Some participants did not expect their project to require a copay given the marketing materials they had received and were surprised by the magnitude of the upfront cost. A few participants reported that they would have had to finance the copay to proceed with the Easy Plan. Other barriers identified include the length of the Easy Plan (2) and the interest rate (1). Only one participant interviewed was a renter, but they reported that this was not a barrier to moving forward. Similarly, the one participant interviewed that lived in a duplex reported that it was not a barrier.

One participant planned on moving forward with the Easy Plan and had started the installation process when they encountered barriers. At this point, the trade ally informed the participant that there was insufficient space for the recommended unit, and it would need to be substituted with a smaller, less efficient unit. This change led to decreased energy savings and an increased copay. After deciding to proceed regardless, the participant learned that the trade ally was not licensed in the county and was in the process of applying, which would cause a delay in their project. As a result, the participant found a company that would install the more efficient unit (that was on sale) for around the same price as the PAYS Program and ultimately moved forward outside the program.

This participant was not the only one to continue forward with the recommended upgrades outside the program. Among the participants we interviewed, the majority seemed to value the recommendations made by the PAYS Program enough to move forward with them. This suggests PAYS is providing useful and actionable information to participants who receive a home assessment and Easy Plan. For the reasons mentioned above; however, these participants chose to move forward without the assistance of the PAYS program. As shown in Figure 12, four participants completed the recommended changes, three completed some of the recommended changes, and another two participants plan to complete them in the future.

Figure 12. Recommendations completed outside the PAYS Program (n=12)



Trade Ally Process Evaluation Results

Trade Ally Experience and Program Satisfaction

- Overall, trade allis reported high satisfaction with and respect for Ameren Missouri and their mission. However, they felt the PAYS Program had room for improvement. Only one of the three trade allies interviewed reported that they would recommend this program to other trade allies.

> *"We have a strong partnership with Ameren and support the concept of what the program is trying to accomplish."*
>
> *– Program Trade Ally*

Marketing

- All three of the trade allies that the evaluation team interviewed reported that they do not directly market the PAYS Program to their customers. Program participants selected HVAC and weatherization trade allies when enrolling in the PAYS Program and trade allies received notification from the implementer when projects were available, including information on the recommended upgrades. Some of the common measures trade allies reported installing through the PAYS Program were insulation, air conditioners, air sealing, and heat pumps. In general, the trade allies reported that the PAYS Program makes up a relatively small percentage of their overall business.

Training

- Trade allies reported that the training they received focused on how to use the implementer's online tool, Smart Sheets, for scheduling and managing projects. They did not receive training related to the measures being installed or quality control checks. All trade allies reported that they were satisfied with the level and depth of training they received and had no suggestions for additional training materials.

Workflow and Installs

- Trade allies were also satisfied with the planning and scheduling workflow and coordination with the implementer. They reported that the process was generally smooth and relatively standard. One trade ally reported disappointment with the number of jobs coming through the pipeline. This trade ally shared they dropped their margin per job with the assumption that the PAYS Program would lead to more jobs than it did and at the time of the interview, they were questioning if the program was still active. Notably, two of the three trade allies reported that they did not always fully agree with the recommended upgrades, which is discussed in more detail in the section on trade ally barriers.

Payment and Financing

- For a project to be closed out, all planned upgrades must be complete, including both the HVAC and weatherization upgrades when applicable. Additionally, trade allies are not paid for their work until all the upgrades are completed, which could lead to significant delays. One trade ally reported frustration that it took as long as 10 to 12 weeks after installation to be paid.

Trade Ally Barriers

- Two of the three trade allies desired more visibility and influence regarding the recommendations and suggested that, in some cases, additional or different measures may have been appropriate for generating maximum savings. These trade allies emphasized the importance of incorporating knowledge on local housing characteristics, building science, local codes, and permits and inspections into the recommendations. They also shared their frustration that once a participant has an active agreement for a PAYS project, the trade allies could not weigh in on the recommendations but maintained liability for the project. One trade ally reported that they had done additional work for free to remedy the unintended consequence of an implementer recommendation when the participant was dissatisfied and could not afford the additional work.
- Trade allies reported that the program's limitation to electric measures and savings is a barrier, specifically the inability to include gas furnaces in projects. This proved problematic because if participants had a gas furnace trade allies were unable to replace full heating/cooling system within the PAYS project. If participants desired to replace their full system, it had to be completed as two projects which was more expensive for the participant. One trade ally noted that if a participant did not replace the gas component of their system, the new install may not perform at its highest capacity, which may limit overall energy savings in relation to the total possible savings.
- Additional barriers reported were the lag in payments, discussed above, and problems negotiating installation prices. When trade allies joined the PAYS Program, they were asked to provide the implementer a price list of their services. These prices had to be negotiated, however, and target prices were not shared with trade allies. All trade allies reported that COVID-19 was not a barrier to the program, with the pandemic causing no more than a week-long supply chain delay for PAYS projects.

10.3.2 Impact Results

Since the PAYS program was new in PY2021, the evaluation team conducted a high-level impact and savings assessment in lieu of a full impact evaluation. This section describes our findings from the program-tracking data review and assessment of reported ex ante savings.

Description of Ex Ante Savings Estimation Approach

Ameren Missouri and the program implementer use home and energy consumption data, proprietary models, and analysis to support the PAYS Program process at two distinct stages.

The first analysis is conducted to identify customers who are ideal candidates for the program. Using Ameren Missouri electric consumption data for residential customers, combined with data on home characteristics and weather, a third-party company identifies homes that use more energy than expected given these factors. This analysis focuses particularly on energy use associated with heating and cooling. Ameren Missouri sends targeted marketing materials to customers identified in the analysis to increase their awareness of the PAYS Program and its potential benefits to them and to encourage participation.

When customers enroll in the PAYS Program, the program implementer sends a data collector to the customer's home to provide direct install measures and share more information about the program. If the home meets program requirements (e.g., passes minimum health and safety screen) and the customer decides to move forward, the data collector conducts a home assessment, typically on the same day. The home assessment is slightly less exhaustive than a full Building Performance Institute (BPI) building audit, in part because of the equipment and/or processes used to take certain measurements and in part because it is performed by a data collector rather than a certified BPI analyst. As part of the home assessment, the data collector records information on characteristics of the home and existing equipment, as well as relevant occupant behaviors, and completes tests appropriate to the home's characteristics, as outlined in Table 105.

Table 105. Home Assessment Data Collection

Data Category	Data Collected
Home Characteristics	▪ Home type ▪ Number of floors ▪ Age of home ▪ Conditioned area (including basement) ▪ Number of windows ▪ Test results: Blower door, duct buster, pressure pan
Existing Equipment	▪ Space heating fuel ▪ Water heating fuel ▪ Thermostat type ▪ Number of incandescent bulbs ▪ Characteristics of heating and cooling systems ▪ Insulation R-value ▪ Presence of hot tub
Customer Behavior	▪ Owner/renter status ▪ Number of occupants ▪ Summer and winter thermostat settings

The results of the home assessment are uploaded into a data collection application and pushed to a custom, proprietary version of the OptiMiser software owned by the program implementer. The implementer uses the model to qualify homes for participation in the PAYS Program, including producing recommended measures, estimated energy and cost savings, and project cost relative to savings.

The implementer described the model as load based, using engineering algorithms that are custom to each home and normalized based on customer energy usage. In addition, the software can calibrate the data to account for missing information, for example if certain data points could not be collected during the home assessment. In addition to qualifying projects and supporting creation of the Easy Plan, the implementer uses

the OptiMiser model results to estimate ex ante savings for Tier 3 projects. For Tier 1 projects, ex ante savings are estimated from deemed savings values for the corresponding installed measures.

Review of Program-Tracking Data

The evaluation team received and reviewed the following three program-tracking data reports:

- The PY2021 Direct Install Report includes the following information for participants who completed Tier 1 projects or above: installation date, measure quantity, and total energy and demand savings for all Tier 1 measures received by the participant. This report includes total savings per household but does not report savings per Tier 1 measure.
- The PY2021 Post Retrofit Report includes the following data for participants who completed Tier 3 projects: detailed participant and household data, key participation dates (e.g., audit date and installation date), modeled whole home consumption data, measure-level details, savings for installed Tier 1 and Tier 3 measures, and anticipated savings towards energy costs.
- The PY2021 Key Assessment Data Report includes participant and household data collected during the home assessment report.
- The following tables summarize the reported measure installations and savings from the PAYS Program tracking reports.
- Table 106 shows the total ex ante savings for Tier 1 measures (direct installs), Tier 3 measures (HVAC and weatherization), and overall for the PAYS Program. The Tier 1 measures implemented for 548 participants account for about 20% of overall PAYS ex ante savings, and the Tier 3 measures implemented for 66 participants account for about 80% of the overall PAYS ex ante savings.

Table 106. PAYS Reported Savings by Tier

Measure	Adjusted Ex Ante Gross Savings (kWh)[a]	Adjusted Ex Ante Gross Savings (kW)[a]	% Adjusted Ex Ante Gross Savings (kWh)	% Adjusted Ex Ante Gross Savings (kW)
Tier 1 Measures (N = 548)b	125,115	15.64	19%	20%
Tier 3 Measures (N = 66)	545,370	62.26	81%	80%
All	670,485	77.90	100%	100%

[a] Ex ante savings are adjusted to correct a data entry error in the Direct Install Report.

[b] Tier 1 savings include adjusted ex ante savings from the Direct Install Report for all non-Tier 3 participants and the Tier 1 savings from the Post Retrofit Report for all Post Retrofit Participants.

Table 107 shows the reported quantity of measures installed, the number and percentage of participants receiving each Tier 1 measure during the direct install process, and the total energy and demand savings reported for all Tier 1 measures, adjusted for tracking data errors. The program-tracking data does not include measure-level savings estimates.

- The data shows that most Tier 1 measures are installed at only a fraction of participant homes. While LEDs had the highest quantity installed, they were installed in only 60% of participant homes. Advanced power strips were the most common measure, installed in 97% of projects.

Table 107. PAYS Reported Savings by Measure, Tier 1

DI Measure	Total Quantity Installed	Number Participants Receiving Measure	% Participants Receiving Measure	Adjusted Ex Ante Gross Savings (kWh) 1,2	Adjusted Ex Ante Gross Savings (kW) 1,2
LED	1,932	331	60%		
Advanced Power Strips	619	537	97%		
Showerhead	113	98	18%		
Bathroom Sink Aerator	168	102	18%		
Kitchen Sink Aerator	47	46	8%		
WH Wrap	43	40	7%		
WH Pipe Wrap	447	105	19%		
Total[b]	**3,367**	**550**	**100%**	**125,115[a]**	**15.64**

[a] Ex ante savings are adjusted to correct a data entry error in the Direct Install Report.

[b] Total adjusted energy and demand savings from the Direct Install Report, including Tier 1 savings estimated for Tier 3 participants. These savings do not match the Tier 1 savings in the previous table because this table includes Tier 1 savings for all participants from the Direct Install Report, and the previous table uses Tier 1 savings for Tier 3 participants from the Post Retrofit Report.

Table 108 shows the number and percentage of participants and measure-level savings for each Tier 1 and Tier 3 measure implemented for participants completing a Tier 3 project. The data show that Tier 1 measures account for a very small fraction of savings compared to Tier 3 measures.

- The vast majority (97%) of energy savings for Tier 3 participants are from Tier 3 measures, and most of these savings are from HVAC equipment upgrades. About three-quarters of Tier 3 participants implemented HVAC upgrades and almost two-thirds (65%) implemented a new thermostat. Less than half of the Tier 3 participants implemented air sealing, attic insulation, and duct sealing measures.

Table 108. PAYS Reported Savings by Measure, Tier 3

Tier	Measure	Number Tier 3 Participants	% of Tier 3 Participants	Ex Ante Gross Savings (kWh)a	% Total Savings (kWh)	Ex Ante Gross Savings (kW)1
Tier 1 Measure	LED	40	61%	13,915	2%	1.59
	Advanced Power Strip	62	94%	3,077	1%	0.35
	Showerhead	10	15%	2,025	0%	0.23
	Bathroom Sink Aerator	9	14%	448	0%	0.05
	Kitchen Sink Aerator	7	11%	588	0%	0.07
	WH Wrap	5	8%	400	0%	0.05
	WH Pipe Wrap	0	0%	-	0%	-
Tier 3 Measures	Air Sealing	30	45%	31,270	6%	3.57
	Duct Sealing	9	14%	30,337	5%	3.46
	Attic Insulation	31	47%	44,907	8%	5.13
	Smart Thermostat	43	65%	63,444	11%	7.24

Tier	Measure	Number Tier 3 Participants	% of Tier 3 Participants	Ex Ante Gross Savings (kWh)a	% Total Savings (kWh)	Ex Ante Gross Savings (kW)1
	HVAC1	49	74%	350,505	62%	40.01
	HVAC2	5	8%	18,622	3%	2.13
	HVAC3	1	2%	6,285	1%	0.72
Total	**66**	**100%**	**564,496**	**100%**		
Subtotal Tier 1			*20,453*	*4%*		
Subtotal Tier 3			*545,370*	*97%*		

[a] Ex ante energy and demand savings as reported in the Post Retrofit Report for Tier 3 participants.

