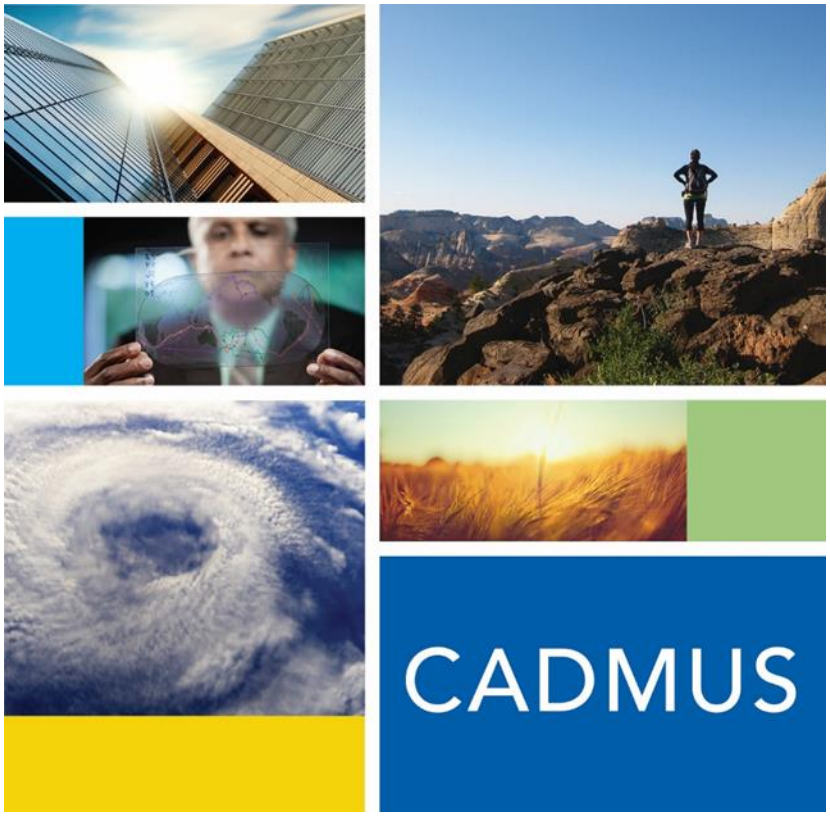

Ameren Missouri Heating and Cooling Program Impact and Process Evaluation: Program Year 2016

July 13, 2017

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Executive Summary

Ameren Missouri engaged Cadmus to perform annual process and impact evaluations of the Heating and Cooling program for a three-year period, from 2016 through 2018. This annual report covers the impact and process evaluation findings for Program Year 2016 (PY16), the period from March 1, 2016, through February 28, 2017—the first year of the three-year program cycle.

Program Description

Ameren Missouri's Heating and Cooling Program provides its residential customers with rebates to install energy-efficient heating and cooling equipment through participating contractors. To participate, residential customers must have measures installed by a participating contractor. Program rebates partially cover the costs of retrofitting and/or replacing heating and cooling equipment.

In PY16, the Heating and Cooling program provided rebates for the following:

- Central Air Conditioners (CAC)
- Air Source Heat Pumps (ASHP) (including ductless heat pumps)
- Geothermal Heat Pumps (GSHP)
- Dual Fuel Heat Pumps (DFHP)
- Electronically Commutated Motors (ECM)

For PY16–18, Ameren has contracted with ICF International (ICF) to implement the program. ICF markets the program, recruits contractors, and conducts training sessions about the program with contractors. ICF also takes primary responsibility for maintaining a website for data reporting, receiving online applications, processing rebates, and conducting quality control checks.

Participating contractors submit all required paperwork for processing rebates on behalf of participants. To become a participating contractor, an HVAC company representative must attend a training session conducted by ICF and sign a participation agreement. As needed, ICF conducts additional contractor training sessions to ensure contractors remain informed of program rules or program updates.

Key Impact Evaluation Findings

The following sections describe Cadmus' key findings for the PY16 evaluation period.

Program Data Adjustments

Cadmus verified a majority of program heating and cooling systems as installed and operating. Surveyed participants indicated that three systems categorized as "early retirement" in the program data should have been categorized as "replace on burnout" due to equipment failure. Equipment failure is subjective—a customer may say their system has failed, but HVAC contractors can, in many cases, make field repairs to demonstrate the system could operate and provide cooling according to program rules. Several surveyed customers indicated total system failure (e.g., destroyed by lightning). In such cases,

Cadmus adjusted program data to indicate the system failed and did not qualify for early retirement. These adjustments affected less than 0.1% of early retirement systems.[1]

Gross Impacts

Cadmus adjusted the gross savings estimates based on metering results and participant survey data. These changes to gross savings estimates include the following:

- ASHPs, ductless heat pumps, and DFHPs received updated heating Effective Full Load Hours (EFLH), based on the results of the metering study and Automated Meter Reading (AMR) data. This resulted in a 20% reduction in energy savings for ASHP measures and approximately a 5% increase in energy savings for DFHPs.
- Installation and operation practices of ASHPs potentially can save additional energy by optimizing the system's usage of electric resistance backup heating. Based on our analysis of metered data, several systems in the monitoring study prematurely disabled the heat pump compressor at unnecessarily high temperatures, causing excessive electric resistance usage. This operation does not significantly impact energy savings because it is also likely to occur on non-participants and baseline systems meaning both baseline are efficient systems operate at this efficiency disadvantage due to the control strategies used by customers. This resulted in systems operating at lower efficiency than rated as the heat pump compressor serves as the primary energy savings element from high-efficiency heat pumps. However there is a potential for the Ameren MIssouri program to encourage contractors and customers to choose higher efficiency control strategies.
- GSHPs operate as expected, with significantly lower use of electric resistance backup heat than ASHPs. The current 2,009 EFLH for geothermal systems was verified as reasonable from limited metering data (n=1 home) and daily Automated Meter Reading (AMR) data (n= 41 homes).

Table 1 summarizes PY16 participation, *ex post* gross per-unit savings, realization and installation rates, and *ex post* total gross savings.

[1] In PY17 Cadmus will discuss with contractors the reasons driving customer adoptions of early retirement measures and whether these measures would be as frequently adopted without rebates.

Table 1. PY16 Summary: *Ex Post* Program Gross Savings Accounting for Installation Rates

Measure	PY16 Participation	Per-Unit *Ex Post* Savings (kWh/hr)	Percent Installed and Operating	Total *Ex Post* Savings (MWh/yr)	Total *Ex Post* Savings (kW/yr)
Air-Source Heat Pump					
ASHP ER with ASHP 16+ ER	207	5,406	100%	1,119	522
ASHP Replace at Fail with ASHP 16+	33	1,587	100%	52	24
ASHP SEER 15 ER Elec Resist Furnace ER	411	10,749	100%	4,418	2,059
ASHP SEER 15 Replace at Fail Elect Resist Furnace	28	8,520	100%	239	111
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)	8	800	100%	6	3
ASHP ER with ASHP SEER 15 ER	239	4,221	100%	1,009	470
ASHP Replace at Fail with ASHP SEER 15	46	820	100%	38	18
ASHP SEER 16+ ER Elec Resist Furnace ER	318	12,449	100%	3,959	1,845
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	30	11,348	100%	340	159
ASHP SEER 16+ Replace at Fail Elec Resist Furnace (NC)	7	2,066	100%	14	7
Ductless Air-Source Heat Pump					
Ductless ASHP ER	9	3,434	100%	31	14
Ductless ASHP Replace Electric Resistance ER	29	6,204	100%	180	84
Ductless ASHP ROF	7	927	100%	6	3
Ductless ASHP Replace Electric Resistance ROF	98	5,438	100%	533	248
Dual Fuel Heat Pump					
DFHP SEER 15_SF	20	755	100%	15	7
DFHP SEER 16_SF	13	987	100%	13	6
DFHP SEER 17+_SF	28	1,402	100%	39	18
DFHP SEER 18+_SF	1	3,270	100%	3	2
Ground Source Heat Pump					
GSHP SEER 14+ ER ASHP with GSHP ER	16	12,702	100%	203	95
GSHP SEER 14+ ER Elec Resist Furnace ER	48	25,346	100%	1,217	567
GSHP SEER 14+ Replace Elec Resist Furnace	126	23,251	100%	2,930	1,365
GSHP - 23 EER ER	67	7,953	100%	533	248
GSHP - 23 EER Replace at Fail	14	3,646	100%	51	24

Measure	PY16 Participation	Per-Unit *Ex Post* Savings (kWh/hr)	Percent Installed and Operating	Total *Ex Post* Savings (MWh/yr)	Total *Ex Post* Savings (kW/yr)
Central Air Conditioner					
CAC SEER 14 ER	3,973	1,633	100%	6,489	6,148
CAC SEER 14 Replace at Fail	141	323	100%	46	43
CAC SEER 15 ER	1,727	1,923	100%*	3,316	3,147
CAC SEER 15 Replace at Fail	70	342	104%*	25	23
CAC SEER 16+ ER	5,131	1,922	100%	9,864	9,345
CAC SEER 16+ Replace at Fail	65	368	100%	24	23
Electronically Commutated Motor					
Concept 3 Installations Continuous Fan ER_50	712	3,292	100%	2,344	1,092
Concept 3 Installations Continuous Fan ER_100	70	3,466	100%	243	113
Concept 3 Continuous Fan Replace at Fail_50	48	3,246	100%	156	73
Concept 3 Continuous Fan Replace at Fail_100	1	3,332	100%	3	2
Concept 3 Installations Auto Fan ER_50	7,612	614	100%	4,672	2,177
Concept 3 Installations Auto Fan ER_100	540	807	100%	436	203
Concept 3 Installations Auto Fan Replace at Fail_50	175	458	100%	80	37
Concept 3 Installations Auto Fan Replace at Fail_100	20	793	100%	16	7
Total**	**22,088**	**-**	**100%**	**44,661**	**30,332**

*Adjustment of less than 0.1% of early retirement systems. Since the total number of replace at fail CAC's was very low this adjustment appears significant due to the low number of replace at fail systems.

** Savings may not sum to totals due to rounding.

Net Savings

As shown in Table 2, the Heating and Cooling program has a savings-weighted net-to-gross (NTG) ratio (excluding NPSO) of 90.6%. NPSO is separately added because it is significant and has a different load shape than the program savings, and therefore has a different impact on demand than energy.

Table 2. PY16 Net Impact Results Summary

Measure Group	*Ex Post* Gross Savings (MWh/yr)	Free Ridership	Participant Spillover	HVAC NPSO	NTG (w/o NPSO)	Net Savings (MWh/yr)	Net Savings (kW/yr)
Air-Source Heat Pump	11,194	3.4%	0.1%	0.4%	97.1%	10,870	5,066
Ductless Air-Source Heat Pump	750	11.5%	2.3%	0.4%	91.2%	684	319
Dual Fuel Heat Pump	70	1.5%	0.0%	0.4%	98.9%	70	32
Ground Source Heat Pump	4,933	5.8%	0.0%	0.4%	94.6%	4,667	2,175
Central Air Conditioner	19,763	16.1%	0.3%	0.4%	84.6%	16,719	15,840
Electronically Commutated Motor	7,949	6.9%	0.3%	0.4%	93.8%	7,456	3,475
Nonparticipant Spillover	-	-	-	-	-	17,977	7,179
Program Total*	**44,661**	**10.0%**	**0.2%**	**0.4%**	**90.6%**	**58,443**	**34,088**

* Savings may not sum to total due to rounding.

As shown in Table 3, the PY16 program achieved 186% of its net energy savings target of 31,399 MWh, as specified in the Ameren Missouri's residential tariff.[2] Appendix A presents the coincidence factors used to calculate demand savings for this program.

[2] Union Electric Company. d/b/a Ameren Missouri's 2nd Filing to Implement Regulatory Changes in Furtherance of Energy File No. EO-2015-0055 Efficiency as Allowed by MEEIA. Appendix B.MEEIA 2016-2018 Summary

Table 3. PY16 Heating and Cooling Program Savings Comparisons

Metric	MPSC-Approved Target	*Planning* Gross Savings Utility Reported[a]	*Ex Post* Gross Savings Determined by EM&V[b]	*Ex Post* Net Savings Determined by EM&V[c]	Percent of Goal Achieved[d]
Energy (MWh)	31,399	49,539	44,661	58,443	186%
Demand (kW)	20,032	32,578	30,332	34,088	170%

[a] Documented by the Vision database

[b] MWh calculated by applying verified program activity to Cadmus' evaluated savings values; kW calculated by applying coincident factors shown in Appendix A.

[c] Calculated by multiplying Cadmus' evaluated gross savings and evaluated NTG ratio and adding NPSO.

[d] Compares MPSC approved target and *ex post* net savings, determined by EM&V.

CSR Impact Evaluation Requirements

According to the Missouri Code of State Regulations (CSR),[3] demand-side programs included as part of a utility's preferred resource plan are subject to ongoing process and impact evaluations that meet certain criteria. Specifically, the CSR requires that impact evaluations of a demand-side program satisfy the requirements listed in Table 4. The table also indicates data Cadmus used to satisfy these impact CSR evaluation requirements for the Heating and Cooling program. At the end of the Process Evaluation section, this report provides a summary of the process CSR requirements in Table 5.

Table 4. Summary Responses to CSR Impact Evaluation Requirements

CSR Requirement	Method Used	Description of Program Method
Approach: The evaluation must use one or both of the following comparisons to determine the program impact:		
Comparisons of pre-adoption and post-adoption loads of program participants, corrected for the effects of weather and other intertemporal differences	✓	The team conducted monthly billing analysis to verify baseline usage of program equipment; post-usage characteristics were verified through a combination of direct-load monitoring of HP systems and daily usage from utility meters
Comparisons between loads for program participants and an appropriate control group over the same period		
Data: The evaluation must use one or more of the following types of data to assess program impact:		
Monthly billing data	✓	Monthly billing data were used to verify baseline energy consumption

[3] State of Missouri. "Administrative Rules: Missouri Code of State Regulations." Revised January 2016. Available online: http://www.sos.mo.gov/adrules/csr/csr.asp

CSR Requirement	Method Used	Description of Program Method
Hourly load data	✓(Partial)	Daily load data were analyzed for 250 participants to verify post-installation usage characteristics
Load research data		
End-use load metered data	✓	Metered load data from 14 ASHPs and 1 GSHP were used to verify post-installation usage patterns
Building and equipment simulation models		
Survey responses	✓	Survey responses were used to verify measures' installation and operation
Audit and survey data on:		
Equipment type/size efficiency	✓	Evaluation team gathered equipment information from homes participating in metering and from program data
Household or business characteristics	✓	Evaluation team collected household characteristics from homes participating in metering and from program data.
Energy-related building characteristics	✓	To compliment daily usage characteristics, Cadmus collected survey data on homes to verify heating and cooling systems were installed in homes in addition to rebated measures

Marketing and Outreach

Ameren Missouri directly markets the Heating and Cooling Program, in concert with participating contractors, which utilize Ameren's program marketing and co-branded materials. Ameren Missouri markets the program through direct mailers, radio and television advertisements, gas station pump toppers, and other channels.

Key Process Evaluation Findings

The Heating and Cooling program has been well received by participants and contractors, who expressed high satisfaction levels with the program: 88% of participants were very satisfied with the program; and 91% of the participants were very satisfied with equipment they installed. Participants most frequently cited energy and costs savings, resulting from the installation of new efficient CACs or GSHPs, as contributing to their satisfaction with their new, efficient equipment. For participants installing ASHPs, energy savings from their new equipment was the second most frequently cited reason for participants' satisfaction with their equipment.

Sixty-nine percent of participants heard about the Heating and Cooling program from a contractor, and participants most frequently made contact with contractors to resolve technical issues with their existing equipment. Participants also learned about the program via Ameren Missouri's marketing efforts (i.e., 11% Ameren Missouri mailing, 8% monthly energy statements, 7% Ameren Missouri

website), and contacted their contractors for reasons other than addressing maintenance issues (e.g., lowering their energy consumption [33%]; taking advantage of rebates [9%]).

Though the Heating and Cooling program's marketing effectively promoted the program to its target audience, a review of marketing materials indicated that marketing messages focused on highlighting rebate levels, and did not focus on the benefits of upgrading to efficient heating and cooling equipment (e.g., resulting energy savings). As noted, however, participants pointed to energy savings resulting from installing their new equipment as a key driver of satisfaction with their new equipment. Additionally, participants most frequently recommended that Ameren Missouri increase or improve program marketing, including emphasizing energy savings from installing new equipment.

Ameren Missouri's pool of registered contractors effectively promoted the Heating and Cooling program to participants, especially when customers made contact with them to address a maintenance issue. Contractors serve as a key driver of promoting the Heating and Cooling program, although eight of 10 contractors said they did not actively advertise the program (participant survey data also suggested limitations to contractors' marketing efforts: 80% of participants selected their contractors because they knew them or they received a referral from a trusted source; only 13% of participants selected their contractors based on their marketing materials). While the Heating and Cooling program engaged a large pool of contractors (398 contractors completed projects in PY16), it remains unknown what percentage of the contractor population in Ameren Missouri's service territory this number represents.

Program Data

ICF updated and maintained program data through the Vision database, though Cadmus found several areas where Vision program tracking data were incomplete and could be refined:

- Measure names for several measures are complex and confusing:
- Missing key measure information on 155 installed systems. Since the missing key measure information was only one of several parameters needed to calculate energy savings Cadmus substituted the average value of other installations within the measure and still counted those systems as installed.

CSR Process Evaluation Requirements

As previously discussed, the Missouri CSR requires that demand-side programs operating as part of a utility's preferred resource plan must be subject to ongoing process and impact evaluations that meet certain criteria. Process evaluations must address, at a minimum, the five questions listed in Table 5, which provides a summary response for each specified CSR process requirement.

Table 5. Summary Responses to CSR Process Evaluation Requirements

CSR Requirement Number	CSR Requirement Description	Summary Response
1	What are the primary market imperfections common to the target market segment?	The primary market imperfection common to the target market was inadequate information and/or knowledge regarding the energy saving benefits of high-efficiency HVAC systems for cooling and electric heating, and the use of electric resistance heating. Additionally, the investment/cost of installing a new HVAC unit can deter customers from ultimately making the decision to purchase until absolutely necessary. Further, when customers replaced a system, the greater upfront costs of high-efficiency systems could cause them to purchase lower-efficiency units, even if system incurred greater lifetime operating costs.
2	Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?	The target market segment was appropriately defined and comprehensively served for the single-family residential market. The target market included: customers living in single-family homes; multifamily buildings of four units or fewer; or in row houses. Specifically, the Heating and Cooling Program offered tiered incentives for customers replacing a failed but functional heating and cooling system (i.e., early retirement).
3	Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?	The program targeted primary end-use technologies within the targeted market segment, offering incentives for all broad measure categories (note: the Efficient Products program offered smart thermostats via the Efficient Products program). For customers who have/or plan to install GSHPs and have electric water heaters, the program could offer de-super heaters in conjunction with GSHPs, if determined to be cost-effective.
4	Are the communication channels and delivery mechanisms appropriate for the target market segment?	Current communication channels proved appropriate. The program benefitted from a broad marketing campaign, which sought to raise customer awareness about the Heating and Cooling program. The campaign included mailings, television, and radio advertisements. Contractors served as the primary driver of customer awareness about incentives for upgrading to efficient equipment, and served as the program's primary "ambassador" to the public.

CSR Requirement Number	CSR Requirement Description	Summary Response
5	What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation of each end-use measure included in the program?	Marketing messages primarily focused on rebates available to target market customers when upgrading to efficient heating and cooling equipment. Expanding messaging to highlight the additional benefits of efficient heating and cooling equipment could further motivate customers to upgrade to efficient equipment.

Key Conclusions and Recommendations

The Heating and Cooling program encourages Ameren Missouri customers to upgrade their heating and cooling equipment to efficient units when making new equipment purchases. The program's contractors play a critical role in delivering the program, and serve as the program's primary interface to the public. While contractors serve as the primary drivers of program participation, the Heating and Cooling program deploys additional mechanisms to raise awareness about the program, reaching customers that, for various reasons, do not have contact with contractors (e.g., experiencing problems with their equipment or maintenance-related issues). The program's two-pronged marketing approach provides an effective means to encourage upgrades to efficient equipment to as broad an audience as possible.

Overall, Ameren Missouri adhered to industry best practices in its design and delivery of marketing tactics that promoted its Heating and Cooling program, though some materials could be improved — specifically regarding communication of important information (and, most applicably, to use of strategic call-outs through bolding/highlighting of important text). Information that should be communicated more effectively includes a focus on available rebate amounts and savings that customers can achieve.

Cadmus offers the following conclusions and recommendations for program improvements:

Conclusion 1. Contractors serve as the Heating and Cooling program's primary interface with the public. Survey data indicate that 69% of participants learned about the Heating and Cooling program from a contractor, and most customers contacted a contractor to resolve maintenance issues. Continuing to expand the program through additional contractors will help ensure that most customers coming into contact with heating and cooling equipment contractors can learn about incentives for upgrading to efficient equipment.

Recommendation 1. The Heating and Cooling program should continue to recruit new contractors active in Ameren Missouri's territory into the program. The program could build on its efforts to work with distributors to also recruit contractors into the program via equipment showrooms and trade shows. The program could solicit feedback from its contractor advisory board on the best ways to expand the network of contractors.

Conclusion 2. Ameren Missouri's program marketing messages reach its target audience, emphasizing available rebates. Many Heating and Cooling program participants in PY16 learned about the program via Ameren Missouri's marketing messages. This messaging encourages customers to inquire about program rebates when in contact with contractors (provided the contractor does not proactively discuss the rebates); alternately, messaging can encourage customers to call contractors to take advantage of the Heating and Cooling program's offers. Marketing messages can more effectively encourage customers to call contractors to upgrade equipment if they know of the benefits (e.g., energy savings, upgrading to efficient equipment).

Recommendation 2. In addition to highlighting rebates, the Heating and Cooling program should emphasize the benefits of efficient equipment and encourage customers to take advantage of the program by calling contractors. The program could highlight energy-efficient heating and cooling equipment saves energy in comparison to less-efficient equipment and can save money on utility bills.

Conclusion 3. In approximately 5% to 10% of participating ASHPs, control systems more often than necessary rely exclusively on electric resistance heating at warmer temperatures. Using excessive electric resistance heating lowers the effective efficiency of installed systems. Lennox recommends using supplemental heat lockout temperatures to allow more efficient HPs to satisfy heating demand, while noting that higher settings offer additional comfort for occupants.

Recommendation 3. Educate customers about the advantages of operating their heat pumps at the lowest possible temperature.[4] While a tradeoff exists regarding comfort, high-efficiency HPs operate twice as efficiently as electric resistance heating, even in cold outdoor conditions. Helping customers understand the energy impacts of their systems' operation can drive customer to demand their systems' most efficient operation. Additionally, contractors do not care for returning to a home after installation to address customers' complaints about comfort. Contractors should be encouraged, however, to explain (and recommend appropriate options) to customers that limiting compressor operation to improve comfort uses significant additional energy.

Conclusion 4. The program stipulates complex qualification requirements and uses confusing measure names. Most installed measures incorporate varying incentive levels and qualifying baseline characteristics, even among similar measures. This leads to confusing measure names and participant qualifications. Since measure savings and incentives vary significantly, correctly classifying each participant proves critical. Participant verification survey's show variances between installed measures and rebated measures, indicative of possible confusion among customers. Half of all contractor installed

[4] The temperature where electric resistance supplemental heating is disabled to favor of higher-efficiency compressor usage.

12 or fewer measures per year, indicating many participating contractors may not have a deep understanding of program requirements as a result of regular participation.

Recommendation 4. Clarify measure qualifications and provide comprehensive measure mapping. With so many contractors in the program, and with many possible replaced equipment types and installed measures, contractors must quickly understand program requirements and incentives available to their customers. Cadmus recommends the following activities to help reduce possible confusion and improper categorization:

- Consider flowcharts or logic maps for contractors and customers to outline the available incentives
- Consider consistent measure-naming conventions so customers can be easily identified through in data tracking
    - Example: [Installed Equipment Type] – [Minimum Efficiency] – [Disposition of Replaced Equipment - Qualifying Replaced Equipment Type] / ASHP - SEER 16+ - Early Retirement of Operating Electric Resistance Heating with Central AC

Conclusion 5. Contractors experience difficulty looking up AHRI numbers, which is a necessary step for participating in the program. Several contractors expressed that they faced significant difficulty looking up AHRI numbers for equipment. Ameren Missouri stated that when they discussed this issue with contractors in advisory council meetings the contractors indicated that looking up AHRI numbers was not an concern.

Recommendation 5. Engage contractors to understand the reasons for their problems with AHRI numbers and take further steps to make the process easier for contractors. Cadmus recommends that ICF continue to engage with contractors to monitor whether contractors face difficulties when looking up AHRI numbers and take steps to ease the process.

Conclusion 6. Metering and AMR data show heating EFLH for air source and dual fuel heat pumps should be updated from the TRM stipulated hours of operation. The Ameren Missouri TRM currently uses the EFLH value specified in the ENERGY STAR Heat Pump Calcualtor of 2,009 hours for heat pumps. Recent analysis of data collected from direct load monitoring shows this values overstates usage for ASHP's and DFHP's.

Recommendation 6. Update heating EFLH used to calculate ex-ante savigns for ASHP and DFHP system. Cadmus recommends heating EFLH for ASHP of 1,496 and DFHP of 1,119. Values are discussed below in the Daily Data Analysis section of the report.

PY15 Recommendation Tracking

Cadmus followed up with Ameren Missouri's response to the PY15 evaluation's recommendations to track measures implemented and not implemented. Table 6 sets forth these actions, as reported by Ameren Missouri.

Table 6. PY15 Evaluation Recommendation Tracking

PY15 Recommendation	Ameren Missouri Response	Explanation
Continue to perform targeted marketing, especially to Ameren Missouri customers with high electric energy consumption (i.e., weather-related heat loads) during the heating season and who are eligible for an HP early-replacement measure.	Implemented	Continued to incorporate targeting to all-electric customers. Fall targeted marketing to this group also incorporated messaging on expiration of tax credits to drive action, resulting in increased heat pump installations through the end of the year.
To the extent possible, continue positive and regular communications, even prior to launching new energy efficiency program offerings; this keeps contractors informed and interested in future participation.	Implemented	During the PY2015 shutdown, hiatus, and PY2016 startup the program provided ongoing communication to participating contractors. Details were shared on program shutdown, interim resources, FAQs, and continuation of standard newsletter, and ultimately proactive information on the new filing, approval, and program launch schedule and training. Maintaining the lines of communication and relationships enabled the Heating and Cooling program to launch in an extremely quick fashion, 17 business days.

Introduction

Ameren Missouri engaged Cadmus to perform annual process and impact evaluations of the Heating and Cooling program for a three-year period (2016 through 2018). This annual report covers the impact and process evaluation findings for Program Year 2016 (PY16): the period from March 1, 2016, through February 28, 2017—the first year of the three-year program cycle.

Program Description

Through the Heating and Cooling program, Ameren Missouri offered customers living in single-family homes, condos, or townhomes incentives for installing high-efficiency central air conditioners (CACs) or heat pumps (HPs) through participating program contractors. The program also offered incentives for installations of electronically commutated fan motors (ECMs). In the past, the program offered an incentive for diagnostic testing and tuning of existing HVAC systems to manufacturer specifications (through the Tune-Up Plus Ameren Missouri Efficiency Analysis). While not offered in PY16, Ameren Missouri has reintroduced this measure in Program Year 2017.

To participate in the program and to receive a rebate, a residential customer must have a qualifying measure installed by a participating contractor. This contractor submits all required paperwork to process the rebate. To become a participating contractor, an HVAC company representative must attend a program training session conducted by ICF International (ICF), the program implementer. Ameren Missouri and participating contractors market and promote the program to potential participants.

Since PY9, Ameren Missouri has offered incentives for efficient heating and cooling equipment and for equipment tune-ups. From PY10 through PY11, Ameren Missouri offered incentives under the CheckMe! Program; this continued in PY12, through a similar program known as CoolSavers, and from PY13 though PY15 via the HVAC Program. The PY15 program year cycle ended in December 2015. While Ameren Missouri's MEEIA 2 filing called for the new program year to start in January 2016, filings were not immediately approved and no program were available until April 2016. The PY16 Heating and Cooling program continues the previous program, offering similar measures and program delivery mechanisms.

The Heating and Cooling program offers tiered incentives for installing efficient heating and cooling equipment that replaces electric-powered equipment or is installed in new construction. Incentives vary by the equipment's efficiency level, whether or not the customer replaces working or broken equipment, and by the equipment type that a heat pump replaces. Due to the various differences between baseline equipment types, the nature of baseline equipment, and the way new equipment types and efficiency levels interact, the program offers 37 different measures.

Ameren Missouri applies a criterion that contractors must observe a temperature drop across the coil for an existing piece of equipment to qualify as working. Ameren Missouri also offers incentives for ECMs installed with new equipment or replacing existing fans. Table 7 shows the 34 measures addressed by the program.

Table 7. PY16 Heating and Cooling Program Measures and Program Activity

Measure Category	Baseline Disposition	Baseline Equipment	Efficiency Level	Incentive	PY16 Participation
Air Source Heat Pump	Early Retirement	Elect Resist	SEER 16+	$900.00	318
	Replace at Fail	Elect Resist	SEER 16+	$900.00	30
	New Construction	N/A	SEER 16+	$650.00	7
	Early Retirement	ASHP	SEER 16+	$650.00	207
	Replace at Fail	ASHP	SEER 16+	$650.00	33
	Early Retirement	Elect Resist	SEER 15	$800.00	411
	Replace at Fail	Elect Resist	SEER 15	$800.00	28
	New Construction	N/A	SEER 15	$500.00	8
	Early Retirement	ASHP	SEER 15	$500.00	239
	Replace at Fail	ASHP	SEER 15	$500.00	46
Ductless Heat Pump	Early Retirement	ASHP	SEER 19+	$300.00	9
	Early Retirement	Elect Resist	SEER 19+	$500.00	29
	Replace at Fail	ASHP	SEER 19+	$300.00	7
	Replace at Fail	Elect Resist	SEER 19+	$500.00	98
Dual Fuel Heat Pump	Replacement	Non-Electric	SEER 15	$175.00	20
	Replacement	Non-Electric	SEER 16	$200.00	13
	Replacement	Non-Electric	SEER 17+	$200.00	28
	Replacement	Non-Electric	SEER 18+	$200.00	1
Ground Source Heat Pump	Early Retirement	ASHP	EER 14+	$2,000.00	16
	Early Retirement	Elect Resist	EER 14+	$2,000.00	48
	Replace at Fail	Elect Resist	EER 14+	$2,000.00	126
	Early Retirement	GSHP	EER 23+	$800.00	67
	Replace at Fail	GSHP	EER 23+	$800.00	14
Central Air Conditioner	Early Retirement	CAC	14 SEER	$300.00	3,973
	Replace at Fail	CAC	14 SEER	$250.00	141
	Early Retirement	CAC	15 SEER	$400.00	1,727
	Replace at Fail	CAC	15 SEER	$275.00	70
	Early Retirement	CAC	16 SEER	$500.00	5,131
	Replace at Fail	CAC	16 SEER	$300.00	65
Electronically Commutated Motor (ECM)	Early Retirement	Continuous PSC* Fan	AHRI Rated	$50.00	712
	Early Retirement	Continuous PSC* Fan	non-AHRI Rated	$100.00	70
	Replace at Fail	Continuous PSC* Fan	AHRI Rated	$50.00	48
	Early Retirement	Continuous PSC* Fan	non-AHRI Rated	$100.00	1
	Early Retirement	Auto PSC* Fan	AHRI Rated	$50.00	7,612
	Early Retirement	Auto PSC* Fan	non-AHRI Rated	$100.00	540
	Replace at Fail	Auto PSC* Fan	AHRI Rated	$50.00	175
	Early Retirement	Auto PSC* Fan	non-AHRI Rated	$100.00	20

*PSC = Permanent Split Capacitor Fan Motor

Program Activity

In PY16, the Heating and Cooling program delivered 22,088 rebates on products purchased by Ameren Missouri participants, as shown in Table 8 (Table 7, above, presents a more detailed breakdown of measure-level participation).

Table 8. PY16 Heating and Cooling Program Activity Summary

Measure	PY16 Totals
Air Source Heat Pump	1,327
Central Air Conditioner	11,107
Ductless Heat Pump	143
Electronically Commutated Motor	9,178
Dual Fuel Heat Pump	62
Ground Source Heat Pump	271
Total	**22,088**

Evaluation Methodology

In evaluating Ameren Missouri's Heating and Cooling program, Cadmus identified the following objectives for PY16:

- Determine heating and cooling savings for heat pumps and ECMs
- Determine cooling savings for CACs
- Evaluate baseline assumptions about equipment usage
- Determine measure-specific net-to-gross (NTG) estimates, including participant and nonparticipant spillover
- Measure customer satisfaction with the program and implementer, along with customers' motivations for participating
- Identify and understand contractors' selling methods and distributors' stocking practices
- Assess program design implementation and opportunities for improvement
- Assess any indications of market change compared to the previous years' standard installation practices

Table 9 lists evaluation activities and briefly explains the purpose of each activity; descriptions of each activity follow the table.

Table 9. PY16 Process and Impact Evaluation Activities and Rationale

Evaluation Activity	Process	Impact	Rationale
Review the Tracking Data	✓	✓	Provide assurance that all necessary program data are tracked accurately and incorporated into savings estimates.
Update Engineering Analysis Variables		✓	Update gross kWh savings estimates.
Conduct a Cost-Effectiveness Analysis		✓	Measure the program's cost-effectiveness using five standard perspectives: total resource cost, utility cost, societal cost test, participant cost test, and ratepayer impact test.
Conduct Surveys with Program Participants	✓	✓	Collect customer feedback about program processes, satisfaction, and information sources about the program. Confirm measure baseline equipment and equipment disposition. Evaluate program free ridership and spillover.
Interview Stakeholders	✓		Identify changes to program delivery, and identify successes and challenges.
Interview Participating Contractors	✓	✓	Provide information about the heating and cooling system market in Missouri to inform nonparticipant spillover and provide information about program operations.
Interview Equipment Distributors	✓	✓	Provide information about the heating and cooling system market in Missouri to inform nonparticipant spillover.
Review Marketing Materials	✓		Identify gaps and opportunities in the program's marketing and outreach strategies and activities.

Evaluation Activity	Process	Impact	Rationale
Key Progress Indicators	✓		In PY16, develop key progress indicators to track progress in subsequent program years.
Conduct Benchmarking Research		✓	Compare the Heating and Cooling program's gross savings and NTG factor to similar HVAC programs.

Data Tracking Review

Cadmus reviewed the program tracking data recorded in the Vision database to determine completeness and to identify variables necessary for impact calculations. Specifically, the team assessed whether ICF gathered the data necessary for an accurate evaluation; these included an assessment of data quality and completeness.

The Vision database, which was continuously updated, contained the following information used in the evaluation:

- Incentive amount
- Measure type
- Customer information
- New HVAC equipment information
- Existing (replaced) equipment information
- Installed System Efficiency
- HVAC system type (AC or HP)
- HVAC system Model Number
- AHRI Certificate Number
- HVAC system size in tons

Engineering Analysis

Heat Pump Metering

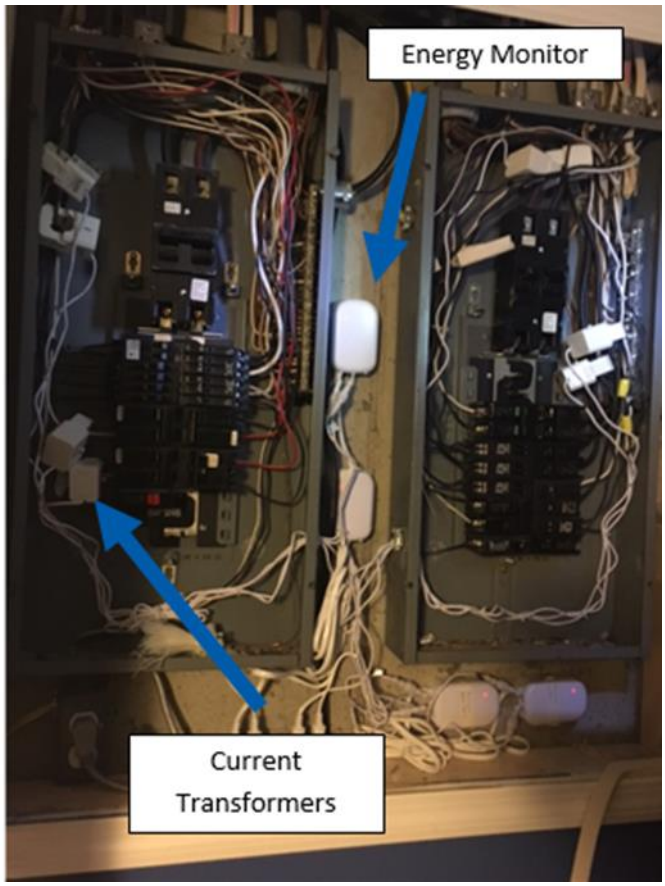
In late November PY16, Cadmus installed direct-load monitoring equipment on a sample of 16 new air source heat pumps (ASHPs) and one ground source heat pumps (GSHP). To record data, the team installed Aeon Labs Home Energy Monitors, Samsung SmartThings hubs, and, where possible, Sense home energy monitors. The team connected the hubs and monitors wirelessly, linking data to a secure server. Cadmus field engineers and a local certified electrician installed the monitoring equipment. These monitors allowed high-frequency monitoring of HP systems' compressors, circulation fans, and electric resistance supplementary heating systems. Where applicable, field engineers installed monitors

on all other heating equipment sources, including secondary heating systems and dehumidifiers. The installed monitoring equipment gathered information for the following activities:

- Validate automatic meter reading (AMR) disaggregation:
  - This study sought to validate hourly heating and cooling disaggregation from AMR meters operated by Ameren Missouri. Predictive analytics would be applied to a larger sample of homes than those currently metered, allowing a larger sample size for measurement and evaluation.
  - As of spring 2017, hourly data remained unavailable from AMR meters, though Cadmus received daily readings. Daily data proved valuable in determining the energy usage of ASHP, and DFHP's however we did not incorporate an updated from the AMR metering for Ductless HP or Geothermal Heat Pumps.
- Examine HP usage profiles:
  - The study sought to understand the usage patterns of the heat pump. Nearly all HPs rely on supplemental heating systems to provide additional heating as temperatures outside of homes drops. Most HPs' heating outputs drop significantly with temperatures, requiring lower efficiency supplemental heat to keep the home warm. Understanding the typical relationship between HPs and supplemental heat affects a system's effectiveness and energy efficiency.

We installed home energy monitors on main electrical panels inside homes by electricians. The monitors communicated wirelessly with a Samsung Smart Hub device that transmitted the data back to a secure server. Additionally, Cadmus engineers verified the installed HPs while on site. Figure 1 shows two HPs monitored using four home energy monitors. The home energy monitors measure each HP and its corresponding furnace.

Figure 1. Samsung Home Energy Monitor



The Aeon Labs home energy monitors archived >99% accuracy over a measurement range from 0 to 200 Amps. Meters sent readings every minute to the secure server.

AMR Analysis

In previous evaluations Cadmus used secondary data[5] for GSHP and ASHP heating savings. Cadmus had planned to use hourly AMR data from a sample of participants to estimate heating and cooling energy consumption and load profiles after installations of heating and cooling systems. Predictive analytics would have been used to calibrate AMR hourly usage data to monitored usage from the metering study, however the daily data did not provide enough detail to do that. Hourly predictive analytics offer advantages in producing much higher resolution data than monthly usage data from energy bills. Due to software issues, Ameren Missouri could not provide hourly usage data from its AMR system. Rather, the company provided daily usage data from its system (from November 2016 through March 2017).

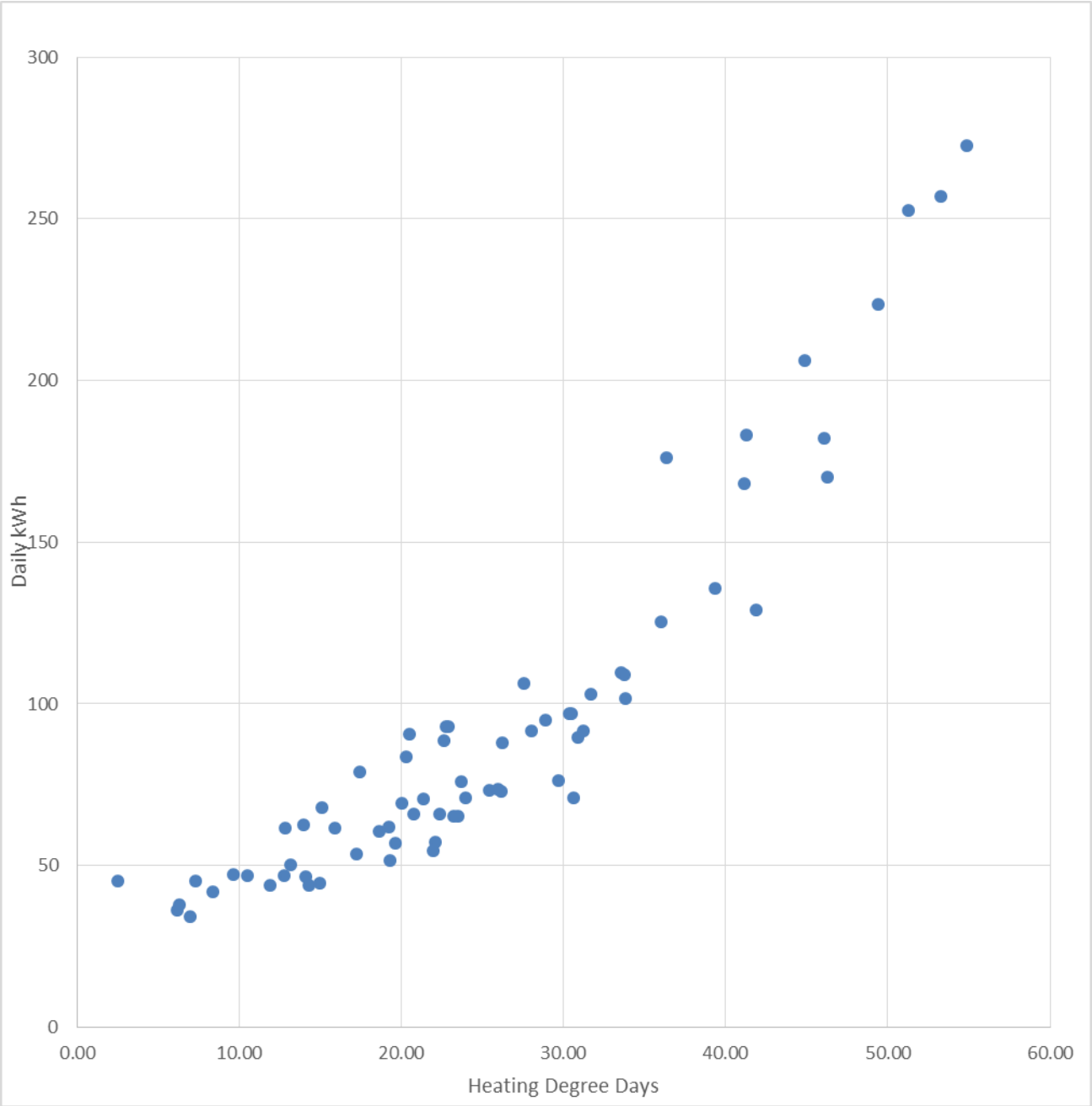
[5] Energy Star Calculator Effective Full Load Hours

The team examined daily usage data to determine the suitability of similar disaggregation activities. While daily usage data do not provide the detail needed to accurately characterize full usage profiles of HPs, they do provide an accurate representation of total energy usage by an HP system. Figure 2 (below) illustrates the reliable dependance of energy usage for homes heated by HPs on outdoor conditions. Given this dependance, the team developed regression equations for predicting heating consumption.

By isolating daily load shapes from daily usage data, Cadmus determined total usage of homes' heating systems. Using additional details provided from participant tracking data and surveys completed by customers we corrected the data to account for homes with multiple heating systems and system type.

The team applied the usage profiles from the heat pump metering study to the larger sample of daily usage data in the AMR study. From the daily usage data, the team calculated Effective Full Load Hours (EFLH) for several installed system types.

Figure 2. Daily Usage Data ASHP Home



Monthly Billing Data Review

In October 2016, Cadmus requested billed usage data of all ASHP and GSHP program customers through 2016's Quarter 2. The monthly billing data allowed verification of customers' baseline usage characteristics prior to their program participation. As shown below, customers' heating usage could be

estimated relative to total installed tonnage and estimated efficiency of the customers' electric heating systems:

$$kWh_{Heating} = Installed\ Tons \times 12 \times Heating\ EFLH \times \left(\frac{1}{Baseline\ HSPF}\right)$$

Using participant tracking data for installed tonnage and the baseline HSPF, estimated through previous evaluations, the team employed the equation to predict the heating energy for each home prior to its inclusion in the Heating and Cooling program.

Cost-Effectiveness Analysis

Using final PY16 Heating and Cooling Program participation and implementation data, as well as the *ex post* gross and net savings estimates presented in this report, Ameren Missouri determined the program's cost-effectiveness using DSMore (a financial analysis tool designed to evaluate the costs, benefits, and risks of demand-side management [DSM] programs and services). As shown in the Cost-Effectiveness Results section, Ameren Missouri assessed cost-effectiveness using all five of the standard perspectives produced by DSMore:

- Total Resource Cost (TRC)
- Utility Cost Test (UCT)
- Societal Cost Test (SCT)
- Participant Cost Test (PART)
- Ratepayer Impact Test (RIM)

Participant Surveys

Cadmus conducted online surveys with participating customers. Customers received an invitation to the online survey via email if their contractors recorded an email address. Customers without recorded email addresses received survey invitations via a mailed (postcard) invitation.

The team conducted two online surveys, administering one immediately after a customer installed a measure, the other six months after installation:

- The immediate survey included questions about measure and program satisfaction, program free ridership, baseline equipment types and dispositions, information sources about the program, contractor satisfaction, and demographics.
- The follow-up survey included questions from the immediate survey for which responses could change over time or for which and, rather than a battery of questions to inform program free ridership, it included a battery of questions to inform program spillover.

Customers were surveyed only once and received an invitation to only one of the two surveys. When customers installed multiple measures, the team randomly selected which measure their survey would address. Table 10 shows participant survey response rates.

Table 10. Participant Survey Response Rates

Survey Type	Number of Invitations	Number of Responses	Response Rates
Immediate Email Survey	1,573	480	30.5%
Immediate Postcard Survey	4,799	564	11.8%
Follow-up Email Survey	1,118	303	27.1%
Follow-up Postcard Survey	2,947	307	10.4%

Cadmus found no difference in the temporal aspects of responses (i.e., the differences between responses from the immediate and follow-up surveys). The team also confirmed no statistically significant difference emerged between survey responses from postcard invitations and from email invitations.

Stakeholder Interviews

In December 2016, Cadmus interviewed Heating and Cooling program stakeholders. The interview design sought to achieve the following:

- Understand program successes and challenges
- Gain insights into program marketing processes
- Obtain information about how the program engaged with contractors
- Identify key quality assurance processes utilized by the program

The team spoke with four stakeholders at Ameren Missouri and ICF, as shown in Table 11. Appendix C provides the stakeholder interview guide.