Assessment of Ex Ante Estimated Savings

Tier 1 Measures

As shown in Table 106, Tier 1 measures account for about 20% of the total PAYS program reported energy and demand savings for PY21. The implementer described that they use deemed savings for Tier 1 measures installed for Tier 1-only participants and used a combination of deemed and modeled savings for Tier 1 measures installed for Tier 3 participants.

The evaluation team analyzed the Direct Install and Post Retrofit reports to assess the consistency and reasonableness of the reported Tier 1 savings, and provides the following findings:

- The most common Tier 1 direct install measure was advanced power strips, which 97% of Tier 1 participants received. Most Tier 1 direct install measures were distributed far less frequently; however, and LEDs and advanced power strips were the only measure types received by more than 20% of Tier 1 participants.
- The Direct Install Report shows the quantity of measures installed for each Tier 1 measure type and the total energy and demand savings for each participant but does not show the estimated savings by Tier 1 measure. This reporting approach made it difficult to determine and assess the energy and demand savings claimed for each Tier 1 measure type but is reasonable if the program uses a deemed savings value for all Tier 1 measures moving forward.
- The evaluation team was able to discern the deemed savings values used for most Tier 1 measures in the Direct Install Report and observed consistent deemed savings for most but not all Tier 1 measures. When the evaluation team recalculated the Tier 1 total savings using the reported quantities and deemed savings values derived from the Direct Install Report (Table 109), the recalculated savings exactly matched the reported ex ante savings for 88% of the Tier 1 participants, and the total recalculated energy savings was 98% of the reported ex ante savings.
  - The deemed savings in the Direct Install Report are generally consistent with the deemed savings values from the Ameren Missouri TRM for comparable measures (Table 109).
- The evaluation team observed differences in the reported quantities and savings for Tier 1 direct install measures implemented for Tier 3 participants in the Direct Install and Post Retrofit reports. The Tier 1 measure quantities reported match in all but six instances. While both reports appear to rely on deemed values, the deemed values differ.

  - When comparing Tier 1 savings between the Direct Install and Post Retrofit reports, the total Tier 1 savings for Tier 3 participants is similar between the Direct Install and Post Retrofit reports, but the Tier 1 savings range widely at the participant level. The differences at the participant level are explained by the different measure-level deemed savings values used in the Direct Install and Post Retrofit reports (Table 109).
  - The Direct Install and Post Retrofit reports seem to overstate Tier 1 measure savings for Tier 3 participants compared to the deemed savings values. The recalculated savings using the Tier 1 deemed savings values is only 79% of the reported Tier 1 savings for Tier 3 participants.
- The evaluation team found what appeared to be a data entry error for one Tier 1 participant, which resulting in a reported kW savings of 194.6 kW for a set of Tier 1 measures with combined deemed kW savings closer to 0.038 kW. The magnitude of this data error resulted in significantly overstated total kW savings for the Tier 1 measures. We corrected this error in the "adjusted ex ante savings" reported in this evaluation.
- For two of the 548 participants who received direct install measures, the Direct Install Report shows Tier 1 measure(s) installed but reports no savings. It is unclear why the implementer reported no savings for these measures. The evaluation team did not adjust for this in the adjusted ex ante savings reported.
- The direct install savings values for advanced power strips match the Ameren Missouri TRM deemed savings value for Tier 1 advanced power strips installed in a home office. The TRM savings value is higher for Tier 1 advanced power strips and for installations on home entertainment centers. If the PAYS Program installs Tier 2 advanced power strips and/or advanced power strips in locations other than home offices, the program should consider updating its deemed savings value for this measure.
- The Post Retrofit Report does not include energy or demand savings for water heater pipe wrap measures.
- Table 109 compares the deemed savings values for Tier 1 measures used in the Direct Install Report, the Post Retrofit Report, as described by the implementer, and from the Ameren Missouri TRM Appendix F. The table shows that the deemed savings derived from the Direct Install Report are consistent with the deemed savings for comparable measures from the TRM Appendix F.

Table 109. Comparison of Deemed Savings Values for Tier 1 Measures

Measure	Derived from Direct Install Report	Post Retrofit Report	Implementer Email	Appendix F
LED	32.51	Multiple	Multiple	Multiple
Advanced Power Strip[a]	31.00	42.50	42.44	31.00
Showerhead	194.58	155.50	155.66	194.72
Bathroom Sink Aerator	35.17	28.00	28.14	35.17
Kitchen Sink Aerator	111.03	84.00	84.42	111.03
WH Wrap	100.55	80.00	0.00	100.55
WH Pipe Wrap	4.64	0.00	3.72	4.64

[a] Appendix F Smart Strip value is the deemed value for Tier 1 advanced power strips installed on home office equipment.

Tier 3 Measures

As shown in Table 106, Tier 3 measures account for about 80% of the total PAYS Program reported energy and demand savings for PY2021. Tier 3 measures include HVAC equipment upgrades, installation of smart thermostats, and implementation of weatherization measures including air sealing, attic insulation, and duct sealing.

As described above, the implementer uses a proprietary energy modeling software to estimate energy savings using information collected during the home energy assessment and whole home consumption data. The evaluation team reviewed the reported energy savings to assess reasonableness of the per-measure and total savings values.

The evaluation team used TRM algorithms and available program-tracking data to estimate the savings for each measure and all measures combined. We calculated savings in two ways: first, with a static baseline for all Tier 3 measures (e.g., using the same existing equipment efficiency value in all calculated), and second, with an adjusted baseline to account for interactivity between the Tier 3 measures. Additional details on this analysis approach are provided in Appendix A.

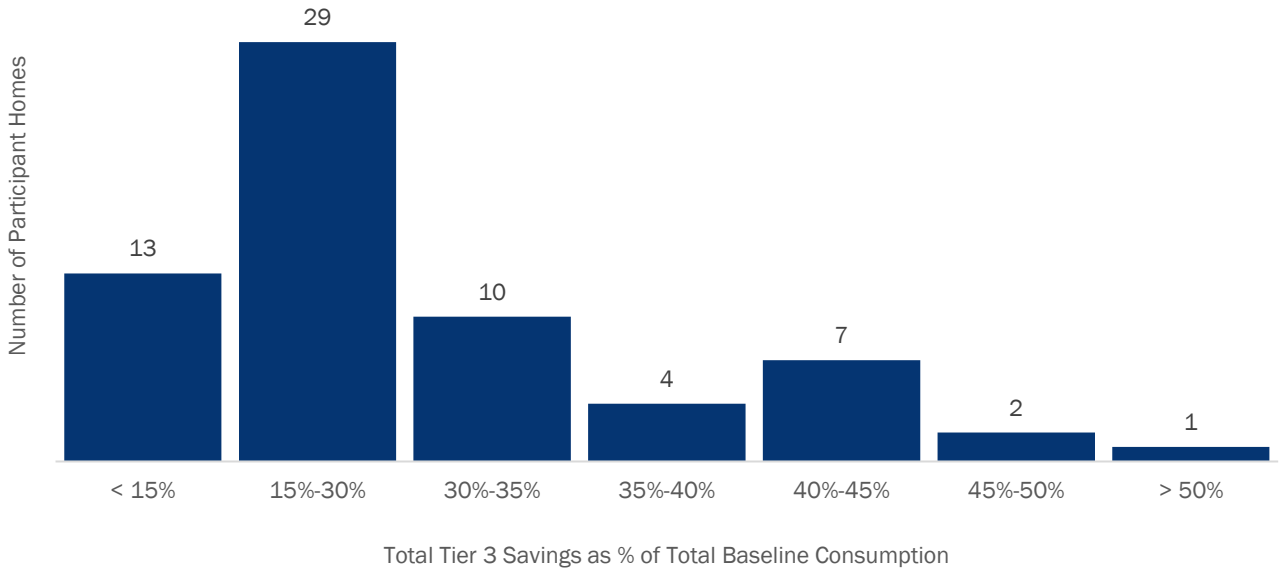
Table 110 shows the results of our analysis. The total calculated savings using a static baseline are similar to (97%) of the reported energy savings from the implementer's energy model. The savings calculated using an adjusted baseline to account for the Tier 3 measures' interactive efforts are only 88% of the reported modeled savings.

Table 110. Comparison of Modeled and Calculated Savings for Tier 3 Measures

Measure	Reported Gross kWh	Calculated Gross kWh - Static Baseline	RR - Static Baseline	Calculated Gross kWh - Adj Baseline	RR - Adj Baseline
HVAC1	350,505	348,487	99%	348,487	99%
HVAC2+HVAC3	24,907	24,764	99%	24,764	99%
Smart Thermostat	63,444	48,631	77%	24,359	38%
Attic Insulation	44,907	58,607	131%	46,766	104%
Air Sealing	31,270	39,668	127%	29,415	94%
Duct Sealing	30,337	9,995	33%	7,134	24%
Total Tier 3	**545,370**	**530,152**	**97%**	**480,925**	**88%**

In addition, we also compared the Tier 3 savings to the total whole home baseline consumption, as shown in Figure 13.

Figure 13. Tier 3 Savings as a Percentage of Baseline Consumption



The evaluation team provides the following findings regarding the reported Tier 3 measure savings:

- The reported Tier 3 savings ranged from 6% to 51% (average 29%) of the estimated baseline whole home consumption for homes with electric heat and ranged from 1% to 31% (average 16%) for homes with natural gas heating.
- The reported Tier 3 savings ranged from 13% to 127% (average 68%) of the estimated baseline total HVAC consumption for homes with electric heat and ranged from 1% to 101% (average 34%) for homes with natural gas heat. For 11 participants, the estimated Tier 3 savings exceeded the estimated total baseline HVAC consumption, suggesting the reported Tier 3 savings may be overstated.
- The reported total Tier 3 savings are similar to the energy savings calculated using TRM algorithms with a static baseline. The Tier 3 measures are highly interactive; however, and failure to account for those interactions can result in overstated savings. The total reported Tier 3 savings are higher than the TRM algorithms with an adjusted baseline to account for interactively, suggesting the modeled savings may be overstated.

11. Multifamily Income Eligible (MFIE)

This section presents the PY2021 evaluation summary, methodology, and results for the MFIE Program. Additional details on the methodology are presented in Appendix A.

11.1 Evaluation Summary

The MFIE Program, known to customers as the Community Savers Multifamily Program, is designed to deliver long-term energy savings and bill reduction opportunities to income eligible Ameren Missouri customers living in multifamily properties. The target market for the program includes property 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:

- Reside in a federal, state, or local subsidized housing property and fall within that program's income guidelines;
- Reside in non-subsidized housing and provide proof of income levels at or below 80% of area median income (AMI); or
- 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 non-qualifying tenants can qualify the entire property if at least 50% of the tenants meet the income-eligibility requirements.

Consistent with the delivery approach for the MFMR Program, the MFIE Program provides a one-stop-shop approach to assist property owners and managers in overcoming barriers to completing comprehensive retrofits. As part of this one-stop-shop approach, ICAST, the program implementer, offers a suite of concierge-style services to assist participants in identifying and executing energy efficiency projects. ICAST Energy Advisors spearhead customer recruitment, assist with the application process, conduct energy assessments, recommend custom project scopes, estimate incentives, and assist participants in coordinating installations. Customers can contract the installation work to outside vendors, or they can work with ICAST's operations team. For projects that are limited to direct-install measures, ICAST has a group of subcontractors who complete the work. ICAST 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.

As part of the one-stop-shop approach to promote deeper savings, ICAST also implements a custom—rather than prescriptive—approach to recommending upgrades, calculating ex ante site savings, and providing customer incentives. In this approach, ICAST calculates all measure savings and incentives against site-specific baselines. Eligible measures include lighting, HVAC, building shell, domestic hot water, and refrigeration measures. In PY2020, program staff added a co-delivery component to the MFIE Program, partnering with Ameren Missouri Gas and Spire Gas to deliver gas-saving measures and to split costs on dual-fuel measures such as building shell upgrades.

Franklin Energy administers the program and leads the development of marketing collateral (in collaboration with Ameren Missouri and ICAST), provides engineering oversight, and processes incentive payments. Franklin Energy also facilitates communication between Ameren Missouri and 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.

Ameren Missouri continued to implement COVID-19 restrictions in PY2021 to limit health risks for program staff and participants. These restrictions included prohibiting work in occupied units, which spurred implementation changes such as offering virtual energy assessments and inspections, as well as offering incentives to tenants to temporarily vacate their unit. Restrictions were eventually lifted in July. Despite managing the COVID-19 restrictions for much of the year, the program team was still able to achieve 6,132 MWh of net electric savings in PY2021.

11.1.1 Participation Summary

In PY2021, the program treated 1,859 premises across 48 projects.[52] These projects resulted in the installations of 27,784 energy-efficient measures (Table 111). This is a notable increase compared to PY2020, where the program team delivered 11,004 measures to 692 unique premises across 22 unique projects. The primary driver of the increased activity in PY2021 compared to PY2020 is the growth in residential lighting installations.

Table 111. PY2021 Multifamily Income Eligible Program Participation Summary

Enduse	Unique Premises		Measures		Ex Ante Savings	
	Number	%	Number	%	MWh	%
Lighting RES	1,493	80%	21,184	76%	429	7%
HeatCool	1,037	56%	1,360	5%	3,409	57%
Water Heating RES	903	49%	2,305	8%	494	8%
HVAC RES	561	30%	600	2%	695	12%
Building Shell RES	95	5%	434	2%	37	1%
Refrigeration RES	49	3%	49	<1%	28	<1%
Cooling RES	26	1%	26	<1%	17	<1%
Appliances RES	12	1%	12	<1%	<1	<1%
Lighting BUS	10	<1%	1,348	5%	586	10%
EXT Lighting BUS	6	<1%	450	2%	244	4%
Motors BUS	4	<1%	5	<1%	13	<1%
Cooling BUS	1	<1%	6	<1%	58	1%
Building Shell BUS	1	<1%	4	<1%	<1	<1%
HVAC BUS	1	<1%	1	<1%	2	<1%
Total	**1,859**	**100%**	**27,784**	**100%**	**6,012**	**100%**

Note: This table includes information on measures that produced electric energy savings. Additional measures were installed through the co-delivery component of the program that only produced gas savings and were funded by gas utilities. These gas-only measures are excluded from this report.

[52] The implementation team split large projects into phases, which are reflected 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.

11.1.2 Key Impact Results

Table 112 presents annual savings achieved in PY2021. The ex post savings are 102% and 120% of the ex ante savings for energy and peak demand, respectively. As shown, the program achieved 229% of Ameren Missouri's net first year energy savings goal but fell short compared to first year demand savings goals and last year demand targets.

Table 112. PY2021 Multifamily Income Eligible Program Impact Summary

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/ Target Net	% of Goal/ Target
First Year Savings							
Energy Savings (MWh)	6,012	102.0%	6,132	100.0%	6,132	2,680	229%
Demand Savings (MW)	0.79	119.5%	0.95	100.0%	0.95	1.20	79%
Last Year Demand Savings							
< 10 EUL (MW)	0.10	191.4%	0.19	100.0%	0.19	-	-
10–14 EUL (MW)	0.18	101.3%	0.18	100.0%	0.18	-	-
15+ EUL (MW)	0.32	109.1%	0.35	100.0%	0.35	1.19	29%

The primary performance metric for the MFIE Program is the average percent energy savings per participating property. 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 18.75% energy savings per property across the channel. Table 113 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—equate to 21% of the recorded baseline energy use. These results are largely driven by the high incidence of HVAC measures and indicate that the program team was successful in delivering comprehensive projects to participants.

Table 113. PY2021 Multifamily Income Eligible Program Average Percent Energy Savings Per Property

Metric	Value
Ex post gross energy savings (kWh) [A]	1,845,580
Total billed pre-participation energy consumption (kWh) [B]	8,914,060
Average percent energy savings per property [A/B]	21%

11.1.3 Key Process Findings

The PY2021 evaluation did not include an in-depth assessment of MFIE Program processes. Findings from interviews with program staff, as well as information from the program-tracking database, however, helped inform the process evaluation requirements for Ameren Missouri's MFIE Program. Below, we summarize key findings from these activities. Additionally, Table 114 summarizes responses to the five CSR process evaluation questions.

Key process findings from the PY2021 MFIE Program include:

- **The COVID-19 pandemic continued to present challenges to the program's model for delivering comprehensive projects, but the successful uptake of relocation incentives mitigated negative impacts**

to overall program performance. These incentives, which encouraged participants to temporarily vacate their premises, were a significant factor in the performance of the MFIE Program in 2021. The incentives allowed the implementation team to enter unoccupied units and complete comprehensive projects while adhering to COVID-19 protocols. Once the COVID-19 restrictions were lifted, the program team was able to leverage the significant pipeline of projects they had developed and demonstrate the full strength of the program; 80% of the total electric-saving measures delivered in PY2021 were installed in the second half of the year. Additionally, the program team nearly tripled the number of premises treated in PY2021 compared to PY2020 and more than doubled the total electric-saving measures installed. As a result, the program achieved 229% of their first year energy savings goals. The program team also and averaged 21% savings per property, exceeding their goal of 18.75%.

- **The program team instituted a pre-approval process for all projects in 2021, expanding upon existing program requirements to influence the comprehensiveness of program project scopes.** Similar to the MFMR Program, MFIE Program implementation staff had little visibility or influence on trade ally projects prior to PY2021. While the MFIE Program has always required that participating properties receive an energy assessment from implementation staff, which provided some opportunity to highlight opportunities and influence scope, trade allies and their customers ultimately had autonomy to determine project scope and timeline. This presented challenges for the program team as they tried to manage program activity to hit their performance targets. The introduction of the pre-approval provided more directed opportunities for the implementation team to successfully influence project scopes and encourage trade allies to pursue more comprehensive projects. This resulted in additional work for the trade allies and strengthened their trust and allyship to the program.
- **The program team successfully promoted the co-delivery component in PY2021, spurring high uptake of measures and spending all the allocated budget.** Ameren Missouri Electric partnered with Spire Gas and Ameren Missouri Gas to sponsor the co-delivery offering, which first launched in PY2020. The goal of the offering is to deliver more comprehensive projects to dual-fuel participants in the MFIE Program. Additionally, co-delivery provides efficiencies to customer service; avoiding the need for multiple utilities to engage with the same customer and splitting the cost of dual-fuel measures. The ability to cost split extends the life of program incentive budgets and, in the case of Ameren Missouri Electric, eliminates the financing of gas savings through electric incentive budgets (e.g., fully funding a dual-fuel measure with electric funds). It is important to note, however, that co-delivery does present some implementation challenges. The introduction of gas saving measures to program offerings can divert limited customer budgets towards these measures, which might offer higher savings potential at a property with gas space heating and hot water heating. Any investment in electric saving measures as part of these projects would necessitate including the project in the program team's average percent savings performance metric, which is based on electric energy savings. If electric saving measures only account for a small portion of the project scope, the percent savings metric can be put at risk. As such, the implementation team must balance the delivery of co-delivery measures in such a way that does not jeopardize their performance metrics.
- **The ICAST one-stop-shop program design continued to align with the majority of the best practices for one-stop-shop multifamily programs, including:** (1) offering a single point of contact (SPOC) for project development and technical assistance; (2) a streamlined application process with assistance from a SPOC; (3) comprehensive energy assessments to identify upgrade opportunities; (4) coordination of rebates; (5) assistance with identifying qualified contractors and soliciting, evaluating, and selecting bids; (6) coordination of installations; and (7) QA/QC inspections of each project. This model positions the program well to be able to effectively overcome barriers to participation and market imperfections for this portion of the multifamily segment.

Table 114. 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?	Market imperfections specific to the multifamily sector include (1) the split incentive for in-unit measures between property owners, managers, and residents;[a] (2) awareness of 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. While COVID-19 impacted the range of projects that could be completed in PY2021, the implementation team delivered a comprehensive set of solutions to the target market segment through the one-stop-shop model. The tracking data indicates 91% of measures that produced electric savings were installed in tenant units. Additionally, at least 17 of the 31 unique properties treated through the program in PY2021 received both tenant and common area upgrades.[53] The program team can continue to increase the comprehensiveness of solutions offered to the target market segment by encouraging
Are the communication channels and delivery mechanisms appropriate for the target market segment?	The program uses a mix of communication channels including traditional channels such as e-mail blasts and distribution of collateral at industry events. The primary recruitment channel used is ICAST's network of existing relationships with larger property ownership and management companies. The program also leverages more tailored outreach to smaller scale property owners. 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.[b] Green Leases are contracts between landlords and tenant(s) 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 are designed to allow both parties financial benefits and incentives, and multifamily building types are ideal buildings for their use. The other market imperfections 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] 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.

[53] 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.

11.1.4 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 implementation team has continued to make improvements to the accuracy and completeness of program-tracking data since PY2019. There continues to be opportunity for improvement, however. The evaluation team identified several errors in the PY2021 tracking data, including domestic hot water efficiencies with missing decimals, system capacities that were an order of magnitude too high, and discrepancies between the first and last year demand reported in the tracking database and project-specific Rebate Approval Forms ("RAFs") for air source heat pump and ductless mini-split heat pump early replacements.
  - **Recommendation #1:** The implementation team should continue to improve QA/QC data checks to ensure consistency between data sources and fields.
- **Conclusion #2:** Similar to PY2020, the current program-tracking database does not include all the project data and inputs used to calculate ex ante energy and demand savings. Some detailed project data and other key information is only available in the project RAFs. Incorporating more information into the tracking database will improve the ability to track program activity and improve the efficiency of evaluation and other quality control measures.
  - **Recommendation #2:** We understand that the MFIE Program will be transitioning to a more prescriptive approach in PY2022. We recommend that program implementation staff incorporate all key parameters for prescriptive algorithms into the program-tracking database (e.g., existing thermostat type, leakage rate, and kWh^{Base} and kWh^{New} for refrigerators, which are currently included in the RAFs, but not in the database). For custom measures that might reference methods or assumptions outside the Ameren Missouri TRM, we recommend documenting the savings estimation methods and any key parameter assumptions used to estimate savings, including associated sources and/or justification when project-specific data or other customized methods are not available or used.
- **Conclusion #3**: The program completed 438 window replacements in PY2021, accounting for about 2% of all measure installations and 1% of ex post energy savings. The Ameren Missouri TRM does not currently include a prescriptive algorithm to estimate savings for window replacements. As such, implementation staff applied an algorithm from the 2017 Missouri Statewide Commercial TRM and used site-specific parameters to calculate ex ante savings.
  - **Recommendation #3:** Assuming window replacements will continue to be a focus for the program in PY2022 and beyond, we recommend adding this measure to the Ameren Missouri TRM, along with standard assumptions for key parameters, given the program's transition to a more prescriptive model.
- **Conclusion #4:** Most discrepancies between ex ante and ex post savings are due to differences in the ISRs applied in the analyses. The evaluation team applied the ISRs outlined in Appendix F of the Ameren Missouri TRM in the ex post analysis. The ex ante analysis appeared to include a variety of ISRs from undocumented sources. We note that the current implementation model allows for the application of site-specific parameters in savings calculations, where available. It is unclear whether the implementation team was applying installation verification rates established through QA/QC visits as ISRs. If this is the case, we note that ISRs are not appropriate for site-specific values because ISRs are researched values that represent a combination of installation rates, equipment failures, and customer removal rates.

- **Recommendation #4:** The program team should rely on the ISRs documented in Appendix F of the Ameren Missouri TRM in ex ante savings calculations.

11.2 Evaluation Methodology

The PY2021 evaluation was mostly limited to impact evaluation activities to assess the performance of the MFIE Program. However, the evaluation team documented some process-related insights through interviews with program staff. The evaluation team explored the following MFIE Program objectives:

- Obtain information on program design and planned implementation with a focus on differences from PY2020;
- Understand program staff and implementer perceptions, experiences, and expected program impacts;
- Verify program-tracking data;
- Estimate the first year ex post gross average percent energy (kWh) savings per participating property;
- Estimate the first year ex post gross demand (kW) demand savings; and
- Estimate the first year ex post gross and net energy (kWh) and demand (kW) savings.

Table 115 provides an overview of the MFIE Program evaluation activities.

Table 115. PY2021 Evaluation Activities for the Multifamily Income Eligible Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in the Fall of PY2021 to understand program staff's perspective 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. ▪ 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 PY2021 net impacts.

11.3 Evaluation Results

11.3.1 Process Results

The MFIE Program is designed 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. To achieve this result, the program design includes various participation pathways, associated market actors, and points of intervention to meet customer's needs. The evaluation team provided detailed documentation of the nuanced program design and implementation strategy, as well as the customer participation experience, in the PY2020 Residential Portfolio Report. The following sections include a summary of program design changes, challenges the program team experienced delivering the program, and impacts these challenges had on program performance.

Program Design Changes

COVID-19 restrictions implemented in PY2020 persisted into PY2021 for much of the year. These restrictions prevented program staff from entering occupied units. Similar to 2020, program staff offered relocation incentives to encourage tenants to temporarily vacate their units to allow in-unit work to be completed. Additionally, program staff continued to leverage other tactics introduced in 2020 to reduce contact with customers, including offering virtual installation verifications and QA/QC inspections, and conducting real-time QA/QC inspections whenever possible. The COVID-19 restrictions were eventually lifted at the end of July, allowing the program team to resume the original design and implementation strategy.

In addition to the COVID-19 restrictions, the program team implemented several other design changes. The most impactful of which was the implementation of a pre-approval requirement for all program incentives. This requirement was critical in reducing potential risk from trade ally projects and allowing the program team to monitor program performance and activity more accurately. In prior program years, the lack of a pre-approval process allowed trade allies to act almost entirely autonomously from the program team, with the exception of the energy assessment process, which was required to be completed by ICAST. This created challenges for program staff as they tried to manage program activity to hit their savings goals and key performance metrics. The implementation team had minimal control over the final scopes of trade ally projects. These projects were often limited in scope, so introduction of the pre-approval process allowed the implementation team an opportunity to influence projects early in the process and encourage more comprehensive scopes. This ultimately generated more work for the trade allies and strengthened their trust and allyship to the program. It also allowed the program team to have more visibility into the project pipeline and to monitor incentive budgets more effectively.