Table 11. PY16 Completed Stakeholder Interviews

Stakeholder Group	Interviews Conducted
Ameren Missouri Program Management	1
ICF Program Management	2
ICF Program Marketing	1
Total	**4**

Throughout PY16, the team regularly spoke with Ameren Missouri program staff to discuss program operations and to coordinate evaluation activities.

Contractor Interviews

Cadmus interviewed 10 participating contractor business owners or managers, seeking to investigate the attribution of nonparticipant spillover and contractor satisfaction with the program. Cadmus randomly selected the contractors for a stratified sample. By stratifying the sample by program equipment sales, the team ensured the interviews included smaller, medium-sized, and larger contractors, as shown in Table 12.

Table 12. Contractor Interview Stratification

Strata	Number of Contractors Interviewed
1 to 10 completed projects	3
11 to 100 completed projects	3
Over 100 completed projects	4

Distributor Interviews

In February 2017, Cadmus collected data from residential heating and cooling equipment distributors operating within Ameren Missouri's service territory. This effort sought to capture data on the volume of recent sales and the market shares of different efficiency levels of equipment sold. The team focused data collection on sales of HPs and CACs of various efficiency levels before and during the 2013–2016 HVAC program (i.e., PY16 data), which could be compared to similar data that the team collected from distributors in PY15 and PY13.

Marketing Review

Cadmus completed a strategy assessment and marketing materials review to assess the Heating and Cooling program's adherence to industry best practices for program marketing strategies and related marketing tactics. In conducting this review, the team examined marketing materials and marketing strategy documents.

Non-Participant Surveys

Cadmus conducted telephone surveys with 200 Ameren Missouri customers who did not participate in any of Ameren Missouri's energy efficiency programs. Cadmus conducted the surveys in order to calculate non-participant spillover (NPSO). To conduct the surveys, Cadmus drew a random sample of 20,000 Ameren Missouri customers and called through the sample until we reached our quota of 200 non-participant customers. The team asked respondents if they had adopted energy efficiency measures and about the influence of Ameren Missouri's efficiency program marketing campaign on their decision to adopt the measures.

Key Progress Indicators

Cadmus plans to track the following key progress indicators for the Heating and Cooling program across the three-year program cycle: program year electric savings, number of contractors registered, and customer satisfaction with the Heating and Cooling program and with Ameren Missouri.

Benchmarking Research

Cadmus researched four other utilities offering measures similar to those from Ameren Missouri's Heating and Cooling program, including early replacement and replace-on-burnout measures. The team conducted secondary research using its benchmarking database, E-Source, and using publicly available information to identify which programs had recently been evaluated and could provide information regarding metrics and topics planned for benchmarking.

Process Evaluation Findings

This section presents Cadmus' process evaluation findings for Ameren Missouri's Heating and Cooling program. The report organizes the findings in four sections: Program Delivery, Marketing and Outreach, Participant Satisfaction, and Contractor Experience.

Program Design

The Heating and Cooling program seeks to achieve energy and demand savings by encouraging residential customers to purchase efficient CACs, HPs, and ECMs. The program targets residential customers in Ameren Missouri's service territory with CAC, HPs (e.g., GSHPs, DFHPs, and ASHPs—including ductless), or electric furnaces, incentivizing the customers to replace existing or broken equipment with efficient units. The program also provides residential customers with incentives to install efficient equipment in new residential construction.

Ameren Missouri's Heating and Cooling program is designed to reduce the administrative burden for residential customers by requiring that participating contractors submit all required paperwork for rebates on the customers' behalf. Participants directly receive rebates from Ameren Missouri after equipment installation.

From PY16 through PY18, Ameren Missouri contracted with ICF to implement the program. ICF recruits and trains contractors, and takes primary responsibility for maintaining a website for receiving online applications, processing rebates, and conducting quality control checks. Table 13 illustrates Ameren Missouri's rebate expenditures for the Heating and Cooling program's measures.

Table 13. Rebated Measures

Qualifying Products	Total Rebate Amount (Thousands) Paid
CACs	$4,526
ASHPs	$980
GSHPs	$445
Ductless HP	$68
DFHP	$12
ECMs	$491
Total	**$6,552**

Program Delivery

This section discusses information shared by program stakeholders during Cadmus' interviews regarding program management and program delivery topics. Interviews primarily focused on program changes, contractor engagement and training, quality assurance processes, successes and challenges, and future program changes.

PY16 Program Changes

In PY16, the Heating and Cooling program's biggest changes included the following:

- Removal of the tune-up measure
- Addition of ductless HP measures
- Addition of GSHP replacing GSHP measure
- Streamlining the application process
- Introducing an app for tablets and smart phones (allowing contractors to submit applications)
- Launch of an online learning and training center

According to stakeholders, Ameren Missouri sought to keep program changes minimal in PY16. While tune-ups represented an important part of the program's past design, the PY16 measure offerings did not include this measure due to the tight timelines faced when launching the program in PY16. According to stakeholders, Ameren Missouri faced a quick program start-up timeline in PY16 as its residential energy efficiency programs had been discontinued towards the end of PY15. The tune-up measure, however, was reintroduced in PY17.

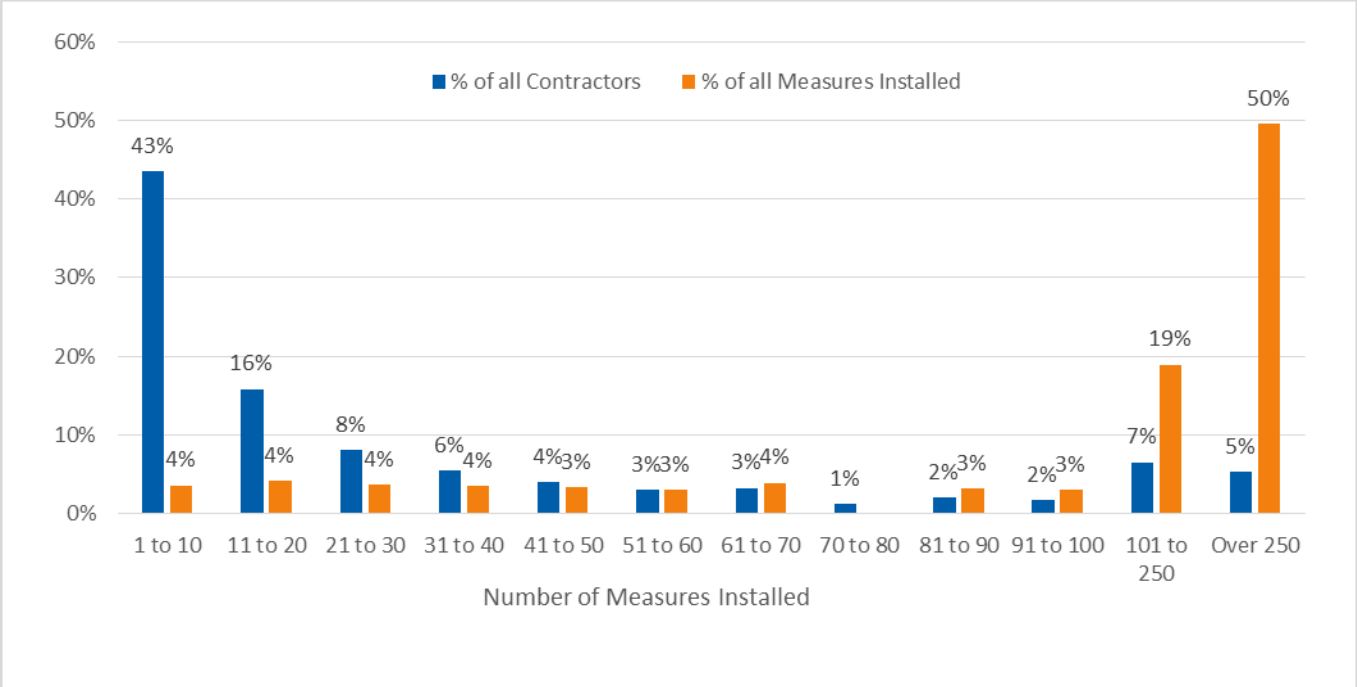
Ameren Missouri also introduced a smart phone and tablet application submission *app* about midway through PY2016, conducting one-on-one trainings with contractors regarding its use. The program implementer contact expected contractors would utilize the *app* more following additional trainings at the beginning of PY17.

Contractor Engagement

Contractors serve as a critical component for delivering the Heating and Cooling program. Contractors install energy-efficient equipment, complete and submit customer rebate applications, and market the program. Stakeholders stated 410 to 450 registered contractors worked for the program in PY16, but did not know the percentage of the active contractors pool this number represents within Ameren Missouri's territory.

Stakeholders noted that registered contractors reflected a wide diversity of businesses, including contractors that joined to program to deliver a few projects (at customers' requests) to contractors that installed hundreds of measures. According to Heating and Cooling program tracking data, 398 different contractors installed an average of 55 measures (including ECMs) in PY16. Minimum to maximum numbers of measures installed by a contractor ranged from one to 1,010 (the largest number of measures installed by a contractor). Figure 3 illustrates the wide range in the number of measures that contractors installed. Though most contractors installed one to ten measures in PY16, the graph shows that 5% of the contractors installed half of the measures in PY16.

Figure 3. Measures Installed by Contractors in PY2016



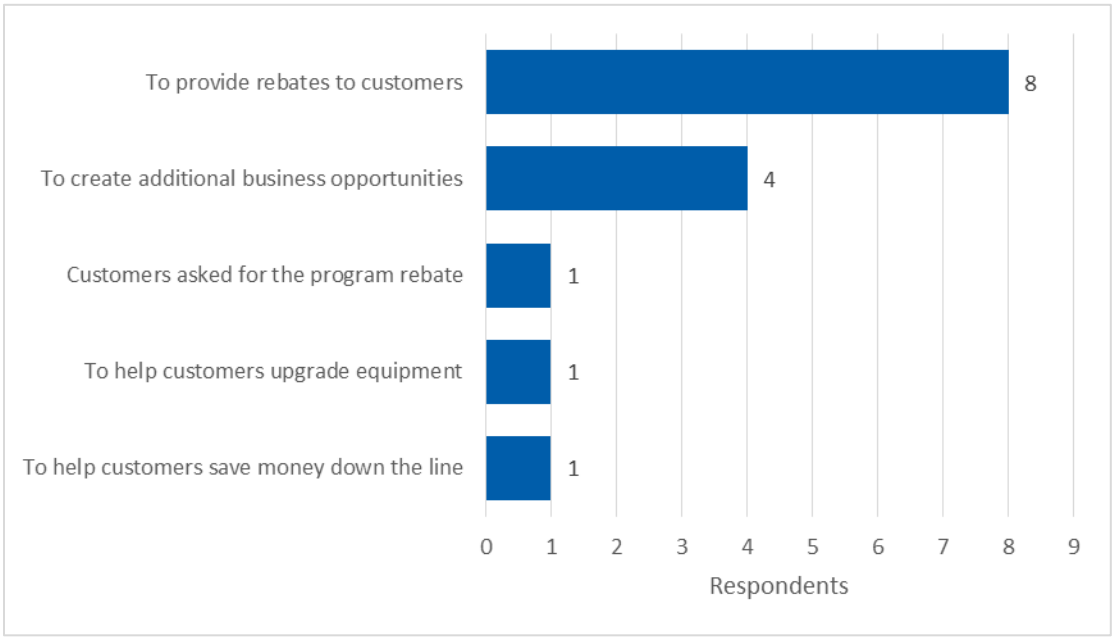
Source: PY16 M&E Tracking Data (n=398)

Recruitment

Stakeholders noted that the Heating and Cooling program rapidly reregistered approximately 85% of the past participating contractors as Ameren Missouri continued to engage with contractors throughout the program's closure period at the end of PY15. In addition to reregistering previous contractors, the program registered contractors that responded to customers' requests for Ameren Missouri rebates. Ameren Missouri continues to conduct outreach to contractors via heating and cooling equipment distributors.

Contractors stated that they participated in the Heating and Cooling program primarily to provide their customers with rebates and to create additional business opportunities. Contractors also participated to address customers' questions about the program rebate, help customers upgrade equipment, and help customers save money down the line, as shown in Figure 4.

Figure 4. Contractors' Reasons for Program Participation



Contractor Interviews: "What were the main reasons you decided to participate in the residential HVAC Program?" n=10 (Multiple responses allowed)

Training

The Heating and Cooling program requires two types of mandatory training for participating contractors:

- An initial enrollment training session
- Annual refresher training at the beginning of each program year

Both trainings cover program rules, incentives, Refrigeration Institute (AHRI) efficiency certifications, and how to qualify measures. Enrollment training for newly registered contractors includes a component on the application system and program attribution (i.e., how to communicate that Ameren Missouri provides the rebates).

Ameren Missouri offers additional voluntary trainings on topics such as AHRI efficiency certifications, and new tablet and smartphone-based application systems. The Heating and Cooling program's online learning center offers all trainings via webinars, though contractors can attend trainings in person.

Nine contractors said they found the "refresher" training valuable in PY16. Four contractors cited specific training benefits, including clarification of eligible equipment, understanding information to collect from a customer, and reminders regarding the functions of paperwork and program processes. One contractor, already very familiar with the program through their role on the program advisory committee, did not learn new material through the training.

In 2016, three contractors participated in additional training, which included the power rebate application. None of the 10 contractors offered suggestions to improve training, and generally indicated

Ameren Missouri did a very good job with training. Many contractors repeatedly reported Ameren Missouri as very responsive to answer questions, and one contractor thought this significantly reduced their need for additional training.

Communication

The Heating and Cooling program engages with contractors through several mechanisms: a contractor advisory group; dedicated program account managers; regular email communications and newsletters; notices about program activity posted at an online contractor portal; and hosting a contractor appreciation dinner. Details follow:

- The contractor advisory group meets quarterly. At these meetings, Ameren Missouri solicits feedback regarding customer engagement, and discusses potential program changes, including new measure roll-outs. According to stakeholders the advisory group mechanism has very effectively engaged contractors with the program.
- Dedicated program account managers remain in contact with contractors in-person, by telephone, and by email. According to the program implementer, the Heating and Cooling program encourages contractors to contact their respective account managers with questions or concerns.
- Regular emails and newsletters to participating contractors include updates on program changes and developments.
- The Heating and Cooling program posts notifications, program documents, and marketing materials at an online portal used by contractors to submit rebate applications.

Stakeholders noted that they have very successfully maintained engagement with the contractor network via established communication mechanisms, crediting their success to rapidly reenroll contractors at the beginning of PY16 to successful utilization of these communications tools.

Distributor Engagement

The Heating and Cooling program actively engages with heating and cooling equipment distributors to promote efficient equipment sales. Distributors can act as Heating and Cooling program ambassadors, and, according to the program implementer, historically have proactively encouraged contractors to sell higher-efficiency equipment. The program implementer stated that, since distributors conduct more frequent and regular interactions with contractors than program staff, distributors provide a helpful link to the contractor community. Distributors can disseminate program information, encourage contractors to sell efficient equipment, and encourage nonparticipating contractors to join the program.

An ICF account manager facilitates distributor engagement on a part-time basis, actively engaging with 14 of the larger distributors—meeting with them regularly to provide program updates and providing them with marketing materials for equipment showrooms.

Quality Assurance Processes

Program stakeholders described several ways in which the Heating and Cooling program conducts quality assurance. These mechanisms involve reviewing applications, surveying customers after equipment installation, and conducting post-installation site visits at customers' residences. Specific quality assurance process elements include the following:

- Conducting in-depth reviews of applications submitted by contractors.
- Sending post-installation surveys to customers by mail, through which customers verify that contractors installed the equipment recorded. With the completed surveys, ICF asks customers to send photographs of the installed equipment.
- Site visits at 200 customer homes to verify equipment installations and to test system performance.

Delivery Successes and Program Achievements

Stakeholders reported that the following program aspects worked particularly well in PY16:

- The program successfully engaged contractors during the program's inactive period at the end of PY15, allowing Ameren Missouri to rapidly reenroll a large number of contractors when the program relaunched in March 2016.
- The program implementer noted that the percentage of flaws in rebate applications dropped by 23% from the previous program year.

Program Implementation Challenges and Potential Changes

Stakeholders noted that break in programs between PY15 and PY16 caused several challenges, including the following:

- Keeping the participating contractors' network engaged
- Not allowing tune-up offers due to the compressed program launch period in PY16
- Potentially missing marketing opportunities at the beginning of the program year

Despite the two months of interruption between PY16 and PY17, due to delays from Commission approval, stakeholders noted that the program would exceed PY15 participation levels, pointing towards this accomplishment as an indicator that the program runs well.

Other than restarting the Heating and Cooling system tune-up measure in PY17, stakeholders did not identify additional planned program changes. While they did not anticipate the tune-up measure's roll out to present a significant challenge, stakeholders noted it would require changes to marketing materials, new contractor training, and new tools for contractors.

Marketing and Outreach

Ameren Missouri markets the Heating and Cooling program directly, providing materials and co-branding opportunities to aid its participating contractors in marketing the program. This marketing

and outreach section assesses the program's marketing strategy and marketing materials, information about contractor marketing practices, and relevant results from the participant surveys.

Marketing Strategy

As part of an evaluative effort to assess its programs' performance, from inception of the three-year plan to the present, Ameren Missouri requested a review of program-specific marketing materials.

Integral program operations include marketing, education, and outreach activities, which ensure that targeted audiences know of energy saving measures and services available, stay informed on ways to access these through Ameren Missouri's network of contractors, and receive education on proper installation and maintenance. Table 14 lists program documents and materials reviewed by Cadmus to assess Heating and Cooling program's strategies and marketing materials.

Table 14. Summary of Program Documents and Materials Review

Research Method	Program Documents/Materials Reviewed
Strategy Assessment	• Program Implementation Guide: *Appendix H—MEEIA 2016-18 Program Template* • Marketing Calendar: *Marketing Flow Chart—9.1.16*
Materials Review	• Advertisements: *banner ads, television ads* • Out of Home Advertising: *in-store signage* • Direct Mail: *bill inserts, free-standing inserts, post cards*

Strategy reviews seek to determine whether programs adhere to industry-recognized marketing best practices. While geographic, economic, and sociographic differences emerge when comparing one utility's service territory to another, and those differences affect program delivery, little variance occurs in overarching program designs and related marketing strategies for a majority of DSM programs.

Cadmus reviewed the program documentation shown in Table 14 to understand the Heating and Cooling program's targeted audience, delivery methods, stated marketing strategies, and supporting tactics, along with a confirmed 2016 advertising schedule. The review used industry insights and the team's expertise in marketing energy efficiency programs to assess the program's marketing strategy.

Strategy Assessment

A targeted effort, Ameren Missouri's Heating and Cooling program focuses on driving purchases of CAC systems or HPs to residential customers that meet one of the following conditions:

- They already have a CAC system
- They may be considering installations of new CAC or HP units.

A contractor network, trained by Ameren Missouri implementation staff, delivers the Heating and Cooling program, selling program-qualified equipment to customers and completing rebate applications. Ameren Missouri's marketing strategy uses targeted tactics to overcome program participation barriers, including limited awareness and understanding of technology, awareness of available trained contractor networks, and high upfront costs. As shown in Table 15, these tactics seek to engage prospective purchasers along with the program's contractor delivery network.

Table 15. Ameren Missouri Heating and Cooling Program Strategies and Tactics

Marketing Tactic	Residential Customer Approach	Contractors Approach
Advertising	TV, digital	NA
Ameren Missouri -Owned Communications (Direct Communications and Direct Mail)	Targeted direct-mail campaign	NA
Co-operative Advertising	NA	Dedicated program
Out of Home Advertising	Dedicated in-store signage	Dedicated in-store signage
Events	N/A	Contractor Training

Ameren Missouri's targeted customer strategy follows a sound design. Digital advertising, deployed to support the Heating and Cooling program, included the following:

- Paid search (live June 27–November 27)
- Banner ads (effective September 5–25, October 3–16, and October 31–November 6)

This provided an effective method for isolating a targeted audience, while employing program messaging that could be adjusted using geographic and demographic data.

Although not a targeted strategy, television ads provide broad-based awareness of program offerings that could help to influence customers to conduct pre-purchase research. The direct-mail campaign, described in the program implementation plan, offers a typically strong performing strategy, where organizations utilize customer data to determine those most open to making purchases, based on data analysis.

2016 Marketing Materials Review

For the Heating and Cooling program, Cadmus assessed 12 different sets of marketing materials (provided by Ameren Missouri). Table 16 shows the materials grouped into four analysis categories.

Table 16. Ameren Missouri Heating and Cooling Program Materials Reviewed

Cluster	Materials Included	# Reviewed
Advertisement	Banner ads, TV commercial	3
Out of Home Advertising	Beam signs, blade signs, fact card, general sign, stickers, brochures, door hangers, rebate forms, tear pad	1
Direct Mail	Bill insert, insert, post card	8
Direct Communication	Letter, e-mail, enrollment form	-
Total		**12**

Ameren Missouri's marketing materials proved adequate to promote its Heating and Cooling program to customers. Direct and easy to comprehend, the materials helped customers to understand available energy efficiency measures and their associated energy and cost savings, while using nontechnical terminology. Materials included a strong call-to-action, informing customers of actions required for participation, and providing clear directions to help them take those actions. Combined, these factors were designed to enhance customers' recall of marketing materials and to drive program participation.

During the review, Cadmus noted that Ameren Missouri had one specialized campaign in addition to its standard suite of Ameren-branded marketing materials. The team particularly noted Ameren Missouri's "That's Something to Smile About!" campaign: its creative and messaging strategy, given its appeal and allure, may help excite and entice customers that, traditionally, have not participated in programs.

Ameren Missouri materials equated programs with available incentives, discounts, and savings; some materials, however, could benefit from additional information addressing benefits. For example, some Heating and Cooling direct-mail materials incorporated multiple citations of specific incentive amounts, but did not mention other benefits from participating. Incorporating additional messaging when space allows that provides customers with other benefits (e.g., "save up to XX% on energy costs" when applicable or "improve the comfort of your home") can further enhance participant's interest.

Heating and Cooling Program Marketing Material Review

As shown in Table 17, Cadmus analyzed 15 Ameren Missouri's Heating and Cooling program materials, comparing against best practices for effective and successful marketing tactics.

Table 17. Best Practice Elements for Marketing Materials

Element	Description
Consistent messaging and "look and feel"	Repetition in messaging and consistency in appearance helps to reinforce brand awareness, making it easier for viewers to understand and remember key program information.
Identifiable target audience	Target audiences become more motivated and engaged if messaging, content, and delivery clearly focus on a program's unique audience, address key barriers, or leverage distinct motivators.
Clear and comprehensive program details and benefits	Successful communications materials convey benefits in simple terms and explain the value proposition, leading to a higher likelihood of understanding and participating in the program.
Direct call to action	Targets will more likely follow through with desired actions if those actions have been clearly stated.
Appropriate messaging and creative, given context	Creative layout, design, and messaging should match marketing and media channels in which it will be placed.
Complementary creative imagery and messaging	An effective and impactful creative platform seamlessly and strategically blends key messaging with imagery and layouts to ensure all components work together to encourage the desired outcomes.
Visual appeal	Visually appealing materials leave positive impressions.
Easy participation steps	Effective marketing and communications materials outline a clear, simple, and—ideally—easy path for consumers to follow to participate in a program.
Memorable and recognizable messages	A memorable and recognizable message increases the likelihood of the target recalling the message, and, in turn, increasing the likelihood of participation.
QA/QC errors	Materials with errors detract from an organization's credibility.

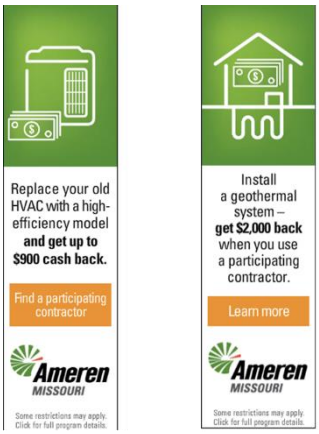
The team assessed each material using a four-point scale for each best-practice attribute, with the total score annotating the materials' overall adherence to industry best practices in developing marketing tactics. The team's analysis of key findings follows, drawn from reviewing Heating and Cooling program marketing materials.

Advertising

Cadmus reviewed two digital banner ads (one for geothermal and one for efficient Heating and Cooling systems in general [shown in Figure 5]), and one 15-second Heating and Cooling commercial. These banner ads used appealing graphics, concise messaging that highlighted rebate amounts in bold, and a strong call-to-action, emphasized through use of an orange button.

The Heating and Cooling commercial provided a great deal of important information in 15 seconds. Designed well, and incorporating animation and a pleasant voiceover, the advertisements clearly explained that rebates were available from Ameren Missouri for installing new Heating and Cooling systems.

Figure 5. Digital Banner Ads



Out of Home Advertising

The team reviewed one piece of out of home advertising material developed by Ameren Missouri for the Heating and Cooling program: a sign placed at gas station pumps. The sign uses "smile" campaign branding, and includes available rebates for Heating and Cooling measures. The ad does not immediately clarify which products the rebates cover (other than a mention of HVAC and a geothermal system). Given the signage's placement, opportunities exist to engage customers uniquely, as they have little else to do while pumping gas for their vehicles.

Figure 6. Gas Pump Sign

Direct Mail

Cadmus reviewed three types of direct-mail materials:

- Bill messaging
- A free-standing insert
- Postcards

Bill messaging varied from month to month, with each alternating month focusing on Heating and Cooling measures and related rebates. The bill's front side presented concise messaging (on its bottom front side), and included slightly larger and more visually appealing graphics on the back. While the messaging contained important information, most bill messages could use additional formatting (e.g., bolding, underlining) to highlight key facts, takeaways, and calls for action. Not all graphics proved visually appealing: the team found the graphic on the August statement's back confusing and hard to follow. This graphic is shown in Figure 7.

Figure 7. August Bill Statement Messaging Graphic (back)

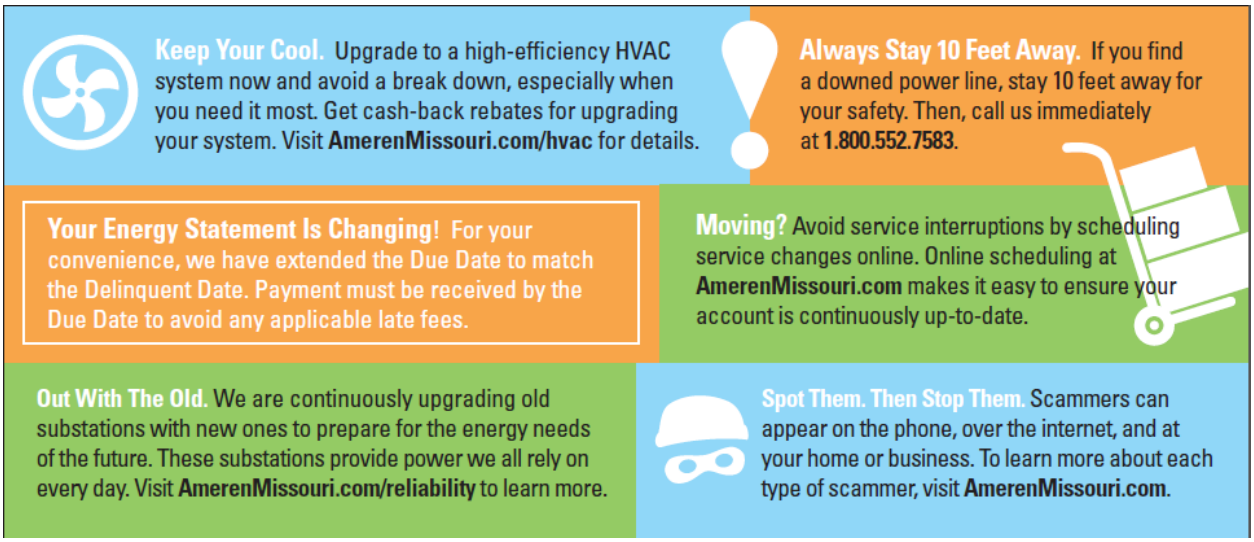


Figure 8 shows an informational insert containing concise messaging that strategically highlights important copy points by using different-sized and color fonts to direct the readers' attention. Very visually appealing, this insert incorporated creative elements that complemented the copy and followed Ameren Missouri branding guidelines. These elements combined to create well-composed materials, which could serve as a model for other residential materials.

Figure 8. Informational Insert

The team reviewed postcards intended to raise awareness of specific incentives provided through the Heating and Cooling program. The postcards included an eye-catching front side, incorporating creative prose and a relevant image that corresponding to the Ameren Missouri brand. The postcards presented a strong call to action, combining educational messaging with an easy-to-comprehend, three-step program participation approach. The postcards served as another effective example of well-developed marketing materials.

The team scored materials against "top 10" best practice elements for effective and successful marketing materials, as shown in Table 18. This scale applied in scoring Individual materials, with scores aggregated for different groups.

Table 18. Marketing Material Review Scores

Focus Area	Advertising	Out of Home Advertising	Direct Mail
Consistent messaging and "look and feel"	3.0	3.0	3.0
Identifiable target audience	3.0	3.0	3.0
Clear and comprehensive program details and benefits	3.0	3.0	3.3
Direct call to action	4.0	3.0	3.4
Appropriate messaging and creative, given context	4.0	3.0	3.1
Complementary creative imagery and messaging	3.0	3.0	3.3
Visual appeal	3.3	2.5	3.1
Easy participation steps	2.8	3.0	3.3
Memorable and recognizable messages	4.0	3.5	3.4
QA/QC errors	No	No	No

Contractor Marketing Practices

The Heating and Cooling program provides contractors with program marketing and offers contractors opportunities to co-brand materials with Ameren Missouri. To support contractors in marketing the program, Ameren Missouri maintains a co-op fund. Participating contractors can apply to utilize this fund for up to 50% of their co-branded marketing expenses. The program implementer noted that, partially due to the break between PY15 and PY16, Heating and Cooling program's PY16 co-op funds supporting contractor marketing efforts were not fully spent.

Two of ten contractors that Cadmus interviewed for this evaluation (both of which completed over 100 projects in PY16) stated that they actively advertised the program. Of the two contractors that actively advertised the program, one used Facebook and the other used direct mail.

When asked for a reason why contractors did not actively market the program, one respondent said he had been in the market for years and acquired most of his business through word-of-mouth or referrals, rather than by directly marketing their business or the Heating and Cooling program. Another contractor stated that Ameren Missouri's marketing efforts were very visible, reducing his company's need to actively market the Heating and Cooling program.

Of the eight contractors saying they did not advertise the program actively, six said they conducted (or currently conduct) limited forms of marketing, including mentions of equipment rebates. These contractors generally used the following marketing approaches:

- Rebates noted in their proposals to customers (four contractors).
- Limited public advertisement, including fliers and bulletins that noted possible rebates but did not cite Ameren Missouri specifically (two contractors).
- Outbound marketing phone calls, seeking HVAC tune-up work from current customers (two contractors).
- Placement on their website (two contractors).

Although four contractors said that they joined the Heating and Cooling program to generate more business, only one of the ten contractors (a contractor completing over 100 projects in PY2017) took advantage of co-branding, using Ameren Missouri's logo on their direct-mail materials. This contractor, however, did not know if doing so increased customers' response or sales rates. None of the contractors reported using co-op funds.

The team asked contractors to estimate what percentage of their efficient heating and cooling equipment business came from customers directly inquiring about equipment (as opposed to contractors marketing efficient equipment). Contractors provided the following responses:

- One contractor (that completed four projects in PY16) stated that their business in efficient equipment came almost exclusively from customers finding the contractor on the Ameren Missouri's website.
- One contractor (that completed 24 projects in PY16) stated that 25% to 30% of their customers seeking efficient equipment located the company through Ameren Missouri's website.
- Three contractors (that completed over 100 projects in PY16) stated that 25% to 50% of their efficient equipment business came directly from customer inquiries.

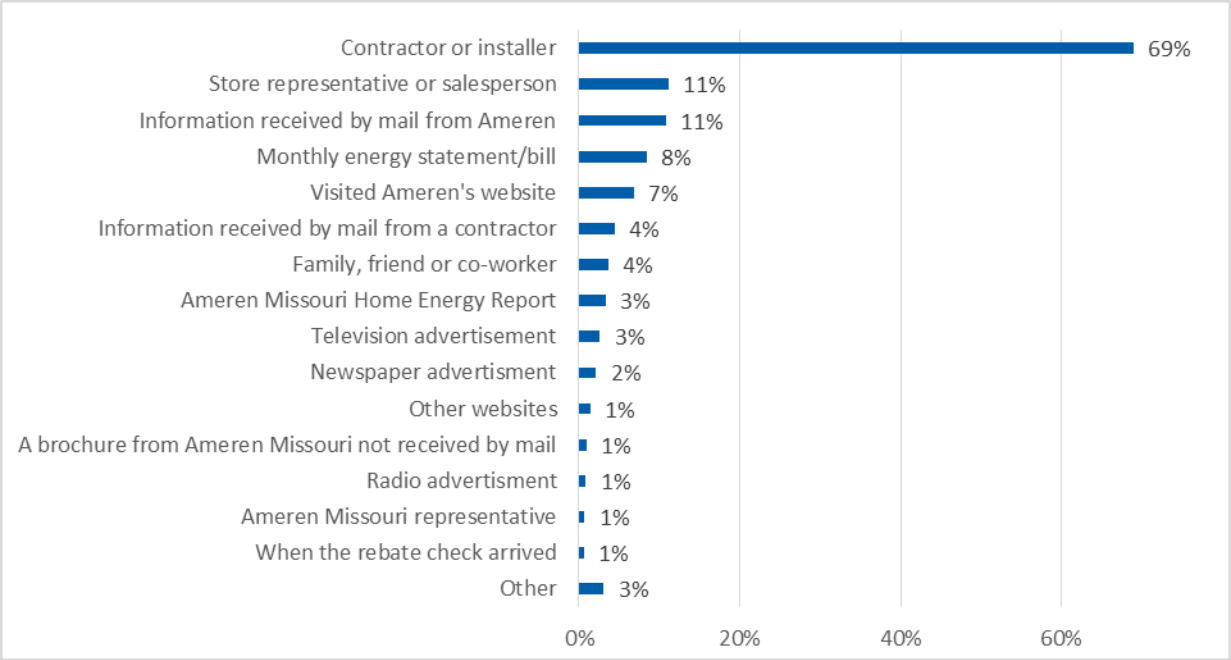
Sources of Participant Program Awareness

Cadmus asked program participants how they heard about the Heating and Cooling program. As shown in Figure 9, participants primarily heard about the program from their contractors or from a store salesperson (80%). Some participants also heard about the program from Ameren Missouri. Participants who indicated that they heard about the program from Ameren Missouri most frequently cited the following sources:

- Mailings (11%)
- Bill statements (8%)
- Ameren Missouri's website (7%)

Only 2% of program participants heard about the Heating and Cooling program from television ads. In addition to sources listed in Figure 9, customers heard about the program from social media, door hangers, and various other ways (which Figure 9 represents as "other").

Figure 9. Customer Sources of Program Awareness

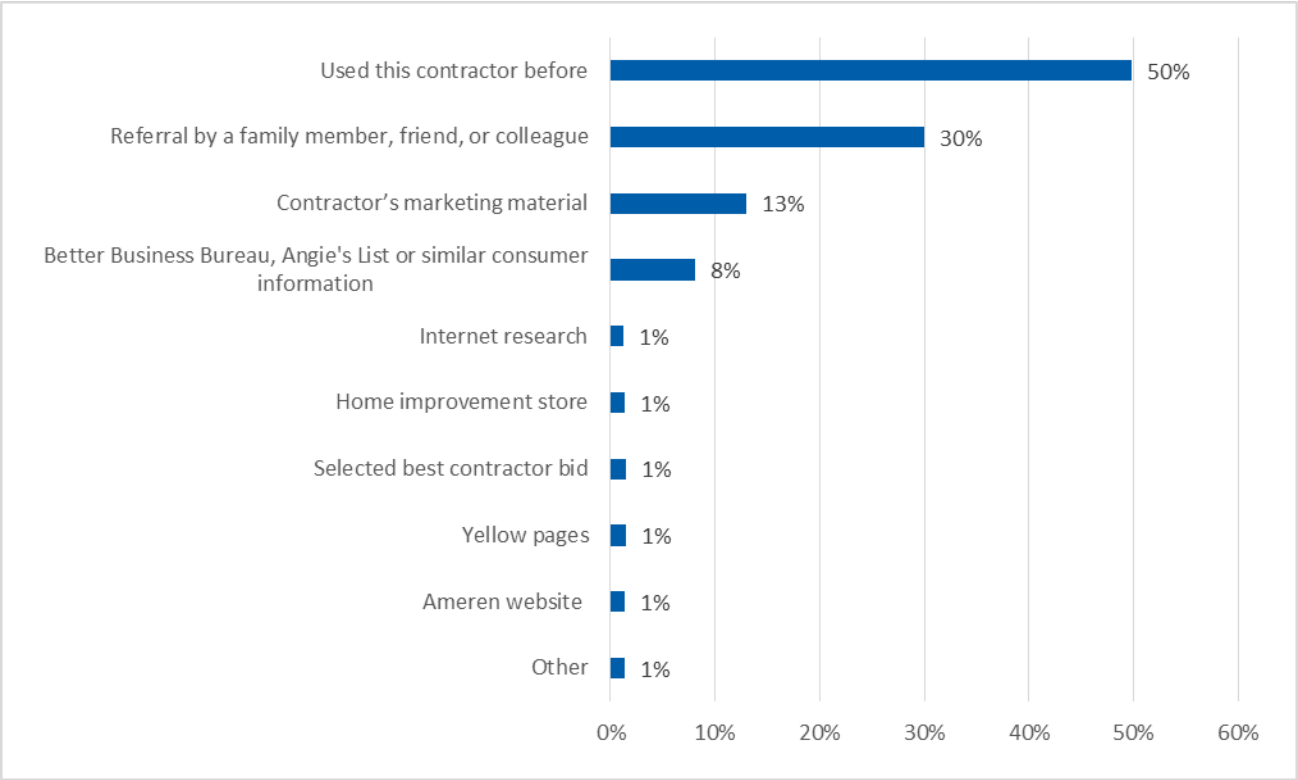


Immediate Participant Survey; A8. "How did you hear about Ameren Missouri's Heating and Cooling Program?" n=1,038 (Multiple responses allowed)

Cadmus also analyzed if participants' method of hearing about the Heating and Cooling program differed according to measures they installed. The team did not observe relationships between measures and sources providing customers' awareness about the Heating and Cooling Program.

As most customers learned about the Heating and Cooling program from a contractor, understanding how participants selected the contractors that installed their systems proves relevant to understanding program marketing process. As shown in Figure 10, most participants selected their contractors based on prior experience with that contractor (50%) or through following a referral from a trusted source (30%). Some participants selected contractors after seeing marketing materials (13%), or after reviewing consumer information resources or doing Internet research (9%). While contractors reported that customers frequently said they found the contractors through Ameren Missouri's website, only 1% of participants indicated using this method.

Figure 10. Participant Reason for Selecting Contractor



Immediate Participant Survey; C1. "How did you select the contractor who installed your system?" n=1,039 (Multiple responses allowed)

Of the 10% of participants who deliberately sought out contractors through consumer information resources or Internet research, 34% reported specifically looking for a program-participating contractor. Almost all of these respondents said it was not difficult to find a contractor that participated in the program (n=203).

Most customers initially made contact with contractors to resolve maintenance issues with existing heating and cooling equipment. As shown in Figure 11 (blue bars), participants initially made contact with their contractors for the following reasons:

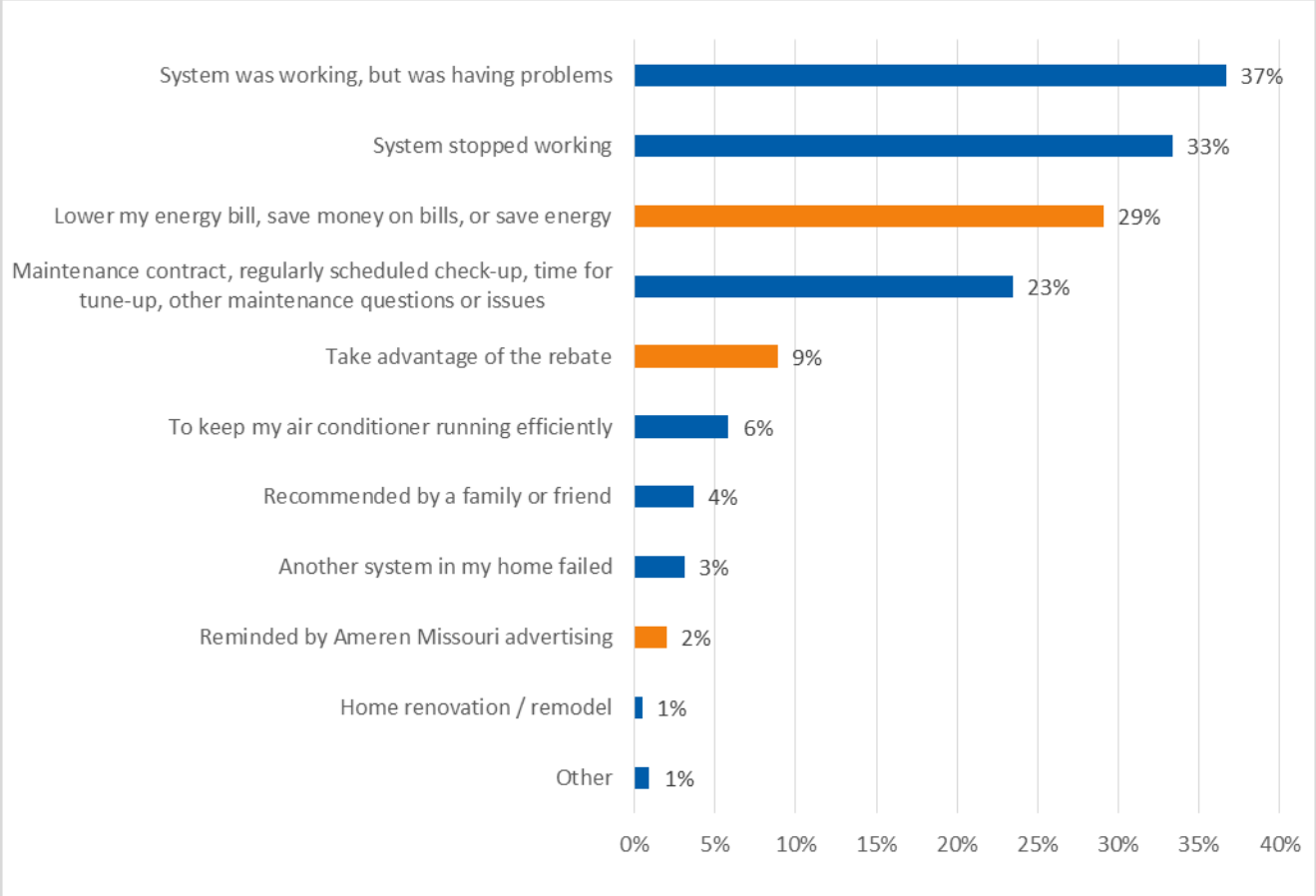
- The system had problems (37%)
- The system stopped working (33%)
- Regular maintenance (11%)
- Keeping existing equipment running efficiently (6%)
- Aging system (5%)
- Learning whether a system needed repairs (4%)
- Another system in the home failed (3%)
- Ensuring the equipment lasted longer (3%)

- Remodeling a home (1%)

Figure 11 also shows (orange bars) that, in addition to contacting contractors to resolve maintenance issues, 45% of participants contacted contractors for other reasons:

- Save money or energy (29%)
- Take advantage of the rebate (9%)
- Based on a recommendation (4%)
- Reminded by Ameren Missouri marketing (2%)
- Other reasons (1%)

Figure 11. Reason Customers Made Contact with Contractors



Immediate Participant Survey (Central Air Conditioners): E12. "Please think back when you first spoke with your contractor in regards to replacing and/or installing your CAC. What prompted the conversation?" n=826 and Immediate Participant Survey (Heat Pumps): F18. "Please think back when your contractor first visited your home. What prompted the visit?" n=133 (Multiple responses allowed) (Total n=959)

Survey data indicated that contractors served as the primary way that participants learned of the program, primarily after experiencing maintenance issues. Marketing efforts, however, also served as an

important driver to encourage customers to purchase efficient equipment. Equally significant, many participants indicated they learned of the program through Ameren Missouri's marketing efforts. Significant numbers of participants also indicated that they contacted contractors to save money or energy, or to take advantage of the program's rebate.

Participant Experience

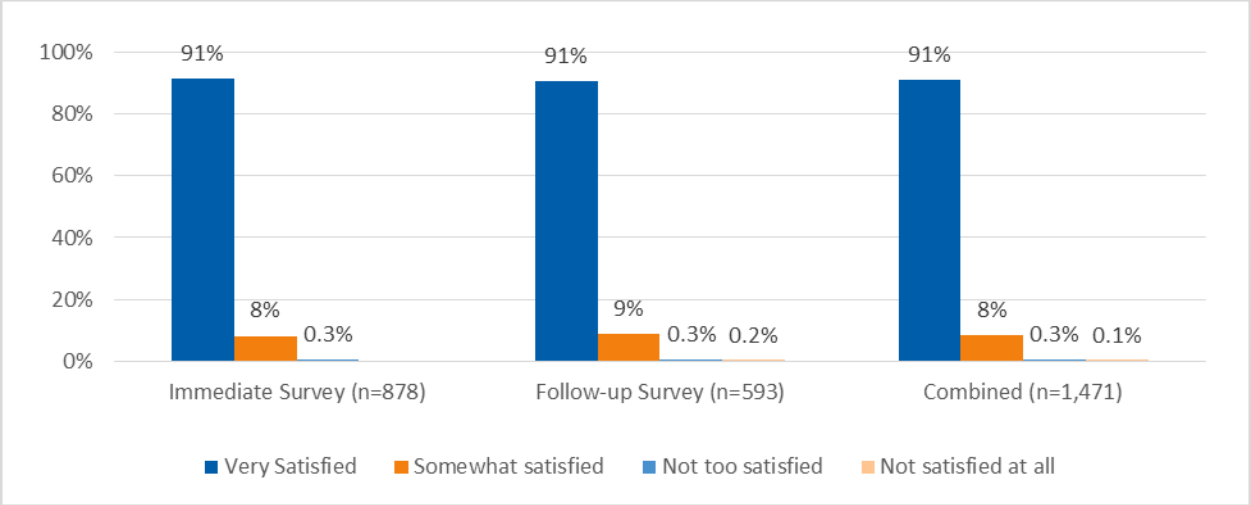
Participant Satisfaction

Cadmus asked participants about their satisfaction with the new equipment, installing contractors, the Heating and Cooling program, and Ameren Missouri. Overall, participants expressed very high satisfaction levels with all program elements.

Satisfaction with the Measure

Participants expressed very high satisfaction levels with their equipment, with almost all participants responding "very satisfied" or "somewhat satisfied." Additionally, as shown in Figure 12, participants' satisfaction did not diminish immediately after installation (i.e., Immediate Participant Survey results) or approximately six month after installation (i.e., Follow-up Participant Survey results).