Lastly, program staff added new program requirements, such as burn hour requirements for certain lighting replacements, and publicized already existing requirements, such as per property incentive caps. These requirements were previously listed in the fine print of program participation agreements, but program staff sought to make these requirements more visible with the goal of creating more transparency about program eligibility and participation requirements.

Implementation Challenges

The MFIE Program was less affected by the COVID-19 restrictions compared to its market rate counterpart; the relocation incentives allowed program staff to continue to sell comprehensive projects scopes and complete in-unit work. Challenges still emerged throughout the year, however. Coordinating the distribution of the relocation incentives and scheduling installations to align with when customers planned to vacate their units slowed equipment installations and extended project timelines. Additionally, some property owners and managers were not interested in the relocation incentive option since they were tasked with distributing the incentives. This deterred some owners and managers from participating.

Following the lifting of the restrictions, the program team had to update program documentation and protocols, and gain approval, before they could return to the original program implementation strategy. In addition, it took time to re-engage with property managers that were previously interested in participating but were put off by the relocation incentives. Some property managers and owners had already re-allocated the funds they had earmarked for the MFIE Program to other projects. Lastly, the supply chain disruptions resulting from the pandemic caused delays in procuring equipment, which further extended project timelines. All these factors led to delays in project completions and extended the ramp-up period to the return of the full program offering.

The co-delivery offering also presented challenges to program staff. These challenges included administrative delays such as finalizing budgets, rebate levels, and savings methodologies for the co-delivery measures that

had been approved. The implementation team started promoting co-delivery measures to customers once they were approved, but delays finalizing incentive levels and savings methodologies meant implementation crews could not install the measures, and therefore had to put the projects and customers on hold. Additionally, the co-delivery offering presented risks to achieving the program's percent energy savings performance target. The inclusion of gas saving measures into the program offerings resulted in some dual-fuel property owners and managers focusing their limited budgets on these measures, which provided substantial cost savings opportunities across HVAC, water heating, and cooking. This left minimal opportunity for investment in electric measures, and therefore resulted in a lower percent energy savings for the property. As a result, the program team was tasked with a delicate balance of delivering the most customer-beneficial projects, while not jeopardizing program performance. This meant program staff had to target enough all-electric properties to balance out dual-fuel properties.

Program Performance

Despite the challenges introduced by the COVID-19 restrictions, the program performed well, achieving 229% of first year energy savings goals, 79% of first year demand savings goals, and an average per property energy savings of 21%. Program staff reported that the introduction of the pre-approval process played a key role in program performance by allowing staff to influence project scopes early in the process to effectively balance the interests of the customer and the trade ally with program performance targets. This process required strong partnership and collaboration with the trade allies, which was fostered by discussions prompted through the pre-approval process. Program staff also reported that the program's incentive structure, which offers larger incentives for HVAC and other non-direct install measures, helped propel the uptake of longer-lived measures by effectively reducing the customer cost of these targeted measures. This is apparent in the number of HVAC, appliance, and building shell measures delivered in PY2021.

The one-stop-shop approach continued to serve as an attractive offering to customers. Program staff reported that property owners and managers appreciate this approach because program staff are there to help participants through every step of the participation process. Owners and managers of income-eligible properties often do not have the experience or skillset to develop detailed project scopes and solicit/review bids from multiple contractors across several different technologies. The one-stop-shop approach alleviates these concerns and makes energy efficiency more accessible to these customers. In addition, for projects where ICAST served as the general contractor, they broke projects up into several phases, which helped drive program spend earlier in the year and allowed contractors and customers to get paid sooner, which made all involved parties more comfortable amid long project timelines.

Lastly, the program team successfully implemented the co-delivery offering. They spent all their allocated gas budgets and successfully delivered comprehensive, customer-centric project scopes, while achieving their per property percent savings target. Additionally, the co-delivery offering allowed program staff to treat participating properties more cost-effectively by splitting measure costs for dual-fuel measures across the utilities, which ultimately extended the life of the electric incentive budget and allowed the program team to treat more customers. This cost-splitting also eliminated the financing of gas savings through electric incentive budgets (e.g., fully funding a dual-fuel measure with electric funds).

11.3.2 Gross Impact Results

As presented in Table 116, the PY2021 MFIE Program achieved 6,132 MWh and 0.95 MW in ex post gross savings, representing energy and demand savings realization rates greater of 102% and 120%, respectively.

Table 116. PY2021 Multifamily Income Eligible Gross Impact Summary

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross
First Year Savings			
Energy Savings (MWh)	6,012	102.0%	6,132
Demand Savings (MW)	0.79	119.5%	0.95
Last Year Demand Savings			
< 10 EUL (MW)	0.10	191.4%	0.19
10–14 EUL (MW)	0.18	101.3%	0.18
15+ EUL (MW)	0.32	109.1%	0.35

The evaluation team completed analysis on the following program measures: common area lighting (Lighting BUS), in-unit lighting (Lighting RES), and exterior lighting (EXT Lighting BUS) upgrades; air source heat pumps, ductless minisplit heat pumps, and advanced and programmable thermostats (HeatCool); bathroom and kitchen faucet aerators and showerheads (Water Heating Res); refrigerators (Refrigeration RES); windows (Building Shell RES); electronically commutated motors and packaged terminal air conditioners (HVAC RES); motors and variable frequency drives (Cooling BUS); central air conditioners (Cooling RES); and clothes washers (Appliances RES). The remainder of this section summarizes the evaluation team's ex post analysis. All calculation methodology, parameters, and assumptions are detailed in this section and sourced in Appendix A.

Table 117 summarizes the total PY2021 MFIE Program ex ante and ex post energy savings and realization rates by enduse.

Table 117. PY2021 Multifamily Income Eligible Annual First Year Gross Impacts

Enduse	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Realization Rate	Ex Post (MW)
HeatCool	3,409	103%	3,525	0.34	142%	0.49
HVAC RES	695	100%	695	0.11	100%	0.11
Lighting BUS	586	101%	592	0.11	101%	0.11
Water Heating RES	494	98%	482	0.04	98%	0.04
Lighting RES	429	100%	429	0.06	100%	0.06
EXT Lighting BUS	244	100%	244	0.00	100%	0.00
Cooling BUS	58	100%	58	0.05	100%	0.05
Building Shell RES	37	100%	37	0.05	100%	0.05
Refrigeration RES	28	100%	28	0.00	100%	0.00
Cooling RES	17	158%	27	0.02	158%	0.03
Motors BUS	13	100%	13	0.00	100%	0.00
HVAC BUS	2	100%	2	0.00	100%	0.00
Building Shell BUS	0	100%	0	0.00	100%	0.00
Appliances RES	0	100%	0	0.00	100%	0.00
Total	**6,012**	**102%**	**6,132**	**0.79**	**120%**	**0.95**

Table 118 summarizes the MFIE Program's total PY2021 last year ex ante and ex post electric demand savings and realization rates by enduse and EUL class.

Table 118. PY2021 Multifamily Income Eligible Annual Last Year Gross Demand Impacts

Enduse	Ex Ante (MW)				Realization Rate	Ex Post (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
HeatCool	0.00	0.13	0.11	0.24	100%	0.00	0.13	0.11	0.24
HVAC RES	0.00	0.00	0.03	0.03	488%	0.10	0.00	0.05	0.15
Lighting BUS	0.10	0.01	0.01	0.11	101%	0.09	0.01	0.02	0.11
Lighting RES	0.00	0.00	0.06	0.06	100%	0.00	0.00	0.06	0.06
Cooling BUS	0.00	0.00	0.05	0.05	100%	0.00	0.00	0.05	0.05
Building Shell RES	0.00	0.00	0.05	0.05	100%	0.00	0.00	0.05	0.05
Water Heating RES	0.00	0.04	0.00	0.04	98%	0.00	0.04	0.00	0.04
Cooling RES	0.00	0.00	0.01	0.01	100%	0.00	0.00	0.01	0.01
Refrigeration RES	0.00	0.00	0.00	0.00	100%	0.00	0.00	0.00	0.00
EXT Lighting BUS	0.00	0.00	0.00	0.00	100%	0.00	0.00	0.00	0.00
Motors BUS	0.00	0.00	0.00	0.00	100%	0.00	0.00	0.00	0.00
Building Shell BUS	0.00	0.00	0.00	0.00	100%	0.00	0.00	0.00	0.00
HVAC BUS	0.00	0.00	0.00	0.00	101%	0.00	0.00	0.00	0.00
Appliances RES	0.00	0.00	0.00	0.00	100%	0.00	0.00	0.00	0.00
Total	**0.10**	**0.18**	**0.32**	**0.60**	**120%**	**0.19**	**0.18**	**0.35**	**0.72**

Table 119 summarizes the MFIE Program's total PY2021 last year ex ante and ex post electric energy and demand savings and realization rates by measure category. The gross realization rates of 102% for electric energy savings and 120% for demand savings indicate the evaluated (ex post) gross savings achieved by the program exceeded the total tracked ex ante savings.

Table 119. PY2021 Multifamily Income Eligible Electric Energy and Demand Savings by Measure Category

Measure Category	Quantity	Energy Savings			Demand Savings		
		Ex Ante (MWh)	Gross Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Gross Realization Rate	Ex Post (MW)
Air Source Heat Pump	296	2,537	104%	2,643	0.21	154%	0.33
Advanced Thermostat	1,026	706	100%	706	0.13	100%	0.13
Business Lighting	1,348	586	101%	592	0.11	101%	0.11
Packaged Terminal Air Conditioner	226	478	100%	478	0.00	100%	0.00
In-Unit Lighting	21,184	429	100%	429	0.06	100%	0.06
Exterior Business Lighting	450	244	100%	244	0.00	100%	0.00
Low-Flow Showerhead	839	346	98%	338	0.03	98%	0.03
Electronically Commutated Motor	375	218	100%	218	0.10	100%	0.10
Ductless Mini-Split Heat Pump	30	164	106%	175	0.00	1003%	0.03
Low-Flow Faucet Aerator	1,466	148	97%	144	0.01	97%	0.01
Motor and VFD	6	58	100%	58	0.05	100%	0.05

Measure Category	Quantity	Energy Savings			Demand Savings		
		Ex Ante (MWh)	Gross Realization Rate	Ex Post (MWh)	Ex Ante (MW)	Gross Realization Rate	Ex Post (MW)
Windows	438	37	100%	37	0.05	100%	0.05
Refrigerator	49	28	100%	28	0.00	100%	0.00
Central Air Conditioner	26	17	158%	27	0.02	158%	0.03
Pool Pump	5	13	100%	13	0.00	100%	0.00
Programmable Thermostat	8	1	100%	1	0.00	100%	0.00
Clothes Washer	12	0	100%	0	0.00	100%	0.00
Total	**27,784**	**6,012**	**102%**	**6,132**	**0.79**	**120%**	**0.95**

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:

- **Lighting RES:** The gross realization rate for residential lighting is 100% for energy and demand savings.
- Ex ante calculations applied an ISR of 100% for 3,962 records (63% of records) and 96.18% ISR for 2,301 records (37% of records). The evaluation team applied an ISR of 98.18% for all residential lighting measures in accordance with Appendix F (v5.0) of the TRM. This decreased energy and demand savings.
- Ex ante calculations applied a WHF of 1 for 369 records (6% of records) and a WHF of 0.97 for 207 records (3% of records). Ex post calculations applied a WHF of 0.99 for all in-unit lighting records in accordance with Appendix F (v5.0) of the TRM. This increased energy and demand savings.
- **Lighting BUS:** The gross realization rate for business lighting is 101% for energy and demand savings.
- Ex ante calculations applied the WHF and HOU assumptions from the Business Deemed Savings Table of Appendix F (v5.0) of the TRM. For most records, ex post calculations applied the HOU and WHF assumptions for non-residential lighting measures from the Income Eligible Deemed Table in Appendix F (v5.0) of the TRM. For measures deemed to be operating 24 hours a day, 365 days per year, however, we applied 8,760 for HOU. This increased energy and demand savings.
- Ex ante calculations applied an ISR of 97.6% for 11 records (19% of records). Ex post calculations applied an ISR of 100% for all business lighting measures in accordance with Appendix F (v5.0) of the TRM. This increased energy and demand savings.
- **Low-Flow Showerhead:** The gross realization rate for low-flow showerheads is 98% for energy and demand savings.
- Ex ante calculations applied an ISR of 100% for 623 records (74% of records) and 94.4% for 218 records (26% of records). Ex post calculations applied an ISR of 96.4%, per Appendix F (v5.0) of the TRM. This reduced energy and demand savings.
- **Low-Flow Faucet Aerator:** The gross realization rate for low-flow faucet aerators is 97% for energy and demand savings.
  - Ex ante calculations applied an ISR of 100% for 979 records (70% of records) and 93% for 426 records (35% of records). Ex post calculations applied an ISR of 95%, per Appendix F (v5.0) of the TRM. This reduced energy and demand savings.

- Ex ante calculations applied a drain factor of 0.75 for 17 low-flow faucet aerator records (1% of records). The evaluation team applied a drain factor of 1.0 for all records in accordance with Appendix F (v5.0) of the TRM. This increased energy and demand savings.

- **Air Source Heat Pump:** The gross realization rate for air source heat pumps is 104% for energy and 154% for demand savings.
  - For 34 ASHP early replacement records, the program-tracking data listed first and last year demand savings as equal. This appears to have resulted from a data transfer error, as the associated RAF for the project correctly calculated first and last year demand savings by applying the existing SEER in the first year calculation and baseline SEER in the last year calculation, per guidance from the Ameren Missouri TRM. The evaluation team calculated ex post savings consistent with the methods outlined in Appendix F (v5.0) of the TRM, as well as those used in the RAF. This increased first year demand savings.
  - Ex ante calculations applied the site-specific existing SEER value to calculate savings for early replacement ASHP records. The evaluation team, in alignment with the methods outlined in the Missouri TRM, de-rated the existing SEER value for early replacement heat pumps by the age of the existing equipment, or otherwise by a default of 12 years, to account for the degradation of the performance of the existing equipment over time. This increased energy and demand savings.
- **Ductless Mini-Split Heat Pump:** The gross realization rate for ductless mini-split heat pumps is 106% for energy and 1,003% for demand savings.
  - For all ductless mini-split heat pumps early replacement records (30 records), the program-tracking data listed first and last year demand savings as equal. This appears to have resulted from a data transfer error, as the associated RAF for the project correctly calculated first and last year demand savings by applying the existing SEER in the first year calculation and baseline SEER in the last year calculation, per guidance from the Ameren Missouri TRM. The evaluation team calculated ex post savings consistent with the methods outlined in Appendix F (v5.0) of the TRM, as well as those used in the RAF. This increased first year demand savings.
  - Ex ante calculations applied the site-specific existing SEER value to calculate savings for early replacement ductless mini-split heat pump records. The evaluation team, in alignment with the methods outlined in the Missouri TRM, de-rated the existing SEER value for early replacement heat pumps by the age of the existing equipment, or otherwise by a default of 12 years, to account for the degradation of the performance of the existing equipment over time. This increased energy and demand savings.
- **Central Air Conditioner:** The gross realization rate for central air conditioners is 158% for energy and demand savings.
  - Ex ante calculations applied the site-specific existing SEER values to calculate savings for early replacement CAC records. The evaluation team, in alignment with the methods outlined in the Missouri TRM, de-rated the existing SEER value for early replacement CACs by the age of the existing equipment, or otherwise by a default of 12 years, to account for the degradation of the performance of the existing equipment over time. This increased energy and demand savings.
- **Electronically Commutated Motors**: The gross realization rate for electronically commutated motors is 100% for energy and demand savings. However, the evaluation team applied a different measure life in the ex post analysis than the program team applied in the ex ante analysis.

- Ex ante calculations applied a measure life of 18 years for ECMs. Ex post applied a measure life of six years, representative of the remaining life of the existing equipment, and in accordance with the Code of Federal Regulations that became effective in July 2019.

11.3.3 Net Impact Results

Because the MFIE Program falls under the umbrella of Income Eligible programs, we applied a default NTGR of 1.0, assuming that both FR and SO are zero. As such, net impacts for the MFIE Program are equal to the gross impacts presented in the section above.

12. Single Family Income Eligible (SFIE)

This section summarizes the PY2021 evaluation methodology and results for the Residential Single Family Income Eligible (SFIE) Program. Additional details on the methodology are presented in Appendix A.

12.1 Evaluation Summary

The Single Family Income Eligible Program, known to customers as the CommunitySavers Single Family Program, is designed to provide whole-home energy efficiency upgrades to income-eligible Ameren Missouri customers living in single family properties, including mobile homes and duplexes.[54] The program historically leveraged three participation channels to achieve this goal: (1) the Single Family Channel; (2) the Mobile Homes Channel; and (3) the Grant Channel. Each channel was designed to reach income-eligible customers in different ways that collectively strive to overcome barriers to energy efficiency among this segment. As part of the adjustments implemented in PY2020 due to the COVID-19 pandemic, the program team permanently merged the Mobile Homes Channel into the Single Family Channel to streamline implementation efforts.

12.1.1 Single Family Channel

The Single Family Channel typically deploys a neighborhood-canvass recruitment approach to schedule home energy assessments with interested customers and identify comprehensive retrofit opportunities. This recruitment approach includes direct customer outreach and partnerships with trusted community groups to encourage participation. Due to the health risks associated with COVID-19, however, the program team temporarily modified their recruitment strategy in PY2020 by recruiting participants through housing organizations with large portfolios of properties rather than direct customer outreach. The program team had less available budget in PY2021 due to intentionally exceeding the PY2020 budget to be able to continue to serve high-need customers through the pandemic. As such, the implementation team had less funding available in PY2021 to return to the traditional canvass outreach strategy. Instead, the program team continued to recruit participants by working with large housing organizations, or other community groups to build a participation pipeline. Specifically, in PY2021 the program team returned to serving customers who live in mobile homes after focusing resources elsewhere in PY2020. Additionally, the implementation team recruited PY2020 participants who only received partial treatment (i.e., contactless HVAC tune-ups or leave-behind kit measures) and offered the full range of energy efficiency treatments.

During PY2021, the program implementation team no longer offered leave-behind kit measures and contactless tune-ups of HVAC systems as they did in PY2020. Consistent with PY2020, however, the implementation team did provide incentives for participants to leave their homes during the comprehensive energy assessment where contractors would directly install certain measures (e.g., LEDs, faucet aerators, efficient showerheads, etc.) and identify deeper savings opportunities to be installed during follow-up visits (e.g., attic insulation, HVAC replacements, duct sealing, etc.).

While the program delivery differed from PY2020 in several ways, the roles and responsibilities of Franklin Energy (Program Administrator) and Resource Innovations (Program Implementer) within the Single Family Channel remained the same. Resource Innovations led customer recruitment efforts, managed sub-contractors, collected program-tracking data, and transferred data to Franklin Energy. The data transfer was completed using an Application Programming Interface (API) which automated the data transfer process from Resource Innovations' database to Franklin Energy's database and calculated energy savings using programmed calculations. Franklin Energy was responsible for reviewing the data submissions and savings

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

calculations, batching invoices, and processing incentives. Franklin Energy also aggregated program-tracking data and provided regular reports on program activity to Ameren Missouri.

12.1.2 Grant Channel

Franklin Energy administered and implemented the Grant Channel which remained largely unchanged from PY2020. Ameren Missouri designed the Grant Channel to reach additional income-eligible customers and provide them with energy efficiency measures through community-based organizations (CBOs). Eligible CBOs were required to serve Ameren Missouri residential electric customers who reside in single family homes and have an annual family income at or below 80% of Area Median Income (AMI). Interested CBOs needed to apply to participate through Franklin Energy. Once enrolled, CBOs ordered measures through a web-based portal or by contacting Franklin Energy directly. CBOs could participate in one or both of the following capacities:

- **Measure distribution**: The majority of CBOs participated in this capacity and received measures at no cost and distributed them to customers who engaged with the CBO. Eligible measures included a four-pack of LEDs, a dirty HVAC filter alarm, two faucet aerators, hot water pipe insulation, and a low-flow showerhead. CBOs are required to verify recipients' eligibility before distributing measures. Due to COVID-19, the program team advised CBOs to conduct contactless distributions in PY2021. Some CBOs dropped measures off directly at customers' homes. Other CBOs had already modified their typical operations to reduce customer contact (e.g., drive-through food distributions) and thus distributed measures consistent with their own protocols.
- **Measure installation**: CBOs that participated in this capacity arranged for the installation of energy-saving measures in the homes of qualified customers. In PY2021, only one CBO participated in this capacity and their measure installations were limited to room ACs. In other years, CBOs have installed LED bulbs, smart thermostats, HVAC dirty filter alarms, high-efficiency faucet aerators, pipe insulation, and low-flow showerheads at no out-of-pocket expense to the participant. Larger energy-saving measures including refrigerators, central air conditioners, fan blower motors, heat pump water heaters, ASHPs, and ductless air source heat pumps were also eligible for installation, but CBOs need to procure the equipment through traditional means and apply for a reimbursement after the installation.[55] Note that CBOs did not distribute any of these larger savings measures in PY2021.

The Grant Channel saw a smaller number of measures distributed by the CBOs in PY2021 compared to PY2020 (90,462 compared to 318,379 measures) due to a smaller available budget. That said, the program team was able to reach a broader geographic area in PY2021 by partnering with new organizations from Central and West Central Missouri and other locations within Ameren Missouri's service territory, as opposed to mostly working with St. Louis-based CBOs, as was the case during PY2020.

12.1.3 Participation Summary

The program team treated 874 participants through the Single Family Channel in PY2021, which accounted for 31% of program ex ante savings. The Grant Channel accounted for the remaining 69% of program ex ante savings. Across both channels the program team and their CBO partners distributed a total of 102,999 measures. Within the Grants Channel, participating CBOs installed or distributed 90,462 measures, which accounted for 88% of the total measures provided to customers across the SFIE Program. This included health

[55] CBOs can pair the Grant reimbursement with incentives from the HVAC and Efficient Products programs. In these cases, Ameren Missouri does not claim the savings through the SFIE Program and instead claims them under the other applicable program.

and safety measures like carbon monoxide and smoke detectors, and/or gas-only measures, which have no savings associated.

Table 120 presents participation in the SFIE Program during PY2021 by channel.

Table 120. PY2021 Single Family Income Eligible Program Participation Summary

Channel	Participants		Measures		Ex Ante Savings	
	Number[a]	%	Number[b]	%	MWh	%
Single Family	874	100%	12,537	12%	1,096	31%
Grant			90,462	88%	2,478	69%
Total	**874**	**100%**	**102,999**	**100%**	**3,574**	**100%**

Note: CBOs that distribute measures through the Grant Channel do not track individual participants.
[a] Includes 13 participants with zero ex ante savings. These participants only received health and safety and/or gas-only measures for which the program does not claim savings.
[b] The Single Family and Grant Channels distributed 3,836 and 4,232 health and safety and/or gas-only measures respectively.

Table 121 presents PY2021 participation in the Grant Channel by CBO. About half of organizations also participated in the program in PY2020 including Buchanan Foundation, People's Community Action Corporation – North City Office, and Food Outreach Inc., among others. The program team worked with several new organizations in PY2021, such as Riverview West Florissant Development Corporation, Communities First, and Young Voices with Action, among others.

Table 121. PY2021 Grant Participation by Organization

Organization	Measures		Ex Ante Savings	
	Number	%	MWh	%
Riverview West Florissant Development Corporation	17,770	20%	452	18%
Communities First	10,800	12%	289	12%
Buchanan Foundation	10,482	12%	314	13%
Ameren Missouri[a]	10,316	11%	327	13%
People's Community Action Corporation - North City Office	6,792	8%	171	7%
Food Outreach Inc.	6,000	7%	161	6%
Community Action Agency of St. Louis County	4,032	4%	101	4%
Young Voices with Action	4,032	4%	90	4%
Hope House of Miller County	3,600	4%	96	4%
Urban League of Metro St. Louis	2,784	3%	62	2%
The Saint Louis Association of Community Organizations (SLACO)	2,016	2%	45	2%
Community of Hope	1,916	2%	53	2%
Northeast Missouri Community Action Agency	1,860	2%	54	2%
Good Samaritan Center	1,657	2%	44	2%
Circle of Light Associates	1,220	1%	36	1%
Keep It Real Youth Outreach	1,158	1%	35	1%
West Central Missouri Community Action Agency	840	1%	21	1%
Winger Food Pantry - Trinity Presbyterian Church	816	1%	18	1%
Cool Down St. Louis	750	1%	58	2%
Central Missouri Community Action Agency	664	1%	17	1%

Organization	Measures		Ex Ante Savings	
	Number	%	MWh	%
KingsVille Neighborhood Association	624	1%	14	1%
Energycare Inc.	200	<1%	15	1%
Jefferson Franklin Community Action Center	96	<1%	2	<1%
Northeast Community Action Center	25	<1%	2	<1%
St. Joachim and Ann Care Service	12	<1%	1	<1%
Total	**90,462**	**100%**	**2,478**	**100%**

[a] Ameren Missouri distributed measures to local fire departments, police departments, and community governments. These organizations then distributed measures to income-eligible customers.

12.1.4 Key Impact Results

Table 122 presents the annual savings achieved in PY2021. As shown, the program (including all distribution channels) achieved 31% of Ameren Missouri's net energy savings goal and 42% of the net demand savings goal for the SFIE Program.