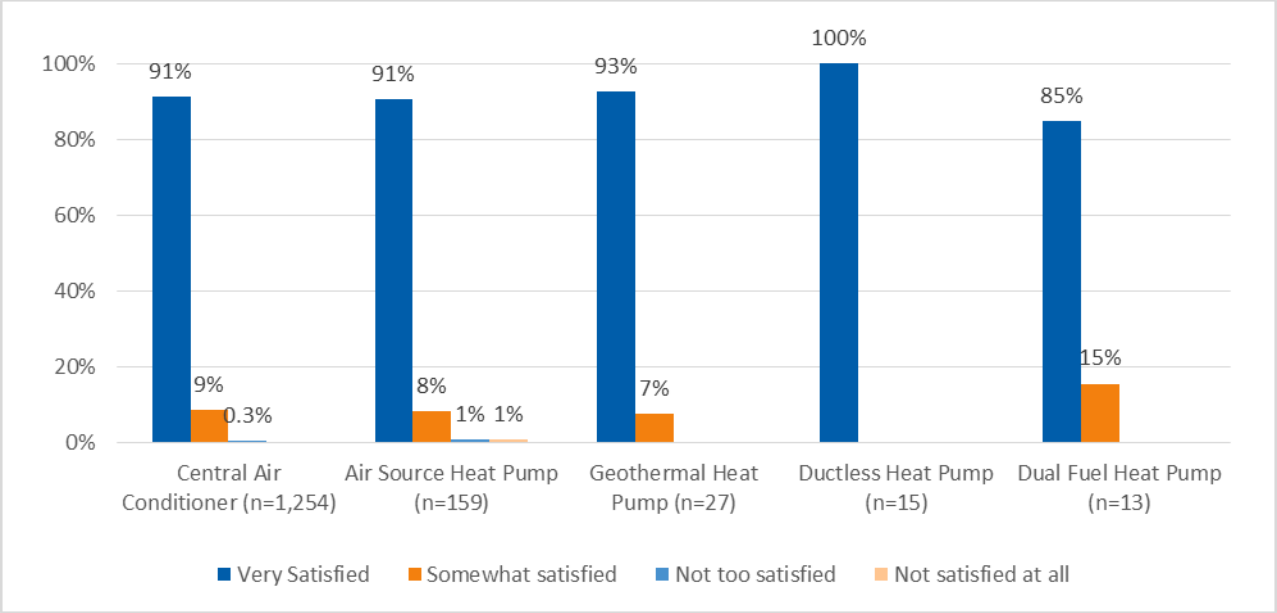
Figure 12. Participant Satisfaction with their Measure—by Survey



Immediate Participant Survey: D4. "How satisfied are you with the performance of your new [measure]?" n=878 and Follow-up Participant Survey: C4. "How satisfied are you with the performance of your new [measure]?" n=593 (Total n=1,471)

The team also analyzed if participants' satisfaction with their equipment differed by measure. As shown in Figure 13, participants experienced very high satisfaction levels across all measure types.

Figure 13. Participant Satisfaction with their Measure—by Measure



Immediate Participant Survey: D4. "How satisfied are you with the performance of your new [measure]?" n=875 and Follow-up Participant Survey: C4. . "How satisfied are you with the performance of your new [measure]?" n=593 (Total n=1,468)

The team asked participants why they were satisfied or dissatisfied with their equipment. Due to a high number of open-ended responses, the team randomly selected 70 responses from participants who installed ASHPs and CACs, and responded they were "very satisfied" with their equipment. Table 19 presents customer satisfaction and Table 20 presents customer dissatisfaction by equipment type.[6] The table does not illustrate the percentage of participants who cited each driver; rather, it illustrates how frequently participants cited the driver in the satisfaction, or dissatisfaction categories.

[6] As noted in Figure 15, the majority of customers expressed satisfaction with their equipment and did not cite any drivers of dissatisfaction. Participants who were "somewhat satisfied" with their equipment more frequently cited drivers of dissatisfaction.

Table 19. Drivers of Customer Satisfaction with Measures

Driver of Satisfaction	%
CACs (n=109)	
Energy/cost savings experienced after installation	30%
Satisfactory overall operation and performance of the unit	29%
Unit provides effective cooling	20%
Unit more quiet than the previous one	17%
Good contractor performance and unit warranty	3%
ASHP (n=101)	
Satisfactory with overall operation and performance of the unit	51%
Energy/cost savings experienced after installation	30%
Unit more quiet than the previous one	19%
GSHP (n=37)	
Energy/cost savings experienced after installation	35%
Satisfactory overall operation/performance of unit	19%
Unit provides effective heating	16%
Unit provides effective cooling	14%
Unit more quiet than the previous one	14%
Good unit warranty	3%
Ductless HP (n=22)	
Satisfactory overall operation/performance of unit	36%
Unit provides effective cooling and heating	27%
Unit more quiet than the previous one	23%
Energy/cost savings experienced after installation	9%
Unit works without ducts	5%
DFHP (n=15)	
Satisfactory overall operation/performance of unit	60%
Energy/cost savings experienced after installation	40%

Immediate Participant Survey: D5. "Why are you [RATING FROM D4] with the performance of your new [MEASURETYPE]?" and Follow-up Participant Survey: C5. "Why are you [RATING FROM D4] with the performance of your new [MEASURETYPE]?" (The number of responses that were coded for each measure for satisfaction or dissatisfaction is indicated next to the measure name in the table)

Table 20. Drivers of Customer Dissatisfaction with Measures

Driver of Dissatisfaction	%
CACs (n=76)	
Unit more noisy than the previous unit	33%
Energy/cost savings not experienced after installation	30%
Poor performance of unit (including insufficient cooling, temperature fluctuations, and condensation)	20%
Installation problems (including undersizing or oversizing units)	8%
High cost of unit	5%
Difficulty operating the unit	4%
ASHPs (n=10)	
Poor unit performance (including ineffective heating)	40%
Energy/cost savings not experienced after installation	30%
Unit more noisy than the previous one	20%
Unit did not provide a satisfactory return on investment	10%
GSHP (n=1)	
Energy/cost savings lower than expected	100%

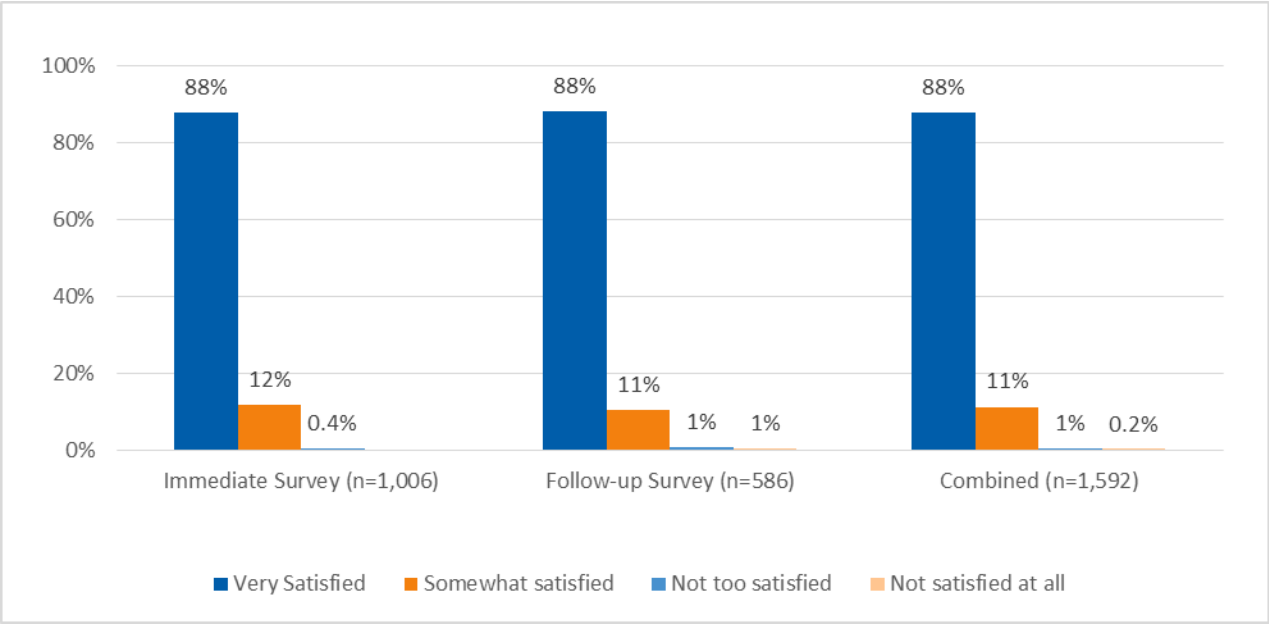
Immediate Participant Survey: D5. "Why are you [RATING FROM D4] with the performance of your new [MEASURETYPE]?" and Follow-up Participant Survey: C5. "Why are you [RATING FROM D4] with the performance of your new [MEASURETYPE]?" (The number of responses that were coded for each measure for satisfaction or dissatisfaction is indicated next to the measure name in the table)

As shown in Table 19 above, energy and cost savings experienced after installation served as a strong driver for participants' satisfaction with their equipment, particularly for CACs and geothermal HPs.

Overall Satisfaction and Suggested Improvements

Cadmus asked participants about their satisfaction levels with the Heating and Cooling program and if they could offer suggestions for improving the program. Participant expressed very high satisfaction levels with the program, and these persisted over time—from immediately after installation to approximately six month after installation (i.e., between the Immediate Participant Survey and the Follow-up Survey). In addition to expressing high satisfaction levels (shown in Figure 14), 99% of participants indicated they would recommend the Heating and Cooling Program to friends and family members (n=1,569).

Figure 14. Participant Satisfaction with the Heating and Cooling Program



Immediate Participant Survey: D8. "Thinking about your overall satisfaction with Ameren Missouri's Heating and Cooling Program, would you say you are:" n=1,006 and Follow-up Participant Survey: C8. "Thinking about your overall satisfaction with Ameren Missouri's Heating and Cooling Program, would you say you are:" n=586

The team also asked participants why they became satisfied or dissatisfied with the program. Due to the large number of open-ended responses to this question, the team analyzed a random sample of responses from participants who reported satisfaction with their contractors, and analyzed all responses from participants not satisfied with their contractors. Reasons for dissatisfaction (listed in Table 22) mostly included responses from participants reporting they were "somewhat satisfied" with the Heating and Cooling program.

Table 21. Reasons for Participant Satisfaction with the Heating and Cooling Program

Reasons for Satisfaction (n=97)	%
The rebates	49%
Overall positive program experience	18%
The program met expectations	11%
Satisfied with environmental benefits of the program	9%
Satisfied with the utility rates	5%
Satisfied with contractor	5%
Satisfied with the equipment value for money	2%

Immediate Participant Survey: D9. "Why are you [RATING FROM D8] with the Heating and Cooling Program?" and Follow-up Participant Survey: C9. "Why are you [RATING FROM C8] Heating and Cooling Program?"

Table 22. Reasons for Participant Dissatisfaction with the Heating and Cooling Program

Reasons for Dissatisfaction (n=46)	%
Dissatisfied with incentive or rebate	37%
Experienced delays in rebate processing	28%
Dissatisfied with rates/cost	26%
Dissatisfied with billing	2%
Dissatisfied with contractor	2%
Dissatisfied with equipment	2%
Desired greater program scope	2%

Immediate Participant Survey: D9. "Why are you [RATING FROM D8] with the Heating and Cooling Program?" and Follow-up Participant Survey: C9. "Why are you [RATING FROM C8] Heating and Cooling Program?"

Though program rebates served as the largest driver for participant satisfaction, expectations that rebates should be higher or delays in receiving rebates also served as a driver for participant dissatisfaction. As noted above (see Figure 14), participants expressed very high satisfaction levels with the Heating and Program overall.

Participants offered 111 recommendations for improving the Heating and Cooling program. Most of these (29%) addressed increasing or improving the program's marketing. Such recommendations included suggestions that Ameren Missouri provide information of federal tax credits for purchasing equipment and emphasize the equipment's energy savings attributes. Other recommendations frequently made by participants included providing higher incentives (22%) and making rebate processing faster and/or provide more information on a rebate's status (22%). Regarding rebate processing, participants frequently cited wanting to know their rebate's status (i.e., when the rebate would arrive). Table 23 lists categorized recommendations offered by program participants.

Table 23. Participant Recommendations

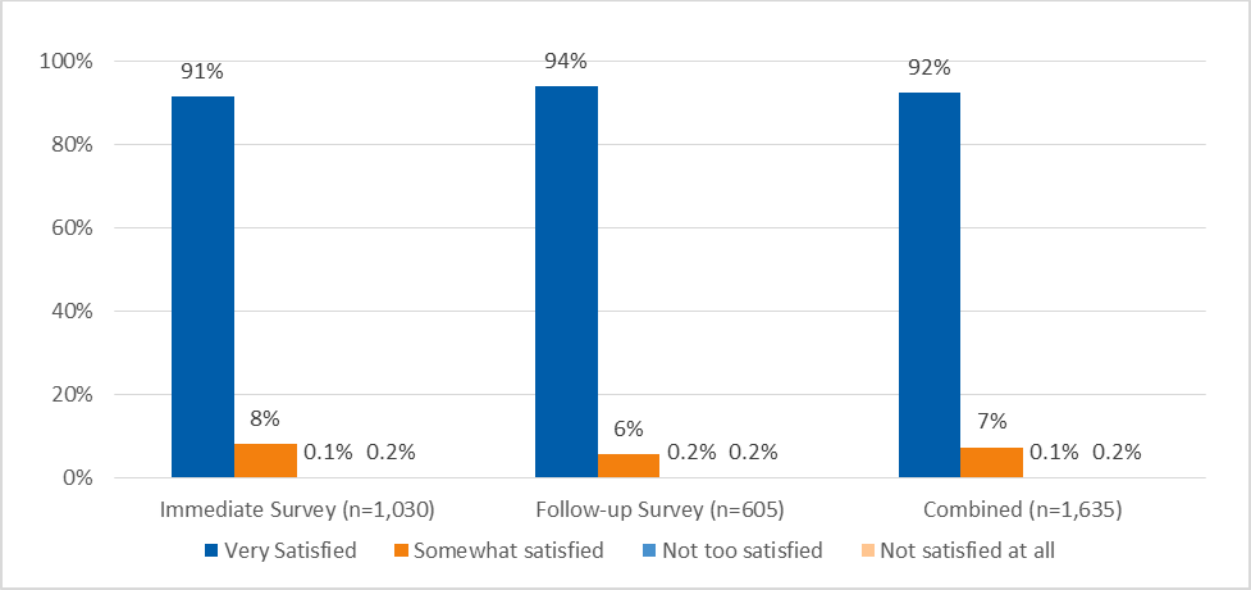
Participant Recommendations (n=111)	%
Increase or improve program marketing (including emphasizing energy savings of measures and providing information about federal tax credits)	29%
Offer higher incentives	22%
Process rebates faster and/or provide more information regarding rebate status	22%
Continue the program in the future	7%
Offer a wider range of measures (including for solar panels)	6%
Offer rebates in other forms (such as discounts on equipment at time of purchase or credits to the utility bill)	5%
Provide measure savings analysis to customers	4%
Offer energy audits	3%
Other recommendations	4%

Immediate Participant Survey: D12. "What suggestions, if any, do you have for improving the program?"

Satisfaction with the Contractor

Cadmus asked participants about their satisfaction with their contractor. Participants expressed very high satisfaction levels with their contractor and, as indicated in Figure 15, the high satisfaction level did not change after six months from the participants' measure installations.

Figure 15. Participant Satisfaction with Contractor



Immediate Participant Survey: D1. "How satisfied are you with the contractor you worked with?" n=1,030 and Follow-up Participant Survey: C1. "How satisfied are you with the contractor you worked with?" n=605

The team also asked participants why they were satisfied or dissatisfied with their contractor. As participants were generally very satisfied with their contractors, they mostly offered positive feedback. Due to the large number of open-ended responses, the team analyzed: a random sample of responses

from participants satisfied with their contractors; and all responses from participants not satisfied with their contractors. Table 25 lists drivers for dissatisfaction, mostly from participants who were "somewhat satisfied" with their contractors.

Table 24. Drivers of Participant Satisfaction with their Contractor

Reasons for Satisfaction (n=139)	%
Satisfied with the efficiency of the contractor	24%
Reliability of the contractor	19%
Satisfied with work the quality of work	17%
Satisfied with the cleanliness of the job site	8%
Satisfied with customer service	7%
Satisfied with the cost and/or warranty of the equipment	6%
Longstanding relationship with contractor	5%
Satisfied with equipment	5%
The contractor met minimum expectations	4%
The contractor made an overall positive impression	3%
The contractor assisted with the paperwork	1%

Immediate Participant Survey: D2. "Why are you [RATING FROM D1] with the contractor?" and Follow-up Participant Survey: C2. "Why are you [RATING FROM C1] with the contractor?"

Table 25. Drivers of Participant Dissatisfaction with their Contractor

Reasons for Dissatisfaction (n=76)	%
Dissatisfied with the quality of work	27%
Dissatisfied with level of communication from contractor	19%
Dissatisfied with installed equipment	17%
Inability to resolve equipment issues	8%
Dissatisfied with the cost of equipment	8%
Delays in installing equipment	6%
Poor site clean-up	4%
Issues processing rebates	4%
Dissatisfied with contractor customer service	4%
Damage during equipment installation	1%

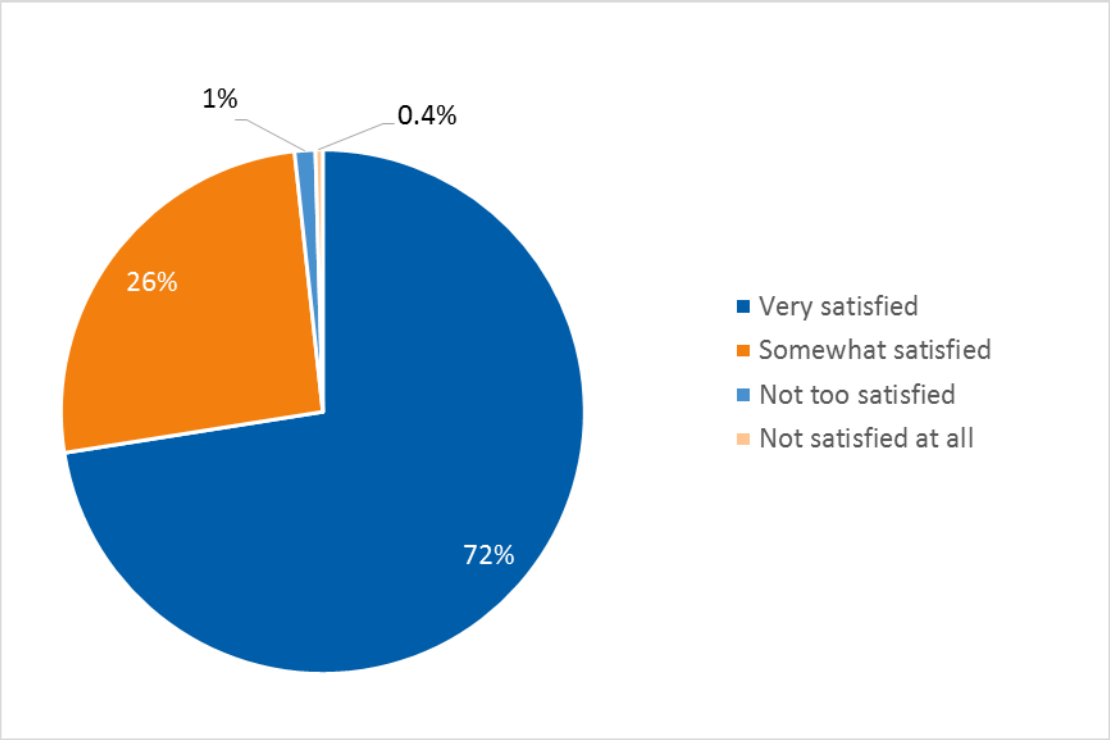
Immediate Participant Survey: D2. "Why are you [RATING FROM D1] with the contractor?" and Follow-up Participant Survey: C2. "Why are you [RATING FROM C1] with the contractor?"

Satisfaction with Ameren Missouri

Cadmus asked participants about their satisfaction levels with Ameren Missouri as their utility. Shown in Figure 16, participants expressed high satisfaction levels with Ameren Missouri as a utility, although their satisfaction with Ameren Missouri was lower than with their equipment, their contractors, or the Heating and Cooling program. Additionally, 44% of participants indicated that their satisfaction with

Ameren Missouri increased after participating in the program, whereas 55% indicated that their satisfaction stayed the same; 1% stated that it did not change (n=1,540).

Figure 16. Participant Satisfaction with Ameren Missouri



Immediate Participant Survey: I1. "Thinking about your overall experiences with Ameren Missouri as your utility, how satisfied would you say you are with Ameren Missouri?" n=966 and Follow-up Participant Survey: H1 "Thinking about your overall experiences with Ameren Missouri as your utility, how satisfied would you say you are with Ameren Missouri?" n=590 (Total n=1,556)

The team asked participants their reasons for satisfaction or dissatisfaction with Ameren Missouri. As shown in Table 26, the biggest satisfaction drivers included reliable and dependable service offered by the utility, Ameren Missouri meeting the customers' expectations as a utility, and good customer service. Drivers of dissatisfaction included utility rates, reliability, and infrastructure or maintenance issues (Table 27).

Table 26. Reasons for Participant Satisfaction with Ameren Missouri

Reason for Satisfaction (n=908)	%
Dependable and/or reliable service	33%
Ameren Missouri meets expectations as a utility	21%
Satisfied with customer service	10%
Satisfied with outage response	9%
Satisfied with utility rates	8%
Only one utility to choose from	7%
Positive overall impression of Ameren Missouri	6%
Incentive or Rebate	6%
Satisfied with infrastructure or maintenance	1%

Immediate Participant Survey: I2. "Why are you [RATING FROM I1] with Ameren Missiouri?" and Follow-up Participant Survey: H2. "Why are you [RATING FROM H1] with Ameren Missiouri?"

Table 27. Reasons for Participant Dissatisfaction with Ameren Missouri

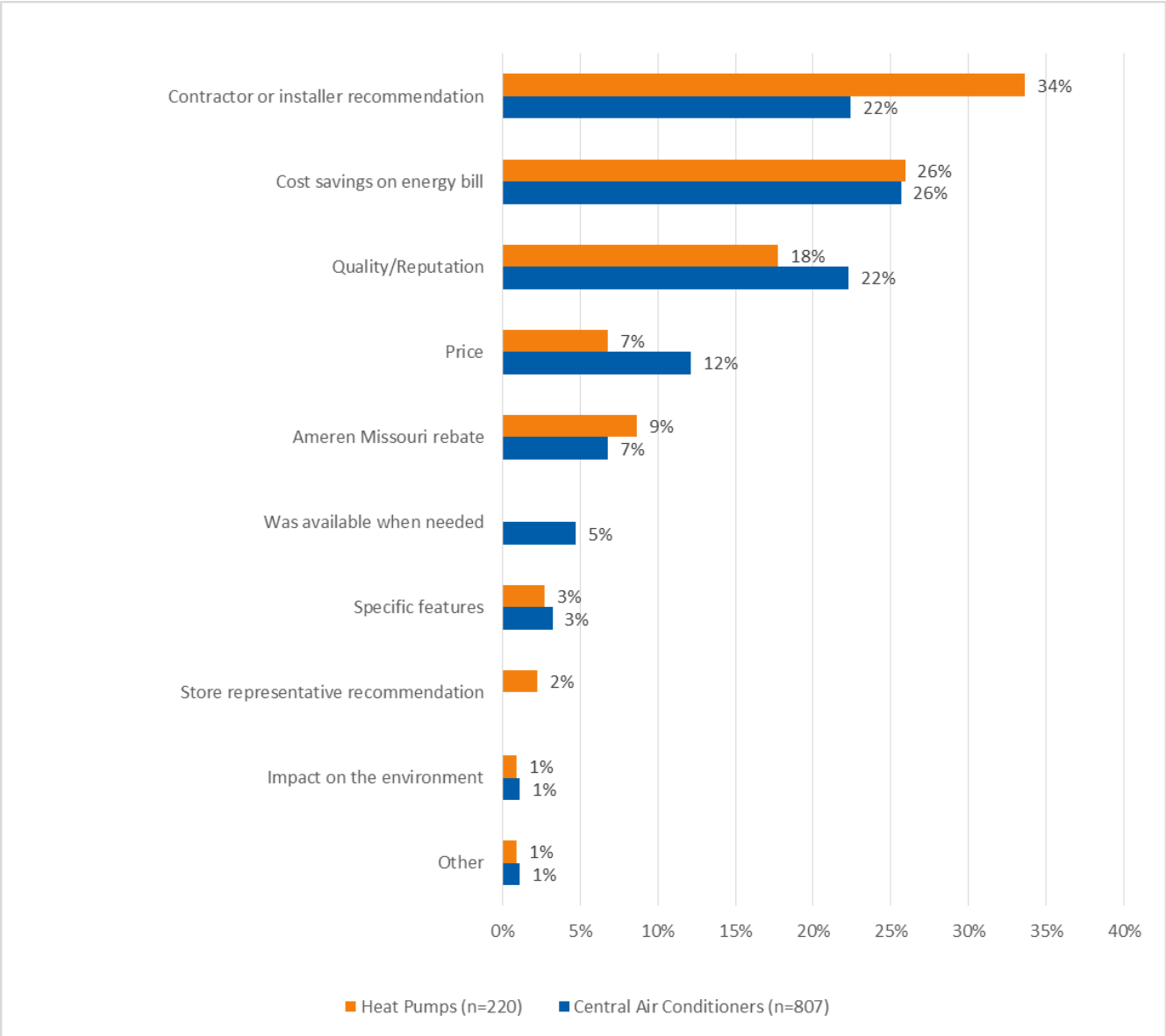
Reason for Dissatisfaction (n=238)	%
Dissatisfied with utility rates/cost	55%
Dissatisfied with reliability of service	16%
Dissatisfied with infrastructure and/or maintenance	8%
Negative overall impression of Ameren Missouri	5%
Dissatisfied with Ameren Missouri's sources of energy	4%
Dissatisfied with the billing process	4%
Dissatisfied with outage response	3%
Dissatisfied with customer service	2%
Rebate processing issue	1%

Immediate Participant Survey: I2. "Why are you [RATING FROM I1] with Ameren Missiouri?" and Follow-up Participant Survey: H2. "Why are you [RATING FROM H1] with Ameren Missiouri?"

Reasons for Selecting Specific Equipment

Cadmus asked participants what factors proved most important in selecting the equipment that they installed. Most participants installing HPs reported the contractor's recommendation as the most important factor in selecting specific equipment (34%), as shown in Figure 17. However, only 22% of participants installing efficient CACs said a contractor's recommendation provided the most important factor in selecting the specific equipment that they installed (the difference between participants installing HPs and CACs is statistically significant: p=0.0006). For participants installing CACs, cost savings were the most important factor (26%). Price was a more important factor for participants installing CACs (12%) than for participants installing HPs (7%) (p=0.0038).

Figure 17. Most Important Factors for Participants to Select Specific Equipment



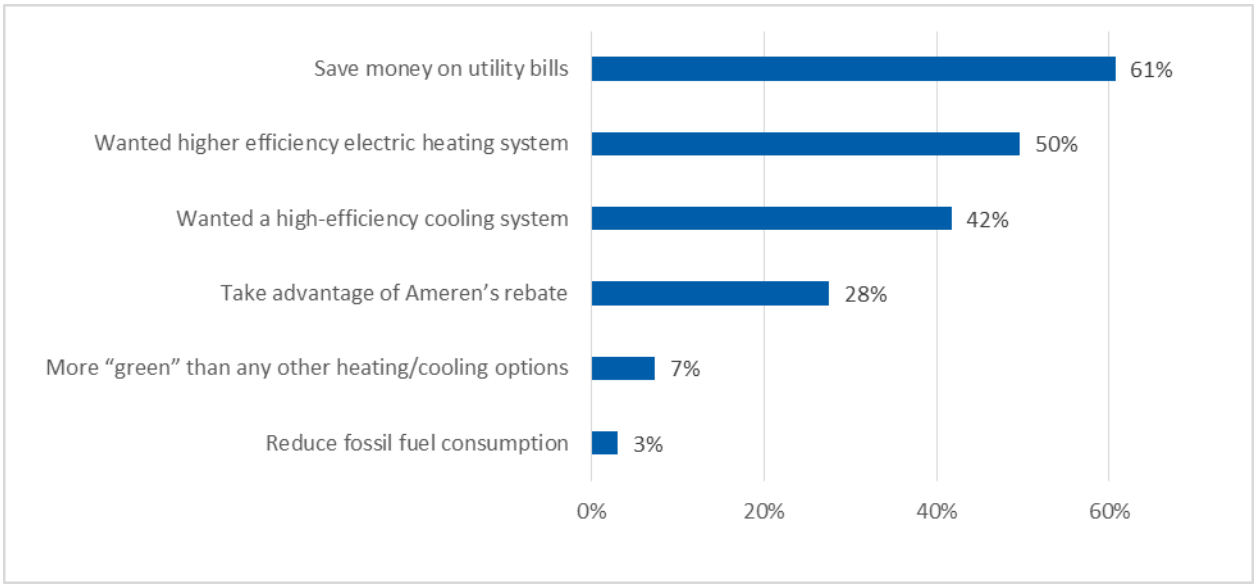
Immediate Participant Survey (Central Air Conditioners): E6. "Which factors were important in your decision to purchase the specific equipment?" n=96 [respondents who only selected one response] and E7 "If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific equipment you selected?" n=711; and Immediate Participant Survey (Heat Pumps): F15. "Which factors were important in your decision to purchase the specific equipment?" n=45 [respondents who only selected one response]) and F16 "If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific equipment you selected?" n=175 (Total n=1,027)

Reasons for Selecting Heat Pumps

Cadmus asked participants installing HPs why they selected specific HP types. Participants installing air source and geothermal HPs primarily selected HP types to save money on utility bills. Participants selected ductless HPs primarily because they wanted a HP but did not have duct work. As shown in

Figure 18, most participants chose an ASHP to save money and/or to take advantage of the technology's efficiency.

Figure 18. Reason Participants Selected ASHPs

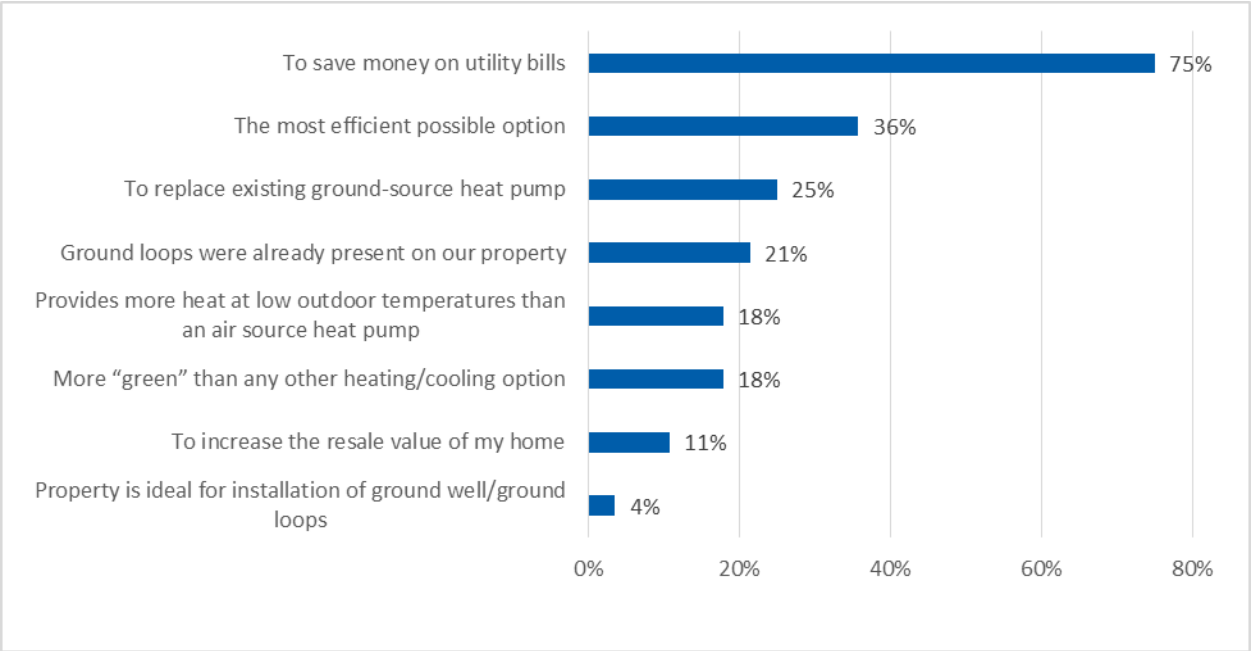


Immediate Participant Survey (Air Source Heat Pumps): F11. "Why did you choose to install an air source HP?" n=96 and Follow-up Participant Survey (Air source HPs): F6. "Why did you choose to install an air source HP?" n=67 (Multiple responses allowed) (Total n=163)

The team asked participants who installed geothermal HPs if they considered installing an ASHPs before selecting the geothermal HP. In response, 73% of participants with geothermal HPs said they considered an ASHP (n=26). Besides seeking efficient heating and cooling sources, participants said they selected geothermal HPs to replace existing HPs (25%) or as they already had an existing ground loop present at their home (21%). Figure 19 shows the results.

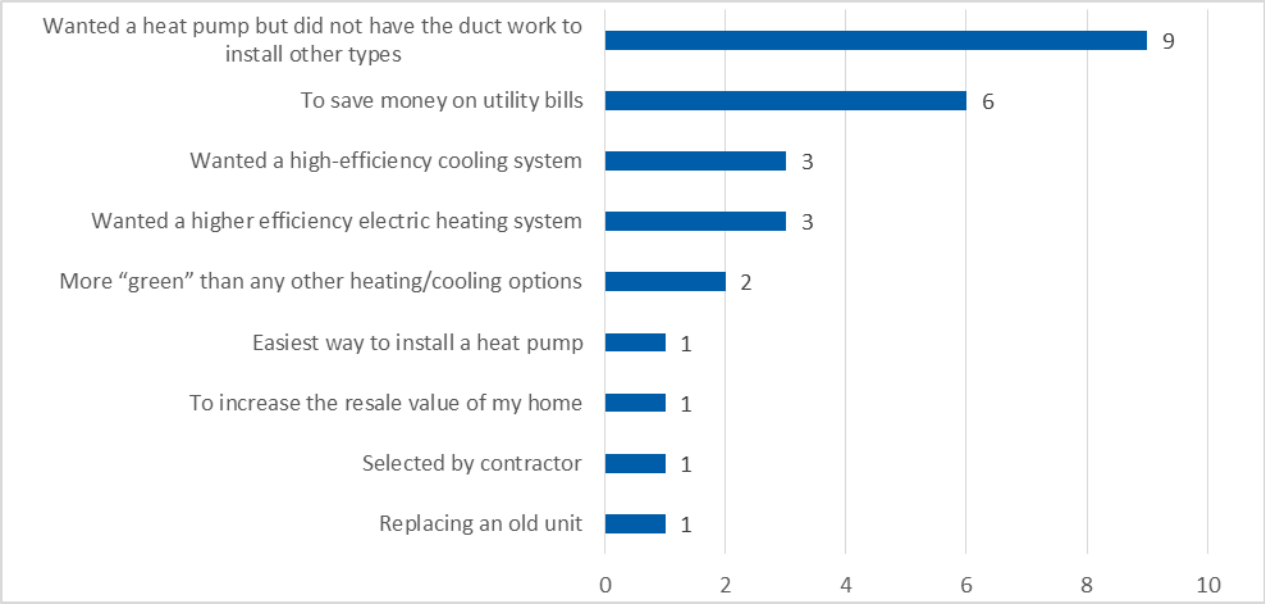
As noted, while participants selected Ductless HP to take advantage of energy savings and efficiencies offered by those systems, most participants selected Ductless HP as it did not require duct work (n=9) or because it provided the easiest way to install a HP (n=1). Figure 20 (below) shows the results.

Figure 19. Reason Participants Selected GSHPs



Immediate Participant Survey (Geothermal Heat Pumps): F13. "Why did you choose to install a ground source HP?" n=22 and Follow-up Participant Survey (Geothermal Heat Pumps): F8. "Why did you choose to install a ground source HP?" n=6 (Multiple responses allowed) (Total n=28)

Figure 20. Reason Participants Selected Ductless HP



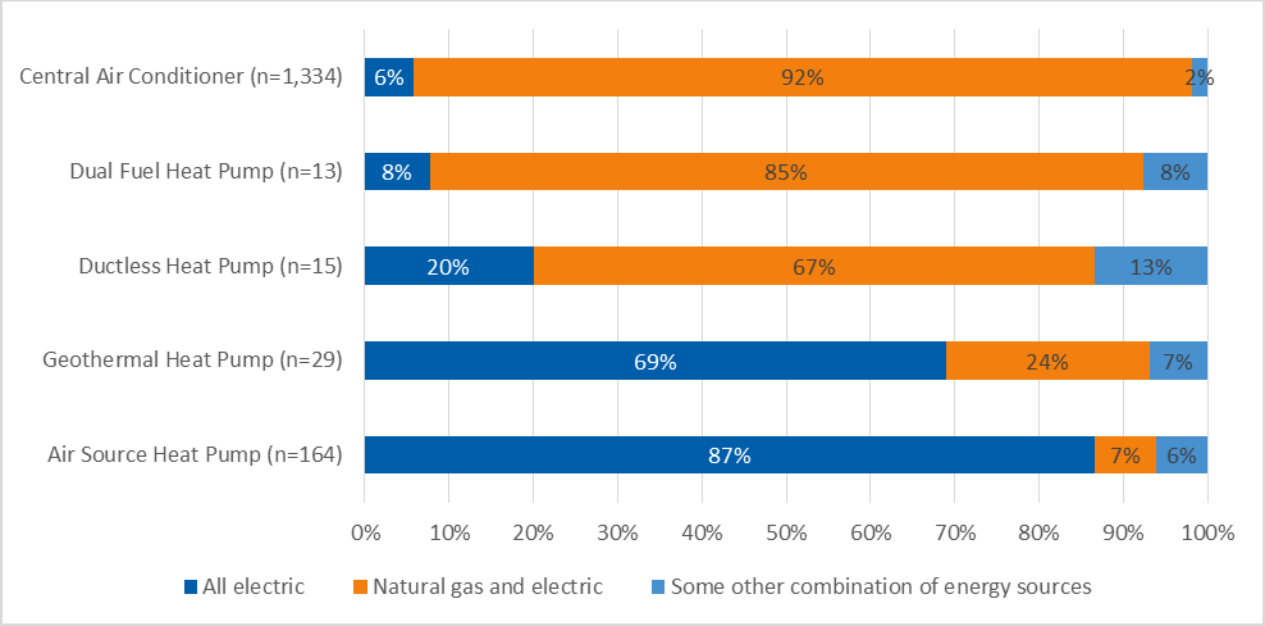
Immediate Participant Survey (Ductless heat pumps): F14. "Why did you choose to install a ductless heat pump?" n=13 and Follow-up Participant Survey (Ductless pumps): F9. "Why did you choose to install a ductless heat pump?" n=3; multiple responses allowed (Total n=16)

Participant Demographics

Cadmus asked participants to provide information about their household characteristics. Per survey results, over 99% of participants owned the home where their measure was installed, and 76% had a gas water heater. An average of 2.6 persons lived in the home where the measure was installed.

The team also asked participants about the kind of energy service they received at their homes. As shown in Figure 21, Participants installing HPs were more likely to use all-electric service than participants installing CACs. Notably, some participants installing DFHPs indicated they had all-electric service.

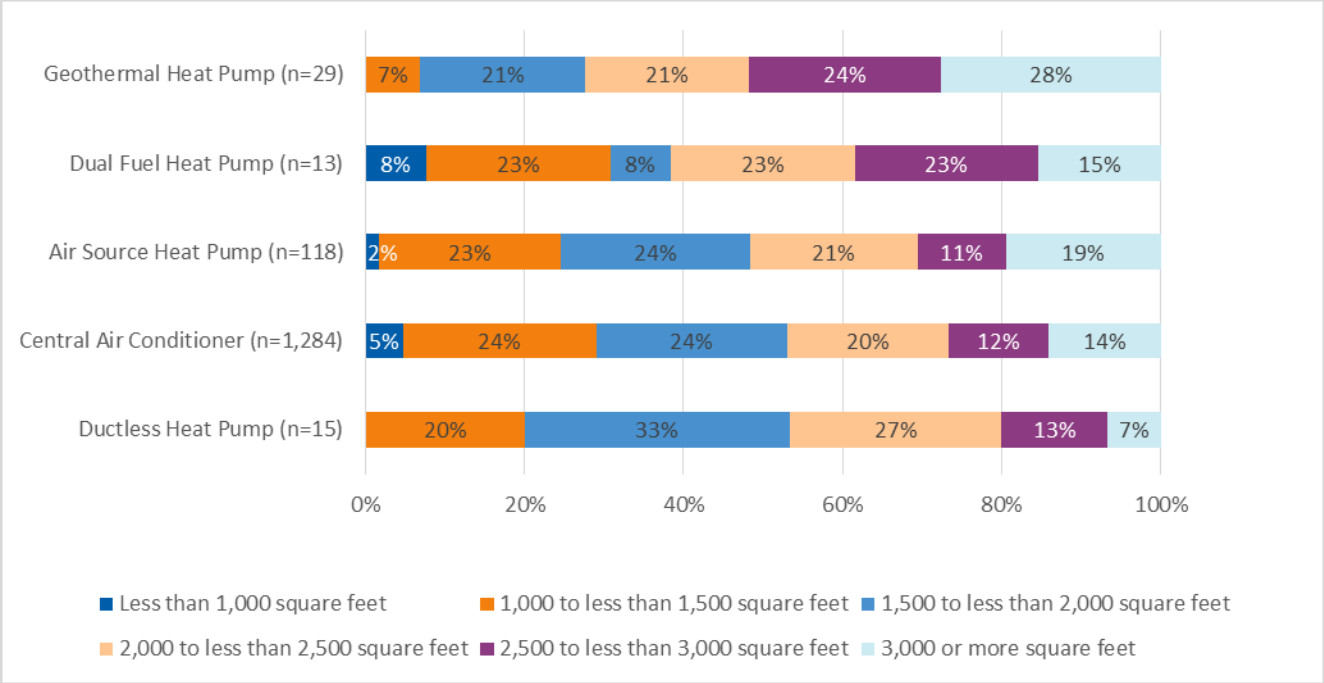
Figure 21. Participant Energy Service—Measure



Immediate Participant Survey: J1. "Is the energy used in your home...." n=970 and Follow-up Participant Survey: H3. "Is the energy used in your home...." n=585 (Total n=1,555)

The team asked participants about the size of their home. As shown in Figure 22, respondents installing HP measures (excepting ductless HPs) more likely had larger homes than those installing CACs. Ductless HPs were more likely installed in smaller homes, suggesting a relationship between home size and the absence or presence of duct work.

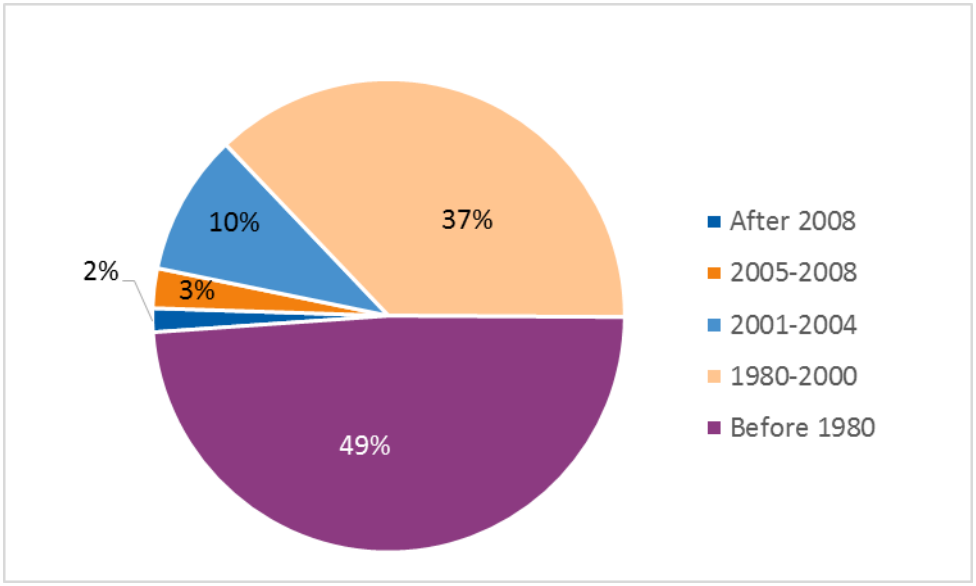
Figure 22. Participant Home Size—Measure



Participant Free Ridership Survey: J5. "Approximately how many square feet of living space does your home have? Don't include the basement unless it is a space that you consider "lived in"." n=938 and Participant Spillover Survey: H5. "Approximately how many square feet of living space does your home have? Don't include the basement unless it is a space that you consider "lived in". n=524 (Total n=1,462)

The team asked participants about their home's age. As shown in Figure 23, most participants lived in homes constructed before 1980, and 86% of participants lived in homes constructed in or before 2000. Only 2% of participants lived in homes constructed after 2008.

Figure 23. Age of Participants' Homes



Immediate Participant Survey: J6. "When was your home built?" n=960 and Follow-up Participant Survey: H6 "When was your home built?" n=583 (Total n=1,543)

Contractor Experience

Overall Experience

While nine of 10 contractors said they did not encounter barriers to program participation, one contractor said, to participate in the program in past years, his firm had to purchase tools (e.g., digital gauges, temperature probes) that no longer remained necessary under the current program protocols (though potentially these will be useful after reintroduction of the tune-up measure).

When asked what program elements worked well, contractors cited the following:

- Rebates helped customers update equipment sooner and purchase higher-efficiency equipment than they would have without the rebates.
- Ameren Missouri's streamlining of the administrative process allowed contractors to stay informed about their project's status and facilitated quick rebate payments.
- Simple equipment selection guidelines facilitated contractor participation.

Three contractors simply said: "It all works well."

Three contractors also provided feedback on what did not work well with the program, with two citing that searching the AHRI database for equipment specifications proved difficult, and one citing a rebate's delayed delivery (i.e., more than two months) meant customers asked his company about the rebate status. This contractor also found the Ameren Missouri representative hard to reach.

Program Delivery

Cadmus asked contractors about their experiences with program delivery, including their experiences with the application process, how they remained up-to-date with the program, and how they determined if equipment qualified for early replacement.

Seven of the 10 contractors said they were very satisfied with the application process; the remaining three were somewhat satisfied. Two of the latter group described experiencing difficulties in locating correct AHRI equipment certification numbers. One very satisfied contractor also described initial or ongoing issues with finding AHRI numbers. Contractors did not mention other issues.

Regarding AHRI numbers, two contractors elaborated that the online search function suggested by Ameren Missouri did not always allow them to find specific products they sought, requiring them to search through 50 to 100 pages of equipment lists to find the exact product. One contractor said he developed a workaround for finding AHRI numbers, and another contractor recommended the Tempstar website as an example of an easy-to-use site, incorporating drop-downs for AHRI certificate numbers.