Table 122. PY2021 Single Family Income Eligible Program Impact Summary

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net	Goal/ Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	3,574	93.3%	3,335	100.0%	3,335	10,822	31%
Demand Savings (MW)	1.05	97.8%	1.03	100.0%	1.03	2.47	42%
Last Year Demand Savings							
< 10 EUL (MW)	0.17	142.5%	0.24	100.0%	0.24	0.57	43%
10–14 EUL (MW)	0.30	100.6%	0.31	100.0%	0.31	0.09	341%
15+ EUL (MW)	0.39	77.3%	0.30	100.0%	0.30	1.81	17%

The primary performance metric for the SFIE Program is the average percent energy savings per participating property in the Single Family Channel. 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 goal of achieving an average 12.5% energy savings per property across the Single Family Channel, with a minimum target of 10% to be eligible for their earnings opportunity. Table 123 summarizes the key inputs to calculating the average percent energy savings according to 2019-21 MEEIA Energy Efficiency Plan guidance.[56] We calculated average percent energy savings per property as total ex post energy savings from the Single Family Channel divided by the total billed energy consumption at the 874 participating properties. Ex post savings—which are based on engineering approaches documented in the Ameren Missouri TRM along with some project-specific data—equate to 14% of the recorded baseline energy use. Note that this metric does not include energy savings from the Grants Channel.

[56] 2019–21 MEEIA Energy Efficiency Plan, p. 53.

Table 123. PY2021 Single Family Income Eligible Program Average Percent Energy Savings Per Property

Metric	Value
Ex post gross energy savings[a] (kWh) [A]	1,077,035
Total billed pre-participation energy consumption (kWh) [B]	7,631,123
Average percent energy savings per property [A/B]	14%

[a] Gross energy savings from the Single Family Channel

Overall, the SFIE Program was the second-largest program in the PY2021 Low-Income Portfolio, accounting for 34% of ex post net Low-Income Portfolio energy savings and 50% of ex post net Low-Income Portfolio demand savings.

12.1.5 Key Process Findings

Pulling from past evaluation years and our PY2021 program staff interviews, we believe the program is well-designed to overcome most of the primary market imperfections in the single family income-eligible market. To meet the requirements of the Missouri Code of State Regulations (CSR)[57] for demand-side process evaluations, we provide responses to the five required process evaluation questions in Table 124, noting that the evaluation team did not conduct a full process evaluation in PY2021, instead the team's efforts focused on the impact evaluation.

Table 124. 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's typical community-driven components each target a specific housing stock subsegment (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. Still, implementation experience shows many neighborhoods have mixed housing stock (including single family, small multifamily, and mobile homes). Notably, Ameren Missouri gained approval through the 11-step stakeholder process to change program eligibility to

[57] 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
	allow the program team to serve attached dwellings of four or fewer units in addition to detached homes and duplexes. Going forward, this change will help the program serve a larger share of homes per neighborhood.
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 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 enduse 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. In PY2021, differently from the previous year, the program team was able to offer its full suite of measures to homes that had only partially benefited from the program in PY2020 and to new participants. This was possible by leveraging the relationships built with CBOs and housing organizations and offering relocation incentives to customers to vacate their homes while COVID-19 restrictions were in place.
Are the communication channels and delivery mechanisms appropriate for the target market segment?	The program team's typical 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 community groups and mobile home park owners; conducting direct outreach to residents through neighborhood canvassing; 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. In PY2020, the program team adapted their approach due to COVID-19. The program team targeted housing organizations with large portfolios of properties rather than contacting customers directly. This streamlined outreach strategy allowed the program team to treat many more properties in PY2020 compared to PY2019. The program team continued to take advantage of this outreach strategy in PY2021, which added greater efficiency to the implementation of the program and was able to target both single family and mobile home customers. For the Grant Channel, the program team is targeting CBOs that are prepared to distribute and install energy efficiency measures outside of the Single Family Channel. While most of the measures distributed or installed through this channel in PY2020 went through CBOs in and around St. Louis, the Grant Channel had a broader geographic reach in PY2021 incorporating CBOs from Central and West Central Missouri, and other locations in the territory. The program team should continue to focus on CBO recruitment in 2022 with an aim of expanding the number of actively participating CBOs, especially those serving rural communities, and those prepared to complete eligible direct installation.
What can be done to more effectively overcome the identified market imperfections and to increase the rate of	The program team can increase the rate of customer acceptance by continuing to expand the network of participating CBOs in both the Grant Channel and the Single Family Channel. This collaborative work with community partners offers the opportunity to engage with many Ameren Missouri customers across the service territory. The distribution and

CSR Required Process Evaluations Questions	Findings
customer acceptance and implementation for select enduses/measure groups included in the Program?	installation arms of both programs offer opportunities for participants to install measures across a range of enduses.

12.1.6 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 are 93.3% of the ex ante gross energy savings and 97.8% of the ex ante gross demand savings (Table 1-4), indicating that the tracked ex ante savings slightly overstate 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 version 4.0 of the Ameren Missouri TRM Appendix F, dated January 1, 2021, and the ex post savings are based on the more recent version 5.0 of Appendix F, dated September 15, 2021; 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 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.
- **Conclusion #2:** Percent of savings per property was similar to PY2020 but slightly lower (14% in PY2021 compared to 16% in PY2020). The co-delivery of gas measures in PY2021 was a challenge perceived by the implementation team to meeting the percent savings metric.
- **Conclusion #3:** The Grant Channel had a broader geographic reach in PY2021 when compared to past years and was critical to meeting customer needs in PY2021. While implementation partners distributed a much smaller number of measures through this channel in PY2021 (90,462) when compared with PY2020 (318,379), the program team built successful relationships with CBOs located outside of St. Louis which allowed Ameren Missouri to reach a much broader geographic area through this channel. As the contactless measure distribution inherent in the design of the Grant Channel was well-suited for serving customers in the midst of the COVID-19 pandemic, the program team was able to exceed their budget for PY2020, leaving less available budget in PY2021. When compared to the number of measures distributed in PY2019 (23,871), the program team has grown the Grants Channel substantially by successfully building partnerships with CBOs throughout Ameren Missouri's service territory.
- **Conclusion #4:** Participation in the Single Family Channel declined in PY2021 (874 participants) compared to PY2020 (1,605) but increased compared to PY2019 (487). In PY2021 the program offered a full suite of measures to its customers and was able to target high need mobile home customers, a key market segment. Additionally, on average, each participating customer received more measures and deeper savings in PY2021, compared to PY2020 due to the concentrated and comprehensive approach. The program team successfully leveraged the outreach strategy

implemented in PY2020 for the Single Family Channel to drive participation through CBOs and housing authorities rather than direct customer outreach. This contributed to building a strong customer pipeline for PY2021, added efficiency for the program implementation, and allowed the program team to offer customers a comprehensive program scope.

12.2 Evaluation Methodology

The evaluation team focused PY2021 evaluation efforts on impact evaluation activities to assess the performance of the SFIE Program. In addition to the overarching research objectives outlined for the Low-Income Portfolio, the evaluation team explored the following program-specific objectives:

- Obtain information on program design and planned implementation with a focus on differences from PY2020
- Understand program staff and implementer perceptions, experiences, and expected program impacts
- Estimate the first-year ex-post gross average percent energy (kWh) savings per property that participated in the Single Family Channel
- Estimate the first-year ex-post net energy (kWh) and demand (kW) savings, and last-year demand savings

Table 125 provides an overview of the SFIE evaluation activities.

Table 125.. PY2021 Evaluation Activities for the Single Family Income Eligible Program

Evaluation Activity	Description
Program Manager and Implementer Interviews	▪ Conducted interviews in the fall of PY2021 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, program-tracking data, and PY2021 evaluation-estimated parameters.

12.3 Evaluation Results

12.3.1 Process Results: Single Family Channel

Performance

In PY2021, the budget available for the Single Family Channel was smaller due to overspending in PY2020 in response to COVID-19-related program modifications. As such, the program team effectively leveraged the partnerships with CBOs and housing organizations it had worked with in PY2020 to build a pipeline of program participants in PY2021. As an initial targeting strategy, the program team identified properties that had only partially benefited from the program in PY2020 due to the COVID-19 restrictions by receiving only contactless

HVAC tune-ups, replacement of inefficient exterior lighting, and/or leave-behind kits. In PY2021, these homes were targeted to receive a comprehensive project scope in line with the program's original design, that included a full home energy assessment, along with major equipment replacements and building shell improvements. As a result, a larger share of participants received more measures in PY2021 compared to PY2020 (5% and 2% of participants respectively received more than ten measures, excluding kits) and a larger share also received deeper savings measures in PY2021 compared to PY2020 (14% and 1% of participants respectively received HVAC and/or refrigeration equipment).

With a smaller budget available and a broader scope of offerings and time dedicated per household, participation in the Single Family Channel (both single family and mobile homes components) decreased in PY2021 compared to PY2020, from 1,605 to 874 participants. Table 126 shows a summary of Single Family Channel activity by measure in PY2021.

Table 126. PY2021 Single Family Activity by Measure

Measure	Number of Participants	Percent of Unique Participants (N=874)
LEDs	695	80%
Faucet Aerator	515	59%
Advanced Thermostat	413	47%
Low-Flow Showerhead	281	32%
ECM Auto Fan	239	27%
Ceiling Insulation	236	27%
Air Sealing	235	27%
Furnace	170	19%
Filter Alarm	170	19%
Duct Sealing	130	15%
Central Air Conditioner	89	10%
HVAC Tune-Up	81	9%
Advanced Tier 2 Power Strips	70	8%
Programmable Thermostat	58	7%
Pipe Insulation	30	3%
Air Source Heat Pump	25	3%
Refrigerator	13	1%
Room Air Conditioner	4	<1%

Leveraging existing relationships with CBOs and housing partners that engaged with the program in PY2020 added greater efficiency to the implementation of the program in PY2021, minimizing the time required for outreach and identification of eligible properties. The implementation team partnered with some large organizations in PY2020 that served eligible customers in Ameren MO service territory such as Beyond Housing, St. Louis Housing Authority, Housing Authority of St. Louis County, and Southeast Missouri State University (SEMO). In PY2021, it also created relationships with new and smaller organizations (e.g., Circle of Light). Unlike in PY2020 when the program implementation team did not serve any mobile homes, in PY2021 the implementation team pursued a high-need mobile home community in Cape Girardeau and was able to

serve these customers beginning in August. In September 2021, restrictions to enter occupied homes were lifted, allowing the program team to serve these mobile homes while occupants were present.

The relationships the program team built with the CBOs and housing organizations that serve income eligible customers in the Ameren Missouri service territory positively impacted the program's success this year. The program team reported they believe community partnerships should remain central to the program's strategy for driving program participation in future years However, the program team also recognized that there are many Ameren Missouri customers in need of the program's services that are not associated with these types of organizations, and the neighborhood outreach approach will also be needed to serve these customers.

In PY2021, the Single Family Channel did not have any gaps or delays in implementation activity, as experienced in PY2020 due to COVID-19. The program team reported exceeding their PY2021 spending goal, which was to spend at least 85% of the approved $2,639,606 budget. Additionally, this program has an earnings opportunity (EO) eligible performance goal minimum of 10% (average savings per property) and a maximum goal of 12.5% in order to receive a EO payout amount. The program team achieved 14% average savings per property in PY2021.

Design Changes

During PY2021, the implementation team for the Single Family Channel offered a comprehensive program delivery that was closer to the original intent of the program design before the COVID-19 restrictions were put into place in March 2020. For most of PY2020, the implementation team was restricted from entering occupied residences, so program activity was limited to offering contactless HVAC tune-ups on exterior units, replacement of inefficient exterior lighting, and leave-behind kits. Only vacant properties would receive a traditional program delivery.

By the start of PY2021, the program team used a relocation incentive strategy that had been implemented since the end of PY2020, where a $50 and $100 incentive was offered to customers to vacate their property so implementation crews could conduct in-home work like HVAC system replacements. This strategy had proven very successful among customers and program partners, and the program team adopted it while COVID-19 restrictions to enter occupied homes were in place. As such, the contactless exterior HVAC tune-ups and leave-behind energy efficiency kits were no longer among the program's offerings in PY2021. Instead, residents temporarily left the home and received a home energy assessment. During the home energy assessment contractors:

- Directly installed certain measures such as exterior and interior LEDs, kitchen and bathroom aerators, high efficiency showerheads, and advanced power strips;
- Cleaned furnace components and performed furnace checks that focus on flame quality, venting and exhaust-gas composition, and potential gas leaks;
- Assessed opportunities for other energy-saving measures that could be installed during follow-up visits (e.g., attic insulation, refrigerators, HVAC system upgrades, etc.);
- Installed smart thermostats, especially if properties did not qualify for a follow-up visit; and
- Checked for the need for health and safety upgrades.

Based on the home energy assessment, residents would be notified of a follow-up visit if their home qualified for an upgrade or replacement of deeper saving measures such as ENERGY STAR® refrigerators,[58] HVAC

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

system, attic insulation, air sealing, and smart thermostats.[59] Residents would receive an incentive to vacate their homes for these follow-up visits as well. In PY2021, neither eligibility criteria for customers nor measure replacement criteria changed compared to PY2020.