Seven contractors stated that they kept informed about the program via Ameren Missouri's monthly emails. Additionally, respondents stated that they kept informed about the program as follows:

- Three through visits by their program representatives
- One via the company's equipment supplier
- One respondent by sitting on the program advisory council

Seven of 10 contractors said they were familiar with Ameren Missouri's early replacement versus replace-on-burnout criteria. When asked, however, how they determined if a customer's existing equipment qualified as early replacement or failed equipment, six of the seven said they simply determined whether the equipment ran or not. One of the seven contractors reported measuring for a temperature drop across the coil. The team, however, did not always speak with the technician responsible for making the decision for qualifying the equipment, and other persons at the company likely knew of specific early retirement criteria.

Gross Impact Evaluation Results

This section details Cadmus' determination of each measure's installation rate and calculations of per-unit savings for Ameren Missouri's Heating and Cooling program.

Measure Installation Verification

Heating and Cooling program measure savings depends on the installed equipment type and efficiency, the removed equipment type and efficiency, and if the removed equipment was operating or had failed. Cadmus asked participants what equipment they had removed or replaced upon installing their new heating or cooling system. Participant responses varied and often did not match the removed or replaced equipment indicated by the measure name. The program implementer verifies existing equipment as part of its quality control process.

Cadmus found instances of customers indicating they replaced equipment other than the equipment specified by the measure name, however no clear patterns to this data emerge to indicate that active miscategorization is occurring. Of the two most common replaced system types Air Source Heat Pumps and Electric Resistance heating, we find parity among responses with 20.7% of participants tracked as replacing electric resistance heating system were surveyed to have replaced ASHP's and 20.9% of participants tracked as replacing ASHP's were surveyed to have replaced electric resistance. Additionally customer responsese indicated that 33% of homes replacing gas heating system and installing an air source heat pump may have qualified for a larger rebate since they claimed to be replacing an electric furnace or air source heat pump. The lack of consistent patterns do not indicate active misscategorization. These findings indicate several possibilities to be explored in future evaluations:

- Customers do not understand the survey or remember the correct equipment for the survey
- Customers confuse the type of equipment they are replacing
- There are confusing program requirements when replacing heating equipment

In effect those survey responses did not impact measure installation due to the parity of responses among measures baselines canceling each other out. However two CAC participant responses were classified as early retirement, confirmed in the survey their replaced CAC was destroyed by a lighting strike. Because those customers confirmed the system was not early replacement and they had no choice to replace their system, they were reclassified as replace on burnout resulting in adjustments to the percentage installed and operating. Measure installation rates are shown in Table 28.

Table 28. Measure Installation

Measure	Surveyed Participants	Percentage Installed and Operating*
Air-Source Heat Pump		
ASHP ER with ASHP 16+ ER	109	100%
ASHP Replace at Fail with ASHP 16+		100%
ASHP SEER 15 ER Elec Resist Furnace ER		100%
ASHP SEER 15 Replace at Fail Elect Resist Furnace		100%
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)		100%
ASHP ER with ASHP SEER 15 ER		100%
ASHP Replace at Fail with ASHP SEER 15		100%
ASHP SEER 16+ ER Elec Resist Furnace ER		100%
ASHP SEER 16+ Replace at Fail Elec Resist Furnace		100%
ASHP SEER 16+ Replace at Fail Elec Resist Furnace (NC)		100%
Ductless Air-Source Heat Pump		
Ductless ASHP ER	13	100%
Ductless ASHP Replace Electric Resistance ER		100%
Ductless ASHP ROF		100%
Ductless ASHP Replace Electric Resistance ROF		100%
Dual Fuel Heat Pump		
DFHP SEER 15_SF	13	100%
DFHP SEER 16_SF		100%
DFHP SEER 17+_SF		100%
DFHP SEER 18+_SF		100%
Ground Source Heat Pump		
GSHP SEER 14+ ER ASHP with GSHP ER	27	100%
GSHP SEER 14+ ER Elec Resist Furnace ER		100%
GSHP SEER 14+ Replace Elec Resist Furnace		100%
GSHP - 23 EER ER		100%
GSHP - 23 EER Replace at Fail		100%
Central Air Conditioner		
CAC SEER 14 ER	914	100%
CAC SEER 14 Replace at Fail		100%
CAC SEER 15 ER		99.8%*
CAC SEER 15 Replace at Fail		104.3%*
CAC SEER 16+ ER		100%
CAC SEER 16+ Replace at Fail		100%

Measure	Surveyed Participants	Percentage Installed and Operating*
Electronically Commutated Motor (ECM)		
Concept 3 Installations Continuous Fan ER_50	56	100%
Concept 3 Installations Continuous Fan ER_100		100%
Concept 3 Continuous Fan Replace at Fail_50		100%
Concept 3 Continuous Fan Replace at Fail_100		100%
Concept 3 Installations Auto Fan ER_50		100%
Concept 3 Installations Auto Fan ER_100		100%
Concept 3 Installations Auto Fan Replace at Fail_50		100%
Concept 3 Installations Auto Fan Replace at Fail_100		100%

*Two systems were reclassified from early retirement to replace on burnout since the equipment was confirmed to have been destroyed.

Heat Pump Monitoring Results

Cadmus monitored ASHP to determine operating efficincy of the systems and validate the AMR data analysis results. The monitoring equipment has been installed since November of 2016, monitoring the heating season and will remain installed through June of 2017 to capture cooling season usage.

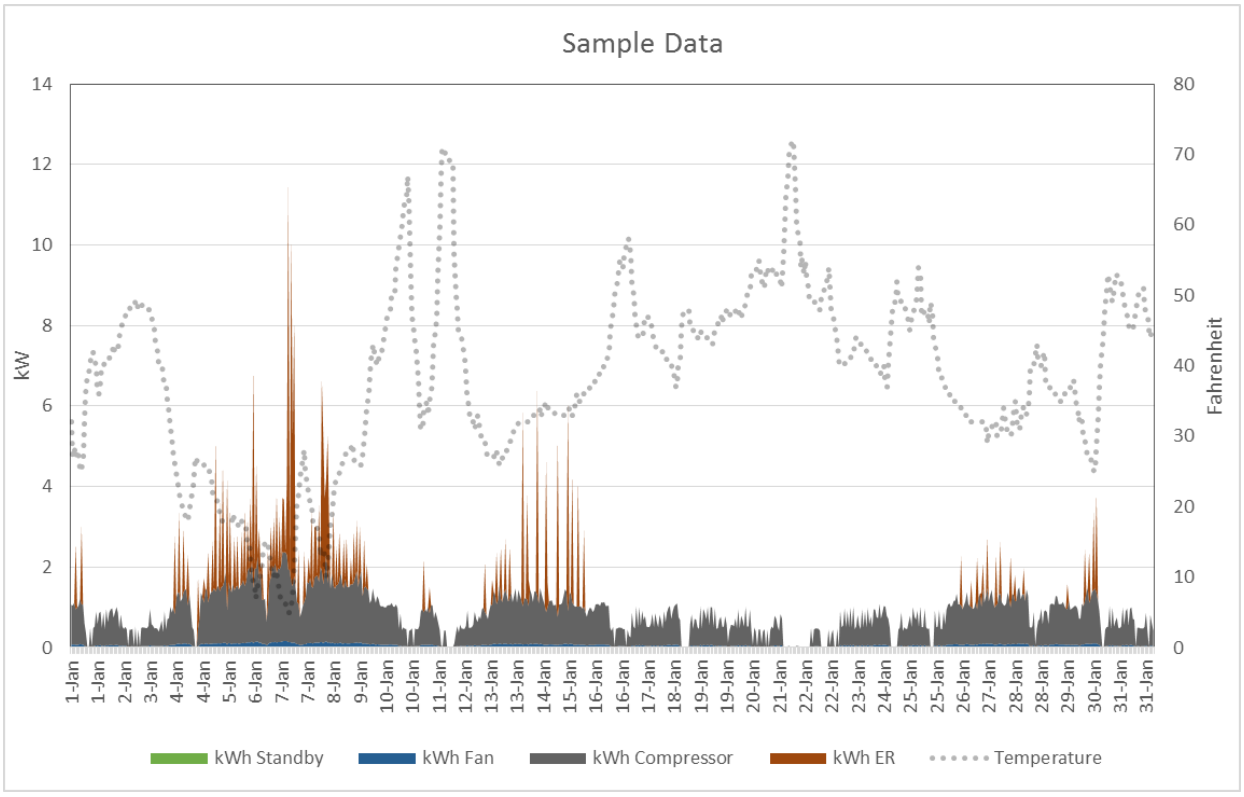
Cadmus utilized HP monitoring systems to gather data from each individual sensor and upload these to Cadmus' server. Three home monitoring systems experiened data connection issues when uploading data to the servers. Two homes' connection issues have been resolved; unfortunately, however, the data avalaible from those homes proved too limited to use, only several days of data was avalaible. One home currently cannot reliabally connect to the Internet, leading to incomplete data. The team plans to revisit that home in spring time to resolve connection issues for the coming cooling season. Of 17 monitored HP systems, Cadmus gathered reliable data from 14 systems.

Table 29. Monitored ASHPs

System Number	Nominal Tons	HSPF
ASHP 1	2.5	8.5
ASHP 2	5.0	8.5
ASHP 3	3.5	9.0
ASHP 4	4.0	11.0
ASHP 5	3.0	9.5
ASHP 6	3.0	9.5
ASHP 7	3.0	8.5
ASHP 8	3.5	8.5
ASHP 9	4.0	9.0
ASHP 10	2.0	9.0
ASHP 11	4.0	9.0
ASHP 12	2.0	8.5
ASHP 13	3.0	10.0
ASHP 14	3.5	8.5
Average	**3.3**	**9.1**

The team monitored usage data from the systems, and aggregated these to hourly usage patterns observed: fan usage, compressor usage, standby usage, and electric resistance backup heating usage.

Figure 24. ASHP Usage Data for January



Using the metering results, the team presents the following findings that may assist Ameren Missouri in communicating optimal system operation to customers and contractors. These findings did not impact overall savings because Cadmus assumed operating inefficiencies would occur in both the baseline and the efficient cases:

Finding #1

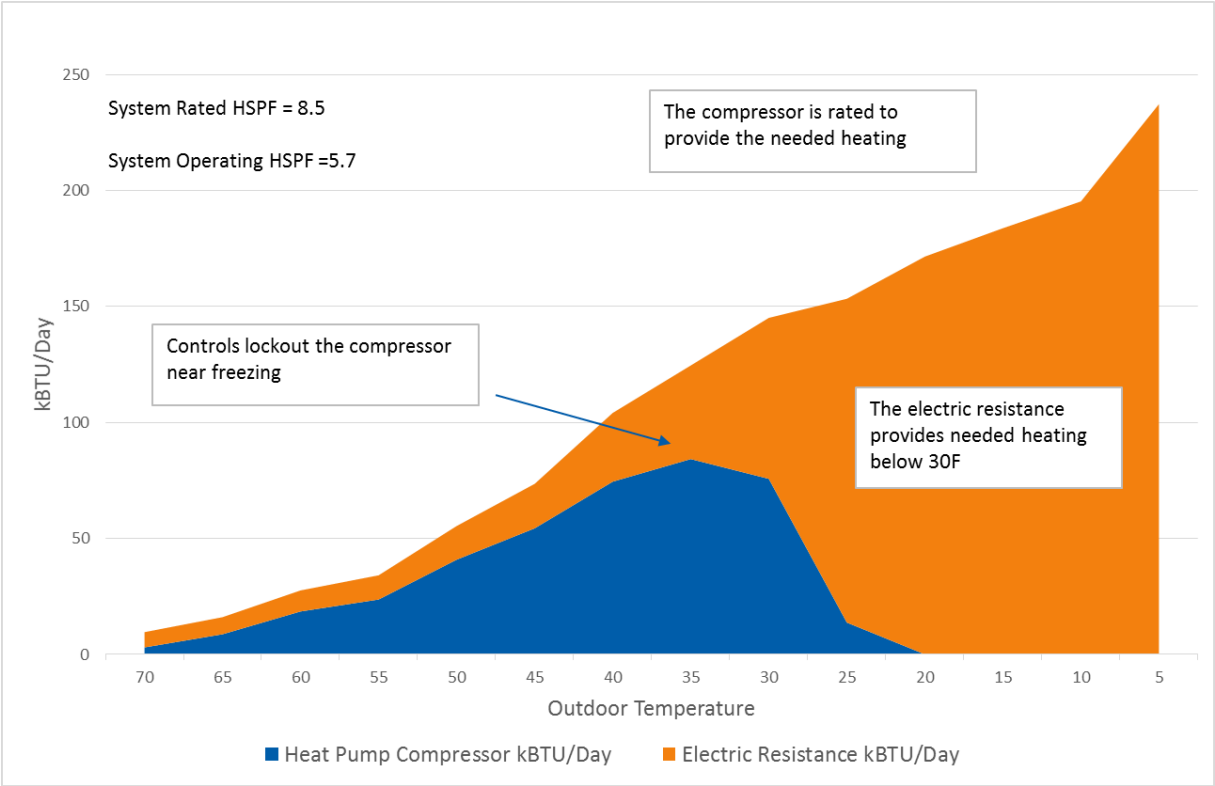
Operation and controls make a significant impact on a system's efficiency.

ASHPs' ability to provide homes with heating decreases as the outdoor temperature drops. Below a certain temperature, a HP can no longer provide enough heat for the home, and it engages backup heating to provide the additional heat required. Metering found several cases of HPs operating well below their system-rated HSPF due to systems using excessive backup heating.

Figure 25 shows the amount of heating provided by the HP compressor and the electric resistance against outside temperature for one metered ASHP (labeled as "8"). Due to controls implemented by the contractor, this system prevents the compressor from operating below freezing. This pattern of compressor operating was observed in two out of 14 systems.

Asked about this usage pattern, the customer remembered the contractor recommending lockout controls on the HP to extend the compressor's life by preventing it from operating during cold weather. According to manufacturer data, this system can provide heating down to -5F. Consequently, the system operated at a lower efficiency than that rated by the manufacturer.

Figure 25. System with Excessive Electric Heating Usage (ASHP 8)



While preventing the compressor from operating at low temperatures may impact the lifespan of the compressor, this system uses only supplemental electric heating below 30F. Since heating efficiency of the supplemental electric resistance heating is equivalent to 3.41 HSPF[7], and this system's settings utilize the supplemental electric resistance heating more than necessary, the average operating HSPF of this system is 5.7 HSPF, below manufacturer rated performance of 8.5 HSPF.

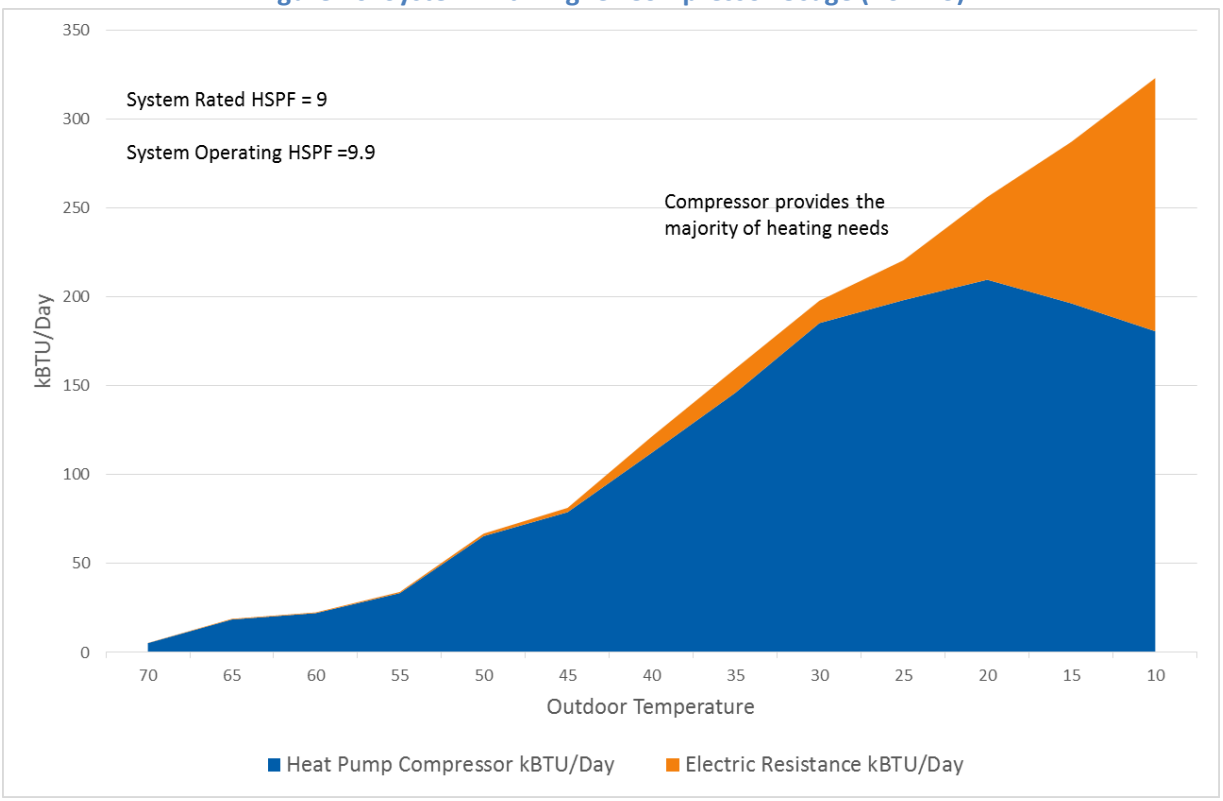
Another difficulty with the system relying on the supplemental electric heating is the system produces more heat when operating in this mode. The typical supplemental heating system produces two times the amount of heating the more efficient heat pump compressor can produce. At lower temperatures when the home requires the most heat, the compressors ability to produce heating declines. This can lead to the notion that the supplemental heating systems is better than the compressor since it's produces hot air out of the supply registers not matter how cold it is outside.

Conversely, other systems operated their compressors as much as possible, optimizing compressor usage to provide the majority of a home's heating needs. This type of compressor operation was

[7] HSPF is the ratio of heating output in kBTU to electrical consumption in kWh(kBTU/kWh). 1 kWh of electric resistance heating is equal to 3.41 kBTU resulting in an HSPF for electric resistance heating of 3.41.

observed in six out of 14 systems. As shown in Figure 26, this ASHP compressor provides the majority of the home's heating needs (to nearly 20F). This system operates at levels higher than its 9.0 HSPF rating at 9.9 HSPF.

Figure 26. System with Higher Compressor Usage (ASHP 3)



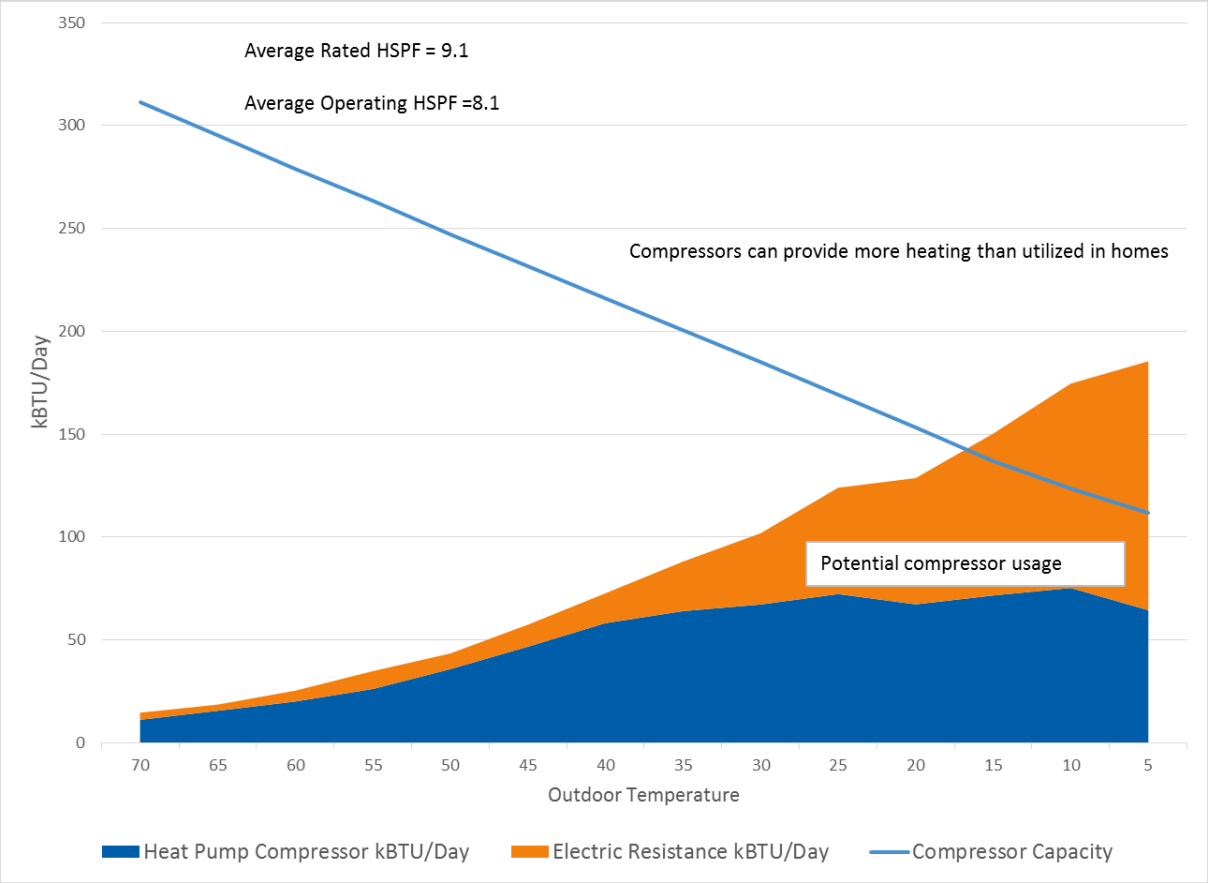
Finding #2

The typical heat pump system compressor can provide more heating than currently utilized.

While a heat pump compressors ability to produce useful heat declines with outdoor temperature, approximately half of the rated heating output is still available at temperatures as low as 20F. Cadmus found on average heat pump systems do not utilize significant amounts of the compressor heating capacity available. While units lose some of this capacity during defrosting cycles, the compressor must be controlled effectively or much of its available capacity may not be utilized. Some system controls turn on electric resistance heating systems when compressors take too long to meet the thermostats set-point.

As shown in Figure 27, the average home included in the metering study had sufficient compressor heating capacity to meet a home's daily heating needs at temperatures of about 20F and above. The average metered heat pump system, however, used a significant amount of electric resistance heating at significantly warmer outdoor temperatures than needed for the electric resistance, therefore operating approximately 10% less efficiently than its AHRI rating.

Figure 27. Average Home HP Usage and Potential Capacity



Some variance occurs between a compressor's rated capacity and the heating produced for the home including supplemental heating, primarily because a system must meet its thermostat setting. If the occupant increases the setpoint on their thermostat, the system must meet that setpoint in a reasonable amount of time.[8] Systems often achieve this by operating the lower efficiency electric resistance heating system. Further, HP compressors may have the ability meet a home's thermostat setpoint, given enough time, but many homeowners would not accept those performance levels. Cadmus believes these effects explain why electric resistance heating usage occurs even at relatively

[8] Heat pump systems use several methods to activate supplemental heating during normal operation based on differential temperatures, or time delay. Differential temperature typically vary between 2 to 5 degrees: if the temperature in the home is more than X degrees away from the thermostat setpoint, supplemental heating will be activated. Using a time delay, if the system does not meet the thermostat setting within X minutes the supplemental heating will be activated.

warm outdoor temperatures. Consequently, the average metered heat pump system used additional electric resistance heating to meet the thermostat settings. At 20F, a typical three-ton ASHP can produce approximately 18 kBTUs of heat, while the typical supplemental electric resistance can produce nearly three times that amount.

These results resemble the findings from an ACEEE paper from 2006,[9] where the systems efficiency rating averaged a 7.5 HSPF rating, but the systems operated at a rating closer to 6.8 HSPF. The team understands that HP controls and additional electric resistance heating usage occurs in homes regardless of the system's rated efficiency. Consequently, the team adjusted the efficiency levels of both the baseline and efficient equipment when computing HP measure savings.

Daily Data Analysis

Air Source Heat Pumps

Cadmus developed a representation of ASHP consumption as a function of heating degree days using the equation below, and then tested this representation against monitored homes to determine its accuracy. The representation took the form of a simple, unit step, linear regression, expressed as follows:

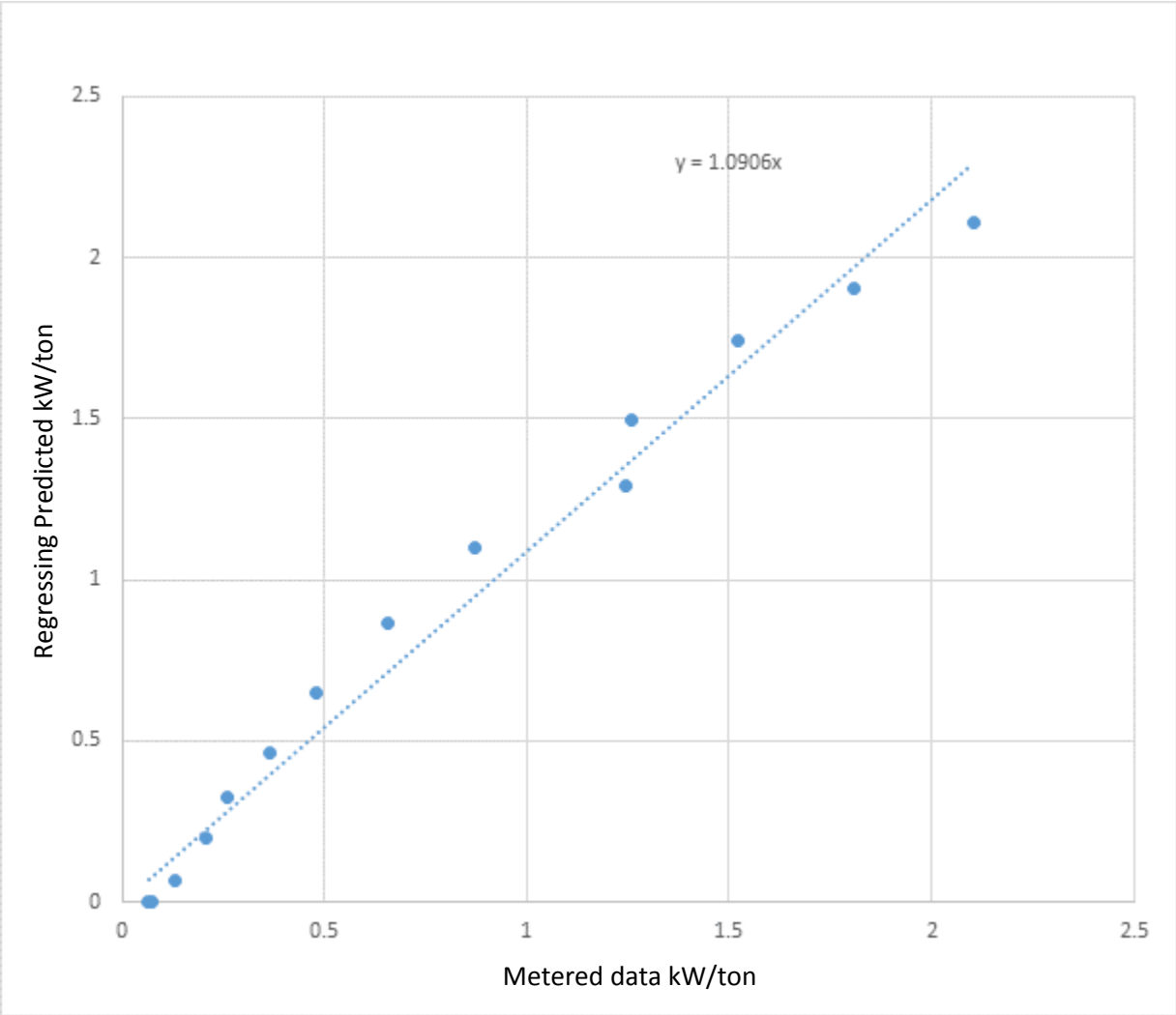
$$Daily\ heating\ kWh = \sum_{days}^{x_i=HDD} (a_i \times x_i + b_i) + (a_{i+1} \times x_{i+1} + b_{i+1})$$

Where **a** terms represent the slope, and **b** terms represent the intercept.

Comparing AMR data to end use metering results for the study homes, Figure 28 shows the daily AMR data slightly overpredicts heating during times of moderate usage (i.e., in the 0.5 to 1.0 kW range). This likely results from other non-HVAC loads having a larger proportional influence on daily monitored data from that same period. The team adjusted for this variance when calculating annualized loads by applying a 9% reduction in heating energy consumption to the regression model. This adjustment applies to both the baseline and efficient energy consumption estimate and savings.

[9] Davis, Baylon, Strand. It Sounded Good on Paper: Field Performance of Residential Heat Pumps in the Pacific Northwest. 2006. ACEEE.

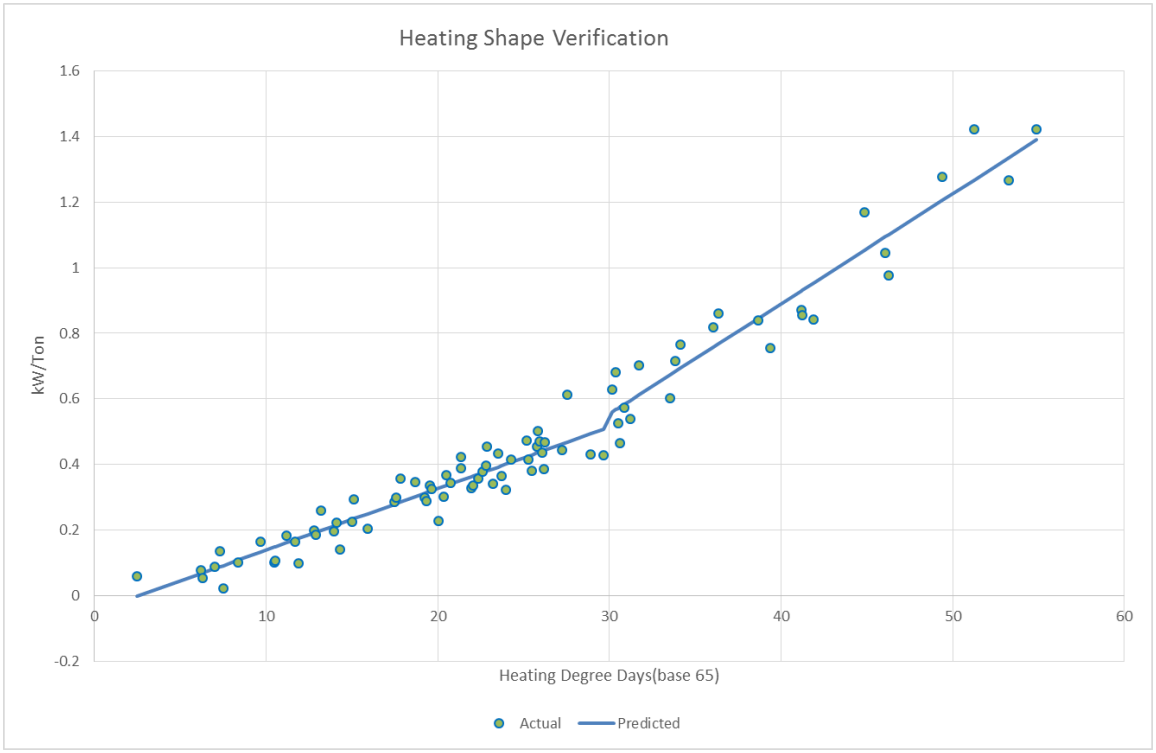
Figure 28. Variance in Predicted Result*



*Data normalized to kW load experienced by the heat pump over the day

Analyzing the 116, cleaned, daily AMR ASHP datasets each representing one home, and normalizing this to the installed tonnage of ASHPs, the team developed an aggregate heating load shape for the sampled homes. Figure 29 shows the predicted average daily heating kW/ton against actual data from the sample's 116 homes. Despite the significance of individual site variance, the aggregate shape shows interesting trends.

Figure 29. Aggregated Heating Loadshape*



*Representing average daily HVAC load and heating degree days/day

Normalized power consumption to outdoor weather conditions shows a noticeable load shape shift near an outdoor temperature of 35F (represented at 30 HDD). Based on the metered data, this shift was expected as electric resistance heating accounted for an increasing portion of the heating load.

As daily AMR data draw upon actual data from the 2016–2017 winter, estimated energy usage was then normalized to normal average daily temperatures for Lambert airport, provided by Ameren Missouri and accepted by Cadmus.

Cadmus calculated EFLH using the following equation;

$$EFLH = \frac{Normalized\ kWh\ Consumption\ ASHP * HSPF\ of\ Sample * HSPF\ correction}{12\ kBTU/hr/ton}$$

Where:

HSPF Correction for ER Performance = The ratio of measured HSPF 8.16 to the nameplate HSPF 9.1 of metered systems

Table 30. Calculated EFLH for ASHP

Normalized ASHP kWh/nominal ton	Average HSPF of Sample	HSPF Correction for ER Performance	Calculated EFLH of ASHPs
2,185	9.16	0.897	1,496

Varability in the daily energy usage of the studied homes was expected by the evaluation team. As with any analysis using billing data, larger sample sizes improves the precision of estimates. Cadmus estimated relative precision of calculted EFLH at plus or minus 3% precision at 90% confidence. We also examined precision for each day in the study period to identify when relative precision increases significantly. Much of the varability is concentrated around periods of lower electrical usage during more temperate days and holidays.

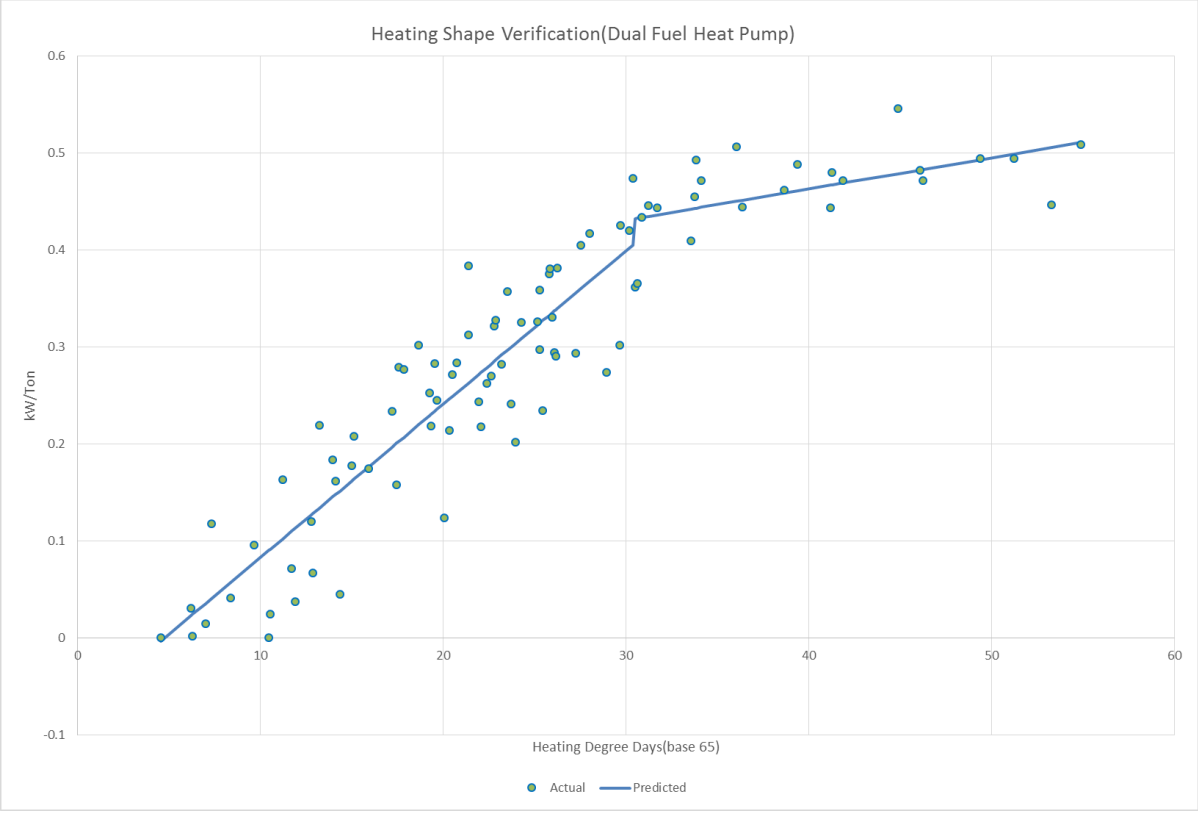
Table 31. ASHP EFLH Precision

EFLH Estimate	Relative Precision	Absolute Precision	Estimated Range
1,496	3%	+-45 hours	1,541 – 1,451

Dual Fuel Heat Pumps

DFHP's operation produces distinctly different usage profiles than ASHPs, as the former use a fuel-fired backup heating system. Analyzing the cleaned, daily dataset of 47 DFHPs, and normalizing to the installed tonnage, Cadmus developed an aggregate heating load shape for the sampled homes. Figure 30 shows predicted heating kW/ton against actual data from the sample's 47 homes. Despite the significance of individual site variance, the aggregate shape shows interesting trends.

Figure 30. Aggregated Heating Loadshape



Normalized energy consumption shows a noticeable load shape shift near an outdoor temperature of 35F (represented at 30 HDD). This load shift to non-electric fuel-heating levels off the load shape at colder temperatures. Typically, DFHPs cannot operate the system's compressor and fuel furnace at the same time. At temperatures below 35F, the team expected a reduction in the HP's energy consumption due to the compressor not operating. Even on the coldest days, however, a typical HP continues to operate, providing useful heating. Consequently, the HP operated longer than expected, increasing the expected effective full load hours.

As daily AMR metered data drew upon actual data from the 2016–2017 winter, this shape has been normalized to normal average daily temperatures for Lambert airport, provided by Ameren Missouri and accepted by Cadmus.

$$EFLH = \frac{Normalized\ kWh\ Consumption\ DFHP * HSPF\ of\ Sample * HSPF\ correction}{12\ kBTU/hr/ton}$$

Where:

HSPF correction for gas usage = The ratio of measured HSPF 10.7 to the nameplate HSPF 9.0 of metered systems. 10.7 HSPF is estimated based on the change over temperatures observed in the AMR data.

Table 32. Calculated EFLH for DFHP

Normalized DFHP kWh/nominal ton	Average HSPF of Sample	HSPF Correction for Gas usage	Calculated EFLH of DFHPs
1,226	9.25	1.185	1,119

Cadmus expected to see variability in the daily energy usage of the studied homes. The relatively low sample size of DFHP leads to less favorable precision of estimated EFLH, where we estimated relative precision at 17% with 90% confidence. We also examined precision for each day in the study period to identify where relative precision increases significantly. Much of the varability is concentrated around periods of lower electrical usage during more temperate days and holidays.

Table 33. DFHP EFLH Precision

EFLH Estimate	Relative Precision	Absolute Precision	Estimated Range
1,119	17%	+-190 hours	1,310 – 929

Ductless Heat Pumps

Cadmus' analysis of daily data for homes using ductless HPs proved inconclusive to determine energy consumption for those systems: the typical response in the daily data was insufficient to draw conclusions on ductless HP. Ductless heat pumps are typically the secondary heating source for homes. Two out of ten survey respondents indicated they use other sources of electric heating in addition to

their ductless heat pump. Also seven out of 10 responses said they use a gas furnace in addition to their ductless heat pump to heat their homes. Since the fractional load of ductless heat pumps is significantly smaller than standard heat pumps, disaggregating system consumption from daily usage data was not feasible with daily usage data.

Geothermal Heat Pump

GSHPs operate differently than other program HPs. Geothermal systems use stable earth temperatures as an exchange source for HP operations. In effect, a geothermal HP's ability to produce useful heating does not vary with outdoor temperatures, though the building's load does.

Analysis of GSHP metered data and the AMR sample indicate that geothermal systems operate using minimal backup electric resistance heating. The home metered in the study operated at the HP compressor's rated capacity for nearly all of the heating season; it did not use the electric resistance backup heating system. The very energy-conscious homeowner kept the electric backup heating system off and planned on manually turning it on as needed. While only a single data point, Cadmus suspects such behaviors are not abnormal for geothermal systems, given their ability to provide their rated capacity at any outdoor temperature.

The daily usage data from the 41 homes with GSHP's confirms this behavior as typical; the team found little evidence that significant amounts of electric resistance heating are ever used. Additionally, daily usage data shows the EFLH value should be significantly higher than ASHPs for the following reasons:

- Low electric resistance heating usage: Throughout the season, the team found little evidence of electric resistance heating, indicating the HP met nearly all heating needs.
- High COP rating of GSHP systems: While measured and daily data show low annual energy usage for GSHPs, their high and consistent COPs mean the system compressors provide much more heating at lower temperatures than a comparable ASHP.

Program ground source heat pump typically have multiple stages of operation, when operating at low stage the performance of those systems is significantly higher than while operating at high stage. The daily AMR data is unable to differentiate between those stages of operation adding significant uncertainty to the total amount of heating provided by the systems reducing our confidence in estimates of EFLH. While we are confident the EFLH values for geothermal systems are higher than air source heat pump due to the reasons stated above, the uncertainty around performance at various staging strategies does not allow Cadmus to estimate an EFLH, therefore Cadmus did not recommend adjustment to the TRM-specified heating EFLH values.

Measure-Specific Gross Savings

This section outlines the methodology and results for Cadmus' evaluated per-unit savings for the following energy efficiency measures rebated through PY16:

- ASHPs
- CACs

- ECMs
- DFHPs
- Ductless HPs
- GSHPs

The 2016 Technical Reference Manual (TRM) uses separate savings values for HP and CAC measures when addressing replace on burnout, early retirement, and new construction applications. The HP measures include baseline categories specific to whether or not they replace another HP or an electric resistance furnace. ECM fan measures are categorized by whether they operate continuously or automatically.

Estimated Savings Results

Cadmus calculated energy savings for each measure type offered through the Heating and Cooling Program. We calculated gross energy savings for each measure using the equations and inputs outlined in this section and the parameters of each installed measure available in the program tracking database. The team calculated savings for each measure separately; the however resulting aggregate level parameters in the summary below.

Table 34. Program Average Size & Efficiency of HVAC systems

Measure	Average Tonnage Installed	Average SEER Installed	Average HSPF Installed	Average EER Installed	Average COP Installed
Air-Source Heat Pump					
ASHP ER with ASHP 16+ ER	3.3	16.9	9.5		
ASHP Replace at Fail with ASHP 16+	3.3	17.3	9.8		
ASHP SEER 15 ER Elec Resist Furnace ER	2.8	15.1	8.7		
ASHP SEER 15 Replace at Fail Elect Resist Furnace	2.6	15.2	8.6		
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)	2.8	15.3	8.9		
ASHP ER with ASHP SEER 15 ER	3.0	15.1	8.7		
ASHP Replace at Fail with ASHP SEER 15	3.1	15.1	8.7		
ASHP SEER 16+ ER Elec Resist Furnace ER	3.1	16.9	9.4		
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	3.2	17.4	9.7		
ASHP SEER 16+ Replace at Fail Elec Resist Furnace (NC)	3.6	18.0	10.5		
Ductless Air-Source Heat Pump					
Ductless ASHP ER	1.7	21.2	11.4		
Ductless ASHP Replace Electric Resistance ER	1.4	22.4	11.7		
Ductless ASHP ROF	1.6	21.6	10.8		
Ductless ASHP Replace Electric Resistance ROF	1.4	22.7	11.4		
Dual Fuel Heat Pump					
DFHP SEER 15_SF	3.4	15.2	8.8		
DFHP SEER 16_SF	3.3	16.2	9.2		

Measure	Average Tonnage Installed	Average SEER Installed	Average HSPF Installed	Average EER Installed	Average COP Installed
DFHP SEER 17+_SF	3.8	18.0	9.6		
DFHP SEER 18+_SF	3.4	18.3	10.5		
Ground Source Heat Pump					
GSHP SEER 14+ ER ASHP with GSHP ER	3.8			28.5	4.5
GSHP SEER 14+ ER Elec Resist Furnace ER	3.9			28.2	4.4
GSHP SEER 14+ Replace Elec Resist Furnace	4.1			27.7	4.4
GSHP - 23 EER ER	4.1			27.2	4.4
GSHP - 23 EER Replace at Fail	4.4			26.7	4.4
Central Air Conditioner					
CAC SEER 14 ER	3.0	14.2			
CAC SEER 14 Replace at Fail	3.0	14.2			
CAC SEER 15 ER	3.3	15.2			
CAC SEER 15 Replace at Fail	3.0	15.1			
CAC SEER 16+ ER	3.1	16.4			
CAC SEER 16+ Replace at Fail	2.9	16.4			

Measure-Specific Per-Unit Savings

Cadmus reviewed the 2016 TRM deemed per-unit savings for all program measures. By comparing these assumptions to the latest data available from the tracking database and metering, the team developed per-unit savings values. The following sections outline each measure's estimated per-unit savings, along with the algorithm and inputs used.

Federal standards for ASHPs increased January 1, 2015. However, the U.S. Department of Energy granted an 18-month grace period during which equipment meeting the old standards could be sold.[10] Therefore, Cadmus did not apply the updated ASHP federal standards until June 1, 2016. For new installations completed before June 1, 2016, Cadmus used 13 SEER and 7.7 HSPF. Beginning in Q2, the baseline was updated to 14 SEER and 8.2 HSPF for a system replaced on burnout.

[10] See: http://www.appliance-standards.org/product/central-air-conditioners-and-heat–Pumps

Air Source Heat Pumps

The team estimated ASHP per-unit savings using the following algorithm:

$$\Delta kWh_{ASHP} = Installed\ Tons \times \left(\frac{Metered\ kWh\ Savings\ Cooling \times Installed\ SEER}{Metered\ SEER\ Cooling\ \times Metered\ Tons\ Cooling} + 12 \times Heating\ EFLH \times \left(\frac{1}{Baseline\ HSPF} - \frac{1}{Installed\ HSPF} \right) \right)$$

Where:

Installed Tons	=	Output capacity of installed ASHP (tons)
Metered kWh Savings Cooling	=	Average cooling savings from PY13 metering (kWh)
Installed SEER	=	SEER rating of the installed ASHP (Btu/Wh)
Metered SEER Cooling	=	SEER rating of the PY13 metered cooling systems (Btu/Wh)
Metered Tons Cooling	=	Output capacity of the PY13 metered cooling systems (tons)
12	=	Conversion constant from tons to kBtu/hr
Heating EFLH	=	Equivalent full-load heating hours
Baseline HSPF	=	HSPF value of the baseline system
Installed HSPF	=	HSPF value of the installed system

Table 35 the values for variables that Cadmus used to estimate ASHP savings in PY16 Q1 and PY16 Q2. Changes from Q1 to Q2 reflect changes in federal standards.

Table 35. ASHP PY16 Savings Variables

Parameter	Ameren Missouri Catalog Name	PY16 Q1	PY16 Q2-4	Source
Metered kWh Savings Cooling	ASHP Early Replacement with ASHP 16+	1,805.00	1,805.00	PY13 metering study*
	ASHP Early Replacement with ASHP SEER 15ER	1,805.00	1,805.00	PY13 metering study*
	ASHP Replace at Fail with ASHP 16+	360.00	334.29	PY13 metering study* updated with new federal standard
	ASHP Replace at Fail with ASHP SEER 15	360.00	334.29	PY13 metering study* updated with new federal standard
	ASHP SEER 15 Early Replacement Electric Resistance Furnace	1,805.00	1,805.00	PY13 metering study*
	ASHP SEER 15 Replace at Fail Electric Resistance Furnace	360.00	334.29	PY13 metering study* updated with new federal standard

Parameter	Ameren Missouri Catalog Name	PY16 Q1	PY16 Q2-4	Source
	ASHP SEER 15 Replace at Fail Electric Resistance Furnace (New Construction)	360.00	334.29	PY13 metering study* updated with new federal standard
	ASHP SEER 16+ Early Replacement Electric Resistance Furnace	1,805.00	1,805.00	PY13 metering study*
	ASHP SEER 16+ Replace at Fail Electric Resistance Furnace	360.00	334.29	PY13 metering study* updated with new federal standard
Metered SEER Cooling	All ASHP	15.20	15.20	PY13 metering study*
Metered Tons Cooling	All ASHP	3.10	3.10	PY13 metering study*
Heating EFLH	All ASHP	1,496	1,496	2016 -2017 AMR Data & HP Metering
Baseline HSPF	ASHP Early Replacement with ASHP 16+	6.30	6.30	Estimated based on early retirement SEER. Cadmus data: HSPF = 0.2675 x SEER + 4.3475
	ASHP Early Replacement with ASHP SEER 15	6.30	6.30	Estimated based on early retirement SEER. Cadmus data: HSPF = 0.2675 x SEER + 4.3475
	ASHP Replace at Fail with ASHP 16+	7.70	8.20	Federal standard
	ASHP Replace at Fail with ASHP SEER 15	7.70	8.20	Federal standard
	ASHP SEER 15 Early Replacement Electric Resistance Furnace	3.41	3.41	Electric resistance heating efficiency(COP = 1)
	ASHP SEER 15 Replace at Fail Electric Resistance Furnace	3.41	3.41	Electric resistance heating efficiency(COP = 1)
	ASHP SEER 15 Replace at Fail Electric Resistance Furnace (New Construction)	7.70	8.20	Federal standard
	ASHP SEER 16+ Early Replacement Electric Resistance Furnace	3.41	3.41	Electric resistance heating efficiency(COP = 1)
	ASHP SEER 16+ Replace at Fail Electric Resistance Furnace	3.41	3.41	Electric resistance heating efficiency(COP = 1)

*The Cadmus Group and Nexant. *Ameren Missouri CoolSavers Impact and Process Evaluation: Program Year 2013*. pp. 40. May 15, 2014. Available online: https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935842419
https://essearch.energystar.gov/search?utf8=%E2%9C%93&sc=0&query=ashp%20sav%20calc&m=&affiliate=www.energystar.gov&commit=Search

Central Air Conditioners

Cadmus estimated CAC per-unit savings using the following algorithm:

$$\Delta kWh_{CAC} = \frac{Metered\ kWh\ Savings\ Cooling * Installed\ Tons * Installed\ SEER}{Metered\ SEER\ Cooling\ \times Metered\ Tons\ Cooling}$$

Where:

Metered kWh Savings Cooling	=	Average cooling savings from PY13 metering (kWh)
Installed tons	=	Output capacity of installed ASHP (tons)
Installed SEER	=	SEER rating of the installed ASHP (Btu/Wh)
Metered SEER Cooling	=	SEER rating of the PY13 metered cooling systems (Btu/Wh)
Metered Tons Cooling	=	Output capacity of the PY13 metered cooling systems (tons)

Table 36 shows the values for variables that the team used to estimate CAC savings in PY16.

Table 36. CAC PY16 Savings Variables

Parameter	Ameren Missouri Catalog Name	PY16	Source
Metered kWh Savings Cooling	CAC SEER 14 Early Replacement	1805.00	PY13 metering study*
	CAC SEER 14 Replace at Fail	360.00	PY13 metering study*
	CAC SEER 15 Early Replacement	1805.00	PY13 metering study*
	CAC SEER 15 Replace at Fail	360.00	PY13 metering study*
	CAC SEER 16+ Early Replacement	1805.00	PY13 metering study*
	CAC SEER 16+ Replace at Fail	360.00	PY13 metering study*
Metered SEER Cooling	All CACs	15.20	PY13 metering study*
Metered Tons Cooling	All CACs	3.10	PY13 metering study*

*The Cadmus Group and Nexant. *Ameren Missouri CoolSavers Impact and Process Evaluation: Program Year 2013*. pp. 40. May 15, 2014. Available online: https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935842419

Electronically Commutated Motors

Cadmus used a Wisconsin study[11] to estimate savings from ECM fans installed through the Heating and Cooling Program. ECM fans save energy depending on the mode in which they are operating; heating,

[11] Energy Center of Wisconsin. *Electricity Use by New Furnaces, A Wisconsin Field Study*. pp. 41. October 2003. Available online: http://www.proctoreng.com/dnld/WIDOE2013.pdf

cooling or while in circulation mode. Cadmus estimated ECM fan per-unit savings using the following algorithms:

$$\Delta kWh_{Auto\ With\ CAC} = \left(\left(\text{Wisconsin Cooling Savings} \frac{\text{kWh}}{\text{year}} + \text{Cooling Savings All Systems} \right) \times \frac{Missouri\ Cooling\ EFLH}{Wisconsin\ Cooling\ EFLH} + \left(\text{Wisconsin Heating Savings kWh/year} \times \frac{Missouri\ Heating\ EFLH}{Wisconsin\ Heating\ EFLH} \right) \right) + \text{Wisconsin Circulation Savings kWh/year} \times \text{\% of Circulation Used} - \text{Standby losses}$$

$$\Delta kWh_{Auto\ Without\ CAC} = \left((\text{Cooling Savings All Systems}) \times \frac{Cooling\ EFLH}{Wisconsin\ Cooling\ EFLH} + \left(\text{Wisconsin Heating Savings kWh/year} \times \frac{Heating\ EFLH}{Wisconsin\ Heating\ EFLH} \right) \right) + \text{Wisconsin Circulation Savings kWh/year} \times \text{\% of Circulation Used} - \text{Standby losses}$$

$$\Delta kWh_{Continous\ Fan} = \left((\text{Wisconsin Cooling Savings kWh/year} + \text{Cooling Savings All System}) \frac{Cooling\ EFLH}{Wisconsin\ Cooling\ EFLH} \times \text{Wisconsin Heating Savings kWh/year} \times \frac{Heating\ EFLH}{Wisconsin\ Heating\ EFLH} \right) + \text{Wisconsin Circulation Savings kWh/year} - \text{Standby losses}$$

Where:

Wisconsin Cooling Savings kWh/year	=	ECM fan savings during the cooling season in Wisconsin (kWh/year)
Cooling Savings All Systems	=	Cooling savings for the fan motor interaction on the cooling compressor (kWh/year)
Cooling EFLH	=	Equivalent full-load cooling hours in Missouri
Wisconsin Cooling EFLH	=	Equivalent full-load cooling hours in Wisconsin
Wisconsin Heating Savings kWh/year	=	ECM fan savings during heating season in Wisconsin (kWh/year)
Heating EFLH	=	Equivalent full load heating hours in Missouri
Wisconsin Heating EFLH	=	Equivalent full load heating hours in Wisconsin
Wisconsin Circulation Savings kWh/year	=	ECM fan savings while the fan is operating in circulation mode

% of Circulation Used	=	Percentage of time Missouri ECMs operate in circulation mode for installations designated “auto mode”
Standby losses	=	Standby losses from ECM controls (kWh/year)

ECM fans can reduce fan speeds and power to save energy in three ways:

- Cooling mode savings
- Heating mode savings
- Circulation mode savings

The team calculated heating mode savings using estimates from a Wisconsin study, adjusting savings by estimating the proportion of heating runtimes in Wisconsin to heating runtimes in Missouri. For other measures, the team adjusted the EFLH for many measures, based on results from the metering studies and daily AMR analysis described above. However, EFLH values are used as a proportional adjustment to account for climate differences between Wisconsin and Missouri. As comparable EFLH data were not available in Wisconsin, the team used the ENERGY STAR Calculator values for this measure. Table 37 shows variable values that the team used to calculate PY16 savings for ECMs.

Table 37. ECM Fans PY16 Savings Variables

Parameter	PY16	Source
Wisconsin Cooling Savings kWh/year	70.00	Secondary source;* however, Cadmus re-weighted the source data to more accurately reflect the actual number of fans operated in continuous mode based on PY13 meter data
Cooling Savings All Systems	25.00	Additional cooling interaction saving of the ECM fan during the cooling season*
Wisconsin Cooling EFLH	542.50	EPA 2002/ENERGY STAR Calculator**
Wisconsin Heating Savings kWh/year	400.00	Secondary source*
Wisconsin Heating EFLH	2,545.25	EPA 2002/ENERGY STAR Calculator**
Wisconsin Circulation Savings kWh/year	2,960.00	Secondary source;* however, Cadmus weighted this value to more accurately reflect the actual number of fans operated in continuous mode based on PY13 meter data
% of Circulation Used	10%	PY13 meter data***
Standby losses	30	Secondary source;* however, Cadmus weighted this values to more accurately reflect the actual number of fans operated in continuous mode based on PY13 meter data
Saint Louis Heating EFLH	2,009.00	EPA 2002/ENERGY STAR Calculator**
Saint Louis Cooling EFLH	1,215.00	EPA 2002/ENERGY STAR Calculator**

*Energy Center of Wisconsin. *Electricity Use by New Furnaces, A Wisconsin Field Study.* pp. 41. October 2003. Available online: http://www.proctoreng.com/dnld/WIDOE2013.pdf

**U.S. Environmental Protection Agency and U.S. Department of Energy. "Life Cycle Cost Estimate for 20 ENERGY STAR Qualified Air Source Heat Pump(s)." Excel file. Last updated April 2009. Available online: https://essearch.energystar.gov/search?utf8=%E2%9C%93&sc=0&query=ashp%20sav%20calc&m=&affiliate=www.energystar.gov&commit=Search

***The Cadmus Group and Nexant. *Ameren Missouri CoolSavers Impact and Process Evaluation: Program Year 2013*. pp. 40. May 15, 2014. Available online: https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935842419

Dual Fuel Heat Pumps

Cadmus estimated per-unit, DFHP savings using the following algorithm:

$$\Delta kWh_{DFHP} = Installed\ Tons \times \left(\frac{Metered\ kWh\ Savings\ Cooling \times Installed\ SEER}{Metered\ SEER\ Cooling\ \times Metered\ Tons\ Cooling} + 12 \times Heating\ EFLH \times \left(\frac{1}{Baseline\ HSPF} - \frac{1}{Installed\ HSPF} \right) \right)$$

Where:

Installed Tons = Output capacity of installed DFHPs (tons)

Metered kWh Savings Cooling = Average cooling savings from PY13 metering (kWh)

Installed SEER	=	SEER rating of the installed DFHP (Btu/Wh)
Metered SEER Cooling	=	SEER rating of the PY13 metered cooling systems (Btu/Wh)
Metered Tons Cooling	=	Output capacity of the PY13 metered cooling systems (tons)
12	=	Conversion constant from tons to kBtu/hr
Heating EFLH	=	Equivalent full-load heating hours
Baseline HSPF	=	HSPF value of the baseline system
Installed HSPF	=	HSPF value of the installed system

Table 38 shows variable values that the team used to estimate savings in PY16 Q1 and PY16 Q2 for DFHPs. Changes from Q1 to Q2 resulted from changes in federal standards.

Table 38. DFHP PY16 Savings Assumptions

Parameter	PY16 Q1	PY16 Q2-Q4	Source
Metered kWh Savings Cooling	360	334	PY13 metering study* updated with new federal standard in Q2
Metered SEER Cooling	15.2	15.2	PY13 metering study*
Metered Tons Cooling	3.1	3.1	PY13 metering study*
Heating EFLH	1,119	1,119	2016 -2017 AMR Data & HP Metering
Baseline HSPF	7.70	8.20	Federal standard

* The Cadmus Group and Nexant. *Ameren Missouri CoolSavers Impact and Process Evaluation: Program Year 2013*. pp. 40. May 15, 2014. Available online: https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935842419

Ductless Heat Pumps

Cadmus estimated per-unit ductless HPs savings using the following algorithm:

$$\Delta kWh = Installed\ Tons \times \left(\frac{Metered\ kWh\ Savings\ Cooling \times Installed\ SEER}{Metered\ SEER\ Cooling \times Metered\ Tons\ Cooling} + 12 \times Heating\ EFLH \times \left(\frac{1}{Baseline\ HSPF} - \frac{1}{Installed\ HSPF} \right) \right)$$

Where:

Installed Tons	=	Output capacity of installed ductless ASHP (tons)
Metered kWh Savings Cooling	=	Average cooling savings from PY13 metering (kWh)
Installed SEER	=	SEER rating of the installed ductless ASHP (Btu/Wh)
Metered SEER Cooling	=	SEER rating of the PY13 metered cooling systems (Btu/Wh)
Metered Tons Cooling	=	Output capacity of the PY13 metered cooling systems (tons)

12	=	Conversion constant from tons to kBtu/hour
Heating EFLH	=	Equivalent full-load heating hours
Baseline HSPF	=	HSPF value of the baseline system
Installed HSPF	=	HSPF value of the installed system

Table 39 shows variable values that the team used to estimate savings in PY16 Q1 and PY16 Q2-Q4 for ductless HPs.

Table 39. Ductless ASHP PY16 Savings Assumptions

Parameter	Ameren Missouri Catalog Name	PY16 Q1	PY16 Q2-Q4	Source
Metered kWh Cooling	Ductless ASHP Early Replacement	1,805	1,805	PY13 metering study*
	Ductless ASHP Early Retirement Electric Resistance	1,805	1,805	PY13 metering study*
	Ductless ASHP Replace at Fail Electric Resistance	360	334.3	PY13 metering study* updated with new federal standard
	Ductless ASHP Replace at Fail	360	334.3	PY13 metering study* updated with new federal standard
Metered SEER Cooling	All Ductless ASHP	15.2	15.2	PY13 metering study*
Metered Tons Cooling	All Ductless ASHP	3.1	3.1	PY13 metering study*
Heating EFLH	All Ductless ASHP	1,496	1,496	Assuming the same full load hours as ASHP**
Baseline HSPF	Ductless ASHP Early Retirement	6.30	6.30	Estimated based on early retirement SEER. Cadmus data: HSPF = 0.2675 * SEER + 4.3475
	Ductless ASHP Early Retirement Electric Resistance	3.41	3.41	Electric resistance heating efficiency(COP = 1)
	Ductless ASHP Replace at Fail Electric Resistance	3.41	3.41	Electric resistance heating efficiency(COP = 1)
	Ductless ASHP Replace at Fail	7.70	8.20	Federal standard

*The Cadmus Group and Nexant. *Ameren Missouri CoolSavers Impact and Process Evaluation: Program Year 2013*. pp. 40. May 15, 2014. Available online: https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935842419

**U.S. Environmental Protection Agency and U.S. Department of Energy. "Life Cycle Cost Estimate for 20 ENERGY STAR Qualified Air Source Heat Pump(s)." Excel file. Last updated April 2009. Available online: https://essearch.energystar.gov/search?utf8=%E2%9C%93&sc=0&query=ashp%20sav%20calc&m=&affiliate=www.energystar.gov&commit=Search

Geothermal Heat Pumps

Cadmus estimated GSHP per-unit savings using the following algorithm:

$$\Delta kWh = Installed\ Tons \times \left(\frac{Metered\ kWh\ Savings\ Cooling \times Installed\ EER}{Metered\ SEER\ Cooling \times Metered\ Tons\ Cooling} + 12 \times Heating\ EFLH \times \left(\frac{1}{Baseline\ HSPF} - \frac{1}{Installed\ HSPF} \right) \right)$$

Where:

Installed Tons	=	Output capacity of installed ASHP (tons)
Metered kWh Savings Cooling	=	Average cooling savings from PY13 metering (kWh)
Installed EER	=	EER rating of the installed GSHP (Btu/Wh)
Metered SEER Cooling	=	SEER rating of the PY13 metered cooling systems (Btu/Wh)
Metered Tons Cooling	=	Output capacity of the PY13 metered cooling systems (tons)
12	=	Conversion constant from tons to kBtu/hour
Heating EFLH	=	Equivalent full-load heating hours
Baseline HSPF	=	Coefficient of performance (COP) value of the baseline system converted to HSPF (COP/3.412)
Installed HSPF	=	COP value of the installed system converted to HSPF (COP/3.412)

Table 40 shows variable values that the team used to estimate savings in PY16 Q1 and PY16 Q2-Q4 for GSHPs. Changes from Q1 to Q2 reflect new federal standards.

Table 40. GSHP PY16 Savings Assumptions

Parameter	Ameren Missouri Catalog Name	PY16 Q1	PY16 Q2-Q4	Source
Metered kWh Savings Cooling	GSHP - 23 EER Early Replacement	1,805	1,805	PY13 metering study*
	GSHP - 23 EER Replace at Fail	360	334.3	PY13 metering study* updated with new federal standard
	GSHP SEER 14+ Early Replacement ASHP with GSHP Electric Resistance	1,805	1,805	PY13 metering study*
	GSHP SEER 14+ Electric Resistance Furnace Early Replacement	1,805	1,805	PY13 metering study*

Parameter	Ameren Missouri Catalog Name	PY16 Q1	PY16 Q2-Q4	Source
	GSHP SEER 14+ Replace at Fail Electric Resistance Furnace	360	334.3	PY13 metering study* updated with new federal standard
Metered SEER Cooling	All GSHP	15.2	15.2	PY13 metering study*
Metered Tons Cooling	All GSHP	3.1	3.1	PY13 metering study*
Heating EFLH	All GSHP	2,009	2,009	ENERGY STAR calculator for Saint Louis
Baseline HSPF	GSHP - 23 EER Early Replacement	9.55	9.55	ICF*** research on installed system types and typical baseline of removed and failed GSHP. Assuming ground loop heat exchange.
	GSHP - 23 EER Replace at Fail	10.58	10.58	ICF*** research on installed system types and typical baseline of removed and failed GSHP. Assuming ground loop heat exchange.
	GSHP SEER 14+ Early Replacement ASHP with GSHP Electric Resistance	7.70	6.30	ICF*** research on installed system types and typical baseline of removed and failed GSHP. Assuming ground loop heat exchange.
	GSHP SEER 14+ Electric Resistance Furnace Early Replacement	3.41	3.41	Electric resistance heating efficiency(COP = 1)
	GSHP SEER 14+ Replace at Fail Electric Resistance Furnace	3.41	3.41	Electric resistance heating efficiency(COP = 1)

*The Cadmus Group and Nexant. *Ameren Missouri CoolSavers Impact and Process Evaluation: Program Year 2013*. pp. 40. May 15, 2014. Available online: https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935842419

**U.S. Environmental Protection Agency and U.S. Department of Energy. "Life Cycle Cost Estimate for 20 ENERGY STAR Qualified Air Source Heat Pump(s)." Excel file. Last updated April 2009. Available online: https://essearch.energystar.gov/search?utf8=%E2%9C%93&sc=0&query=ashp%20sav%20calc&m=&affiliate=www.energystar.gov&commit=Search

***Email from M Cano to J Berg, J Walczyk, L Wilkson, M Gregory, L Brouk; "RE: Information On GSHP". Sent November 26, 2014

Summary

Table 41 lists per-unit *ex ante* and *ex post* gross savings by measure.

Table 41. PY16 Summary: Comparison of *Ex Ante and Ex Post* Per-Unit Gross kWh Savings

Measure	*Ex Ante** (kWh/yr)	*Ex Post* (kWh/yr)	Realization Rate
Air-Source Heat Pump			
ASHP ER with ASHP 16+ ER	6,487	5,406	83%
ASHP Replace at Fail with ASHP 16+	1,770	1,587	90%
ASHP SEER 15 ER Elec Resist Furnace ER	13,903	10,749	77%
ASHP SEER 15 Replace at Fail Elect Resist Furnace	11,562	8,520	74%
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)	N/A	800	N/A
ASHP ER with ASHP SEER 15 ER	4,862	4,221	87%
ASHP Replace at Fail with ASHP SEER 15	860	820	95%
ASHP SEER 16+ ER Elec Resist Furnace ER	16,448	12,449	76%
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	13,160	11,348	86%
ASHP SEER 16+ Replace at Fail Elec Resist Furnace (NC)	N/A	2,066	N/A
Ductless Air-Source Heat Pump			
Ductless ASHP ER	4,594	3,434	75%
Ductless ASHP Replace Electric Resistance ER	7,465	6,204	83%
Ductless ASHP ROF	1,746	927	53%
Ductless ASHP Replace Electric Resistance ROF	7,906	5,438	69%
Dual Fuel Heat Pump			
DFHP SEER 15_SF	370	755	204%
DFHP SEER 16_SF	542	987	182%
DFHP SEER 17+_SF	1,037	1,402	135%
DFHP SEER 18+_SF	1,079	3,270	303%
Ground Source Heat Pump			
GSHP SEER 14+ ER ASHP with GSHP ER	12,667	12,702	100%
GSHP SEER 14+ ER Elec Resist Furnace ER	27,201	25,346	93%
GSHP SEER 14+ Replace Elec Resist Furnace	22,840	23,251	102%
GSHP - 23 EER ER	8,607	7,953	92%
GSHP - 23 EER Replace at Fail	3,607	3,646	101%
Central Air Conditioner			
CAC SEER 14 ER	1,636	1,633	100%
CAC SEER 14 Replace at Fail	323	323	100%
CAC SEER 15 ER	1,927	1,923	100%
CAC SEER 15 Replace at Fail	377	342	91%
CAC SEER 16+ ER	1,929	1,922	100%
CAC SEER 16+ Replace at Fail	351	368	105%

Measure	*Ex Ante** (kWh/yr)	*Ex Post* (kWh/yr)	Realization Rate
Electronically Commutated Motor			
Concept 3 Installations Continuous Fan ER_50	3,289	3,292	100%
Concept 3 Installations Continuous Fan ER_100	3,289	3,466	105%
Concept 3 Continuous Fan Replace at Fail_50	3,289	3,246	99%
Concept 3 Continuous Fan Replace at Fail_100	3,289	3,332	101%
Concept 3 Installations Auto Fan ER_50	794	614	77%
Concept 3 Installations Auto Fan ER_100	794	807	102%
Concept 3 Installations Auto Fan Replace at Fail_50	785	458	58%
Concept 3 Installations Auto Fan Replace at Fail_100	785	793	101%

*Per unit savings as documented in the Ameren Missouri 2017 TRM

Table 42. PY16 Summary: Comparison of *Ex Ante and Ex Post* Per-Unit Gross Demand Reduction

Measure	*Ex Ante* (kW)	*Ex Post (kW)*	Realization Rate
Air-Source Heat Pump			
ASHP ER with ASHP 16+ ER	3.02	2.52	83%
ASHP Replace at Fail with ASHP 16+	0.83	0.74	90%
ASHP SEER 15 ER Elec Resist Furnace ER	6.48	5.01	77%
ASHP SEER 15 Replace at Fail Elect Resist Furnace	5.39	3.97	74%
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)	N/A	0.37	N/A
ASHP ER with ASHP SEER 15 ER	2.27	1.97	87%
ASHP Replace at Fail with ASHP SEER 15	0.40	0.38	95%
ASHP SEER 16+ ER Elec Resist Furnace ER	7.67	5.80	76%
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	6.13	5.29	86%
ASHP SEER 16+ Replace at Fail Elec Resist Furnace (NC)	N/A	0.96	N/A
Ductless Air-Source Heat Pump			
Ductless ASHP ER	2.14	1.60	75%
Ductless ASHP Replace Electric Resistance ER	3.48	2.89	83%
Ductless ASHP ROF	0.81	0.43	53%
Ductless ASHP Replace Electric Resistance ROF	3.69	2.53	69%
Dual Fuel Heat Pump			
DFHP SEER 15_SF	0.17	0.35	205%
DFHP SEER 16_SF	0.25	0.46	182%
DFHP SEER 17+_SF	0.48	0.65	135%
DFHP SEER 18+_SF	0.50	1.52	303%

Ground Source Heat Pump			
GSHP SEER 14+ ER ASHP with GSHP ER	5.90	5.92	100%
GSHP SEER 14+ ER Elec Resist Furnace ER	12.68	11.81	93%
GSHP SEER 14+ Replace Elec Resist Furnace	10.65	10.84	102%
GSHP - 23 EER ER	4.01	3.71	92%
GSHP - 23 EER Replace at Fail	1.68	1.70	101%
Central Air Conditioner			
CAC SEER 14 ER	1.55	1.55	100%
CAC SEER 14 Replace at Fail	0.31	0.31	100%
CAC SEER 15 ER	1.83	1.82	100%
CAC SEER 15 Replace at Fail	0.36	0.32	91%
CAC SEER 16+ ER	1.83	1.82	100%
CAC SEER 16+ Replace at Fail	0.33	0.35	105%
Electronically Commutated Motor (ECM)			
Concept 3 Installations Continuous Fan ER_50	1.53	1.53	100%
Concept 3 Installations Continuous Fan ER_100	1.53	1.62	105%
Concept 3 Continuous Fan Replace at Fail_50	1.53	1.51	99%
Concept 3 Continuous Fan Replace at Fail_100	1.53	1.55	101%
Concept 3 Installations Auto Fan ER_50	0.37	0.29	77%
Concept 3 Installations Auto Fan ER_100	0.37	0.38	102%
Concept 3 Installations Auto Fan Replace at Fail_50	0.37	0.21	58%
Concept 3 Installations Auto Fan Replace at Fail_100	0.37	0.37	101%

To estimate the program's total gross energy savings, the team applied per-unit values shown in Table 41 to Heating and Cooling PY16 participation rates, as shown in Table 43.

Table 43. PY16 Summary: *Ex Post* Program Gross Savings Accounting for Installation Rates

Measure	PY16 Partici-pation	Per-Unit *Ex Post* Savings (kWh/yr)	Percent Installed and Operating	Total *Ex Post* Savings (kWh/yr)	Total *Ex Post* Savings (kW/yr)
Air-Source Heat Pump					
ASHP ER with ASHP 16+ ER	207	5,406	100%	1,119,118	522
ASHP Replace at Fail with ASHP 16+	33	1,587	100%	52,361	24
ASHP SEER 15 ER Elec Resist Furnace ER	411	10,749	100%	4,417,657	2,059
ASHP SEER 15 Replace at Fail Elect Resist Furnace	28	8,520	100%	238,573	111
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)	8	800	100%	6,396	3
ASHP ER with ASHP SEER 15 ER	239	4,221	100%	1,008,826	470
ASHP Replace at Fail with ASHP SEER 15	46	820	100%	37,739	18
ASHP SEER 16+ ER Elec Resist Furnace ER	318	12,449	100%	3,958,872	1,845
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	30	11,348	100%	340,454	159
ASHP SEER 16+ Replace at Fail Elec Resist Furnace (NC)	7	2,066	100%	14,460	7
Ductless Air-Source Heat Pump					
Ductless ASHP ER	9	3,434	100%	30,902	14
Ductless ASHP Replace Electric Resistance ER	29	6,204	100%	179,921	84
Ductless ASHP ROF	7	927	100%	6,489	3
Ductless ASHP Replace Electric Resistance ROF	98	5,438	100%	532,926	248
Dual Fuel Heat Pump					
DFHP SEER 15_SF	20	755	100%	15,099	7
DFHP SEER 16_SF	13	987	100%	12,825	6
DFHP SEER 17+_SF	28	1,402	100%	39,244	18
DFHP SEER 18+_SF	1	3,270	100%	3,270	2
Ground Source Heat Pump					
GSHP SEER 14+ ER ASHP with GSHP ER	16	12,702	100%	203,231	95
GSHP SEER 14+ ER Elec Resist Furnace ER	48	25,346	100%	1,216,587	567
GSHP SEER 14+ Replace Elec Resist Furnace	126	23,251	100%	2,929,627	1,365
GSHP - 23 EER ER	67	7,953	100%	532,846	248
GSHP - 23 EER Replace at Fail	14	3,646	100%	51,049	24

Measure	PY16 Partici-pation	Per-Unit *Ex Post* Savings (kWh/yr)	Percent Installed and Operating	Total *Ex Post* Savings (kWh/yr)	Total *Ex Post* Savings (kW/yr)
Central Air Conditioner					
CAC SEER 14 ER	3,973	1,633	100%	6,489,117	6,148
CAC SEER 14 Replace at Fail	141	323	100%	45,609	43
CAC SEER 15 ER	1,727	1,923	100%	3,315,651	3,147
CAC SEER 15 Replace at Fail	70	342	104%	24,953	23
CAC SEER 16+ ER	5,131	1,922	100%	9,863,907	9,345
CAC SEER 16+ Replace at Fail	65	368	100%	23,914	23
Electronically Commutated Motor					
Concept 3 Installations Continuous Fan ER_50	712	3,292	100%	2,343,923	1,092
Concept 3 Installations Continuous Fan ER_100	70	3,466	100%	242,624	113
Concept 3 Continuous Fan Replace at Fail_50	48	3,246	100%	155,831	73
Concept 3 Continuous Fan Replace at Fail_100	1	3,332	100%	3,332	2
Concept 3 Installations Auto Fan ER_50	7,612	614	100%	4,671,625	2,177
Concept 3 Installations Auto Fan ER_100	540	807	100%	435,781	203
Concept 3 Installations Auto Fan Replace at Fail_50	175	458	100%	80,224	37
Concept 3 Installations Auto Fan Replace at Fail_100	20	793	100%	15,863	7
Total	**22,088**	**-**	**100.00%**	**44,660,830**	**30,332**

Net Impact Evaluation Results

Cadmus determined total program net impacts by calculating total gross savings by measure group and then by applying the following[12]:

- Participant Free Ridership
- Participant Spillover
- Nonparticipant Spillover (NPSO)
- HVAC NPSO

Cadmus determined participant free ridership and participant spillover ratios using participant surveys completed during PY16.

Free ridership equals the percentage of savings that would have occurred in a program's absence due to participants purchasing the same measures without the program's influence. Thus, free riders can be considered customers who would have purchased a measure independent of a program. As they account for some program costs but none of its benefits, they decrease a program's net savings.

Spillover equals savings that occur when customers undertake installation of energy efficiency measures or perform energy-efficient activities without receiving financial assistance. For participating customers, this is due to their experience participating in a given program, whereas non participating customers engage in energy-efficient activities due to awareness resulting from program marketing. Unlike free ridership, spillover savings do not generate program costs; rather, energy-saving benefits occur, which increase net savings.

To calculate the Heating and Cooling program's NTG, the team used the following formula:

$$\boldsymbol{NTG = 1 - Freeridership + Participant\ Spillover + HVAC\ Nonparticipant\ Spillover}$$

Cadmus applied the resulting NTG ratio to the *ex post* gross savings for each program measure to calculate net savings for the program measures, then added the Heating and Cooling program generated NPSO savings to arrive at total net program savings. Because NPSO is of significant size and does not have the same load shape as the program, we did not include NPSO in the NTG ratio associated with the program, but rather added the net energy and demand impacts separately.

Table 44 presents our estimates of the PY16 program's net impacts.

[12] Cadmus relied upon the Uniform Methods Project definition of spillover than includes both participant and nonparticipant spillover that include subsets of both like and non-like spillover. This is located on page 3 of the linked document. https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf

Table 44. PY16 Net Impact Results Summary

Program Measure	*Ex Post* Gross Savings* (MWh/yr)	Free Ridership	Spill-over	HVAC NPSO	NTG	Net Savings* (MWh/yr)	Net Savings* (kW/yr)
ASHP ER with ASHP 16+ ER	1,119	3.4%	0.1%	0.4%	97.1%	1,087	506
ASHP Replace at Fail with ASHP 16+	52					51	24
ASHP SEER 15 ER Elec Resist Furnace ER	4,417					4,290	1,999
ASHP SEER 15 Replace at Fail Elect Resist Furnace	239					232	108
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)	6					6	3
ASHP ER with ASHP SEER 15 ER	1,008					980	457
ASHP Replace at Fail with ASHP SEER 15	38					37	17
ASHP SEER 16+ ER Elec Resist Furnace ER	3,959					3,844	1,792
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	340					331	154
ASHP SEER 16+ Replace at Fail Elec Resist Furnace (NC)	14					14	7
Subtotal*	**11,194**	**3.4%**	**0.1%**	**0.4%**	**97.1%**	**10,870**	**5,066**
Ductless ASHP ER	31	11.5%	2.3%	0.4%	91.2%	28	13
Ductless ASHP Replace Electric Resistance ER	180					164	76
Ductless ASHP ROF	6					6	3
Ductless ASHP Replace Electric Resistance ROF	533					486	227
Subtotal*	**750**	**11.5%**	**2.3%**	**0.4%**	**91.2%**	**684**	**319**
DFHP SEER 15_SF	15	1.5%	0.0%	0.4%	98.9%	15	7
DFHP SEER 16_SF	13					13	6
DFHP SEER 17+_SF	39					39	18
DFHP SEER 18+_SF	3					3	2
Subtotal*	**70**	**1.5%**	**0.0%**	**0.4%**	**98.9%**	**70**	**32**
GSHP SEER 14+ ER ASHP with GSHP ER	203	5.8%	0.0%	0.4%	94.6%	192	90
GSHP SEER 14+ ER Elec Resist Furnace ER	1,217					1,151	536
GSHP SEER 14+ Replace Elec Resist Furnace	2,930					2,771	1,292
GSHP - 23 EER ER	532					504	235
GSHP - 23 EER Replace at Fail	51					48	23
Subtotal*	**4,933**	**5.8%**	**0.0%**	**0.4%**	**94.6%**	**4,667**	**2,175**
CAC SEER 14 ER	6,489	16.1%	0.3%	0.4%	84.6%	5,490	5,201
CAC SEER 14 Replace at Fail	46					39	37

Program Measure	*Ex Post* Gross Savings* (MWh/yr)	Free Ridership	Spill-over	HVAC NPSO	NTG	Net Savings* (MWh/yr)	Net Savings* (kW/yr)
CAC SEER 15 ER	3,316					2,805	2,658
CAC SEER 15 Replace at Fail	25					21	20
CAC SEER 16+ ER	9,864					8,345	7,906
CAC SEER 16+ Replace at Fail	24					20	19
Subtotal*	**19,763**	**16.1%**	**0.3%**	**0.4%**	**84.6%**	**16,7120**	**15,840**
Concept 3 Installations Continuous Fan ER_50	2,344					2,199	1,025
Concept 3 Installations Continuous Fan ER_100	243					228	106
Concept 3 Continuous Fan Replace at Fail_50	156					146	68
Concept 3 Continuous Fan Replace at Fail_100	3	6.9%	0.3%	0.4%	93.8%	3	1
Concept 3 Installations Auto Fan ER_50	4,672					4,382	2,042
Concept 3 Installations Auto Fan ER_100	436					409	191
Concept 3 Installations Auto Fan Replace at Fail_50	80					75	35
Concept 3 Installations Auto Fan Replace at Fail_100	16					15	7
Subtotal*	**7,949**	**6.9%**	**0.3%**	**0.4%**	**93.8%**	**7,456**	**3,475**
NPSO						**17,997**	**7,179**
Program Total	**44,661**	**10.0%**	**0.2%**	**0.4%**	**90.6%**	**58,443**	**34,088**

* Savings may not sum to totals due to rounding

Free Ridership Results

Cadmus used a participant self-report approach to determine free ridership ratios for 969 participants who chose to install a HVAC program measure. This approach relied on a standard battery of questions that focused on the following key areas:

- Would the participant have installed a high-efficiency replacement without the program incentive?
- How soon would the participant have taken the action with the program rebate?
- Did the program rebate cause the participant to purchase a system with a higher efficiency rating than they would have purchased without the program?
- How important was the program rebate in the participant's decision to purchase and install a high-efficiency system?
- How important was the advice from the contractor in the participant's decision to purchase and install the high-efficiency system?

Based on participant responses, Cadmus applied a free ridership score ranging from 0% to 100% to each participant individually, based on their collective responses to the set of survey questions. Cadmus then averaged individual free ridership scores participants (weighted by evaluated gross energy savings) to arrive at measure category level free ridership estimates for the program.

Cadmus used the following process for determining a participant's free ridership score:

- The team categorized customers as 0% free riders if:
  - They had no plans to install the measure in the absence of the program's incentives and would not have installed the measure within one year in the program's absence;
  - They considered installing the measure before learning about the program, but would not have done so without program incentives; or
  - In the absence of program incentives, they would have purchased or installed less-efficient equipment.
- The team categorized customers as 100% free riders if they would have installed the same measure at the same time without the program and if they confirmed the program rebate and advice from their contractor was "not at all important" in their decision to purchase the high-efficiency HVAC equipment.[13][14]
- The team assigned a partial free ridership score (ranging from 12.5% to 75%) to customers who already had plans to install the measure, but who said their decisions about which product to purchase or when they would purchase it was influenced by the program. For customers highly likely to install energy-efficient equipment right away and for whom the program had less influence over their decisions, the team assigned a higher free ridership percentage than for those whom the program may not have had as large an influence (or whose purchases may have occurred later in the program's absence).
- Of the 827 central air conditioner respondents, the team adjusted the core freeridership score for 112 participants whose equipment installations qualified as early retirement (discussed further below). These 112 early retirement customers reported they would have replaced their system at the same time without Ameren Missouri's program, which indicates they were free riders of the early retirement incentive and would have likely replaced their system regardless of the program. After translating survey responses into each participant's free ridership score, Cadmus calculated an average free ridership estimate, weighted by evaluated savings, for each

[13] According to The Energy Efficiency Program Impact Evaluation Guide, from the State and Local Energy Efficiency Action Network, dated December 2012, "A participant is a total free rider if he or she would have absolutely installed the exact same project at the exact same time, at the same price, even if the program did not exist—and they know that."

[14] When respondents reported that a contractor was involved in the customer's purchasing decision they were asked an additional question about how important the advice from the contractor was on their decision to purchase and install the high-efficiency program equipment.

program measure category. (Appendix B, Table 60, shows the conversion of each raw survey response option into free ridership scoring matrix values, and the free ridership score combinations and scoring legend the team used to categorize customer survey responses for incentive-based measures.)

Free Ridership Results

Table 45 provides PY16 free ridership estimates by measure group.

Table 45. Heating and Cooling Free Ridership Results

Measure Group	n	Total Weighted Free Ridership Estimate*	Absolute Precision at 90% Confidence
Air-Source Heat Pump	97	3.4%	±2%
Ductless Air-Source Heat Pump	12	11.5%	±8%
Dual Fuel Heat Pump	10	1.5%	±3%
Ground Source Heat Pump	23	5.8%	±4%
Central Air Conditioner	827	16.1%	±2%

*Estimates are weighted by *ex post* gross program savings.

Free Ridership Scoring

Appendix B, Table 61 to Table 66, contains the full set of free ridership responses for the HVAC measures; free ridership survey response combinations; the free ridership score assigned to each combination; and the number of responses. Responses of "yes," "no," or "partial" relate to whether the specific response indicates free ridership.

Distribution of Free Ridership Scores

Figure 31 shows the distribution of assigned free ridership scores for air-source heat pump respondents. Approximately 85% of air-source heat pump survey respondents received scores as 0% free riders, while we estimated 12% at low free ridership levels (12.5% and 25%). We assigned a moderate free ridership level (50%) for 2% of respondents, while we estimated 1% of respondents as true free riders (100%).

Figure 31. Overall Distribution of Air-Source Heat Pump Free Ridership Scores (n=97)

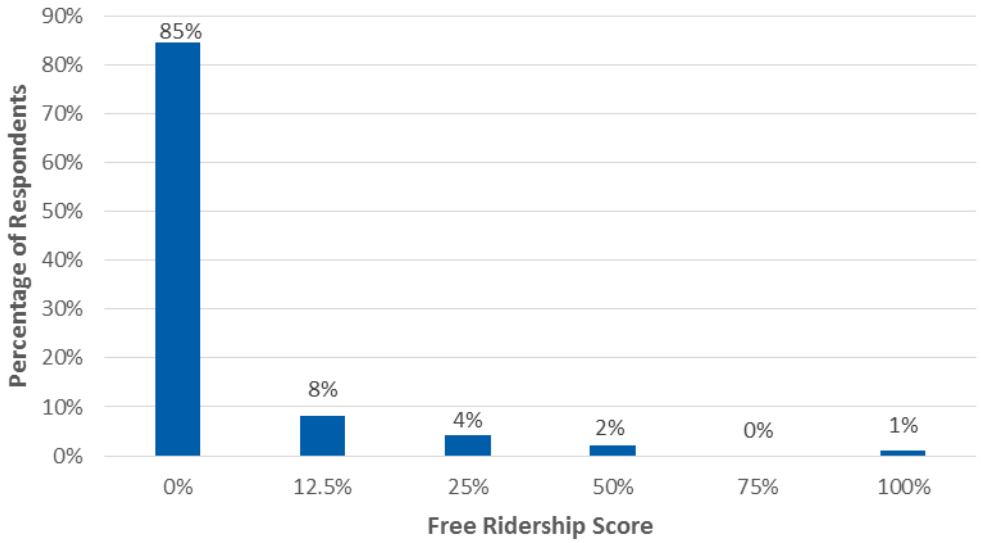
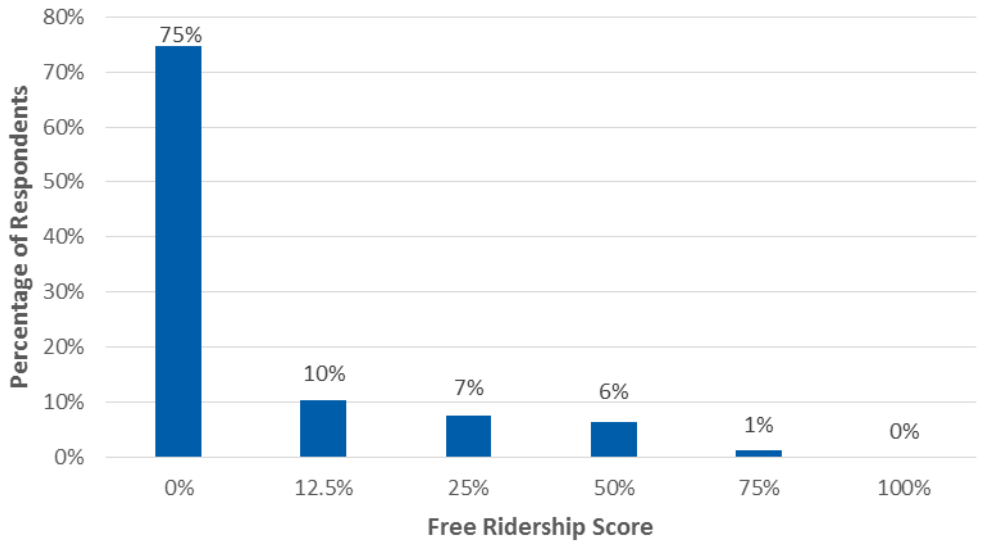


Figure 32 shows the distribution of assigned core free ridership scores for central air conditioner respondents. Approximately 75% of central air conditioner survey respondents received core scores as 0% free riders, while we estimated 17% at low free ridership levels (12.5% and 25%). We assigned a moderate free ridership level (50% and 75%) for 7% of respondents, while we estimated no respondents as true free riders (100%).

Figure 32. Core Distribution of Central Air Conditioning Free Ridership Scores (n=827)



Additionally, for early retirement customers who indicated they were planning on replacing their systems around the same time without the early replacement incentive, Cadmus applied a net-of-freerider adjustment to adjust net savings based on the replace on burnout gross savings, as the

customer indicated their system was going to be replaced anyways. The effective free ridership score for these customers is approximately 81% and was applied to 14% of respondents. We calculated the 81% effective free riderhip score using the following equation:

$$Net\ of\ free\ ridership\ adjustment\ (81\%) = 1 - [\Delta\ kWh\ replace\ on\ burnout\ savings\ (368\ kWh) \div\ \Delta\ kWh\ early\ retirement\ savings\ (1922\ kwh)]$$

Figure 33 shows the distribution of assigned free ridership scores for ductless air-source heat pump respondents. Approximately 58% of ductless air-source heat pump survey respondents received scores as 0% free riders, while we estimated 33% at low free ridership levels (12.5% and 25%). We assigned a moderate free ridership level (50%) for 8% of respondents, while we estimated no respondents as true free riders (100%).

Figure 33. Overall Distribution of Ductless Air-Source Heat Pump Free Ridership Scores (n=12)

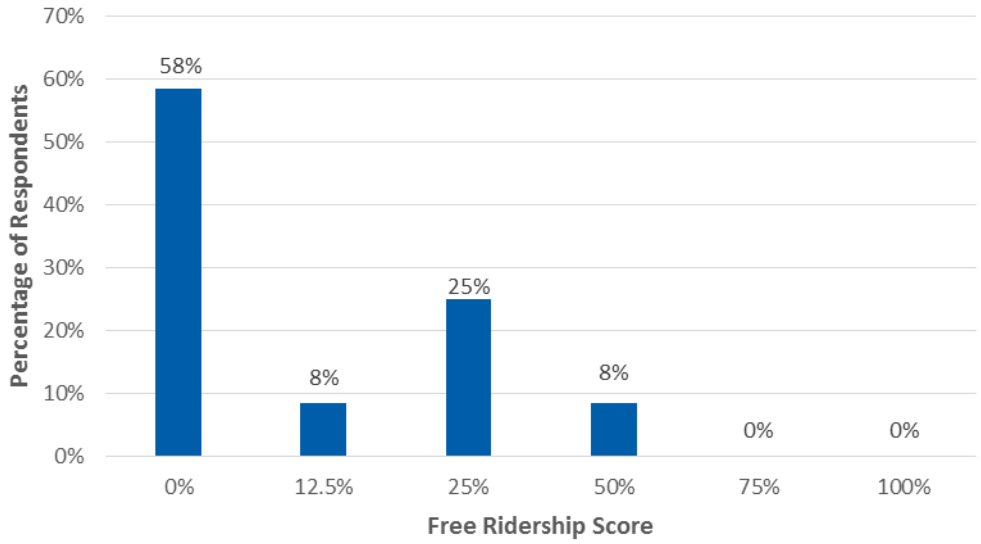


Figure 34 shows the distribution of assigned free ridership scores for ground source heat pump respondents. Approximately 70% of ground source heat pump survey respondents received scores as 0% free riders, while we estimated 33% at low free ridership levels (12.5% and 25%). We assigned a moderate free ridership level (50%) for 8% of respondents, while we estimated no respondents as true free riders (100%).