During the home energy assessment, contractors left behind educational materials for customers including (1) a savings and tips sheet with information about what was installed during the home assessment, the benefits of the installed equipment, tips for saving energy, and who to contact in case they had questions; (2) a work authorization sheet that let customers know if they were eligible for any of the deeper savings measures available through the program, with information about the benefits of making those upgrades, and information on how to schedule the follow-up visit; and (3) a smart thermostat reference guide, for participants who received this measure, which included quick tips and was meant to be a useful resource in addition to the smart thermostat's manual. The latter was a new addition to the materials packet for customers in PY2021 due to the high number of calls that the program team received related to participants installing and programming smart thermostats.

Implementation Challenges

One of the implementation challenges the program team faced was related to co-delivery of gas and electric services and the perceived impact of co-delivery on the average percent energy savings per property metric. According to the program team, there tends to be less opportunity for driving electric savings when the program targets homes with natural gas components. Additionally, they mentioned concerns that the additional number of homes treated in a co-delivery model increases the total electricity usage in the percent savings metric, as measured by the total billed pre-participation energy consumption (kWh) but does not necessarily increase the program total electric savings. This was perceived to "weigh down" the program's percent savings metric, and presented a challenge within the implementation team to hit the percent savings metric while continuing to treat all eligible income-eligible households, regardless of fuel type.

Customers and the program team also faced some inconveniences related to the relocation incentives, which were provided as gift cards from the implementation team. Some customers understandably did not want to vacate their homes when weather conditions were too uncomfortable outside. The processing of gift cards created an additional administrative burden for the implementation team and the housing partners, despite the gift cards' success. However, this strategy was no longer needed once restrictions around entering occupied properties were lifted towards the end of 2021. The implementation team plans to use the gift card strategy in the future, given its success, for specific cases of homes in high need where customers are reluctant to participate or for those who are still not comfortable being home while the implementation crew does its work for health reasons.

12.3.2 Process Results: Grant Channel

Performance

Participating CBOs distributed a smaller number of measures in PY2021, when compared to PY2020 through the Grant Channel (90,462 measures in PY2021 compared to 318,379 in PY2020). The number of measures in PY2021 was significantly higher than those in PY2019 (23,871 measures distributed); indicating that PY2020 was an outlier. In PY2020, there was an increase in the demand for CBOs services within Ameren Missouri service territory, and a subsequent jump in the number of CBOs that engaged with the program and the number of measures distributed, compared to PY2019. This led to overspending the program's budget in

[59] Smart thermostats were also installed during the home energy assessment at the contractor's discretion, especially in the case of properties that did not qualify for a follow-up visit.

PY2020 and to a smaller available budget for PY2021. As a result, the program team had to plan accordingly by allocating a maximum allowable amount for each month. According to the program team, this did not interfere with any of the requests submitted by the CBOs and allowed the Grant Channel to reach their budget spend goal for PY2021.

Despite the smaller number of measures distributed, the Grant Channel had a broader geographic reach in PY2021 compared to the PY2020. While most CBOs were St. Louis-based in PY2020, in PY2021 the program team worked with new organizations that serve Ameren Missouri customers from Central and West Central Missouri, and other locations within Ameren's service territory. In PY2021, 25 CBOs partnered with the program team, compared to 19 CBOs in PY2020.Table 127 includes a summary of the CBOs that participated in the program in PY2021.

Table 127. Participating Organizations in the Grant Channel

Organization	City	Measures Distributed	Percent of Measures Distributed
Riverview West Florissant Development Corporation	St. Louis	17,770	20%
Communities First	St. Louis	10,800	12%
Buchanan Foundation	St. Louis	10,482	12%
Ameren Missouria	St. Louis	10,316	11%
People's Community Action Corporation - North City Office	St. Louis	6,792	8%
Food Outreach Inc.	St. Louis	6,000	7%
Community Action Agency of St. Louis County	Overland	4,032	4%
Young Voices with Action	St. Louis	4,032	4%
Hope House of Miller County	Lake Ozark	3,600	4%
Urban League of Metro St. Louis	St. Louis	2,784	3%
The Saint Louis Association of Community Organizations (SLACO)	St. Louis	2,016	2%
Community of Hope	St. Louis	1,916	2%
Northeast Missouri Community Action Agency	Kirksville	1,860	2%
Good Samaritan Center	Excelsior Springs	1,657	2%
Circle of Light Associates	St. Louis	1,220	1%
Keep It Real Youth Outreach	St. Louis	1,158	1%
West Central Missouri Community Action Agency	Appleton City	840	1%
Winger Food Pantry - Trinity Presbyterian Church	St. Louis	816	1%
Cool Down St. Louis	St. Louis	750	1%
Central Missouri Community Action Agency	Columbia	664	1%
KingsVille Neighborhood Association	St. Louis	624	1%
Energycare Inc.	St. Louis	200	<1%
Jefferson Franklin Community Action Center	Hillsboro	96	<1%
Northeast Community Action Center	Bowling Green	25	<1%
St. Joachim and Ann Care Service	St. Charles	12	<1%

[a] Ameren Missouri distributed measures to local fire departments, police departments, and community governments. These organizations then distributed measures to income-eligible customers.

Implementation Challenges and Design Changes

Similar to PY2020, implementation and design challenges due to COVID-19 continued into PY2021 for the Grant Channel. One of the most impactful design changes that began in PY2020 due to COVID-19 health risks was the restriction around entering participants' homes. This resulted in very few in-home installations of energy efficiency measures like air conditioners, smart thermostats, and refrigerators over the two-year period. PY2021 was no different, with only one CBO (Energycare, Inc.) conducting some in-home installations of room air conditioners. For most of the program measures distributed through the different CBOs, the program team had to rely on customer installations. Similar to PY2020, participants signed an agreement upon receiving energy efficiency measures stating they would install the equipment in their home to try to reduce resale of the measures. The CBOs would collect some personal information about the customer and equipment (name, full address, and equipment sticker ID#[60]), but no information regarding household characteristics, baseline conditions, or information about the old equipment that would be replaced was collected. Further, the program team experienced some supply chain challenges that limited the availability of window air conditioners. The program was only able to offer that measure starting in July 2021 as the supplier could not provide window air conditioners earlier.

12.3.3 Gross Impact Results

Measure-Level In-Service Rates

In-service rates (ISRs) indicate the percentage of program measures that are installed and in use and vary based on measure type and distribution approach. For example, HVAC equipment is likely to be installed and in use, while an LED bulb may remain on a participant's shelf rather than in use. For Direct Install distribution methods, ISRs are typically close to 100% because a qualified program contractor directly installed the measure at the participant location.

Conversely, a "giveaway" distribution approach—such as those used in the Grant channel—will tend to have a lower ISR because participants may not install the items for various reasons. The evaluation team leveraged PY2019 SFIE participant survey responses to calculate ISRs for LEDs (100%), advanced power strips (95%), showerheads (94%), and aerators (89%) that were installed through the Single Family channel. For LED, aerator, and showerhead measures distributed through the Grant channel "giveaway" methods, we applied the ISRs used for similar measures distributed through the RAR Program in PY2019. All other ISRs were taken from the TRM version 5.0 of Appendix F. Note that the TRM algorithms for some measures do not include an ISR term and thus implicitly deem the ISR at 100%. We present all ISRs used for the PY2021 evaluation as part of our Detailed Impact Analysis Methodology for the SFIE Program (Appendix A). We applied the ISR values to each measure in the ex post analysis to calculate the PY2021 gross savings.

Gross Impact Results

As presented in Table 128, the PY2021 SFIE Program achieved 3,335 MWh and 1.03 MW in ex post gross first-year savings, resulting in 93.3% and 97.8% realization rates, respectively.

[60] In PY2020, the program team added stickers with unique IDs to the larger, more expensive equipment, like air conditioners and smart thermostats in response to some instances where customers were selling their equipment, instead of installing them in their home. Later, the program team would conduct QA/QC calls with 10% of customers who received these larger measures and ask them to read the number off the back of the unit to confirm the equipment was installed and operating in their home.

Table 128. PY2021 Single Family Income Eligible Gross Impact Summary

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross
First Year Savings			
Energy Savings (MWh)	3,574	93.3%	3,335
Demand Savings (MW)	1.05	97.8%	1.03
Last Year Demand Savings			
< 10 EUL (MW)	0.17	142.5%	0.24
10–14 EUL (MW)	0.30	100.6%	0.31
15+ EUL (MW)	0.39	77.3%	0.30

Table 129 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 rate but range from 47.7% for faucet aerators to 124.9% for dirty filter alarms. Lighting measures account for the largest portion of ex post energy savings (46%), with a gross realization rate of 97.1%. Dirty filter alarm measures account for the next largest share of ex post savings (8.9%), air source heat pump (8.5%), low-flow showerhead (6.6%), smart thermostat (5.9%), central air conditioner (5.1%), and ECM auto fan (4.8%). All other measures are individually less than 5% of program savings, a majority are close to or much less than 1%, and together account for only about 15% of ex post program energy savings.

Table 129. PY2021 Single Family Income Eligible Annual 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)
Lighting	1,565	97.1%	1,520	0.23	97.1%	0.23
Dirty Filter Alarm	237	124.9%	296	0.11	124.9%	0.14
Air Source Heat Pump	288	98.1%	282	0.05	99.4%	0.05
Low-Flow Showerhead	364	60.9%	221	0.03	60.9%	0.02
Smart Thermostat	160	123.1%	197	0.11	100.8%	0.11
Central Air Conditioner	192	88.7%	170	0.18	88.7%	0.16
ECM Auto Fan	139	115.3%	160	0.06	115.3%	0.07
Room Air Conditioner	126	97.5%	123	0.12	97.5%	0.12
Low-Flow Faucet Aerator	249	47.7%	119	0.02	47.8%	0.01
Ceiling Insulation	52	95.7%	50	0.02	95.8%	0.02
Tune-Up	49	93.5%	46	0.05	93.0%	0.04
Air Sealing	44	100.5%	45	0.02	100.5%	0.02
Pipe Insulation	43	100.0%	43	0.00	99.9%	0.00
Tier 2 Advanced Power Strip	27	100.0%	27	0.00	100.0%	0.00
Setback Thermostat	28	90.7%	25	0.02	87.6%	0.02
Refrigerator	7	100.0%	7	0.00	100.0%	0.00
Duct Sealing	3	97.5%	3	0.00	97.6%	0.00
Duct Insulation	0.03	96.7%	0	0.00	96.7%	0.00
Total	**3,574**	**93.3%**	**3,335**	**1.05**	**97.8%**	**1.03**

Table 130 presents the total PY2021 last-year ex ante and ex post electric demand savings and realization rates by measure by EUL class. The total ex post gross last-year demand savings are 97.2% of the ex ante gross last-year demand savings. Lighting (27%) and dirty filter alarm (16%) measures contributed the largest portion of the program's ex post last-year gross demand savings. The measures accounting for the next largest percent of demand savings are room air conditioner and smart thermostat (both at 14%), ECM auto fan (9%), and tune-up (5%). All other measures are individually less than 5% of program savings, a majority are close to or much less than 1%, and together account for only about 15% of ex post program demand savings.

Table 130. PY2021 Single Family Income Eligible Annual Last Year Gross Demand Impacts

Measure Category	Ex Ante (MW)				Realization Rate	Ex Post (MW)			
	<10	10–14	15+	Total		<10	10–14	15+	Total
Lighting	0.00	0.00	0.23	0.23	97.1%	0.00	0.00	0.23	0.23
Dirty Filter Alarm	0.00	0.11	0.00	0.11	124.9%	0.00	0.14	0.00	0.14
Air Source Heat Pump	0.00	0.00	0.01	0.01	34.4%	0.00	0.00	0.00	0.00
Low-Flow Showerhead	0.00	0.03	0.00	0.03	60.9%	0.00	0.02	0.00	0.02
Smart Thermostat	0.00	0.11	0.00	0.11	100.8%	0.00	0.11	0.00	0.11
Central Air Conditioner	0.00	0.00	0.04	0.04	90.5%	0.00	0.00	0.03	0.03
ECM Auto Fan	0.01	0.00	0.06	0.06	115.3%	0.07	0.00	0.00	0.07
Room Air Conditioner	0.12	0.00	0.00	0.12	97.5%	0.12	0.00	0.00	0.12
Low-Flow Faucet Aerator	0.00	0.02	0.00	0.02	47.8%	0.00	0.01	0.00	0.01
Ceiling Insulation	0.00	0.00	0.02	0.02	95.8%	0.00	0.00	0.02	0.02
Tune-Up	0.05	0.00	0.00	0.05	93.0%	0.04	0.00	0.00	0.04
Air Sealing	0.00	0.00	0.02	0.02	100.5%	0.01	0.00	0.01	0.02
Pipe Insulation	0.00	0.00	0.00	0.00	99.9%	0.00	0.00	0.00	0.00
Tier 2 Advanced Power Strip	0.00	0.00	0.00	0.00	100.0%	0.00	0.00	0.00	0.00
Setback Thermostat	0.00	0.02	0.00	0.02	87.6%	0.00	0.02	0.00	0.02
Refrigerator	0.00	0.00	0.00	0.00	100.0%	0.00	0.00	0.00	0.00
Duct Sealing	0.00	0.00	0.00	0.00	97.6%	0.00	0.00	0.00	0.00
Duct Insulation	0.00	0.00	0.00	0.00	96.7%	0.00	0.00	0.00	0.00
Total	**0.17**	**0.30**	**0.39**	**0.86**	**98.5%**	**0.24**	**0.31**	**0.30**	**0.85**

Discrepancies between ex ante savings calculated by the program team and ex post savings calculated by the evaluation team are primarily driven by parameter values updated in the most recent TRM (version 5.0 of Appendix F updated September 2021), the use of participant-specific information from the tracking data when available instead of TRM default values, and ISR values developed from the 2019 participant survey.