Figure 34. Overall Distribution of Ground Source Heat Pump Free Ridership Scores (n=23)

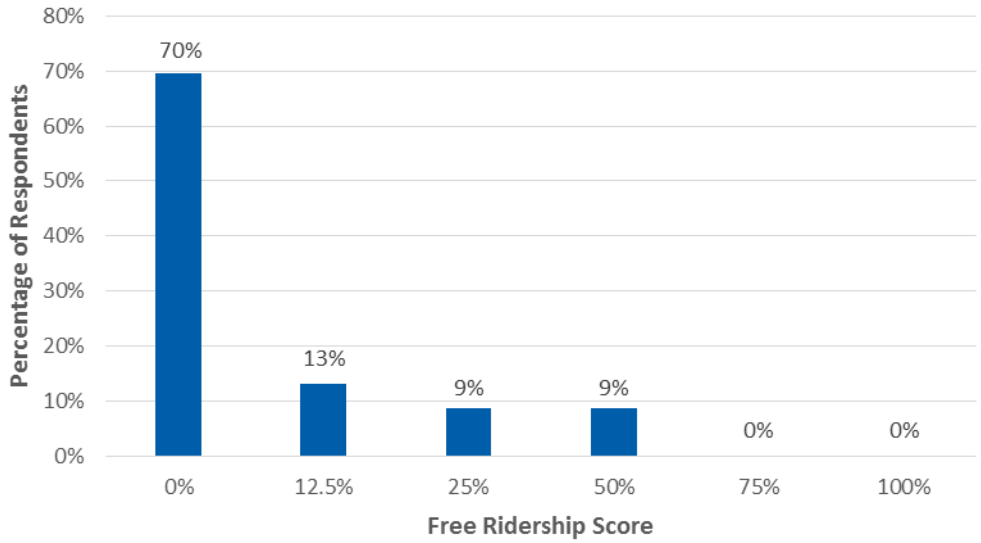
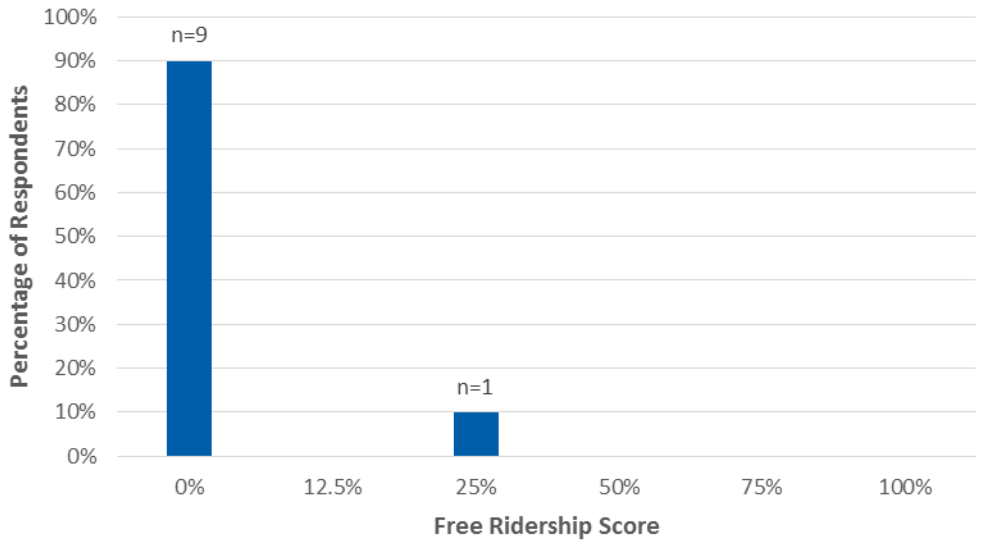


Figure 35 shows the distribution of assigned free ridership scores for duel-fuel heat pump respondents. Nine of the ten duel-fuel heat pump survey respondents received 0% free rider scores, while we estimated one respondent as a 25% free rider.

Figure 35. Overall Distribution of Duel Fuel Heat Pump Free Ridership Scores (n=10)



Participant Spillover Results

Cadmus asked Heating and Cooling Program participants whether they had undertaken additional energy-efficient actions since participating in the program. To calculate spillover, we asked them to rate

the importance of the following factors on their decisions to purchase additional energy efficient equipment:

- Receiving funding through Ameren Missouri's Heating and Cooling Program
- Information they heard from Ameren Missouri or their HVAC contractor about the benefits of installing the additional equipment

Nine survey respondents reported installing an additional energy-efficient measure after participating in the Heating and Cooling Program and said their experience in the Program was "very important" to the subsequent decision to purchase a high-efficiency equipment rather than a standard efficiency model.

We estimated energy savings for the participants' spillover responses, and then divided the total Heating and Cooling Program survey sample spillover savings for each program measure group by the survey sample Heating and Cooling Program gross program savings, drawn from the survey sample, and as described in the following equation:

$$Spillover\ \% = \frac{\sum[Spillover\ kWh\ savings\ for\ all\ program\ measure\ group\ respondents]}{\sum[Program\ kWh\ savings\ for\ all\ program\ measure\ group\ respondents]}$$

Table 46 presents the spillover details by program measure group.[15]

[15] No spillover activity was attributed to Ameren by ground source heat pump or dual-fuel heat pump respondents and participant spillover estimates for the measure groups are 0%.

Table 46. Participant Spillover

Measure Group	Spillover Measure	Participant Spillover kWh/year Savings[a]	Total Survey Sample Program kWh/year Savings	Spillover %
Air-Source Heat Pump	Insulation	192.3[a]	544,130.2	0.1%
	Windows	186.9[b]		
Ductless Air-Source Heat Pump	Smart Thermostat	462.0[c]	19,747.6	2.3%
Central Air Conditioning	Ductless Air- Source Heat Pump	927[d]	971,603.5	0.3%
	Insulation	192.3[a]		
	Insulation	192.3[a]		
	Recycled a refrigerator	247.2[e]		
	Smart Thermostat	462.0[b]		
	Windows	186.9[b]		

[a]Average ceiling insulation savings per home, calculated for the PY15 Home Energy Analysis program.
[b]Based on savings calculated for the PY15 Home Energy Analysis program.
[c]Based on savings calculated for the PY15 Efficient Products evaluation.
[d]Based on savings calculated for the PY16 Heating and Cooling program.
[e] Based on ½ savings calculated for the PY15 Refrigerator Recycling evaluation to account for the uncertainty of whether the unit was resold into the market.

Nonparticipant Spillover

Effective program marketing and outreach generates program participation *and* increases general energy efficiency awareness among customers. The cumulative effect of sustained utility program and general marketing can affect customers' perceptions of their energy usage, and, in some cases, motivates customers to take efficiency actions outside of the utility's program. The energy savings caused by, but not rebated through, a utility's demand-side management activity are spillover savings. The spillover savings accrued by customers who did not participate in Ameren Missouri's programs are nonparticipant spillover, or NPSO.

During PY16, Ameren Missouri spent over $1.1 million dollars to market individual residential efficiency programs (excluding low-income and Home Energy Report).[16] To understand whether Ameren Missouri's program-specific marketing efforts generated energy efficiency improvements outside of Ameren Missouri's incentive programs, Cadmus implemented a phone survey of residential customers who did not participate in Ameren Missouri's incentive programs in PY16. As this survey has been

[16] The Home Energy Report program is evaluated using billing analysis, which accounts for both program savings and spillover savings. Thus, it is excluded from this NPSO analysis.

implemented annually since PY13, the PY16 version represents the latest effort in monitoring nonparticipant activity.

Methodology

Survey Sampling and Disposition

From Ameren Missouri's entire residential customer base, Cadmus selected customers who did not participate in any Ameren Missouri program in PY16; these 674,577 customers served as the sample frame for the nonparticipant survey.[17] From this sample frame, the team randomly selected 20,000 customers for the survey sample. The team called customers from this sample until reaching a quota of 200 nonparticipant-completed surveys.[18]

The team cross-checked each respondents' account IDs and phone numbers against the final participant program tracking databases to ensure that respondents were not confused by the questions and, in fact, did participate in the program. Our analysis found that two survey respondents participated in the Multifamily Efficient Kits program, however they did not report spillover measures. The NPSO analysis focused on 198 verified nonparticipants to avoid potential double-counting of program-specific spillover.

Like and Non-like Spillover Measures

The survey asked respondents whether they installed any of the 11 energy efficiency measures offered by Ameren Missouri programs (known as "like" spillover), with the notable exception of products in the Lighting and HVAC programs. The like NPSO analysis excluded products in the Lighting and HVAC programs to avoid double-counting NPSO savings already captured through the programs' own like NPSO analyses, as described in those reports.

In addition, the survey asked respondents whether they installed energy efficiency measures or performed energy saving actions that were outside of Ameren Missouri's PY16 program offerings (known as "non-like" spillover). The rationale for including non-like spillover is that Ameren Missouri's program marketing and outreach raise general awareness of energy efficiency and may result in Ameren Missouri customers taking additional steps to save energy on their own. For example, some respondents reported installing non-like measures previously offered through Ameren Missouri programs and might have been influenced by Ameren Missouri's prior program marketing and outreach. In addition, Ameren

[17] Invalid or duplicate phone numbers were removed from the sample frame. Home Energy Report participants were also removed from the sample frame.

[18] A small number of survey respondents (n=17) self-reported that they participated in an Ameren Missouri residential program in PY16, so they are not part of the 200 nonparticipant completes.

Missouri customers might have adopted other non-like measures due to Ameren Missouri's program marketing and outreach changing their general attitudes towards energy efficiency.

NPSO Selection Criteria

To confirm a relationship between Ameren Missouri's energy efficiency programs and measures adopted by nonparticipants, Cadmus created a set of selection criteria and operationalized these into survey questions. To be included in the NPSO analysis, nonparticipating respondents had to meet all of the following criteria:

a) They were familiar with at least one Ameren Missouri program, rebate, or discount[19]

b) At least one element of Ameren Missouri's program marketing and outreach motivated them to adopt the measure

c) They had a valid reason for considering the adopted measure energy efficient

d) For a like measure, they had not received a rebate from Ameren Missouri, and had not already tried to receive a rebate from Ameren Missouri, and stated a valid reason why they did not apply for an Ameren Missouri rebate for the measure

e) They had a valid reason for why they decided to install the measure

f) The adopted measure generated electric savings, not gas savings

For criterion b), the team asked respondents to rate several Ameren Missouri program marketing and outreach elements (in Table 47) in motivating them to adopt the spillover measure, as either "very important", "important", "not too important", or "not at all important". For like measures, the measure in question met criterion b) if the respondent found at least one element "very important" or "important" in deciding to adopt the measure. For non-like measures, respondents must find at least one element "very important".

Table 47. Ameren Missouri marketing and outreach elements for Criterion B

Statement
Information about energy savings from Ameren Missouri's marketing or bill-inserts
Information from colleagues or friends who installed energy-efficient equipment and received a rebate from Ameren Missouri
If applicable, past participation in an Ameren Missouri rebate program
If applicable, information from the energy assessment conducted at your home through Ameren Missouri

[19] Responding "Yes" to C2 "Have you ever seen or heard of the Ameren Missouri energy efficiency programs?" or C10 "Are you aware that Ameren Missouri offers rebates and discounts for energy-saving equipment in your home?"

Criterion c) helped ensure that spillover measures actually generated energy savings. For applicable measures, the team asked respondents how they knew their product was energy efficient. Responses passing criterion c) included "it's ENERGY STAR rated" or "the retailer/dealer/contractor told me it was."

If respondents reported having adopted a like measure, the team asked whether they had received a rebate from Ameren Missouri to double-check that the respondents were truly did not participate in the program. Then, the team asked why they or their contractor did not apply for a rebate through Ameren Missouri. If respondents reported that they applied for such a rebate but did not receive it as their product did not qualify, their adopted measure did not pass criterion d). Hence, the team excluded it in NPSO.

The team also asked respondents why they decided to adopt the measure. If the response directly contradicted criterion b), c), or d), then the measure does not pass criterion e). For example, one respondent said that they installed an "Efficient room air conditioner" because "it was free and I didn't have any choice." Thus, this response contradicts criterion b), that Ameren Missouri's marketing and outreach had an influence on the measure adoption.

As the PY16 evaluation only concerns electric savings generated by Ameren Missouri's programs, the team asked respondents for the fuel type of their water heaters, heating systems, and cooling systems. The reported like and non-like measures satisfy criterion f) if the measures had a corresponding electric water heater, electric heat, or electric cooling.

Results

Of 198 verified nonparticipant respondents, 27 respondents adopted measures that were not incentivized and passed all six NPSO criteria (see Appendix C). None of these 27 respondents received an incentive from Ameren Missouri for any measure. They were only influenced by Ameren Missouri program marketing and outreach, and adopted NPSO measures on their own.

From these 27 respondents, 6 respondents reported adopting a total of seven non-incentivized like measures; and 23 respondents adopted a total of 32 non-incentivized non-like measures.

Like NPSO

Table 48 shows like measures and gross evaluated kWh savings attributed to Ameren Missouri, achieving average savings of 176 kWh (Variable A).

Table 48. Like NPSO Response Summary

Individual Reported Like Measures	Importance of Ameren Missouri Influence on Adoption	Measure Savings (kWh)*	Allocated Savings	Total kWh Savings	Avg kWh Per Spillover Measure
Efficient kitchen faucet aerators	Somewhat	250*	50%	125	A
Efficient kitchen faucet aerators	Very	250*	100%	250	
Efficient kitchen faucet aerators	Very	250*	100%	250	
Efficient room air conditioner	Somewhat	45**	50%	22	
Efficient room air conditioner	Somewhat	45**	50%	22	
Efficient showerheads	Very	331*	100%	331	
Learning or "smart" thermostat	Somewhat	462**	50%	231	
Total (n=7)				**1,231**	**176**

*Based on savings calculated for the PY16 EE Kits program.

**Based on savings calculated for the PY16 Efficient Products program.

To determine total like NPSO generated by Ameren Missouri marketing in PY16, Cadmus extrapolated like NPSO savings per like measure (Table 48) to Ameren Missouri's entire PY16 residential nonparticipant population. Table 49 presents the like NPSO analysis, resulting in like NPSO total evaluated savings of 5,050 MWh at the portfolio level.

Table 49. Like NPSO Analysis

Variable	Metric	Value	Source
A	Average kWh Savings per Like Measure	176	Survey Data; PY16 Impact Evaluation
B	Number of Like Measures	7	Survey Data
C	Number of Nonparticipant Respondents	198	Survey Disposition
D	Total Residential Population Minus PY16 Participants	812,009	Customer Database
E	Total Like NPSO MWh Savings Applied to Population	5,050	(((B ÷ C) × A) × D)/1000

Like NPSO savings in PY16 (5,050 MWh) are smaller than savings reported in PY15 (12,247 MWh). This is due to three factors: a) the total *ex post* residential portfolio savings in PY16 (95,249 MWh) decreased from PY15's 142,016 MWh, b) the like NPSO savings as a percent of total portfolio savings in PY16 (5.3%) also decreased from 8.6% in PY15, and c) several measures are no longer "like" measures as in PY15, such as insulation, refrigerator/freezer recycling, programmable thermostats, and windows. Whereas PY15's survey reported like measures from a variety of Ameren Missouri programs, PY16's reported like measures are mostly efficient kitchen faucet aerators from the EE Kits program and efficient room air conditioners in the Efficient Products program.

Non-like NPSO

Cadmus followed a similar methodology as for like spillover in computing non-like spillover with two exceptions. Table 50 shows non-like measures and gross evaluated kWh savings attributed to Ameren Missouri, achieving average savings of 110 kWh (Variable A in Table 50). The first exception, in contrast

with the like NPSO, we only counted non-like NPSO when the respondent rated Ameren Missouri's influence on the measure adoption as "very important". Due to uncertainty around how Ameren Missouri's marketing influences non-like measure adoption, we were more conservative in counting savings. For the second exception, we estimated savings from individual measures more conservatively:

- Because ENERGY STAR market shares are generally high for efficient clothes washers, freezers, and refrigerators, the team allocated only 50% of the measure savings. Although respondents rated the program as "very important" in their decision to purchase, it is likely that at least some respondents would have bought an ENERGYSTAR product regardless of Ameren Missouri's influence.
- For the measure defined as "removing a refrigerator or freezer", it is possible that respondents sold it or gave it to someone else rather than recycling, in which case the savings generated from the removing would be over-estimated. Again, even though the respondent rated Ameren Missouri's marketing as very important, and had mentioned it as an energy saving activity, we allocated 50% of the savings to spillover.
- We excluded efficient dishwashers from the spillover analysis because virtually all dishwashers on the market are already ENERGYSTAR-certified.

Table 50. Non-like NPSO Response Summary

Individual Reported Non-like Measures	Quantity	Measure Savings (kWh)	Allocated Savings	Total kWh Savings	Avg kWh Per Spillover Measure
Insulation	3	192*	100%	577	A
Efficient clothes washer (gas water heating)	2	34**	50%	34	
Efficient clothes washer (electric water heating)	1	120***	50%	60	
Efficient freezer	4	61†	50%	122	
Efficient refrigerator	2	37††	50%	37	
Efficient water heater (other than heat pump water heater)	2	157†††	100%	314	
Efficient Windows	2	187^	100%	374	
Programmable (but not "smart") thermostat	1	83^^	100%	83	
Programmed thermostat to reduce usage	8	83^^	100%	664	
Removed a refrigerator or freezer	3	494^^^	50%	741	
Scheduled an air conditioner tune-up	4	126^^	100%	504	
Total (n=32)				**3,510**	**110**

*Average ceiling insulation savings per home, calculated for the PY15 Home Energy Analysis.

**Deemed savings for gas water heating and unknown dryer fuel, from the Illinois TRM Version 5.0 Volume 3.

***Deemed savings for electric water heating and unknown dryer fuel, from the Illinois TRM Version 5.0 Volume 3.

†Deemed savings for ENERGY STAR Freezer from Ameren Missouri 2012 Energy Efficiency Filing Appendix A TRM.

††Deemed savings for ENERGY STAR Refrigerator from the Illinois TRM Version 5.0 Volume 3.

†††Deemed savings from Ameren Missouri 2012 Energy Efficiency Filing Appendix A TRM.

^Based on savings calculated for the PY15 Home Energy Analysis.

^^Based on savings calculated for the PY15 Heating and Cooling program.

^^^Based on savings calculated for the Appliance Recycling program (refrigerator/freezer recycling savings minus refrigerator/freezer replacement savings).

Using the same extrapolation method as for the like NPSO analysis, Cadmus determined total non-like NPSO generated by Ameren Missouri's PY16 marketing in MWh savings. Table 51 presents the non-like NPSO analysis, resulting in non-like NPSO evaluated savings of 14,396 MWh the portfolio level.

Table 51. Non-like NPSO Analysis

Variable	Metric	Value	Source
A	Average kWh Savings per Non-like Measure	110	Survey Data; PY15 Impact Evaluation; Ameren Missouri TRM; Illinois TRM
B	Number of Non-like Measures	32	Survey Data
C	Number of Nonparticipant Respondents	198	Survey Disposition
D	Total Residential Population Minus PY16 Participants	812,009	Customer Database
E	Total Non-like NPSO MWh Savings Applied to Population	14,396	(((B ÷ C) × A) × D)/1000

Spillover Allocation to Individual Programs

Combining the above analyses, Cadmus observed 19,446 MWh of combined like and non-like NPSO, consisting of 20.4% of total evaluated savings. The team considered the following three approaches for allocating total observed NPSO to individual programs:

- **Even Allocation**: The most straightforward approach allocated NPSO evenly across the residential programs (i.e., made a 20.4% adjustment to each program's NTG). This equaled applying NPSO at the portfolio-level, and, therefore, assumed all programs contributed equally to generating NPSO.
- **"Like" Programs:** Another approach allocated NSPO savings to specific programs based on the measure that the nonparticipant installed. Note that this approach is only applicable to like NPSO. For example, one nonparticipant reported installing a start thermostat, motivated by Ameren Missouri's marketing. Using this approach, the team would assign NPSO savings associated with the installation to the Efficient Products Program. While this approach established a clear connection between a reported spillover measure and Ameren Missouri's program (which promoted that measure), the research found this direct measure-program relationship did not prove as straightforward as it appeared. Specifically, while all 7 respondents reporting like NPSO were aware of Ameren Missouri programs, only one respondent was familiar with the specific program corresponding to the measure they installed.[20] This indicated that Ameren Missouri generated NPSO through the cumulative effects of various program-specific marketing efforts, and mapping spillover measures solely to the program offering the specific measure could undervalue the overall impact of cumulative and sustained energy efficiency messaging.
- **Marketing Budget and Program Size.** The final allocation approach the team considered—and eventually chose to use—assigned overall NSPO as a function of each program's marketing and program budget (shown in Table 52). This approach remained consistent with the theory that

[20] C11 "What rebates or discounts have you heard about?"

NPSO resulted from the cumulative effects of program-specific marketing and program activity over a period—not necessarily by a single, program-specific marketing effort. In addition, while NPSO most commonly was associated with mass media marketing campaigns, the scale of program activity also counted as a factor. For example, even without a significant marketing campaign, a program's size can drive NPSO through word-of-mouth and in-store program messaging. The team found this approach accurately reflected and attributed NSPO to programs, ensuring those total costs (including marketing) and total benefits (net savings including NPSO) are properly accounted for when assessing overall program cost-effectiveness.

Table 52. Combined Savings and Marketing Allocation

Program	Program *Ex Post* Gross Savings (MWh)	Percentage of Portfolio Savings	Program Marketing	Percentage of Total Marketing	Combined Savings & Marketing (AxB)	Percentage of Combined Savings & Marketing
Lighting	38,349	40.4%	$45,000	5.6%	2.3%	5.9%
Efficient Products	2,940	3.1%	$97,882	12.2%	0.4%	1.0%
HVAC	**44,661**	**46.9%**	**$608,571**	**75.6%**	**35.4%**	**92.4%**
Smart Thermostats	3,732	3.9%	$52,530	6.5%	0.3%	0.7%
EE Kits	5,478	5.8%	$1,479	0.2%	0.0%	0.0%
Total	**95,249**	**100%**	**$805,462**	**100%**	**38.3%**	**100%**

Using the Market Budget and Program Size allocation method, Cadmus distributed the portfolio-level result of 19,446 MWh NPSO to each of Ameren Missouri's residential programs. As shown in Table 53**,** the results of this approach reflected each program's impact on the nonparticipant population, proxied by the combined effect of marketing expenditures and program savings. The HVAC program achieved 92.4% of the total NPSO, at 17,977 MWh.

Table 53. NPSO by Program

Program	Program Gross Savings (MWh)	Total NPSO (MWH)	Percent of Combined Savings/Marketing	Program-Specific NPSO (MWh)
Lighting	38,349		5.9%	1,144
Efficient Products	2,940		1.0%	190
HVAC	**44,661**	**19,446**	**92.4%**	17,977
Smart Thermostats	3,732		0.7%	130
EE Kits	5,478		0.0%	5
Total	**95,249**		**100%**	**19,446**

Heating and Cooling Program-Specific Nonparticipant "Like" Spillover

To understand whether Ameren Missouri's HVAC Program influenced energy efficiency heating and cooling equipment market sales (in addition to units sold through the Heating and Cooling Incentive

Program), the team applied the PY13, PY15, and PY16 distributors' sales data to estimate overall market shares of energy-efficient HVAC equipment. Additionally, the team interviewed 10 participating PY16 residential HVAC contractors, seeking to estimate the program's influence on energy-efficient HVAC equipment sales in 2016.

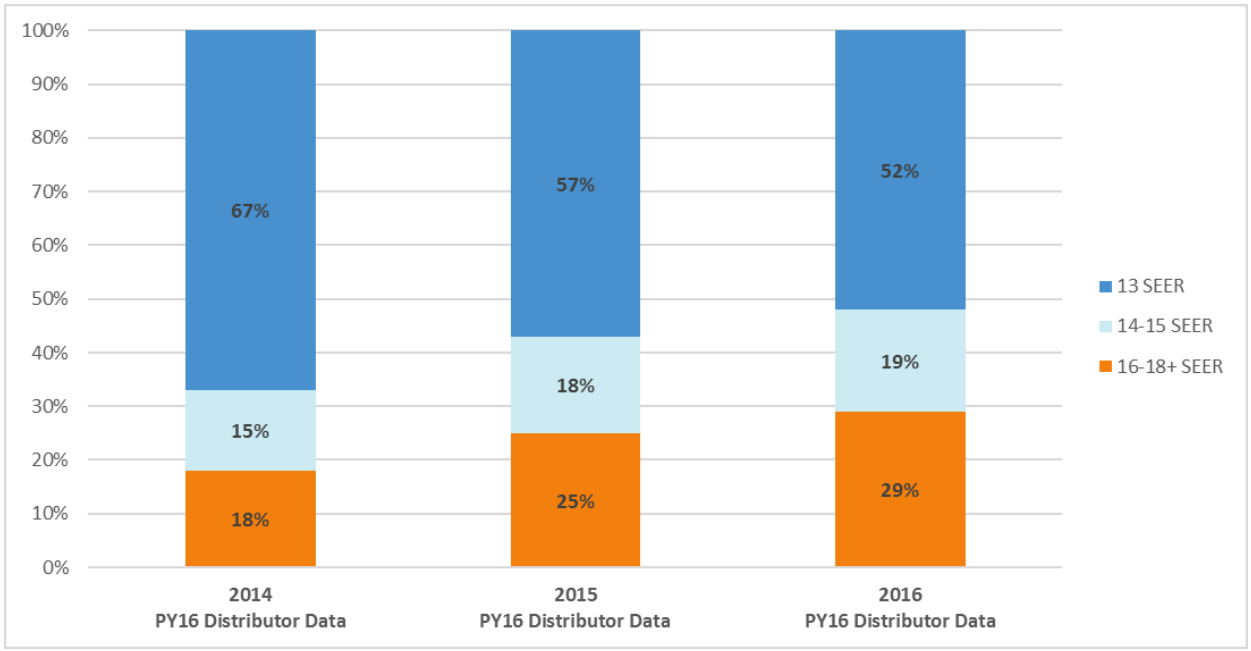
PY16 Distributor Data

In February 2017, the team collected high-level sales data from five distributors. As shown in Table 54 and Figure 36, distributor sales data indicated shares of 13 SEER units decreased from 67% of overall sales in 2014 to 52% in 2016, while sales of SEER 14 to 18+ increased. Units with SEER ratings of 16 to 18+ achieved the largest increases.

Table 54. Distributor Sales by SEER Level and Year for PY16

SEER	2014 PY16 Distributor	2015 PY16 Distributor	2016 PY16 Distributor
13	67% (n=17,796)	57% (n=15,993)	52% (n=15,401)
14-15	15% (n=3,856)	18% (n=4,963)	19% (n=5,758)
16-18+	18% (n=4,867)	25% (n=6,906)	29% (n=8,743)
Total Yearly HVAC Sales (split ACs and HPs)	**100% (n=26,519)**	**100% (n=27,862)**	**100% (n=29,902)**

Figure 36. Distributor Sales by SEER Level and Year for PY16



PY13 and PY16 Distributor Data

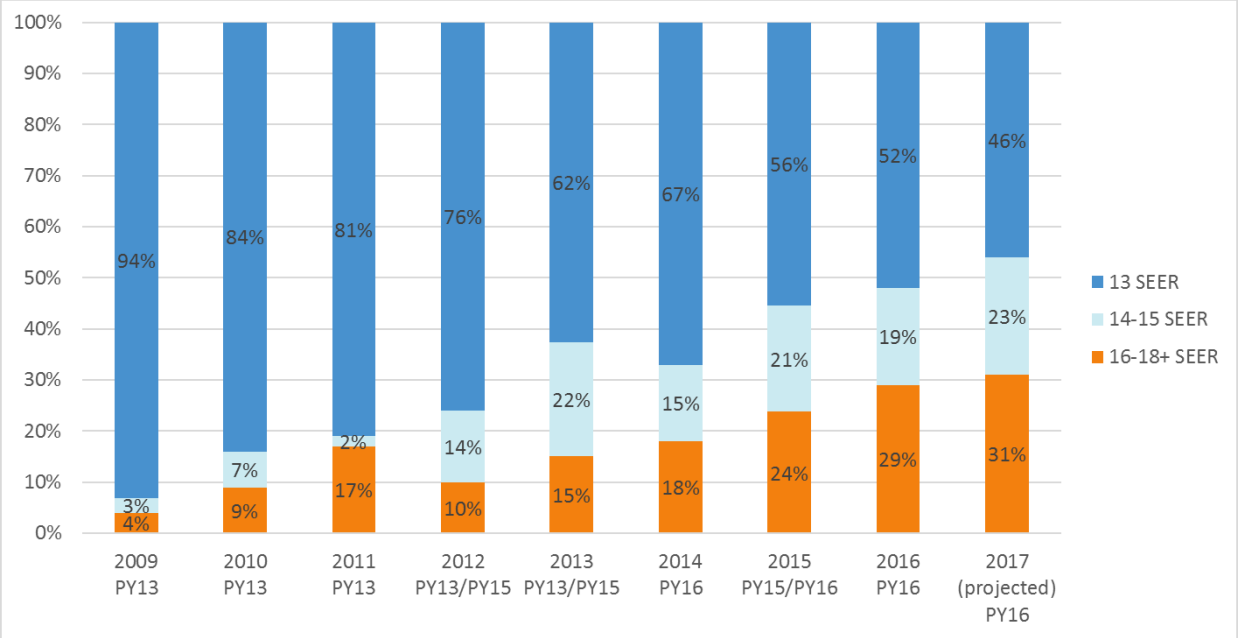
Figure 37 compares all data collected from distributors for PY13, PY15, and PY16, revealing the following:

- The number of units sold by SEER level from 2009 through 2016

- Distributors' reported sales projections for PY17

The PY13 data cover the years 2009 through 2013, while the PY15 data cover 2012, 2013, and 2015. PY16 data cover a single year. The datasets show the percentage of 13 SEER units decreasing year-over-year, with the maximum at 94% market share for 13 SEER units reported in 2009 and the minimum at 52% market share for 13 SEER units reported in 2016. While the team only 2016 market shares for HVAC nonparticipant like spillover (discussed below), results from 2009 through 2016 showed consistent trends, reflecting a lack of program activity in 2012 and increasing program effects for each year the program continued.

Figure 37. Combined Distributor Data from PY13, PY15, and PY16 by SEER Level and Year*



*This derives from combined sales distribution data for PY13 (n=4,439) and from one distributor; PY15 (n=63,366) from four distributors; and PY16 (n=32,187). It cannot be considered representative of all distributor types or systems, makes and models, or Ameren Missouri's service territory.

Contractor Data

Cadmus asked contractors to rate the importance of different factors in influencing sales of efficient ACs and HPs (both program and nonprogram) in Ameren Missouri's program territory. The team asked contractors to allocate this importance, on a scale of zero to 100% for product availability, marketing, contractor training, customer education, pricing, and any other factors volunteered by the contractor. The combined percentages attributed to all factors equaled 100% of sales. These factors were defined as follows:

- Product Availability: contractor's ability to order efficient products to then sell to their customers.
- Training: education for technicians and contractors about efficient CAC's and HP's to ensure they are able to assist customers with their residential HVAC purchases.

- Customer Education: education for consumers about the benefits of efficient residential HVAC purchases.
- Market Factor: any effort, whether local or national, aimed at promoting energy efficient ACs or heat pumps, such as changes to codes and standard requirements or energy legislation.
- Pricing Factor: the effect of efficient equipment price relative to the price of lower efficiency products.
- Other Factor: to be identified by interviewees

The team then asked contractors to estimate, as a percentage (between zero and 100%), the program's influence on each market factor. For example, a contractor might say that customer education efforts resulted in 5% (of 100%) of all market factors on their energy efficient AC and HP sales, while the program may be responsible for 100% of the customer education within Ameren Missouri's territory.

- To guide each contractor's estimation, the team provided the contractor with detailed information about Ameren Missouri's efforts to influence each market factor, with these efforts summarized as follows:
- Product Availability: Ameren Missouri's activities designed to increase availability of energy-efficient residential HVAC equipment
- Marketing: Ameren Missouri's activities designed to raise awareness of the Residential HVAC program and of the rebates and tax credits
- Contractor Training: Ameren's program requirements designed to ensure that contractors understood the program's processes and activities additional, optional, technical HVAC training
- Customer Education: Ameren Missouri's activities designed to provide customers with a program overview, along with specific rebates available
- Pricing: rebates Ameren Missouri provided to reduce the cost differential between high-AC and HP equipment and lower-efficiency products
- Other: Ameren Missouri's influence on any other factors identified by interviewees

For each contractor, the team multiplied the relative importance of each market factor by the rated program influence, and summed the results for each factor to reach an attribution percentage for each contractor. The team then weighted the 10 contractor attribution percentages by their total program sales to determine the 49.3% program-weighted attribution percentage shown in Table 56 (below).

Findings

Using Ameren Missouri's total customer count and the CAC/HP saturation percentage, Cadmus estimated the market for CAC and HP units replaced annually (assuming burnout occurs linearly throughout the effective useful life [EUL] of all units). As shown in Table 55, the team estimated the PY16 market size for CACs and HPs as approximately 51,115 units. With 11,675 program participants in 2016, the program affected approximately 23% of the overall market for new CACs and HPs.

Table 55. Total CAC and HP Market

Line	Input	Value	Source
1	Residential Customers	1,049,168	Provided by Ameren Missouri, December 2016 (from Data Warehouse)
2	CAC/HP Saturation	87%	Provided by Ameren Missouri
3	EUL	18	Ameren Missouri TRM (for New Systems, pg. 11)
4	1/EUL (number of units that die each year)	5.6%	1/Line 3 (EUL)
5	"Replaceable" Units/Year	51,115	Line 1 * Line 2 * Line 4

To determine the total nonparticipant like spillover generated by the program from 2016, the team used the input variables shown in Table 56.

Table 56. Nonparticipant Like Spillover Input Variables Summary

Variable	Input	Value	Notes
A	Annual CAC Market per Year	51,115	See Table 55
B	PY16 Market Share of Distributor Sales Above SEER 13	48%	2016 Distributor Data
C	PY16 Annual Program Sales	11,675	Cadmus. *Ameren Missouri HVAC Program Impact and Process Evaluation: Program Year 2016.* April 29, 2017. (Table 1)
D	Average CAC/HP Contractor Attribution Percentage	49.3%	2016 Contractor Interviews
E	Weighted Average CAC/HP Unit Savings (kWh/unit)	384	Cadmus. *Ameren Missouri HVAC Program Impact and Process Evaluation: Program Year 2016.* April 29, 2017. (Table 1)
F	Program Savings (kWh)	44,660,826	Cadmus. *Ameren Missouri HVAC Program Impact and Process Evaluation: Program Year 2016.* April 29, 2017. (Table 1)

To estimate the HVAC nonparticipant like spillover percentage (Variable M in Table 57), the team used input variables from Table 56 to estimate nonprogram sales of energy-efficient CAC and HP units above 13 SEER. The team also applied the contractor interviews' attribution results to differentiate naturally occurring nonprogram sales to those influenced by the program. Table 57 sets forth these calculations.

Table 57. Nonparticipant Like Spillover Analysis

Variable	Input	Value	Source
G	Total PY16 Distributor Sales Above SEER 13	24,535	A * B
H	PY16 Annual Program Sales	11,675	C
I	PY16 Nonprogram Sales Above SEER 13	12,860	G – H
J	Count of Naturally Occurring Sales	12,439	G * 1-D
K	Count of Nonparticipant Like Spillover Sales	384	I – J
L	Nonparticipant Like Spillover Savings (kWh)	161,788	K * E
M	% Nonparticipant Like Spillover	0.4%	L / F

Using this information, the team estimated overall HVAC nonparticipant like spillover as 0.4% of total, PY16-reported, *ex post* gross savings; this value represents over 161 MWh of savings.

According to distributor sales data, the relative proportion of high-efficiency units has steadily increased from 2012 to 2016, with distributors reporting a drop in 13 SEER units (from 76% of all sales in 2012 to only 52% in 2016) while SEER 16 to 18 units generally increase. Notably, distributors estimated that their 2017 share of 13 SEER units will further decrease to 46% of all sales.

Benchmarking

Cadmus selected four similar programs to compare with Ameren Missouri's Heating and Cooling program. The team conducted secondary research using its benchmarking database, E-Source, and publicly available evaluation reports to identify programs with the most recent evaluations available and containing information regarding metrics and topics for planned benchmarking. Table 58 compares the following:

- Measures offered (early replacement and replace on burnout)
- SEER/EER levels
- Measure incentive ranges
- Annual gross per-unit energy savings (kWh/yr)
- Annual gross per-unit demand savings (kW/yr)

Table 58. Residential HVAC Program Measure Comparisons*

Utility	Year	Program	SEER/ EER	Incentive Range	Evaluated Gross Per-Unit Energy Savings (kWh/yr)	Evaluated Gross Per-Unit Demand Savings (kW/yr)	Net-to-Gross Ratio (excluding NPSO)
Early Replacement ASHPs							
Ameren Missouri	2016	Heating and Cooling Program	15 to 16	$500-$800	4,221 -10,749**	1.9-4.8	97.1%
			16+	$600 -$900	5,406 -12,449**	2.4-5.5	
Dayton Power and Light	2015	Residential Heating and Cooling Program	14 to 16	$400	3,093	0.4	N/A
			16+	$600	3,301	0.44	
PPL Electric Utilities	2015-2016	Residential Home Comfort	15 to16	$200	875	N/A	68% (FR=39%, SO=7%)
Vectren Indiana	2014	Residential HVAC Program	16+	$400	1,082	0.47	50%
Replace on Burnout ASHPs							
Ameren Missouri	2016	Heating and Cooling Program	15 to 16	$500-$800	820 -8,520**	0.4 - 3.8	97.1%
			16+	$600 -$900	1,587-11,348**	0.7-5.0	
Dayton Power and Light	2015	Residential Heating and Cooling Program	14 to 16	$400	964	0.14	N/A
			16+	$600	1,454	0.17	
PPL Electric Utilities	2015-2016	Residential Home Comfort	15 to 16	$200	875	N/A	68% (FR=39%, SO=7%)
Vectren Indiana	2014	Residential HVAC Program	16+	$400	984	0.37	50%
Early Replacement CACs							
Ameren Missouri	2016	Heating and Cooling Program	14	$300	1,633	1.49	84.6%
			15	$400	1,923	1.75	
			16	$500	1,922	1.75	
Arizona Utility	2016	Residential HVAC Program	15	$200-400	2,299	N/A	53% (FR=51%, SO=4%)
			16		2,478	N/A	
			17		2,692	N/A	
			18+		3,237	N/A	
Dayton Power and Light	2015	Residential Heating and Cooling Program	14 to16	$200	1,089	0.44	N/A
			16+	$600	1,246	0.51	
PPL Electric Utilities	2015-2016	Residential Home Comfort Program	16+	$250	264	N/A	47% (FR=58%, SO=5%)
Vectren Indiana	2014	Residential HVAC Program	16+	$300	355	0.45	50%

Utility	Year	Program	SEER/ EER	Incentive Range	Evaluated Gross Per-Unit Energy Savings (kWh/yr)	Evaluated Gross Per-Unit Demand Savings (kW/yr)	Net-to-Gross Ratio (excluding NPSO)
Replace on Burnout CACs							
Ameren Missouri	2016	Heating and Cooling Program	14	$250	323	0.29	84.6%
			15	$275	342	0.31	
			16	$300	368	0.34	
Arizona Utility	2016	Residential HVAC Program	15	$200-$400	713	N/A	53% (FR=51%, SO=4%)
			16		828	N/A	
			17		1,149	N/A	
			18+		1,313	N/A	
Dayton Power and Light	2015	Residential Heating and Cooling Program	14 to 16	$200	196	0.12	N/A
			16+	$600	223	0.09	
PPL Electric Utilities	2015-2016	Residential Home Comfort	16+	$250	264	N/A	47% (FR=58%, SO=5%)
Vectren Indiana	2014	Residential HVAC Program	16+	$300	320	0.43	50%
Early Replacement GSHPs							
Ameren Missouri	2016	Heating and Cooling Program	14+	$2,000	12,702-25,345**	5.6-11.3	94.6%
			23+	$800	7,953	3.5	
Dayton Power and Light	2015	Residential Heating and Cooling Program	16 to 18	$80.00/ton	7,092	0.36	N/A
			19+		6,773	0.45	
Replace on Burnout GSHPs							
Ameren Missouri	2016	Heating and Cooling Program	14+	$2,000	23,251**	10.3	94.6%
			23+	$800	3,646	1.6	
Dayton Power and Light	2015	Residential Heating and Cooling Program	16 to 18	$80.00/ton	6,984	0.25	N/A
			19+		6,713	0.5	

*PPL Electric Utilities did not distinguish between early replacement and replace on burnout when reporting energy savings, though offering both for ASHP and CAC units.

** Electric resistance baseline heating requirement is unique to Ameren Missouri resulting in significantly higher savings for these measures.

References

In conducting the benchmarking research, the Cadmus team used the following reports:

- Cadmus. 2016. "Pennsylvania Act 129 of 2008 Energy Efficiency and Conservation Plan." Prepared for PPL Electric Utilities.
- Cadmus. 2015. "2014 Core Plus Evaluation." Prepared for Vectren Energy Delivery of Indiana.
- Cadmus. 2016. "2015 Evaluation, Measurement, and Verification Report." Prepared for Dayton Power and Light.

Cost-Effectiveness

Ameren Missouri assessed cost-effectiveness using the following five tests, as defined by the California Standard Practice Manual:[21]

- Total Resource Cost (TRC) Test
- Utility Cost Test (UCT)
- Ratepayer Impact Measure (RIM)
- Participant Test (PART)
- Societal Test

DSMore takes hourly prices and hourly energy savings from specific measures installed through the Heating and Cooling program, and correlates prices and savings to 33 years of historic weather data. Using long-term weather ensures that the model captures low-probability, high-consequence weather events, and appropriately values these. As a result, the model produces an accurate evaluation of the demand-side efficiency measure relative to other alternative supply options.

Key assumptions include the following:

- Discount Rate = 6.46%
- Line Losses = 5.72%
- Summer Peak would occur during the 16th hour of a July weekday, on average
- Avoided Electric T&D = $23.03/kW in 2016 and growing at a rate of 2% annually for the next 24 years
- Escalation rates for different costs occur at the component level, with separate escalation rates for fuel, capacity, generation, T&D, and customer rates carried out over 25 years

Ameren Missouri used evaluation results as model inputs (e.g., PY16-specific Heating and Cooling program participation counts, per-unit gross savings, NTG, NPSO).

Particularly, measure load shapes drove model assumptions, as indicated when the model should apply savings during the day. This ensured that the load shape for an end use matched the system peak impacts of that end use, and provided the correct summer coincident savings. Ameren Missouri used measure lifetime assumptions and incremental costs based on the program database, the Ameren Missouri TRM, or the original Batch Tool.

A key step in the analysis process required PY16 Ameren Missouri program-spending data: actual spending, broken down into contractor administration, incentives, and marketing costs. Ameren

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

Missouri applied contractor administration, marketing, and other costs —including R&D, EM&V, Educational Outreach, Portfolio Administration, Potential Study, and Data Tracking— at the program level, while incentives were applied at the measure level.

Table 59 summarizes cost-effectiveness findings by test. Any benefit-cost score of 1.0 or higher passed the test as cost-effective. As shown, the Heating and Cooling program passed the UCT, TRC, Societal, and PART tests.

Table 59. Cost-Effectiveness Results (PY16)

Program	UCT	TRC	RIM	Societal	PART
Heating and Cooling	7.47	4.01	0.86	5.56	5.74

Appendix A. End-Use Load Shapes and Coincidence Factors

Appendix E

End-Use Category Energy Load Shapes

% Energy by Month

	Residential End-Use Category Load Shape								
Month	**Building Shell**	**Cooling**	**Freezer**	**HVAC**	**Lighting**	**Miscellaneous**	**Pool Spa**	**Refrigeration**	**Water Heating**
January	11.1297%	0.1200%	7.9579%	11.1297%	10.1182%	8.4893%	8.6451%	7.7053%	10.3527%
February	9.3077%	0.1100%	7.2518%	9.3077%	8.8441%	7.7366%	7.1145%	7.2169%	9.0720%
March	7.0042%	0.3130%	8.1080%	7.0042%	9.2879%	8.4863%	8.6052%	8.0272%	9.5543%
April	3.7116%	1.5047%	7.9918%	3.7116%	8.4645%	8.2144%	8.0702%	7.8752%	8.4799%
May	4.0888%	6.5410%	8.4083%	4.0888%	7.9393%	8.4847%	8.6052%	8.5646%	8.3600%
June	10.3973%	21.0823%	8.5730%	10.3973%	6.8508%	8.2122%	8.0702%	8.9112%	7.7065%
July	14.0100%	28.4780%	9.6095%	14.0100%	6.7864%	8.4883%	8.6451%	9.4239%	6.7712%
August	13.3207%	27.0766%	9.6095%	13.3207%	7.0565%	8.4840%	8.5653%	9.4212%	6.3688%
September	6.6759%	12.6605%	8.4277%	6.6759%	7.3792%	8.2136%	8.3032%	8.4971%	6.9373%
October	3.7011%	1.8472%	8.2582%	3.7011%	8.4539%	8.4869%	8.6052%	8.5653%	7.9644%
November	5.9593%	0.1444%	7.8465%	5.9593%	8.9880%	8.2122%	8.1088%	7.8717%	8.4752%
December	10.6937%	0.1222%	7.9579%	10.6937%	9.8312%	8.4915%	8.6619%	7.9204%	9.9577%

End-Use Category Energy to Coincident Peak Demand Factors

	Building Shell	**Cooling**	**Freezer**	**HVAC**	**Lighting**	**Miscellaneous**	**Pool Spa**	**Refrigeration**	**Water Heating**
	0.0004660805	0.0009474181	0.0001685722	0.0004660805	0.0001492529	0.0001148238	0.0002354459	0.0001285253	0.0000887318

Source: Ameren Missouri 2016-2018 Energy Efficiency Plan. MPSC file number EO-2015-0055 Appendix E to evaluated energy savings.

Appendix B. Free Ridership Scoring Tables

Table 60 illustrates how initial survey responses are translated into whether the response is "yes," "no," or "partially" indicative of free ridership (in parentheses). The value in brackets is the scoring decrement associated with each response option. Each participant free ridership score starts with 100%, which we decrement based on their responses to the eight questions, as show in Table 60.

Table 60. Raw Survey Responses Translation to Free Ridership Scoring Matrix Terminology

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE]?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?
Yes (Yes) [-0%]	I wanted the cheapest option available (Yes) [-0%]	Around the same time (Yes) [-0%]	Yes (Yes) [-0%]	I would have installed a different high-efficiency air conditioning system (Yes) [-0%]	Lower efficiency (No) [-100%]	Very important (No) [-50%]	Very important (No) [-50%]
No (No) [-50%]	I wanted the most efficient option possible (Yes) [-0%]	Later in the same year (Partial) [-25%]	No (No) [-0%]	I would have decided not to purchase a high-efficiency air conditioning system at all (No) [-100%]	Same efficiency (Yes) [-0%]	Somewhat important (Partial) [-25%]	Somewhat important (Partial) [-25%]
Don't Know (Partial) [-25%]	I researched my options and decided this was the right balance of efficiency and cost (Yes) [-0%]	In one or two years (No) [-100%]	Don't Know (Partial) [-0%]	Don't Know (Partial) [-25%]	Higher efficiency (Yes) [-0%]	Not very important (Partial) [-25%]	Not very important (Partial) [-25%]
	My contractor convinced me this was the right balance of efficiency and cost (No) [-50%]	After more than three years (No) [-100%]			Don't Know (Partial) [-25%]	Not at all important (Yes) [-0%]	Not at all important (Yes) [-0%]
	I heard Ameren Missouri provided an incentive for this efficiency (No) [-50%]	Don't Know (Partial) [-25%]				Don't Know (Partial) [-25%]	Don't Know (Partial) [-25%]

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE]?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?
	It's the same efficiency as my old unit (Yes) [-0%]						
	I wanted something more efficient than my old unit (Yes) [-0%]						
	Don't Know (Partial) [-25%]						

Below, we illustrate the unique response combinations from air-source heat pump participants answering the Ameren Missouri Heating and Cooling Program free ridership survey questions (actual responses mapped to "yes," "no," or "partial," as indicative of free ridership); the free ridership score assigned to each combination; and the number of responses (see Table 61).