We describe the key drivers of differences between ex ante and ex post savings for measures that contributed at least 5% of SFIE program ex post savings below.

- **Lighting**: The gross realization rate for lighting is 97.1% for electric energy and demand savings.
  - The program team applied ex ante deemed default savings values from version 4.0 of Appendix F for all measures, by measure reference ID but the evaluation team adjusted the ISRs to 100% for the Single Family Channel based on the PY2019 participant survey included in version 5.0 of Appendix F.

- **Dirty Filter Alarm**: The gross realization rate for dirty filter alarms is 124.9% for electric energy and demand savings.
  - The largest driver of this difference occurs in the Grants Channel. The program team used a default ISR of 44% for ex ante savings but we applied the participant survey ISR of 58% for ex post savings to all records included in version 5.0 Appendix F. This increased savings total ex post savings would be even higher except that it is offset by a reduction in the Single Family Channel savings.
  - For the Single Family Channel, we applied the heating system type reported in the tracking data to adjust the savings for homes with gas furnaces by setting the "% (electric) Heating" factor to zero from the default of 96%. This change impacted a majority of the records (94% had gas heating) and offset some of the savings gained in the Grants Channel.
- **Air Source Heat Pump**: The gross realization rate for ASHPs is 98.1% for electric energy and 99.4% for electric demand savings.
  - We updated some ex ante 2019 measure codes to 2021 version 5.0 Appendix F values. This included updated measure codes to reflect where ASHPs were installed in multifamily building types. The majority of the records are single family homes, so the impact of this revision was minimal.
  - We also applied actual existing SEER values from the program-tracking data, and derated SEER by the age of the existing equipment or by a default of 12 years, except in cases where the participant received a tune-up on the existing equipment earlier in the year. In addition, if the participant received a tune-up on the existing equipment earlier in the year, the evaluation team applied the tracked existing nameplate SEER to ex post calculations with no derating.
- **Low-Flow Showerhead**: The gross realization rate for low-flow showerheads is 60.9% for both electric energy and demand savings.
  - We made significant ex post adjustments for showerhead measures provided through the Grants Channel. First, our team adjusted ISRs for these measures to 54% (from the PY2019 participant survey) based on the delivery mechanism, where ex ante savings assumed an ISR of 91% (included in version 4.0 Appendix F). Additionally, we applied the updated deemed per unit savings values included in version 5.0 Appendix F, where ex ante applied values from version 4.0 of Appendix F.
  - We made minor ex post savings adjustments to the Single Family Channel, including updating savings for several multifamily sites from the incorrect single-family values and applying the 91% ISR from 2019 participant surveys instead of the 94% ISR from version 4.0 Appendix F TRM.
- **Smart Thermostat**: The gross realization rate for smart thermostats is 123.1% for electric energy and 100.8% for electric demand savings.
  - We applied updated version 5.0 Appendix F ex post savings values, actual household type, existing equipment type, heating fuel type, and SEER efficiency values from the program-tracking database when available, whereas the program team applied ex ante defaults from version 4.0 of Appendix F. The key driver of ex ante and ex post savings differences was our use of actual participant HVAC system types and associated performance values from the tracking data.
- **Central Air Conditioner**: The gross realization rate for central air conditioners is 88.7% for electric energy and demand savings. We made several significant ex post updates:

- We updated all ex ante 2019 measure codes to new 2021 version 5.0 Appendix F values, which was the key driver of the ex ante and ex post differences. In addition, we also updated measure codes to reflect the tracked building type for multifamily records, whereas the program team used single family ex ante savings values for all claims, resulting in lower ex post savings.
- In addition, the program team applied deemed default ex ante savings values from version 4.0 of Appendix F for all measures and failed to incorporate any tracked project-specific information such as the equipment capacity and efficiency. The evaluation team applied actual existing SEER values from the program-tracking database.
  - In cases where a participant did not receive a tune-up on the existing equipment earlier in the year, the evaluation team derated the tracked existing SEER value by the age of the existing equipment, or otherwise by a default of 12 years, to account for the degradation of the performance of the existing equipment over time. When the participant received a tune-up on the existing equipment earlier in the year, the evaluation team applied the tracked existing nameplate SEER to ex post calculations with no derating. On average, the existing SEER value that we applied to ex post calculations was higher than the default value provided in Appendix F, resulting in lower ex post savings.

12.3.4 Net Impact

Because the SFIE Program falls under the umbrella of income-eligible programs, we applied a default NTGR of 1.0, assuming that both free ridership and spillover are zero. As such, net impacts for the SFIE Program are equal to the gross impacts presented in the section above.

13. Do-it-Yourself (DIY) Kits

This section summarizes the evaluation methodology and results for the PY2021 Do-it-Yourself (DIY) Kits offering.

13.1 Evaluation Summary

In PY2021, Ameren Missouri offered energy-efficient measures to income eligible single family and multifamily customers through DIY Kits to assist them during the COVID-19 pandemic. Each DIY Kit contained easy-to-install energy-efficient measures that could help income eligible customers save both energy use and energy related expenses.

Each kit may be valued up to $250 and comes with a step-by-step installation guide to ensure proper installation of the energy-efficient measures.[61] Participants may also call Ameren Missouri Energy Specialists should they have any questions or need assistance with measure installation. DIY Kits include the following energy-efficient measures:

- Advanced power strips
- LED light bulbs
- Pipe insulation
- Low-flow showerheads
- Low-flow kitchen and bath faucet aerators
- Weather stripping
- Window insulation kit
- Door corner pad
- Smart thermostats[62]

In addition to energy and energy bill savings, DIY Kit program participants may receive a one-time bill credit of $150 for verified installation of energy efficiency measures. To receive the bill credit, participants must complete a Statement of Credit Application, which details the DIY Kit measures and quantities installed. Along with the Statement of Credit Application, the program requires participants to submit photos of measures installed to as way to verify installation.

13.1.1 Participation Summary

Ameren Missouri did not have savings or participation goals set for the DIY Kits in PY2021. Table 61 provides a summary of the number of customers who received kits, measures distributed, and ex ante energy (MWh) savings.

[61] The installation guide is also available through the DIY Kit program webpage: DIY_Kit_Program_Installation_Guide.pdf (amerenmissourisavings.com).
[62] DIY Kits may include Emerson Sensi™ Wi-Fi smart thermostats, if ordered.

Table 131. PY2021 DIY Kits Program Reported Participation Summary

Measure Category	Customers[a]		Measures		Ex Ante Savings	
	Number	%	Quantity	%	MWh	%
Advanced Power Strips	2,706	95%	5,552	5%	281	8%
Air Sealing	2,706	95%	22,208	21%	433	12%
Domestic Hot Water (DHW)	2,706	95%	22,208	21%	668	19%
Lighting	2,706	95%	55,520	52%	1,806	51%
Thermostat[b]	1,001	35%	1,020	1%	351	10%
Total	**2,707**		**106,508**		**3,539**	

[a] There were a total of 2,853 unique accounts. Of these, 1,600 unique accounts received a bill credit. However, 146 unique accounts did not have any other measures associated with them apart from the bill credit. As such, we excluded the 146 accounts from the analysis.

[b] There were 88 unique accounts that installed a smart thermostat in January 2022. These accounts received and installed other DIY Kit measures in PY2021. For consistency with impact evaluation, we excluded the smart thermostats installed in January 2022 from the analysis, but included all other measures installed in PY2021.

13.1.2 Key Impact Results

The DIY Kits offering achieved first year ex post gross and net energy savings of 1,905 MWh and ex post gross and net demand savings of 0.39 MW as shown in Table 63.

Table 132. PY2021 DIY Kits Program Impact Summary Impact

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross	NTGR[a]	Ex Post Net[a]	Goal/Target Net[b]	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	3,539	53.9%	1,906	100.0%	1,906		
Demand Savings (MW)	0.74	51.9%	0.39	100.0%	0.39		

[a] The DIY Kit Program falls under the umbrella of income eligible programs. As such, we applied a default NTGR of 1.0, assuming that both free ridership and spillover are zero. This results in net impacts that are equal to gross impacts.

[b] There were no goals or targets set for the DIY Kit program.

13.2 Evaluation Methodology

The evaluation team limited research efforts for the DIY Kits offering to impact evaluation activities in PY2021. We explored the following specific objectives:

- Review and verify program tracking data; and
- Estimate the first year ex post gross and net energy (kWh) and demand (kW) savings.

Table 133 provides an overview of the DIY Kits evaluation activities.

Table 133. PY2021 Evaluation Activities for the DIY Kits Offering

Evaluation Activity	Description
Program Material and Data Review	▪ Reviewed program-tracking data and available program materials to inform impact evaluation approach

Evaluation Activity	Description
	▪ Reviewed program database to check that program data are complete and that program-installed measures meet all program requirements
Gross Impact Analysis	▪ Analyzed the program database to determine the number of kits distributed in 2021 ▪ Estimated ex post gross impacts using measure-level deemed savings values based on the latest version of the Ameren Missouri TRM (i.e., version 5.0 Appendix F)

Impact Methodology

The evaluation team focused PY2021 DIY Kit evaluation efforts on impact evaluation to estimate ex post savings for measures distributed through the DIY Kits offering and conducted the following evaluation tasks:

- Reviewed program-tracking data
  - The evaluation team reviewed program-tracking data to determine the distribution of measures and the completeness of variables necessary to estimate ex post impacts (e.g., TRMId, measure descriptions, bill credits, etc.).
- Applied per unit savings estimates from Ameren Missouri TRM, Appendix F v. 5.0.[63]
  - After reviewing measure-level program-tracking data, we then applied the per-unit energy (kWh) and demand (kW) savings estimates included in Ameren Missouri TRM, Appendix F v. 5.0, filed in September 2021, to each record included in the dataset.
- Multiplied per-unit savings by measure quantity and an in-service rate (ISR) to determine total ex post energy and demand savings for DIY Kits measures.
  - Our team used measure quantities included in the program-tracking data and an ISR based on individual customers receiving bill credits for verified measure installation to determine total ex post kWh and kW savings. We assigned each record an ISR of 100% if the customer had received a bill credit for verifying measure installation and 0% if they did not. Notably, of 2,707 unique participants who received a DIY Kit, 1,454 received bill credits, indicating that 54% submitted a Statement of Credit Application and photos to verify installation of the DIY Kit measures they received.

13.3 Evaluation Results

In the remainder of this section, we present the results of the impact evaluation.

13.3.1 Gross Impact Results

As presented in Table 134 the PY2021 DIY Kit offering achieved 1,906 MWh and 0.39.43 MW in ex post gross savings, resulting realization rates of 54% and 52% for first year energy and demand savings, respectively.

[63] Source: Appendix F - Deemed Savings Table_2021_09_15.xlsx

Table 134. PY2021 DIY Kits Program Gross Impact Summary

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross
First Year Savings			
Energy Savings (MWh)	3,539	53.9%	1,906
Demand Savings (MW)	0.74	51.9%	0.39

Table 135 shows the ex ante, ex post, and gross realization rates for first year electric energy (MWh) and demand (MW) savings, by measure. Measure-level realization rates were consistently at 52% in PY2021 except for thermostats, which realized 66% of first year savings. This is most likely due to the difference in PY2021 TRM values for first year per unit kWh used to assess savings. For example, per unit ex ante energy savings estimates were lower (344 kWh per household) compared to the per unit savings values included in Ameren Missouri TRM, Appendix F v. 5.0 (467 kWh), which our team used for ex post savings calculations.[64] The use of bill credits to determine whether measures were in-service as previously described also contributed to lower realization rates as only 54% of customers who received kits verified measure installation and therefore received a bill credit.

Table 135. PY2021 DIY Kits Annual First Year Gross Impacts

Measure Category	Energy Savings			Demand Savings		
	Ex Ante (MWh)	Gross Realization Rate	Ex post (MWh)	Ex Ante (MW)	Gross Realization Rate	Ex Post (MW)
Advanced Power Strips	281	52%	147	0.03	52%	0.02
Air Sealing	433	52%	227	0.20	52%	0.11
Domestic Hot Water	668	52%	350	0.06	52%	0.03
Lighting	1,806	52%	948	0.27	52%	0.14
Thermostat	351	66%	233	0.18	50%	0.09
Total	**3,539**	**54%**	**1,906**	**0.74**	**52%**	**0.39**

13.3.2 Net impacts

Because the DIY Kit Program falls under the umbrella of income eligible programs, we applied a default NTGR of 1.0, assuming that both free ridership and spillover are zero. As such, net impacts for the DIY Kit Program are equal to the gross impacts presented in the section above.

[64] Source: Appendix F - Deemed Savings Table_2021_09_15.xlsx

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