Table 61. Frequency of ASHP Free Ridership Scoring Combinations

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE] …?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed…?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say…?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?	FR Score	Count
Yes	Yes	Yes	Yes	x	x	Yes	Yes	100%	1
Yes	Yes	Yes	Yes	x	x	Yes	No	50%	1
Yes	Yes	Yes	Yes	x	x	Partial	Partial	50%	1
Yes	Yes	Yes	Yes	x	x	Partial	No	25%	4
Yes	Yes	Yes	Yes	x	x	No	No	12.5%	2
Yes	Yes	Yes	Partial	Partial	x	Partial	No	12.5%	1
Yes	Yes	Yes	No	Yes	Yes	No	No	12.5%	1
Yes	Yes	Partial	Partial	Partial	x	No	No	0%	1
Yes	Yes	Partial	No	No	x	x	x	0%	1
Yes	Yes	No	x	x	x	x	x	0%	2
Yes	No	Yes	Yes	x	x	Partial	Partial	12.5%	2
Yes	No	Yes	Yes	x	x	Partial	No	0%	10
Yes	No	Yes	Yes	x	x	No	No	0%	4
Yes	No	Yes	Partial	Partial	x	Partial	No	0%	1
Yes	No	Yes	No	Yes	Yes	No	Partial	0%	1
Yes	No	Partial	Yes	x	x	Yes	No	0%	1
Yes	No	Partial	Yes	x	x	Partial	Partial	0%	1
Yes	No	Partial	No	Yes	No	x	x	0%	2
Yes	No	Partial	No	No	x	x	x	0%	2
Yes	No	No	x	x	x	x	x	0%	3
Partial	Yes	Partial	Yes	x	x	Partial	Partial	12.5%	1
Partial	No	Yes	Partial	Partial	x	Partial	Partial	0%	1
Partial	No	Yes	Partial	Partial	x	Partial	No	0%	1
Partial	No	Partial	Partial	Partial	x	Partial	Partial	0%	1
Partial	No	Partial	No	No	x	x	x	0%	1
Partial	No	No	x	x	x	x	x	0%	2
No	Yes	Yes	Yes	x	x	Partial	Partial	12.5%	1
No	Yes	Yes	Yes	x	x	Partial	No	0%	2
No	Yes	Yes	Yes	x	x	No	No	0%	1
No	Yes	Yes	Partial	Yes	Partial	No	No	0%	1
No	Yes	Partial	Yes	x	x	Partial	No	0%	1
No	Yes	Partial	Partial	Partial	x	No	No	0%	1
No	Yes	Partial	No	Yes	No	x	x	0%	1
No	Yes	Partial	No	No	x	x	x	0%	2
No	Yes	No	x	x	x	x	x	0%	1
No	Partial	Partial	No	Partial	x	Partial	Partial	0%	1
No	No	Yes	Yes	x	x	Yes	No	0%	2
No	No	Yes	Yes	x	x	Partial	Partial	0%	1
No	No	Yes	Yes	x	x	Partial	No	0%	7
No	No	Yes	No	No	x	x	x	0%	1
No	No	Partial	Yes	x	x	Partial	No	0%	2
No	No	Partial	Yes	x	x	No	No	0%	1
No	No	Partial	Partial	Partial	x	Partial	Partial	0%	1
No	No	Partial	Partial	Partial	x	No	No	0%	1
No	No	Partial	Partial	No	x	x	x	0%	2
No	No	Partial	No	Yes	Yes	Partial	No	0%	1
No	No	Partial	No	Yes	No	x	x	0%	1
No	No	Partial	No	Partial	x	Partial	No	0%	1
No	No	Partial	No	No	x	x	x	0%	3
No	No	No	x	x	x	x	x	0%	12

Below, we illustrate the unique response combinations from central air conditioner participants answering the Ameren Missouri Heating and Cooling Program free ridership survey questions (actual responses mapped to "yes," "no," or "partial," as indicative of free ridership); the free ridership score assigned to each combination; and the number of responses (see Table 62).

Table 62. Frequency of CAC Free Ridership Scoring Combinations (Part 1)

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE] ...?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed...?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say...?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?	FR Score	Count
Yes	Yes	Yes	Yes	x	x	Yes	Partial	75%	10
Yes	Yes	Yes	Yes	x	x	Yes	No	50%	2
Yes	Yes	Yes	Yes	x	x	Partial	Partial	50%	47
Yes	Yes	Yes	Yes	x	x	Partial	No	25%	39
Yes	Yes	Yes	Yes	x	x	No	Partial	25%	5
Yes	Yes	Yes	Yes	x	x	No	No	12.5%	17
Yes	Yes	Yes	Partial	Yes	Yes	Partial	Partial	50%	2
Yes	Yes	Yes	Partial	Yes	Yes	Partial	No	25%	2
Yes	Yes	Yes	Partial	Yes	Yes	No	Partial	25%	1
Yes	Yes	Yes	Partial	Yes	Partial	Partial	No	12.5%	1
Yes	Yes	Yes	Partial	Yes	No	x	x	0%	2
Yes	Yes	Yes	Partial	Partial	x	Partial	Partial	25%	3
Yes	Yes	Yes	Partial	Partial	x	Partial	No	12.5%	2
Yes	Yes	Yes	No	Yes	Yes	No	No	12.5%	3
Yes	Yes	Yes	No	Yes	Partial	No	No	0%	1
Yes	Yes	Yes	No	Yes	No	x	x	0%	1
Yes	Yes	Yes	No	Partial	x	Partial	Partial	25%	1
Yes	Yes	Yes	No	Partial	x	Partial	No	12.5%	1
Yes	Yes	Yes	No	No	x	x	x	0%	1
Yes	Yes	Partial	Yes	x	x	Partial	Partial	25%	7
Yes	Yes	Partial	Yes	x	x	Partial	No	12.5%	4
Yes	Yes	Partial	Yes	x	x	No	Partial	12.5%	2
Yes	Yes	Partial	Yes	x	x	No	No	0%	1
Yes	Yes	Partial	Partial	Yes	Yes	Partial	Partial	25%	2
Yes	Yes	Partial	Partial	Yes	No	x	x	0%	1
Yes	Yes	Partial	Partial	Partial	x	Partial	Partial	12.5%	4
Yes	Yes	Partial	Partial	Partial	x	Partial	No	0%	1
Yes	Yes	Partial	Partial	Partial	x	No	No	0%	1
Yes	Yes	Partial	No	Yes	No	x	x	0%	2
Yes	Yes	Partial	No	Partial	x	Partial	No	0%	2
Yes	Yes	Partial	No	Partial	x	No	Partial	0%	1
Yes	Yes	Partial	No	Partial	x	No	No	0%	1
Yes	Yes	Partial	No	No	x	x	x	0%	2
Yes	Yes	No	x	x	x	x	x	0%	19
Yes	Partial	Partial	Yes	x	x	Partial	No	0%	1
Yes	Partial	Partial	Partial	Partial	x	Yes	Partial	12.5%	1
Yes	No	Yes	Yes	x	x	Yes	Yes	50%	1
Yes	No	Yes	Yes	x	x	Yes	Partial	25%	2
Yes	No	Yes	Yes	x	x	Yes	No	12.5%	15
Yes	No	Yes	Yes	x	x	Partial	Partial	12.5%	28
Yes	No	Yes	Yes	x	x	Partial	No	0%	77
Yes	No	Yes	Yes	x	x	No	Partial	0%	1
Yes	No	Yes	Yes	x	x	No	No	0%	31
Yes	No	Yes	Partial	Yes	Yes	Partial	No	0%	1
Yes	No	Yes	Partial	Yes	Yes	No	No	0%	1
Yes	No	Yes	Partial	Yes	Partial	Partial	No	0%	3
Yes	No	Yes	Partial	Yes	No	x	x	0%	4
Yes	No	Yes	Partial	Partial	x	Partial	Partial	0%	4
Yes	No	Yes	Partial	Partial	x	Partial	No	0%	6
Yes	No	Yes	Partial	Partial	x	No	Partial	0%	1
Yes	No	Yes	Partial	Partial	x	No	No	0%	3
Yes	No	Yes	No	Yes	Yes	No	No	0%	3
Yes	No	Yes	No	Yes	No	x	x	0%	6
Yes	No	Yes	No	Partial	x	Partial	Partial	0%	1
Yes	No	Yes	No	Partial	x	Partial	No	0%	2
Yes	No	Yes	No	Partial	x	No	No	0%	2
Yes	No	Yes	No	No	x	x	x	0%	6
Yes	No	Partial	Yes	x	x	Yes	Partial	12.5%	1
Yes	No	Partial	Yes	x	x	Partial	Partial	0%	6
Yes	No	Partial	Yes	x	x	Partial	No	0%	11
Yes	No	Partial	Yes	x	x	No	No	0%	5
Yes	No	Partial	Partial	Yes	Yes	Partial	No	0%	2
Yes	No	Partial	Partial	Yes	Yes	No	Partial	0%	1
Yes	No	Partial	Partial	Yes	Partial	Partial	No	0%	1
Yes	No	Partial	Partial	Yes	Partial	No	No	0%	1
Yes	No	Partial	Partial	Partial	x	Partial	Partial	0%	5
Yes	No	Partial	Partial	Partial	x	Partial	No	0%	4
Yes	No	Partial	Partial	Partial	x	No	Partial	0%	1
Yes	No	Partial	Partial	Partial	x	No	No	0%	4
Yes	No	Partial	No	Yes	No	x	x	0%	1
Yes	No	Partial	No	Partial	x	Partial	No	0%	2
Yes	No	Partial	No	Partial	x	No	No	0%	1
Yes	No	Partial	No	No	x	x	x	0%	4
Yes	No	No	x	x	x	x	x	0%	44

Table 62. Frequency of CAC Free Ridership Scoring Combinations (Part 2)

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE] …?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed…?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say…?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?	FR Score	Count
Partial	Yes	Yes	Yes	x	x	Partial	No	12.5%	1
Partial	Yes	Yes	Yes	x	x	No	No	0%	1
Partial	Yes	Yes	Partial	Partial	x	Partial	Partial	12.5%	1
Partial	Yes	Yes	No	No	x	x	x	0%	1
Partial	Yes	Partial	Yes	x	x	Partial	No	0%	1
Partial	Yes	Partial	Partial	Yes	Yes	Partial	No	0%	1
Partial	Yes	Partial	Partial	Yes	Yes	No	No	0%	1
Partial	Yes	Partial	Partial	Partial	x	Partial	Partial	0%	3
Partial	Yes	Partial	Partial	Partial	x	Partial	No	0%	2
Partial	Yes	Partial	No	Partial	x	Partial	No	0%	1
Partial	Yes	No	x	x	x	x	x	0%	9
Partial	Partial	Yes	Yes	x	x	Partial	Partial	12.5%	1
Partial	No	Yes	Yes	x	x	Partial	Partial	0%	1
Partial	No	Yes	Yes	x	x	Partial	No	0%	2
Partial	No	Yes	Yes	x	x	No	No	0%	1
Partial	No	Yes	Partial	Partial	x	Partial	No	0%	3
Partial	No	Yes	Partial	No	x	x	x	0%	1
Partial	No	Yes	No	Yes	No	x	x	0%	1
Partial	No	Yes	No	Partial	x	No	No	0%	1
Partial	No	Partial	Yes	x	x	Partial	Partial	0%	3
Partial	No	Partial	Yes	x	x	Partial	No	0%	4
Partial	No	Partial	Yes	x	x	No	No	0%	1
Partial	No	Partial	Partial	Yes	Partial	Partial	Partial	0%	1
Partial	No	Partial	Partial	Partial	x	Partial	Partial	0%	6
Partial	No	Partial	Partial	Partial	x	Partial	No	0%	4
Partial	No	Partial	Partial	Partial	x	No	Partial	0%	1
Partial	No	Partial	Partial	Partial	x	No	No	0%	1
Partial	No	Partial	Partial	No	x	x	x	0%	1
Partial	No	Partial	No	Partial	x	Partial	Partial	0%	2
Partial	No	Partial	No	Partial	x	Partial	No	0%	1
Partial	No	Partial	No	Partial	x	No	No	0%	1
Partial	No	Partial	No	No	x	x	x	0%	2
Partial	No	No	x	x	x	x	x	0%	12
No	Yes	Yes	Yes	x	x	Yes	No	12.5%	2
No	Yes	Yes	Yes	x	x	Partial	Partial	12.5%	2
No	Yes	Yes	Yes	x	x	Partial	No	0%	6
No	Yes	Yes	Yes	x	x	No	No	0%	1
No	Yes	Yes	Partial	Partial	x	Partial	No	0%	1
No	Yes	Yes	Partial	No	x	x	x	0%	1
No	Yes	Yes	No	No	x	x	x	0%	1
No	Yes	Partial	Yes	x	x	Partial	Partial	0%	3
No	Yes	Partial	Yes	x	x	Partial	No	0%	7
No	Yes	Partial	Yes	x	x	No	No	0%	2
No	Yes	Partial	Partial	Yes	Yes	Partial	Partial	0%	1
No	Yes	Partial	Partial	Yes	Yes	Partial	No	0%	1
No	Yes	Partial	Partial	Partial	x	Partial	Partial	0%	4
No	Yes	Partial	Partial	Partial	x	Partial	No	0%	1
No	Yes	Partial	Partial	Partial	x	No	Partial	0%	1
No	Yes	Partial	Partial	Partial	x	No	No	0%	2
No	Yes	Partial	No	Yes	Yes	Partial	No	0%	1
No	Yes	Partial	No	Yes	Yes	No	No	0%	1
No	Yes	Partial	No	Partial	x	Partial	Partial	0%	4
No	Yes	Partial	No	Partial	x	No	Partial	0%	2
No	Yes	Partial	No	No	x	x	x	0%	3
No	Yes	No	x	x	x	x	x	0%	31
No	No	Yes	Yes	x	x	Yes	No	0%	6
No	No	Yes	Yes	x	x	Partial	Partial	0%	4
No	No	Yes	Yes	x	x	Partial	No	0%	10
No	No	Yes	Yes	x	x	No	No	0%	4
No	No	Yes	Partial	Yes	Yes	Partial	No	0%	1
No	No	Yes	Partial	Yes	Partial	Partial	No	0%	1
No	No	Yes	Partial	Yes	No	x	x	0%	2
No	No	Yes	Partial	Partial	x	Yes	No	0%	1
No	No	Yes	Partial	Partial	x	Partial	Partial	0%	1
No	No	Yes	Partial	Partial	x	Partial	No	0%	4
No	No	Yes	Partial	No	x	x	x	0%	1
No	No	Yes	No	Yes	Yes	Partial	No	0%	1
No	No	Yes	No	Yes	Yes	No	No	0%	1
No	No	Yes	No	Yes	No	x	x	0%	3
No	No	Yes	No	Partial	x	Partial	Partial	0%	1
No	No	Yes	No	Partial	x	Partial	No	0%	1
No	No	Yes	No	No	x	x	x	0%	5

Table 62. Frequency of CAC Free Ridership Scoring Combinations (Part 3)

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE] ...?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed...?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say...?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?	FR Score	Count
No	No	Partial	Yes	x	x	Yes	No	0%	1
No	No	Partial	Yes	x	x	Partial	Partial	0%	5
No	No	Partial	Yes	x	x	Partial	No	0%	12
No	No	Partial	Yes	x	x	No	No	0%	6
No	No	Partial	Partial	Yes	Yes	Partial	No	0%	2
No	No	Partial	Partial	Yes	Yes	No	No	0%	2
No	No	Partial	Partial	Yes	Partial	Partial	Partial	0%	1
No	No	Partial	Partial	Partial	x	Partial	Partial	0%	4
No	No	Partial	Partial	Partial	x	Partial	No	0%	6
No	No	Partial	Partial	Partial	x	No	Partial	0%	1
No	No	Partial	Partial	Partial	x	No	No	0%	2
No	No	Partial	Partial	No	x	x	x	0%	1
No	No	Partial	No	Yes	Yes	Partial	Partial	0%	1
No	No	Partial	No	Yes	Yes	Partial	No	0%	2
No	No	Partial	No	Yes	No	x	x	0%	2
No	No	Partial	No	Partial	x	Yes	Partial	0%	1
No	No	Partial	No	Partial	x	Partial	Partial	0%	2
No	No	Partial	No	Partial	x	Partial	No	0%	3
No	No	Partial	No	Partial	x	No	Partial	0%	1
No	No	Partial	No	Partial	x	No	No	0%	5
No	No	Partial	No	No	x	x	x	0%	5
No	No	No	x	x	x	x	x	0%	79

For central air conditioner respondents, the team adjusted the core freeridership score for 112 participants whose equipment installations qualified as early retirement. These 112 customers indicated they would have replaced their system at the same time without Ameren Missouri's program, indicating they were freeriders of the early retirement incentive Table 63 below shows the original freeridership score and the number of respondents adjusted to the 81% freeridership score that is reflective of freeridership associated with the early retirement incentive.The 81% freeriderhips score is equal to the ratio of replace on burnout and early retirement measure dispositions.

Table 63. Frequency of CAC Free Ridership Scoring Adjustments

Original Free Ridership Score	Number Adjusted to 81% Free Ridership Score
0%	59
12.5%	16
25%	16
50%	16
75%	5

Below, we illustrate the unique response combinations from ductless air-source heat pump participants answering the Ameren Missouri Heating and Cooling Program free ridership survey questions (actual responses mapped to "yes," "no," or "partial," as indicative of free ridership); the free ridership score assigned to each combination; and the number of responses (see Table 64).

Table 64. Frequency of Ductless ASHP Free Ridership Scoring Combinations

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE] …?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed…?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say…?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?	FR Score	Count
Yes	Yes	Yes	Yes	x	x	Partial	Partial	50%	1
Yes	Yes	Yes	Yes	x	x	Partial	No	25%	2
Yes	No	Yes	Yes	x	x	Yes	Partial	25%	1
Yes	No	Yes	Yes	x	x	Partial	Partial	12.5%	1
Yes	No	Yes	Yes	x	x	Partial	No	0%	3
Yes	No	Partial	No	Yes	No	x	x	0%	1
No	Yes	No	x	x	x	x	x	0%	1
No	No	Partial	Partial	Partial	x	Partial	No	0%	2

Below, we illustrate the unique response combinations from ground source heat pump participants answering the Ameren Missouri Heating and Cooling Program free ridership survey questions (actual responses mapped to "yes," "no," or "partial," as indicative of free ridership); the free ridership score assigned to each combination; and the number of responses (see Table 65).

Table 65. Frequency of GSHP Free Ridership Scoring Combinations

FR1. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new [MEASURE] this year?	FR2. You installed a [MEASUREEFFICIENCY] [MEASURE]. Why did you choose to install this particular unit?	FR3. Without Ameren Missouri's rebate, were you planning to install a [MEASURE] …?	FR4. [IF FR3 = 1, 2, 98, 99] Were you planning to install the same [MEASURE] without the rebate from Ameren Missouri?	FR5. [IF FR4= 2, 98, 99] Would you have installed a different [MEASURE] without the Ameren Missouri rebate or would you have decided to not purchase one at all?	FR6. [IF FR6= 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed…?	FR7. How important was the Ameren Missouri incentive on your decision to purchase the [MEASURE]? Would you say…?	FR8. How important was the advice from the contractor in your decision to purchase the [MEASURE]?	FR Score	Count
Yes	Yes	Yes	Yes	x	x	Partial	Partial	50%	2
Yes	Yes	Yes	Yes	x	x	Partial	No	25%	2
Yes	Yes	Yes	Yes	x	x	No	No	12.5%	1
Yes	Yes	No	x	x	x	x	x	0%	1
Yes	No	Yes	Yes	x	x	Partial	Partial	12.5%	2
Yes	No	Yes	Yes	x	x	Partial	No	0%	2
Yes	No	Partial	Yes	x	x	Partial	No	0%	1
Yes	No	Partial	No	No	x	x	x	0%	1
Yes	No	No	x	x	x	x	x	0%	1
Partial	Yes	Partial	Partial	Partial	x	Partial	Partial	0%	1
Partial	Yes	Partial	Partial	No	x	x	x	0%	1
Partial	No	No	x	x	x	x	x	0%	2
No	Yes	Partial	Yes	x	x	No	No	0%	1
No	Partial	Yes	Yes	x	x	Yes	No	0%	1
No	No	Partial	Yes	x	x	No	Partial	0%	1
No	No	Partial	No	Partial	x	Partial	No	0%	1
No	No	No	x	x	x	x	x	0%	2

Below, we illustrate the unique response combinations from dual-fuel heat pump participants answering the Ameren Missouri Heating and Cooling Program free ridership survey questions (actual responses mapped to "yes," "no," or "partial," as indicative of free ridership); the free ridership score assigned to each combination; and the number of responses (see Table 66).

Table 66. Frequency of DFHP Free Ridership Scoring Combinations

E16. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new high-efficiency air conditioning system this year?	E17. You installed a [MEASUREEFFICIENCY] central air conditioner. Why did you choose to install this particular unit?	E18. Without Ameren Missouri's rebate, were you planning to install a high-efficiency air conditioning system ...?	E19. [IF E18 = 1, 2, 98, 99] Were you planning to install the same high-efficiency air conditioning system without the rebate from Ameren Missouri?	E20. [IF E19 = 2, 98, 99] Would you have installed a different high-efficiency air conditioning system without the Ameren Missouri rebate or would you have decided to not purchase one at all?	E21. [IF E20 = 1] Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed...?	E22. How important was the Ameren Missouri incentive on your decision to purchase the high-efficiency air conditioning system? Would you say...?	E23. How important was the advice from the contractor in your decision to purchase the high-efficiency air conditioning system?	FR Score	Count
Yes	Yes	Yes	Yes	x	x	Partial	No	25%	1
Yes	Yes	No	x	x	x	x	x	0%	1
Yes	No	Yes	Yes	x	x	Partial	No	0%	1
Yes	No	Yes	Partial	Yes	Yes	Partial	No	0%	1
Partial	No	Partial	Partial	Partial	x	Partial	No	0%	1
No	Yes	Yes	Yes	x	x	Partial	No	0%	1
No	Yes	Partial	Partial	Partial	x	Partial	Partial	0%	1
No	Yes	Partial	No	No	x	x	x	0%	1
No	No	Yes	Yes	x	x	Partial	No	0%	1
No	No	Yes	Partial	Partial	x	Partial	No	0%	1

Appendix C. Stakeholder Interview Guide, Contractor Interview Guide, Immediate Participant Survey, Follow-up Participant Survey, Nonparticipant Spillover Survey Data

Ameren Missouri Heating and Cooling Program
Stakeholder Interview Guide (PY16)

Respondent name:_____

Respondent phone: _____

Interview date: _____ Interviewer initials: _____

In PY16 Cadmus will interview both Ameren and ICF Heating and Cooling program managers. The interview will focus on changes to the program design. The interview will also assess the program at year end and identify recommendations for improving the program in subsequent years.

Introduction

1. Please describe your roles and responsibilities.

2. Who do you coordinate with regarding the program? [Probe: internal and external program stakeholders]

    a. What types of communication do you have with these program stakeholders (i.e., formal or informal)? [Probe: frequency, satisfaction, challenges, etc.]

3. How does the program handle communication with participating contractors? [Probe: communication channels, frequency, satisfaction, challenges, etc.]

4. How has the program engaged with HVAC distributors this year? [Probe: communications channels, activities, frequency, objectives/goals of engagement]

Program Goals

5. Appendix B[1] showed that you anticipated installation of 30,059 measures and an estimated annual savings 31,399 MWh and 20.0 MW. Are these the correct PY16 program goals?

6. Does the program have any process or non-impact goals for PY16? [Probe: increased awareness, market transformation, spillover measures such as duct sealing or insulation]

7. In your opinion, how has the program performed in PY16 (in terms of both process and savings/participation goals)?

8. Why do you think this is?

Program Design and Implementation

[1] State of Missouri. "In the Matter of Union Electric Company d/b/a Ameren Missouri's 2nd Filing to Implement Regulatory Changes in Furtherance of Energy Efficiency as Allowed by MEEIA." File No. EO-2015-0055. February 5, 2016. Refer to Appendix B.

9. How, if at all, has the program changed from last year? [Probe: Incentive changes, changes to the measure mix, changes to program delivery, reason for not offering tune-ups, change to federal standard baseline for ASHP]

10. In your opinion, should any additional measures be considered for inclusion in future programs? If so, what measures? [Probe: ask about tune-ups, heat pump water heaters, and other measures that are on the Residential Program Measures list but not on the program, also if the program has considered GSHP desuperheaters and marketing new construction installation scenarios)

11. How does the program recruit contractors and encourage their participation?

12. What mechanisms are in place to allow contractors to provide feedback in regards to the program?

13. What training does ICF offer to contractors (what kind of topics are covered, has there been any specific focus in PY16, are elements of this training mandatory)?

    a. What are the goals of the training sessions?

    b. In what ways are the trainings effective in achieving their goals (if not, please describe how they may be improved)?

14. How do you believe the training, and contractor involvement in the program, impacts the region's standard HVAC diagnostic, sizing, and efficiency practices?

Quality Control

15. Please explain how the program's quality control process works.

16. Does the program have any procedures in place to verify that contractors correctly record the disposition and type of original customer equipment? If so, what are they?

Marketing Efforts

17. What kind of marketing have you done in PY16? [Probe: Distributor, contractor, customer]

Customer and Contractor Feedback

15. Are there any recurring or common customer or contractor praises or complaints? If so, what are they? [Probe: if customers request additional measures]

16. How are customers' and contractors' problems and questions dealt with?

17. Have you had many customers or contractors dissatisfied with the program? If so, why?

18. Do customers or contractors ask you to include measures in your program that you do not currently offer?

    a. How does this compare to previous program years?

19. What are the goals of your marketing strategies this year? How effective have the marketing strategies and activities been this year to meet their goals?

20. Do you have any plans to change marketing practices in the future?

Successes, Challenges, Suggestions for Improvement

21. What would you say is working particularly well so far in PY16? Why is that?

22. Conversely, what is not working as well as anticipated? Why is that?

23. Overall, do you have any suggestions for how to improve the program?

24. What changes are being planned or considered for PY17?

Summary

25. From your perspective, what are the biggest challenges facing the program in PY17?

Is there anything else you'd like us to know about your experience administrating/ implementing the program so far this year?

This sheet is for the interviewer to use.

	Blue cells are text that the interviewer will read out loud
	Orange cells are to be completed by Interviewer

Interviewer reads blue cells. Interviewer records data in orange cells.

	Contractor/Manufacturer
	Contact Name
	Date of Interview
	Hello, my name is _____ and I'm calling from Cadmus, an independent evaluator for Ameren Missouri's residential HVAC program. We are evaluating the program to identify what has or has not worked well to date. We would appreciate your perspective on the program and as a thank you for your time, we will send you a $50 Visa gift card. This survey will take about 25 minutes. It includes both questions about your experience with the residential HVAC program and questions about equipment sales for the business owner or manager. Are you the right person to talk to? Would you be willing to talk to us now, or may I set up a time to call you? [After they say YES] Thank you. [If needed: Anything you say is confidential and we will combine it with responses to similar questions provided by other participating contractors.]
Process and Satisfaction	
General	
	What were the main reasons you decided to participate in the residential HVAC Program? [READ RESPONSES, SELECT ALL THAT APPLY] *A) We saw the program marketing [If not mentioned ask if the program marketing has any influence]* *b) We saw our competitors marketing the program* *C) Customers asked for the program rebate* *D) Ameren Missouri / ICF recruited us to participate* *E) To provide rebates to customers* *F) To create additional business opportunities* *G) Competitive advantage* *H) It's the right thing to do* *I) Referred by a participating contractor* *j) We have participated in the past* *K) Referred by a participating distributor* *L) Other [SPECIFY: _____]*
	Did you encounter any barriers to participating in the program? [Probe: did you have to buy new equipment? Add staff/hours to handle paperwork?]
Marketing	
	Do you actively advertise the residential HVAC program, beyond telling customers about incentives while on-site? *A) [IF YES] what forms of advertising have you used?*
	Are there any other ways your company promotes the Ameren Missouri HVAC Program? (PROBE: highlight incentives in customer cost proposals, customer education, word-of-mouth, discussion with other contractors)?
	In what ways, if any, did the program enhance your marketing efforts?
	A) Did you use any new forms of marketing due to program co-branding assistance or co-op funds?

	B) Did you have a higher rate of response or sales when co-branding with Ameren Missouri?
	About what percentage of your business in efficient heating and cooling equipment comes from customers contacting you directly requesting efficient equipment (as opposed to you marketing efficient equipment)?
Training	
	What were the most valuable aspects of the "refresher" training that participating contractor undertook in 2016 (If this iis a new contractor ask about the "intake" training)?
	Did you, or anyone on your team, participate in additional trainings offered by the Ameren Missouri Program? Is so, please describe the training? *A) [If interviewee attended additional trainings] What were the most valuable aspects of this/these training(s)?*
	Do you have any recommendations for improving training(s)?
Program Delivery	
	Are you familiar with Ameren Missouri's Early Replacement versus Replace on Burnout criteria? [If "No" record answer and skip question, if "Yes" continue] How do you determine if a customer's existing equipment qualifies as early replacement or failed equipment?
	How would you rate your satisfaction with the application process for new residential HVAC installations? Are you [read]: *A. Very satisfied* *B. Somewhat satisfied* *C. Not too satisfied* *D. Not satisfied at all* *[IF C OR D] Why do you say you are [INSERT ANSWER]?*
	How do you typically stay informed about the Program throughout the year? (probe for most "effective" form of program communication.)
	What do you think worked particularly well about the Program?
	Is there anything about the program that didn't work well?
	Do you have any suggestions for improving the Program?
Informing Replacement Freeridership	
	How has the program's training improved your ability to convince customers of the benefits of high-efficiency systems?
	How influential would you say the early replacement incentive was in encouraging your customers to make the decision to install a new unit THIS YEAR? *A. Very influential* *B. Somewhat influential* *C. Not too influential* *D. Not influential at all* *E. Record additional verbatim response*
	For those participants who you believe would have replaced their working system even without the rebate, what percentage do you think would have installed a lower efficiency system without the Ameren Missouri rebates?
	Think about the percentage of heat pumps and ACs you installed before you began participating in the program (e.g. 80% CACs, 20% heat pumps). Compared to then, in this past year, has the percentage of heat pumps increased, decreased or remained unchanged? *A. (Increased) What was the prior %, what is it now?* *B. (Decreased) What was the prior %, what is it now?* *C. (Unchanged)*

Sales of Efficient Equipment	
	One of the purposes of the program is to increase customer demand for energy-efficient equipment. Do you feel the program is accomplishing this? Why do you say that?
	Are your customers more or less interested in purchasing energy-efficient options today than they were before 2013? *A) (More) (Why do you say this?)* *B) (Less) (Why do you say this?)*
Estimate of Program Influence on Sales	
Factors	*For the next part of the interview, I want to review some factors that we believe may have an impact on contractors ability and/or willingness to sell energy efficiency ACs and heat pumps. These factors, which I'll explain in more detail, include product availability, contractor training, customer education, market factors, and pricing.* *First, the Product Availability Factor refers to contractor's ability to order efficient products to then sell to their customers.* *The Contractor Training Factor refers to any efforts to educate technicians and contractors about efficient ACs and heat pumps, to ensure they are able to assist customers with their residential HVAC purchases.* *The Customer Education Factor refers to any efforts, whether local or national, or in-person or via some other channel, to specifically educate consumers about the benefits of efficient residential HVAC equipment.* *The Market Factor refers to any effort , whether local or national, aimed at promoting energy efficient ACs or heat pumps, such as changes to codes and standard requirements or energy legislation.* *And finally, the Pricing Factor refers to the the effect of efficient equipment price relative to the price of lower efficiency products.*
Other Factors	***1.*** *"Can you think of any other key factors we should add to this list so that we are capturing all of the factors that impact contractor's ability to sell energy efficient equipment?"* ***2.*** *If they say "yes", add these factors and then confirm. "Thank you, now that we have added "xyz" as a factor, would you say that we have captured all of the factors that impact energy efficient sales?"* ***3.*** *If "no" to #1 or if they confirm the "xyz" factor captures all the factors, follow up with, "Great, now that we have identified all of the factors that impact a contractors ability to sell energy efficient equipment, let's move on to Task 1.*
Task 1	*For this task, we would like you to help us estimate the influence of each of these market factors on the annual sales of efficient AC and heat pump units (both program and non-program) in the Ameren Missouri program area. This is intended as a conceptual exercise to quantify your opinion of how influential each factor is on annual sales of efficient equipment- it is not expected to be an objective measure. So for each of the factors we just discussed I'll read following sentence: "[Factor] is responsible for about X% of annual sales volume." The total percentage for all the factors combined should add up to 100%.*
Task 2	*The next step will be to review how Ameren Missouri's HVAC program impacts these same factors. I will provide a brief summary of Ameren Missouri's efforts and ask you to esimate Ameren's influence on this factor in the form of a %. The percentages you estimate in this Task do not need to sum to 100%, but no individual entry should exceed 100%.*
Product Availability	*[IF CONTRACTOR INDICATED THIS FACTOR >0%] Ameren Missouri tries to influence the Product Availability factor by offering discounts on energy efficient residential HVAC equipment. These discounts may cause contractors to request more of these products from distributors, who may, in turn, keep more energy efficienct products in stock. You'd indicated the Product Availability factor does affect energy efficient sales. Thinking about all the entities or market actors that may influence this factor, about what portion (or percentage) of the total influence would you attribute to Ameren Missouri's Residential HVAC program? What if the program was not available?*

Market	*[IF CONTRACTOR INDICATED THIS FACTOR >0%] Ameren Missouri tries to influence the Market factor by marketing the program via contractors (to whom it provides program materials and co-branding opportunities), internet banner advertising, radio advertising, television advertising, and direct/targeted mailing. Marketing materials are focused on rebates and tax credits, as well as general program information. Marketing materials drive customers to the Ameren Residential HVAC website (AmerenMissouri.com/hvac). The website highlights measure rebates, provides a list of participating contractors, and a Program overview. About what portion (or percentage) of the total market factor influence would you attribute to Ameren Missouri's Residential HVAC program? Why do you say that?*
Contractor Training	*[IF CONTRACTOR INDICATED THIS FACTOR >0%] Ameren Missouri tries to influence the Contractor Training factor by providing mandatory training to contractors about program processes each year, and provides additional voluntary technical training (AHRI) for contractors throughout the year. About what portion (or percentage) of the total contractor training factor influence would you attribute to Ameren Missouri's Residential HVAC program? Why do you say that?*
Customer Education	*[IF CONTRACTOR INDICATED THIS FACTOR >0%] Ameren Missouri tries to influence the Customer Education factor by providing customers with a program overview and information about specific rebates that are available, and does not get deeply into the details of general "energy education". About what portion (or percentage) of the total customer education factor influence would you attribute to Ameren Missouri's Residential HVAC program? Why do you say that?*
Pricing	*influence this factor by offering discounts on select high-ACs and Heat Pumps. Discounts (including a seasonal incentive on the high end of the range) range as follows:* *Air-source heat pump: $500 to $1,000* *Central air-conditioners: $275 to $600* *Ductless heat pump: $300 to $600* *Dual-fuel heat pump: $175 to $200* *Ground-source heat pump: $800 to $2,000* *About what portion (or percentage) of the total Pricing Factor influence would you attribute to Ameren Missouri's Residential HVAC program? Why do you say that?*
Closing	That concludes our interview. Please save the worksheet with your inputs, and email it back to me. Thank you for participating today. Your feedback is critical to helping Ameren Missouri optimze the Lighting Program's influence on the market for high-efficiency lighting.
	Please confirm your mailing address for the gift card:

CADMUS

Ameren Missouri 2016 Online HVAC Survey

Research Topics	Survey Question Mapping
Program Processes, how participants learn about the HVAC program	A1-A4
Program processes, product purchase decisions	B1
Program processes, participant engagement with contractors	C1-C6
Participant satisfaction, program processes and products?	D1-D15
Program processes, central air-conditioner installation decision-making and baseline equipment	E1-E11
Free ridership, central air-conditioners	E12-E23
Program processes, heat pump installation decisions and baseline equipment	F1-F17
Free Ridership, Heat Pumps	F18-F33
Program processes, ECM installation decisions, baseline and usage	G1-G15
Free Ridership, ECM	G16-G21
Program processes, smart thermostat installation decisions and baseline equipment	H1-H15
Program processes, smart thermostat use	H16-H25
Free Ridership, smart thermostats	H26-H34
Participant satisfaction, Ameren	I1-I2
Participant Demographics	J1-J10

Red text = programming instructions (not visible to respondents)

***[Measuretype]* = measure name imported from panel data**

Green text = open-ended responses

(Skipped) responses are not visible (99 = code for nothing selected / skipped question)

Catalogue ID - From Tracking Data Base	[MEASURENAME] - For Initial Measure Verification	[MEASURETYPE] - As Appears in Most Survey Questions	[MEASUREEFFICIENCY] - For Selected Free ridership Question	Category - Determines Applicability of Survey Sections
ASHP ER with ASHP 16+ ER	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
ASHP ER with ASHP SEER 15 ER	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP Replace at Fail with ASHP 16+	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
ASHP Replace at Fail with ASHP SEER 15	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP SEER 15 ER Elec Resist Furnace ER	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP SEER 15 Replace at Fail Elect Resist Furnace	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP SEER 15 Replace at Fail Elect Resist Furnace (NC)	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP SEER 16+ ER Elec Resist Furnace ER	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
CAC SEER 14 ER	central air conditioner (14 SEER)	central air conditioner	14 SEER	Central Air Conditioner
CAC SEER 14 Replace at Fail	central air conditioner (15 SEER)	central air conditioner	15 SEER	Central Air Conditioner
CAC SEER 15 ER	central air conditioner (15 SEER)	central air conditioner	15 SEER	Central Air Conditioner
CAC SEER 15 Replace at Fail	central air conditioner (15 SEER)	central air conditioner	15 SEER	Central Air Conditioner
CAC SEER 16+ ER	central air conditioner (16+ SEER)	central air conditioner	16+ SEER	Central Air Conditioner
CAC SEER 16+ Replace at Fail	central air conditioner (16+ SEER)	central air conditioner	16+ SEER	Central Air Conditioner
Concept 3 Continuous Fan Replace at Fail_50	furnace fan	furnace fan		ECM
Concept 3 Installations Auto Fan ER_100	furnace fan	furnace fan		ECM
Concept 3 Installations Auto Fan ER_50	furnace fan	furnace fan		ECM
Concept 3 Installations Auto Fan Replace at Fail_100	furnace fan	furnace fan		ECM

Concept 3 Installations Auto Fan Replace at Fail_50	furnace fan	furnace fan		ECM
Concept 3 Installations Continuous Fan ER_100	furnace fan	furnace fan		ECM
Concept 3 Installations Continuous Fan ER_50	furnace fan	furnace fan		ECM
DFHP SEER 15_SF	dual-fuel heat pump (15 SEER)	dual-fuel heat pump	15 SEER	Heat Pump
DFHP SEER 16_SF	dual-fuel heat pump (16 SEER)	dual-fuel heat pump	16 SEER	Heat Pump
DFHP SEER 17+_SF	dual-fuel heat pump (17+ SEER)	dual-fuel heat pump	17+ SEER	Heat Pump
DFHP SEER 18+_SF	dual-fuel heat pump (18+ SEER)	dual-fuel heat pump	18+ SEER	Heat Pump
Ductless ASHP ER	dual-fuel heat pump	dual-fuel heat pump	high efficiency	Heat Pump
Ductless ASHP Replace Electric Resistance ER	ductless heat pump	ductless heat pump	high efficiency	Heat Pump
Ductless ASHP Replace Electric Resistance ROF	ductless heat pump	ductless heat pump	high efficiency	Heat Pump
Ductless ASHP ROF	ductless heat pump	ductless heat pump	high efficiency	Heat Pump
GSHP - 23 EER ER	ground source heat pump (23 EER)	ground source heat pump	23 EER	Heat Pump
GSHP - 23 EER Replace at Fail	ground source heat pump (23 EER)	ground source heat pump	23 EER	Heat Pump
GSHP SEER 14+ ER ASHP with GSHP ER	ground source heat pump (14+ SEER)	ground source heat pump	14+ SEER	Heat Pump
GSHP SEER 14+ ER Elec Resist Furnace ER	ground source heat pump (14+ SEER)	ground source heat pump	14+ SEER	Heat Pump
GSHP SEER 14+ Replace Elec Resist Furnace	ground source heat pump (14+ SEER)	ground source heat pump	14+ SEER	Heat Pump

A. All HVAC Measures – Verification and Program Awareness

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

INTRO: Thank you for participating in Ameren Missouri's Heating and Cooling Program. We would like to know more about your experience with the program. Instructions for participating in the prize drawing are provided at the end of this survey.

A1. Our records indicate that you received a rebate for installing a new high efficiency **[MEASURENAME] [AND SMART THERMOSTAT(S) IF APPLICABLE]**. Is this correct? **[FORCED RESPONSE (NO SKIP)]**

1. Yes
2. No, I did not receive a rebate **[TERMINATE]**
3. **[IF SMART THERMOSTAT]** No, I only installed the **[MEASURETYPE]**
4. **[IF SMART THERMOSTAT]** No, I only installed the **[SMART THERMOSTAT]**(s) **[TERMINATE *AND SURVEY IN EFFICIENT PRODUCTS*]**

A2. **[ASK IF MEASURETYPE = FURNACE FAN]** Did you install your new furnace fan with a new furnace, or did you install it with an existing furnace?

1. I installed it with a new furnace
2. I installed it with an existing furnace
98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A3. **[ASK IF A2=1]** Do you have a central air conditioner or heat pump?

1. Yes
2. No **[TERMINATE]**
98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A4. **[ASK IF A3 = 1]** Did you install the air-conditioner or heat pump when you installed the furnace?

1. Yes
2. No **[TERMINATE]**
98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A5. **[ASK IF A4 = 1]** Why did you not get a rebate for the air conditioner or heat pump?

1. I did get a rebate from Ameren **[TERMINATE]**
2. Because my contractor said it did not qualify **[TERMINATE]**
3. The efficiency was too low **[TERMINATE]**
4. Because I did not get a new indoor cooling coil to my install didn't qualify **[TERMINATE]**
5. Because I was unable to get a valid AHRI certificate, thus did not qualify for a rebate **[TERMINATE]**
6. **[SPECIFY:_____]** **[TERMINATE]**

98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A6. Are you or any members of your household employed by Ameren Missouri or by a company that sells, installs, or services heating and cooling equipment? **[FORCED RESPONSE (NO SKIP OR DK)]**

1. Yes, I or someone in my household works for Ameren Missouri **[TERMINATE]**
2. Yes, I or someone in my household works for a company that sells, installs or services heating and cooling equipment **[TERMINATE]**
3. No one in my household works for the companies listed above

A7. Prior to this survey, were you aware that the rebate you received after installing your new high efficiency **[MEASURETYPE] [AND SMART THERMOSTAT]** was provided by Ameren Missouri?

1. Yes
2. No

98. Don't Know
99. (Skipped)

A8. How did you hear about Ameren Missouri's Heating and Cooling Program? **[RANDOMIZE ORDER – CHECK ALL THAT APPLY]**

1. From my contractor or installer
2. Visited Ameren's Web site
3. Other Web site, which site? **[SPECIFY:_____]**
4. On my Monthly Energy Statement/Bill
5. Information that I received by mail from Ameren
6. Information that I received by mail from a contractor
7. A brochure from Ameren that I did not receive by mail
   Where did you find the brochure that informed you about the program, or who gave it to you? **[SPECIFY:_____]**
8. When my rebate check arrived
9. Door hanger
10. Family, friend or co-worker
11. Newspaper
12. Radio
13. Ameren Missouri representative
14. Television advertisement
15. Ameren Missouri Home Energy Report
16. Signs or displays in a store
17. Store representative or salesperson
18. Social Media (Facebook, Twitter)
19. Some other way **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

B. All HVAC Measures - Purchase Patterns and Decision-making

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED. MEASURE-SPECIFIC PURCHASE PATTERN AND DECISION-MAKING QUESTIONS WILL BE ADDRESSED IN EACH MEASURE'S SECTION

B1. What was the primary reason you purchased a new **[MEASURETYPE]**? **[SELECT ONE RESPONSE]**

1. To replace broken equipment
2. To replace aging equipment
3. To improve the comfort of my home
4. To improve the safety of my home
5. The purchase was part of a larger home renovation
6. The equipment is for a newly constructed home
7. To save money on energy costs
8. To help the environment
9. Some other reason, please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

C. ALL HVAC Measures - Participation Process – Contractors

ASK ALL PARTICIPANTS

C1. How did you select the contractor who installed your system? **[RANDOMIZE ORDER, CHECK ALL THAT APPLY]**

1. I have used this contractor before
2. The contractor approached me directly
3. Ameren website
4. The contractor was referred to me by a family member, friend, or colleague
5. Online advertisement
6. I saw contractor's marketing materials
7. I saw contractor's newspaper/TV/radio advertisement
8. Through business owners in my neighborhood or network
9. Yellow pages
10. Angie's List or similar consumer information source
11. Better Business Bureau
12. Some other way, please specify **[SPECIFY:_____]**

98. Don't Know
98. (Skipped)

C2. [**ASK IF C1 = 8, 9, 10, 11, 12**] Did you specifically seek out a contractor who participated in the program in order to receive a rebate for your equipment?

1. Yes
2. No

98. Don't know
99. (Skipped)

C3. **[ASK IF C2=1]** How difficult was it to find a contractor that participated in the program?

1. Not difficult at all
2. Not too difficult
3. Somewhat difficult
4. Very difficult

98. Don't know
99. (Skipped)

C4. Please check any options listed below that your contractor discussed with you prior to installing your **[MEASURETYPE]**. Please note, options listed below may or may not have been applicable to your situation. **[RANDOMIZE ORDER, CHECK ALL THAT APPLY]**

1. Rebates from Ameren Missouri for high efficiency equipment
2. Contractor or manufacturer rebates
3. State or federal tax credits or rebates
4. Additional energy-efficient equipment or home improvements
5. Energy saving tips
6. None of the above

98. Don't Know
99. (Skipped)

C5. **[ASK IF C4 = 2]** How much was the rebate you received from the contractor or manufacturer?

1. **[RECORD RESPONSE:_____]**
2. I did not receive a rebate from the contractor or manufacturer

98. Don't Know
99. (Skipped)

C6. **[ASK IF C4 = 3]** How much was the tax credit you received (or will receive)?

1. **[RECORD RESPONSE:_____]**
2. I did not receive a tax credit from the contractor or manufacturer

98. Don't Know
99. (Skipped)

D. All HVAC Measures – Participant Satisfaction

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

D1. How satisfied are you with the contractor you worked with?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D2. **[ASK IF D1 = 1, 2, 3 OR 4]** Why are you **[RATING FROM D1]** with the contractor?
[RECORD RESPONSE:_____]

D3. How satisfied are you with the time it took to receive your rebate in the mail?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D4. How satisfied are you with the performance of your new **[MEASURETYPE]**?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D5. **[ASK IF D4 = 1, 2, 3 OR 4]** Why are you **[RATING FROM D4]** with the performance of your new **[MEASURETYPE]**?

[RECORD RESPONSE:_____]

D6. **[ASK IF SMART THERMOSTAT]** How satisfied are you with the performance of your new smart thermostat(s)?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D7. **[ASK IF D6= 1, 2, 3 OR 4]** Why are you **[INSERT RATING FROM D6]** with the performance of your new smart thermostat(s)?

[RECORD RESPONSE:_____]

D8. Thinking about your overall satisfaction with Ameren Missouri's Heating and Cooling Program, would you say you are:

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D9. **[ASK IF D8 = 1, 2, 3 OR 4]** Why are you **[RATING FROM D8]** with Ameren Missouri's Heating and Cooling Program?

[RECORD RESPONSE:_____]

D10. Would you recommend Ameren Missouri's Heating and Cooling Program to friends or family members?

1. Yes
2. No
98. Don't Know
99. (Skipped)

D11. What suggestions, if any, do you have for improving the program?

1. Specify suggestions: **[RECORD RESPONSE:_____ _____]**
2. No suggestions
99. (Skipped)

E. Central Air Conditioner Questions

ASK QUESTIONS OF PARTITIPANTS THAT HAVE INSTALLED CENTRAL AIR CONDITIONERS

E1. Did you install your central air conditioner in a newly constructed home or in an existing home?

1. Newly constructed home
2. Existing home
99. (Skipped)

E2. **[ASK IF E1=1 AND SKIP TO E4]** At the time when you purchased / constructed your new home, what type(s) of heating and cooling systems did you consider or were offered by your contractor? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Ground Source Heat Pump
3. Ductless Heat Pump
4. Standard-efficiency air conditioner
5. High-efficiency gas furnace
6. Standard-efficiency gas furnace
7. High-efficiency electric furnace
8. Standard-efficiency electric furnace
9. Window air conditioner units
10. Room air conditioner units
11. Baseboard electric system
12. Only considered or was only offered high-efficiency air conditioner

98. Don't Know
99. (Skipped)

E3. **[ASK IF E1=2]** At the time when you decided to install your new efficient air conditioning system, what other type(s) of cooling systems did you consider or were offered by your contractor? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Ground Source Heat Pump
3. Ductless Heat Pump
4. Standard-efficiency air conditioner
5. Window air conditioner unit(s)
6. Room air conditioner(s)
7. Other **[SPECIFY:_____]**
8. Only considered or was only offered high-efficiency air conditioner

98. Don't Know
99. (Skipped)

E4. Do you have any of the following currently installed in addition to your new efficient air conditioner at your home? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Window air conditioner unit(s)
3. Ground Source Heat Pump
4. Ductless Heat Pump
5. Standard-efficiency air conditioner
6. Room air conditioner unit(s)
7. Another high-efficiency air conditioner
8. Room air conditioners
9. Space heater(s)
10. High-efficiency gas furnace
11. Standard-efficiency gas furnace
12. High-efficiency electric furnace
13. Standard-efficiency electric furnace
14. Baseboard electric system
98. Don't Know
99. (Skipped)

E5. At what point did you determine the exact air conditioner you wanted to buy?

1. I knew which model I wanted before calling a contractor
2. I decided after the contractor provided me with option
98. Don't Know
99. (Skipped)

E6. Which factors were important in your decision to purchase the specific equipment you selected? Please select all that apply. **[CHECK ALL THAT APPLY]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. Other, Please specify: **[SPECIFY: _____]**
98. Don't Know
99. (Skipped)

E7. **[ASK IF MORE THAN ONE RESPONSE IS CHECKED IN E6]** If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific equipment you selected? **[ONLY SHOW RESPONSES CHECKED IN E6; SELECT ONE RESPONSE]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. **[INSERT "OTHER SPECIFY" RESPONSE FROM E6]**
98. Don't Know
99. (Skipped)

E8. **[ASK IF NOT SMART THERMOSTAT CUSTOMER]** What type of thermostat do you use to control your heating and cooling equipment?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

E9. **[ASK IF NOT SMART THERMOSTAT CUSTOMER]** Did you install this thermostat when you installed your new air conditioning system?

1. Yes
2. No
98. Don't Know
99. (Skipped)

E10. **[ASK IF E9=1]** What type of thermostat did you have before installing the new thermostat?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

E11. What type of cooling system did you replace and remove when installing your new efficient air conditioning system?

1. Nothing
2. Window air conditioning unit(s)
3. Air source heat pump
4. Room air conditioning unit(s)
5. Ground source heat pump
6. Central air-conditioning
7. Other **[SPECIFY:_____]**
8. I kept my cooling system
9. I didn't have a cooling system
98. Don't Know
99. (Skipped)

Central Air Conditioning Free Ridership Questions

The next set of questions specifically pertain to the installation of your central air conditioning system.

E12. **[ASK IF E1=2]** Please think back when you first spoke with your contractor in regards to replacing and/or installing your central air conditioner. What prompted the conversation? **[INDICATE ALL THAT APPLY]**

1. My air conditioner stopped working (i.e., unit failed)
2. My air conditioner was working, but was having problems (i.e., wasn't cooling properly or was making a noise)
3. Maintenance contract / Regularly scheduled check up
4. To take advantage of the rebate
5. It was time for a tune-up
6. To ensure that it lasts longer
7. To find out if it needs any repairs
8. To keep my air conditioner running efficiently
9. To save energy
10. To lower my energy bill, save money on bills
11. Reminded by Ameren Missouri advertising
12. Reminded by advertising other than Ameren Missouri
13. Recommended by a family or friend
14. Other **[SPECIFY:_____]**
98. Don't Know
99. (Skipped)

E13. **[ASK IF E1=2]** Did your contractor offer you the option to repair or tune-up your system instead of replacing it?

1. Yes
2. No
98. Don't Know
99. (Skipped)

E14. **[IF E13 =1]** About how much would the repair have cost?

1. **[RECORD ANSWER:_____]**
98. Don't Know
99. (Skipped)

E15. **[IF E13 =1]** Why did you opt for replacing the unit instead of repairing it? **[MARK ALL THAT APPLY]**

1. The repair costs were too much; was not worth it
2. I would have had to replace it soon anyway
3. The contractor convinced me installing a high-efficiency model was worth it/ would save me money in the long-run
4. I wanted to take advantage of Ameren Missouri's rebates while available
5. I wanted to take advantage of manufacturer rebates or tax credits while available
6. Other **[SPECIFY:_____]**
98. Don't Know
99. (Skipped)

E16. Before you knew about the incentive from Ameren Missouri, were you already planning to install a new high-efficiency air conditioning system this year?

1. Yes
2. No
98. Don't Know
99. (Skipped)

E17. You installed a **[MEASUREEFFICIENCY]** central air conditioner. Why did you choose to install this particular unit?

1. I wanted the cheapest option available
2. I wanted the most efficient option possible
3. I researched my options and decided this was the right balance of efficiency and cost
4. My contractor convinced me this was the right balance of efficiency and cost
5. I heard Ameren Missouri provided an incentive for this SEER
6. It's the same efficiency as my old unit
7. I wanted something more efficient than my old unit
8. Other **[SPECIFY:_____]**
98. Don't Know
99. (Skipped)

E18. Without Ameren Missouri's rebate, were you planning to install a high-efficiency air conditioning system …?

1. Around the same time
2. Later in the same year
3. In one or two years
4. After more than three years
98. Don't Know
99. (Skipped)

E19. **[IF E18 = 1, 2, 98, 99]** Were you planning to install the same high-efficiency air conditioning system without the rebate from Ameren Missouri?

1. Yes
2. No
98. Don't Know
99. (Skipped)

E20. **[IF E19 = 2, 98, 99]** Would you have installed a different high-efficiency air conditioning system without the Ameren Missouri rebate or would you have decided to not purchase one at all?

1. I would have installed a different high-efficiency air conditioning system
2. I would have decided not to purchase a high-efficiency air conditioning system at all
98. Don't Know
99. (Skipped)

E21. **[IF E20 = 1]** Without Ameren's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system than the one you installed…?

1. Lower efficiency
2. Same efficiency
3. Higher efficiency
98. Don't Know
99. (Skipped)

E22. How important was the Ameren Missouri incentive on your decision to purchase the high-efficiency air conditioning system? Would you say…?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
98. Don't Know
99. (Skipped)

E23. How important was the advice from the contractor in your decision to purchase the high-efficiency air conditioning system?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
98. Don't Know
99. (Skipped)

F. Heat Pumps

ASK OF PARTICIPANTS WHO HAVE INSTALLED HEAT PUMPS

F1. Did you install your heat pump in a newly constructed home or in an existing home?

1. Newly constructed home
2. Existing home
99. (Skipped)

F2. **[IF F1=1 SKIP TO F4]** At the time when you purchased / constructed your new home, what other type(s) of heating and cooling systems did you consider or were offered by your contractor? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Ground Source Heat Pump
3. Ductless Heat Pump
4. Standard-efficiency air conditioner
5. High-efficiency air conditioner
6. High-efficiency gas furnace
7. Standard-efficiency gas furnace
8. High-efficiency electric furnace
9. Standard-efficiency electric furnace
10. Baseboard electric system
11. Window air conditioner unit(s)
12. Room air conditioner unit(s)
13. Only considered or was only offered heat pump
98. Don't Know
99. (Skipped)

F3. **[IF F1=2]** At the time when you purchased your new heat pump, what other type(s) of heating and cooling systems did you consider or were offered by your contractor? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Ground Source Heat Pump
3. Ductless Heat Pump
4. Standard-efficiency air conditioner
5. High-efficiency air conditioner
6. High-efficiency gas furnace
7. Standard-efficiency gas furnace
8. High-efficiency electric furnace
9. Window air conditioner unit(s)
10. Room air conditioner unit(s)
11. Standard-efficiency electric furnace
12. Baseboard electric system
13. Only considered or was only offered heat pump
98. Don't Know
99. (Skipped)

F4. For what purpose did you install your heat pump?

1. Primarily heating
2. Primarily cooling
3. Both heating and cooling
98. Don't Know
99. (Skipped)

F5. What type of heating system did you replace and remove before you installed the heat pump?

1. Electric forced air furnace
2. Electric baseboard heat
3. Ground source heat pump
4. Air Source Heat Pump
5. Gas heating system (boiler, furnace)
6. Other **[SPECIFY:_____]**
7. I kept my previous heating system
8. Nothing – this is new construction
98. Don't Know
99. (Skipped)

F6. What type of cooling system did you replace and remove before you installed the heat pump?

1. Window air conditioning unit(s)
2. Room air conditioning unit(s)
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Central air conditioning system
6. Other **[SPECIFY:_____]**
7. I kept my previous cooling system
8. I didn't have a cooling system

98. Don't Know
99. (Skipped)

F7. Do you have any of the following currently installed in addition to your new heat pump at your home? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Window air conditioner unit(s)
3. Ground Source Heat Pump
4. Ductless Heat Pump
5. Standard-efficiency air conditioner
6. Room air conditioner unit(s)
7. Another high-efficiency air conditioner
8. Space heater(s)
9. High-efficiency gas furnace
10. Standard-efficiency gas furnace
11. High-efficiency electric furnace
12. Standard-efficiency electric furnace
13. Baseboard electric system
14. None of the above

98. Don't Know
99. (Skipped)

F8. **[ASK IF NOT SMART THERMOSTAT CUSTOMER]** What type of thermostat do you use to control your heating and cooling equipment?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)

98. Don't Know
99. (Skipped)

F9. **[ASK IF NOT SMART THERMOSTAT CUSTOMER]** Did you install this thermostat when you installed your new heat pump?

1. Yes
2. No
98. Don't Know
99. (Skipped)

F10. **[IF F9=1]** What type of thermostat did you have before installing the new thermostat?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

F11. **[IF MEASURETYPE=ASHP]** Why did you choose to install an air source heat pump?

1. I wanted a higher efficiency electric heating system
2. I wanted a high-efficiency cooling system
3. It is more "green" than any other heating/cooling options
4. I wanted to reduce fossil fuel consumption
5. I wanted to save money on my utility bills
6. I wanted to take advantage of Ameren's rebate
7. Other **[SPECIFY:_____]**
98. Don't Know
99. (Skipped)

F12. **[IF MEASURETYPE=GSHP]** Before you selected your **[MEASURETYPE]**, did you consider installing an air source heat pump?

1. Yes
2. No
98. Don't Know
99. (Skipped)

F13. **[IF MEASURETYPE=GSHP]** Why did you specifically choose to install a ground source heat pump?

1. It is the most efficient possible option
2. It is more "green" than any other heating/cooling option
3. To save money on my heating and cooling bills
4. Our property is ideal for installation of ground well/ground loops
5. Ground loops were already present on our property
6. To replace my existing ground-source heat pump
7. To increase the resale value of my home
8. It provides more heat at low outdoor temperatures than an air source heat pump
9. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

F14. **[IF MEASURETYPE=DUCTLESS HP]** Why did you specifically choose to install a ductless heat pump?

1. I wanted to install a Heat Pump but I did not have the duct work to install other types of heat pumps
2. It was the easiest way to install a Heat Pump at my home
3. To save money on my heating and cooling bills
4. To increase the resale value of my home
5. I wanted a higher efficiency electric heating system
6. I wanted a high-efficiency cooling system
7. It is more "green" than any other heating/cooling options
8. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

F15. At what point did you determine the exact model and brand of heat pump that you wanted to buy?

1. I knew which model I wanted before calling a contractor
2. I decided after the contractor provided me with option

98. Don't Know
99. (Skipped)

F16. Which factors were important in your decision to purchase the specific model and brand you selected? Please select all that apply. **[CHECK ALL THAT APPLY]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. Other, Please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped

F17. **[ASK IF MORE THAN ONE RESPONSE IS CHECKED IN F16]** If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific model and brand you selected? **[ONLY SHOW RESPONSES CHECKED IN F16; SELECT ONE RESPONSE]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. **[INSERT "OTHER SPECIFY" RESPONSE FROM F16]**

98. Don't Know
99. (Skipped)

Heat Pump Free Ridership Questions

F18. **[IF F1=2]** Please think back when your contractor first visited your home. What prompted the visit? [**INDICATE ALL THAT APPLY]**

1. My air conditioner or heat pump stopped working (i.e., unit failed)
2. My air conditioner or heat pump was working, but was having problems (i.e., wasn't cooling properly or was making a noise)
3. Maintenance contract / Regularly scheduled check up
4. To take advantage of the rebate
5. It was time for a tune-up
6. To ensure that it lasts longer
7. To find out if it needs any repairs
8. To keep my air conditioner running efficiently
9. To save energy
10. To lower my energy bill, save money on bills
11. It didn't cost much to discuss upgrading my system with the contractor
12. Reminded by Ameren Missouri advertising
13. Reminded by advertising other than Ameren Missouri
14. Recommended by a family or friend
15. Other **[SPECIFY:_____]**
98. Don't Know
99. (Skipped)

F19. **[IF F18=2]** Did your contractor offer you the option to repair or tune-up your system instead of replacing it?

1. Yes
2. No
98. Don't Know
99. (Skipped)

F20. **[IF F19 = 2]** So, to the best of your knowledge your system was not repairable and had to be replaced?

1. Yes
2. No
98. Don't Know
99. (Skipped)

F21. **[IF F19 =1**] About how much would the repair have cost?

1. **[RECORD ANSWER:_____]**
98. Don't Know
99. (Skipped)

F22. **[IF F19 =1]** Why did you opt for replacing the unit instead of repairing it? **[MARK ALL THAT APPLY]**

1. The repair costs were too much; was not worth it
2. I would have had to replace it soon anyway
3. The contractor convinced me installing a high-efficiency model was worth it/ would save me money in the long-run
4. I wanted to take advantage of Ameren Missouri's rebates while available
5. I wanted to take advantage of manufacturer rebates or tax credits while available
6. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

F23. Before you knew about the heat pump incentive from Ameren Missouri, were you already considering a heat pump as your replacement system?

1. Yes
2. No

98. Don't Know
99. (Skipped)

F24. **[IF F23= 1]** Why were you considering a heat pump?

1. It was more efficient
2. I wanted heating as well
3. I knew about Ameren's incentive
4. I already had a heat pump
5. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

F25. **[IF F23= 2]** Why did you decide to install a heat pump?

1. It was more efficient
2. I wanted heating as well
3. I found out about Ameren Missouri's incentive
4. The contractor told me about Ameren's incentive
5. The contractor told me about the benefits of a heat pump
6. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

F26. Before you knew about the incentive from Ameren Missouri, were you already planning to install a high-efficiency heat pump this year?

1. Yes
2. No
98. Don't Know
99. (Skipped)

F27. You installed a **[MEASUREEFFICIENCY]** heat pump. Why did you choose to install this particular system? **[MARK ALL THAT APPLY]**

1. I wanted the cheapest option available
2. I wanted the most efficient option possible
3. I researched my options and decided this was the right balance of efficiency and cost
4. My contractor convinced me this was the right balance of efficiency and cost
5. I heard Ameren Missouri provided incentive rebate for this system
6. It's the same efficiency as my old unit
7. I wanted something more efficient than my old unit
98. Don't Know
99. (Skipped)

F28. Without Ameren Missouri's rebate, would you have installed a high-efficiency heat pump system…?

1. Around the same time
2. Later in the same year
3. In one or two years
4. After more than three years
98. Don't Know
99. (Skipped)

F29. **[IF F28= 1, 2, 98, 99]** Would you have installed the same high-efficiency heat pump without the rebate from Ameren Missouri?

1. Yes
2. No
98. Don't Know
99. (Skipped)

F30. **[IF F29= 2, 98, 99]** Would you have installed a different high-efficiency heat pump without the Ameren Missouri rebate or would you have decided to not purchase one at all?

1. I would have installed a different high-efficiency heat pump
2. I would have decided not to purchase a high-efficiency heat pump at all
98. Don't Know
99. (Skipped)

F31. **[IF F30= 1]** Without Ameren Missouri's rebate, would you have installed a lower efficiency system, the same efficiency system, or a higher efficiency system?

1. Lower efficiency
2. Same efficiency
3. Higher efficiency
98. Don't Know
99. (Skipped)

F32. How important was the Ameren Missouri rebate on your decision to purchase and install the high-efficiency heat pump?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
98. Don't Know
99. (Skipped)

F33. How important was the advice from the contractor in your decision to purchase and install the high-efficiency heat pump? Would you say…?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
98. Don't Know
99. (Skipped)

G. ECM Questions

ASK OF PARTICIPANTS WHO INSTALLED ONLY ECM MEASURE – NO OTHER MEASURE

G1. What type of heating system do you have?

1. Air Source Heat Pump
2. Electric furnace
3. Gas furnace
4. Ground Source Heat Pump
5. Other [**SPECIFY:**_____]
99. (Skipped)

G2. What type of cooling system do you have?

1. Air Source Heat Pump
2. Ground Source Heat Pump
3. Central air conditioner
4. Window air conditioner(s)
5. Other [**SPECIFY:**_____]
6. None

99. (Skipped)

G3. Your new furnace fan (with a high efficiency variable speed motor for your heating and cooling system) is able to vary speed to change the airflow that your heating and cooling system delivers. Did your previous fan have this ability?

1. Yes
2. No

98. Don't Know
99. (Skipped)

G4. Why did you decide to install a new furnace fan? **[INDICATE ALL THAT APPLY]**

1. My previous fan motor stopped working (i.e., unit failed)
2. My previous fan motor but was having problems
3. I was unsatisfied with the airflow
4. To take advantage of the rebate
5. Maintenance contract / Regularly scheduled check up
6. To keep my air conditioner running efficiently
7. To save energy
8. To lower my energy bill, save money on bills
9. It didn't cost much
10. Reminded by Ameren Missouri advertising
11. Reminded by advertising other than Ameren Missouri
12. Recommended by a family or friend

98. Don't Know
99. (Skipped)

G5. **[ASK IF NOT SMART THERMOSTAT CUSTOMER, OTHERWISE SKIP TO G9]** What type of thermostat do you use to control your heating and cooling equipment?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)

98. Don't Know
99. (Skipped)

G6. Did you install this thermostat when you installed your new furnace fan?

1. Yes
2. No
98. Don't Know
99. (Skipped)

G7. **[IF G6=1]** What type of thermostat did you have before installing the new thermostat?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

G8. Do you operate your fan in "continuous" mode to circulate air?

1. Yes
2. No
98. Don't Know
99. (Skipped)

G9. **[IF G8=1]** Can you estimate the average number of hours per day it is set to "continuous" for each season?

1. Spring/fall: ___ [0-24]
2. Summer: _____[0-24]
3. Winter: _____ [0-24]
98. Don't Know
99. (Skipped)

G10. **[IF G8=1]** Would you say the time you operate your fan in circulation mode has…

1. Increased?
2. Decreased?
3. Stayed the same?
98. Don't Know
99. (Skipped)

G11. **[IF G10=1 OR 2]** Can you estimate the hours of [**INCREASE/DECREASE]** for each season?

1. Spring/fall: [**SPECIFY:**_____0-24]
2. Summer: **[SPECIFY:**_____0-24]
3. Winter: [**SPECIFY:**_____0-24]
98. Don't Know
99. (Skipped)

G12. At what point did you determine the exact model and brand you wanted to buy?

1. I knew which model I wanted before calling a contractor
2. I decided after the contractor provided me with option
98. Don't Know
99. (Skipped)

G13. Which factors were important in your decision to purchase the specific model and brand you selected? Please select all that apply. **[CHECK ALL THAT APPLY]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. Other, Please specify: **[SPECIFY: _____]**
98. Don't Know
99. (Skipped)

G14. **[ASK IF MORE THAN ONE RESPONSE IS CHECKED IN G14]** If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific model and brand you selected? **[ONLY SHOW RESPONSES CHECKED IN G14; SELECT ONE RESPONSE]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. **[INSERT "OTHER SPECIFY" RESPONSE FROM G14]**
98. Don't Know
99. (Skipped)

ECM Free Ridership Questions

G15. Before you knew about the furnace fan incentive from Ameren Missouri, were you already considering installing a new fan?

1. Yes
2. No
98. Don't Know
99. (Skipped)

G16. Without Ameren Missouri's rebate, would you have installed a new furnace fan….?

1. Around the same time
2. Later in the same year
3. In one or two years
4. After more than three years
98. Don't Know
99. (Skipped)

G17. **[IF G17= 1, 2, 98, 99]** Would you have installed the same fan without the rebate from Ameren Missouri?

1. Yes
2. No
98. Don't Know
99. (Skipped)

G18. **[IF G18= 2, 98, 99]** Would you have installed a different fan without the Ameren Missouri rebate or would you have decided to not purchase one at all?

1. I would have installed a different fan motor
2. I would have decided not to purchase one at all
98. Don't Know
99. (Skipped)

G19. How important was the Ameren Missouri rebate on your decision to purchase and install the furnace fan?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
98. Don't Know
99. (Skipped)

G20. How important was the advice from the contractor in your decision to purchase and install the furnace fan?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important

98. Don't Know
99. (Skipped)

H. Smart Thermostat

ASK OF PARTICIPANTS WHO HAVE INSTALLED SMART THERMOSTATS IN THE EFFICIENT PRODUCTS PROGRAM AND ALSO PARTICIAPTED IN THE HVAC PROGRAM

INTRO TEXT: Next, we have a few questions about the smart thermostat(s) that you purchased and installed. The answers to these questions are important because they will help Ameren Missouri determine how much energy is being saved as a direct result of their energy efficiency program.

H1. **[IF QTY=1:** Our records indicate that you purchased a **[THERMOSTAT BRAND]** "smart" thermostat, is this correct? **IF QTY > 1:** Our records indicate that you purchased **[QTY] [THERMOSTAT BRAND]** "smart" thermostats, is this correct?

1. Yes
2. No

H1a. What kind of thermostat(s) did you purchase? **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

H2. **[IF QTY=1]** Is the smart thermostat currently installed in your home? **[IF QTY>1]** Are all of the smart thermostats that you purchased currently installed in your home?

1. Yes
2. **[INCLUDE OPTION IF QTY> 1]** Only one is installed
3. **[INCLUDE OPTION IF QTY> 2]** Only two are installed
4. **[IF QTY= 1]** No **[IF QTY> 1]** None are installed

98. Don't Know
99. (Skipped)

H3. **[IF H2= 4 AND QTY=1]** Was the thermostat installed and then removed, or has it not been installed yet? **[IF H2= 2, 3 / OR IF H2= 4 AND QTY>1]** Were any of these thermostats installed and then removed, or have they not been installed yet?

1. Installed and removed
2. Not installed yet
3. Given to someone else / installed at another property
4. **[OPTION APPEARS IF QTY>1]** Some other situation, please describe: **[RECORD RESPONSE _____]**

98. Don't Know
99. (Skipped)

H4. **[IF H3 = 1]** Why did you install and then remove the smart thermostat(s)? [**RANDOMIZE RESPONSE ORDER, MARK ALL THAT APPLY**]

1. Too difficult to use
2. Did not adjust temperatures correctly
3. Thermostat broke
4. Did not think it was saving energy
5. I preferred my previous thermostat
6. Other reason (please specify) **[RECORD RESPONSE _____]**

98. Don't Know
99. (Skipped)

H5. **[IF H3 = 2 AND QTY=1]** Why has the smart thermostat not been installed in your home yet? **[IF H3 = 2 AND QTY>1]** Why haven't all the smart thermostats been installed in your home yet?

1. **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

[IF H2= 4 THEN SKIP TO I1 NOW]

H6. **[ASK IF QTY=1 AND H2= 1 / OR IF H2= 2, 3]** What type of heating and cooling systems is the smart thermostat connected to? **[OR IF QTY>1 AND H2= 1 / OR IF H2= 3]** What types of heating and cooling systems are your smart thermostats connected to? **[MARK ALL THAT APPLY]**

1. High-efficiency central air conditioner
2. Standard-efficiency central air conditioner
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Ductless Heat Pump
6. High-efficiency gas furnace
7. Standard-efficiency gas furnace
8. High-efficiency electric furnace
9. Standard-efficiency electric furnace
10. Some other heating or cooling system **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

H7. **[ASK IF QTY=1 AND H2= 1 / OR IF H2= 2]** What type of thermostat did you replace with the smart thermostat? **[SELECT ONE]** **[OR IF QTY>1 AND H2= 1 / OR IF H2= 3]** What type(s) of thermostat did you replace with the smart thermostats? **[SELECT UP TO 2 IF QTY=2, SELECT UP TO 3 IF QTY=3]**

1. My new smart thermostat(s) are installed in a newly-constructed home
2. My new smart thermostat(s) replaced other smart thermostat(s) (may also be called "learning" thermostats)
3. Replaced a programmable thermostat (a thermostat that can be programmed, but is not "smart" or connected to communication devices)
4. Replaced a traditional/manual thermostat

98. Don't Know
99. (Skipped)

H8. **[IF H7 ≠ 1]** Which option best represents how you most often used or interacted with your OLD thermostat? [**RECORD ONE RESPONSE**]

1. Kept thermostat(s) set at a constant temperature throughout each season
2. [**OPTION APPEARS IF H9 = 2 OR 3**] Relied on the programmed schedule of temperatures, and never manually changed the temperature
3. [**OPTION APPEARS IF H9 = 2 OR 3**] Relied on the programmed schedule of temperatures, but sometimes manually changed the temperature
4. Manually adjusted temperature using a regular schedule by changing the temperature for different times of the day or week
5. Manually adjusted temperature using no regular schedule
6. Some other way **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

H9. **[IF H7 = 2, 3 OR 4]** Why did you replace your existing thermostat? **[RANDOMIZE ORDER, MARK ALL THAT APPLY]**

1. To save energy
2. To save money on my utility bills
3. The Ameren Missouri rebate
4. Other rebates or coupons (not from Ameren Missouri)
5. Part of a "package deal" with other equipment being replaced at the same time
6. To update my home with the latest technology
7. To take advantage of the features of the smart thermostat
8. Some other reason **[SPECIFIY:_____]**

98. Don't Know
99. (Skipped)

H10. Did you purchase the thermostat at a store, or from a contractor? **[SELECT ONE RESPONSE]**

1. Local retail store
2. Online Store
3. Contractor
4. Other, please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

H11. **[ASK IF H11≠ 4, 98 OR 99]** At what point did you determine the exact model and brand you wanted to buy?

1. I knew which model I wanted before **[IF H11=1 OR 2: "VISITING THE STORE", IF H11=3: "CALLING A CONTRACTOR"]**
2. **[IF H11=1 OR 2]** I decided at the **[IF H11=1: "STORE", IF H11=2: "ONLINE STORE"]**
3. **[IF H11=3]** I decided after the contractor provided me with options

98. Don't Know
99. (Skipped)

H12. Which factors were important in your decision to purchase the specific model and brand you selected? Please select all that apply. **[RANDOMIZE ORDER, CHECK ALL THAT APPLY]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. Other, please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

H13. **[ASK IF MORE THAN ONE RESPONSE IS CHECKED IN H12]** If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific model and brand you selected? **[ONLY SHOW RESPONSES CHECKED IN H12; SELECT ONE RESPONSE]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. **[INSERT "OTHER SPECIFY" RESPONSE FROM H13]**

98. Don't Know
99. (Skipped)

H14. How did you learn that the thermostat qualified for an Ameren Missouri Rebate?

1. From the contractor
2. From a representative at the store
3. Ameren Missouri website
4. Other, please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

Smart Thermostat Usage

H15. How easy is the smart thermostat to use?

1. Very easy
2. Somewhat easy
3. Not too easy
4. Not at all easy

98. Don't Know
99. (Skipped)

H16. Is the function on your smart thermostat that senses when you are home or away working? (This function is also called "geofencing" or "occupancy sensing.")

1. Yes
2. No

98. Don't Know
99. (Skipped)

H17. Is your smart thermostat connected to the internet?

1. Yes
2. No

98. Don't Know
99. (Skipped)

H18. What features of your smart thermostat do you like best? **[RANDOMIZE ORDER, CHECK ALL THAT APPLY]**

1. Thermostat design / aesthetic
2. Thermostat ease of use
3. Automatically programs itself / automatically adjusts the temperature when you're away
4. Gives me detailed information about my energy use
5. Dehumidifying capabilities (When thermostat uses HVAC system to lower indoor humidity level)
6. Maintenance reminders
7. Mobile app
8. Remote monitoring of household temperature and thermostat settings
9. Ability to check local weather from thermostat and smartphone/tablet app
10. Other features (please specify) **[SPECIFY_____]**
11. None of the above

98. Don't Know
99. (Skipped)

H19. In what ways have you ever accessed your thermostat since it was first installed, to do things such as changing your temperature settings or schedules? **[MARK ALL THAT APPLY]**

1. The thermostat itself
2. Website on a PC or laptop
3. Smartphone or tablet app
4. I have not accessed my thermostat since it was installed

98. Don't Know
99. (Skipped)

H20. In past 30 days, how have you <u>most often</u> accessed your thermostat? **[SELECT ONE]**

1. The thermostat itself
2. Website on a PC or laptop
3. Smartphone or tablet app
4. I have not accessed my thermostat in the past month

98. Don't Know
99. (Skipped)

H21. How do you currently use your thermostat's interactive capabilities? **[CHECK ALL THAT APPLY]**

1. Check how much energy I have used
2. Adjust the temperature while at home
3. Adjust the temperature while away from home
4. Modify my thermostat schedule while at home
5. Modify my thermostat schedule while away from home
6. Check inside or outside temperature
7. Just checked it out to see what it has to offer
8. Have not used interactive capabilities
9. Other (please specify) **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

H22. Did you or someone in your household set up and program the thermostat, or did the contractor set it up for you?

1. I or someone in my household set up/programmed it
2. Contractor set up/programmed it
3. No one set up or programmed the thermostat

98. Don't Know
99. (Skipped)

H23. **[ASK IF H22= 1]** How easy was it to set up your smart thermostat? Would you say it was…?

1. Very easy
2. Somewhat easy
3. Not too easy
4. Not at all easy

98. Don't Know
99. (Skipped)

H24. How is your smart thermostat currently controlled? **[SELECT ONE]**

1. I keep it at a constant temperature throughout the season
2. I rely on the programmed schedule of temperatures, and never manually change the temperature
3. I rely on the programmed schedule of temperatures, but sometimes manually change the temperature
4. I manually adjust the temperature using a regular schedule by changing the temperature for different times of the day or week
5. I manually adjust the temperature using no regular schedule
6. Some other way (please specify) **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

Smart Thermostat Free Ridership Questions

H25. Did you first find out about the Ameren Missouri rebate before or after you purchased your new thermostat?

1. Learned of rebate before purchase
2. Learned of rebate after purchase
98. Don't Know
99. (Skipped)

H26. **[ASK IF H25=2]** Please confirm: You purchased your new thermostat and *then* found out it qualified for a rebate from Ameren Missouri afterwards, is that correct?

1. Yes, that is correct **[SKIP TO H32]**
2. No, that is not correct
98. Don't Know
99. (Skipped)

H27. Before you knew about the rebate from Ameren Missouri, were you already planning to install a smart thermostat this year?

1. Yes
2. No
98. Don't Know
99. (Skipped)

H28. Without Ameren Missouri's rebate, would you have installed a smart thermostat …?

1. Around the same time
2. Later in the same year
3. In one or two years
4. After more than three years
98. Don't Know
99. (Skipped)

H29. **[READ IF H28 = 1,2, 98, 99]** Would you have installed the same smart thermostat without the rebate from Ameren Missouri?

1. Yes
2. No
98. Don't Know
99. (Skipped)

H30. **[IF H29 = 2, 98, 99]** Would you have installed a different thermostat without the Ameren Missouri rebate or would you have decided to not purchase one at all?

1. I would have installed a different thermostat
2. I would have decided not to purchase one at all
98. Don't Know
99. (Skipped)

H31. **[IF H30 = 1]** When you say you would have installed a thermostat without the rebate from Ameren Missouri, would you have installed…?

1. A smart thermostat (also called a "learning" thermostat)
2. A programmable thermostat (a thermostat that can be programmed, but is not "smart" or connected to communication devices)
3. A manual thermostat
4. Would not have installed a new thermostat
98. Don't Know
99. (Skipped)

H32. How important was the Ameren Missouri rebate on your decision to purchase and install the smart thermostat?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
98. Don't Know
99. (Skipped)

H33. How important was the advice from the contractor in your decision to purchase and install the smart thermostat? Would you say…?

1. Very important
2. Somewhat important
3. Not very important
4. Not at all important
98. Don't Know
99. (Skipped)

I. Satisfaction with Ameren Missouri

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

I1. Thinking about your overall experiences with Ameren Missouri as your utility, how satisfied would you say you are with Ameren Missouri?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

I2. **[ASK IF I1= 1, 2, 3 OR 4]** Why are you "[**RATING FROM I1**]" with Ameren Missouri as your utility?

[RECORD RESPONSE:_____]

I3. Based on your experience with the Heating and Cooling Program, would you say your satisfaction with Ameren Missouri has:

1. Increased
2. Stayed about the same, or
3. Decreased?
98. Don't Know
99. (Skipped)

J. All HVAC Participants Customer Demographics

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

We are almost finished! There are just a few final questions about your home that will help us with our analysis.

J1. Is the energy used in your home . . .

1. All electric,
2. Natural gas and electric,
3. Some other combination of energy sources?
98. Don't Know
99. (Skipped)

J2. Is your hot water heater electric or gas?

1. Electric
2. Gas
98. Don't Know
99. (Skipped)

J3. Which of the following best describes your home or residence? **[SELECT ONE RESPONSE]**

1. Single-family home (not a duplex, townhome, or apartment)
2. Manufactured or modular home
3. Mobile home
4. Row house or townhome
5. Two or three family attached residence
6. Apartment with four or more units
7. Condominium
8. Other **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

J4. Do you own or rent this residence?

1. Own
2. Rent

98. Don't Know
99. (Skipped)

J5. Approximately how many square feet of living space does your home have? Don't include the basement unless it is a space that you consider "lived in".

1. Less than 1,000 square feet
2. 1,000 to less than 1,500 square feet
3. 1,500 to less than 2,000 square feet
4. 2,000 to less than 2,500 square feet
5. 2,500 to less than 3,000 square feet
6. 3,000 or more square feet

98. Don't Know
99. (Skipped)

J6. When was your home built?

1. After 2008
2. 2005-2008
3. 2001-2004
4. 1980-2000
5. Before 1980

98. Don't Know
99. (Skipped)

J7. Counting yourself, how many people normally live in your household on a full-time basis? Please include everyone who lives in your home, whether or not they are related to you, and exclude anyone just visiting or children who may be away at college or in the military.

1. Please enter a number: **[RECORD NUMERIC RESPONSE:_____]**
2. I prefer not to answer this question

99. (Skipped)

End of survey message for those who get to last page of the survey (eligible for drawing): Those are all of our questions! Click to the next page to verify your information for the prize drawing. **[CONTINUE TO SWEEPSTAKES VERIFICATION]**

Termination for non-aware or ineligible ECM - without thermostat (eligible for drawing): That is all of our questions. You are eligible to enter the prize drawing. **[CONTINUE TO SWEEPSTAKES VERIFICATION]**

Termination for non-aware or ineligible ECM - with thermostat (eligible for drawing): That is all of our questions at this time. We may email you an invitation to take another survey about your smart thermostat purchase. You are eligible to enter the prize drawing. **[CONTINUE TO SWEEPSTAKES VERIFICATION]**

Termination for HVAC employee screen (eligible for drawing): We are not surveying households where somebody works with heating and cooling equipment about this program. However, you are still eligible to enter the prize drawing. **[CONTINUE TO SWEEPSTAKES VERIFICATION]**

Termination for Ameren employee screen (not eligible for drawing): We are not surveying Ameren Missouri employee households about this program. We appreciate your participation and thank you for your time. **[TERMINATE]**

J8. As a token of our appreciation, you are eligible to participate in a random drawing to win one of five $100 gift cards that we are awarding to Ameren Missouri customers who take this survey (see details below).

No purchase necessary to enter to win. Must be 18 years or older to participate or win. The odds of winning are dependent upon the number of persons participating in the drawing. The drawing starts on August 31, 2016 and ends on February 28, 2017. Winners will be randomly selected on March 15, 2017. Visit Ameren.com/Sweepstakes for official rules, odds of winning and entry details. Sponsor: Ameren Missouri.

How would you like to receive your gift card if you win the drawing?

1. Mail the gift card to me:
   [PLEASE PROVIDE YOUR NAME AND ADDRESS:_____]
2. Send me an "e-card" gift certificate by email:
   [PLEASE PROVIDE YOUR EMAIL ADDRESS:_____]
3. I do not want to participate in the drawing.

99. (Skipped)

Closing message for respondents who enter drawing:

We appreciate your participation and thank you for your time.
Prize winners will be randomly selected on March 15, 2017.
Visit Ameren.com/Sweepstakes for official rules, odds of winning and entry details.
Sponsor: Ameren Missouri.

Closing message for respondents who decline to enter drawing:

This completes the survey. We appreciate your participation and thank you for your time.

CADMUS

Ameren Missouri 2016 Online HVAC Survey

Research Topics	Survey Question Mapping
Program Processes, how participants learn about the HVAC program	A8
Program processes, product purchase decisions	B1
Program processes, participant engagement with contractors	C1-C3
Participant satisfaction, program processes and products?	D1-D11
Spillover Questions	E1-E11
Program processes, central air-conditioner installation decision-making and baseline equipment	F1-F9
Program processes, heat pump installation decisions and baseline equipment	G1-G15
Program processes, ECM installation decisions, baseline and usage	H1-H14
Program processes, smart thermostat installation decisions and baseline equipment	I1.-I18
Program processes, smart thermostat use	I19-I24
Participant satisfaction, Ameren	J1-J3
Participant Demographics	K1-K7

Red text = programming instructions (not visible to respondents)

***[Measuretype]* = measure name imported from panel data**

Green text = open-ended responses

(Skipped) responses are not visible (99 = code for nothing selected / skipped question)

Catalogue ID - From Tracking Data Base	[MEASURENAME] - For Initial Measure Verification	[MEASURETYPE] - As Appears in Most Survey	[MEASUREEFFICIENCY] - For Selected Free	Category - Determines Applicability of Survey

		Questions	ridership Question	Sections
ASHP ER with ASHP 16+ ER	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
ASHP ER with ASHP SEER 15 ER	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP Replace at Fail with ASHP 16+	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
ASHP Replace at Fail with ASHP SEER 15	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP SEER 15 ER Elec Resist Furnace ER	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP SEER 15 Replace at Fail Elect Resist Furnace	air source heat pump (15 SEER)	air source heat pump	15 SEER	Heat Pump
ASHP SEER 16+ ER Elec Resist Furnace ER	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
ASHP SEER 16+ Replace at Fail Elec Resist Furnace	air source heat pump (16+ SEER)	air source heat pump	16+ SEER	Heat Pump
CAC SEER 14 ER	central air conditioner (14 SEER)	central air conditioner	14 SEER	Central Air Conditioner
CAC SEER 14 Replace at Fail	central air conditioner (15 SEER)	central air conditioner	15 SEER	Central Air Conditioner
CAC SEER 15 ER	central air conditioner (15 SEER)	central air conditioner	15 SEER	Central Air Conditioner
CAC SEER 15 Replace at Fail	central air conditioner (15 SEER)	central air conditioner	15 SEER	Central Air Conditioner
CAC SEER 16+ ER	central air conditioner (16+ SEER)	central air conditioner	16+ SEER	Central Air Conditioner
CAC SEER 16+ Replace at Fail	central air conditioner (16+ SEER)	central air conditioner	16+ SEER	Central Air Conditioner
Concept 3 Continuous Fan Replace at Fail_50	furnace fan	furnace fan		ECM
Concept 3 Installations Auto Fan ER_100	furnace fan	furnace fan		ECM
Concept 3 Installations Auto Fan ER_50	furnace fan	furnace fan		ECM
Concept 3 Installations Auto Fan Replace at Fail_100	furnace fan	furnace fan		ECM
Concept 3 Installations Auto Fan Replace at Fail_50	furnace fan	furnace fan		ECM
Concept 3 Installations Continuous Fan ER_100	furnace fan	furnace fan		ECM
Concept 3 Installations Continuous Fan ER_50	furnace fan	furnace fan		ECM

DFHP SEER 15_SF	dual-fuel heat pump (15 SEER)	dual-fuel heat pump	15 SEER	Heat Pump
DFHP SEER 16_SF	dual-fuel heat pump (16 SEER)	dual-fuel heat pump	16 SEER	Heat Pump
DFHP SEER 17+_SF	dual-fuel heat pump (17+ SEER)	dual-fuel heat pump	17+ SEER	Heat Pump
DFHP SEER 18+_SF	dual-fuel heat pump (18+ SEER)	dual-fuel heat pump	18+ SEER	Heat Pump
Ductless ASHP ER	dual-fuel heat pump	dual-fuel heat pump	high efficiency	Heat Pump
Ductless ASHP Replace Electric Resistance ER	ductless heat pump	ductless heat pump	high efficiency	Heat Pump
Ductless ASHP Replace Electric Resistance ROF	ductless heat pump	ductless heat pump	high efficiency	Heat Pump
Ductless ASHP ROF	ductless heat pump	ductless heat pump	high efficiency	Heat Pump
GSHP - 23 EER ER	ground source heat pump (23 EER)	ground source heat pump	23 EER	Heat Pump
GSHP - 23 EER Replace at Fail	ground source heat pump (23 EER)	ground source heat pump	23 EER	Heat Pump
GSHP SEER 14+ ER ASHP with GSHP ER	ground source heat pump (14+ SEER)	ground source heat pump	14+ SEER	Heat Pump
GSHP SEER 14+ ER Elec Resist Furnace ER	ground source heat pump (14+ SEER)	ground source heat pump	14+ SEER	Heat Pump
GSHP SEER 14+ Replace Elec Resist Furnace	ground source heat pump (14+ SEER)	ground source heat pump	14+ SEER	Heat Pump

A. All HVAC Measures – Verification and Program Awareness

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

INTRO: Thank you for participating in Ameren Missouri's Heating and Cooling Program. We would like to know more about your experience with the program. Instructions for participating in the prize drawing for participating in the survey are provided at the end of these questions.

A1. Our records indicate that you received a rebate for installing a new high efficiency **[MEASURENAME]**. Is this correct? **[FORCED RESPONSE (NO SKIP)]**

1. Yes
2. No, I did not receive a rebate **[TERMINATE]**

A2. **[ASK IF MEASURETYPE = FURNACE FAN]** Did you install your new furnace fan with a new furnace, or did you install it with an existing furnace?

1. I installed it with a new furnace
2. I installed it with an existing furnace
98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A3. **[ASK IF A2=1]** Do you have a central air conditioner or heat pump?

1. Yes
2. No **[TERMINATE]**
98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A4. **[ASK IF A3 = 1]** Did you install the air-conditioner or heat pump when you installed the furnace?

1. Yes
2. No **[TERMINATE]**
98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A5. **[ASK IF A4 = 1]** Why did you not get a rebate for the air conditioner or heat pump?

1. I did get a rebate from Ameren **[TERMINATE]**
2. Because my contractor said it did not qualify **[TERMINATE]**
3. The efficiency was too low **[TERMINATE]**
4. Because I did not get a new indoor cooling coil to my install didn't qualify **[TERMINATE]**
5. Because I was unable to get a valid AHRI certificate, thus did not qualify for a rebate **[TERMINATE]**
6. **[SPECIFY:_____]** **[TERMINATE]**
98. Don't Know **[TERMINATE]**
99. (Skipped) **[TERMINATE]**

A6. Are you or any members of your household employed by Ameren Missouri or by a company that sells, installs, or services heating and cooling equipment? **[FORCED RESPONSE (NO SKIP OR DK)]**

1. Yes, I or someone in my household works for Ameren Missouri **[TERMINATE]**
2. Yes, I or someone in my household works for a company that sells, installs or services heating and cooling equipment **[TERMINATE]**
3. No one in my household works for the companies listed above

A7. Prior to this survey, were you aware that the rebate you received after installing your new high efficiency **[MEASURETYPE]** was provided by Ameren Missouri?

1. Yes
2. No
98. Don't Know
99. (Skipped)

A8. How did you hear about Ameren Missouri's Heating and Cooling Program? **[RANDOMIZE ORDER – CHECK ALL THAT APPLY]**

1. From my contractor or installer
2. Visited Ameren's Web site
3. Other Web site, which site? **[SPECIFY:_____]**
4. On my Monthly Energy Statement/Bill
5. Information that I received by mail from Ameren
6. Information that I received by mail from a contractor
7. A brochure from Ameren that I did not receive by mail
   Where did you find the brochure that informed you about the program, or who gave it to you? **[SPECIFY:_____]**
8. When my rebate check arrived
9. Door hanger
10. Family, friend or co-worker
11. Newspaper
12. Radio
13. Ameren Missouri representative
14. Television advertisement
15. Ameren Missouri Home Energy Report
16. Signs or displays in a store
17. Store representative or salesperson
18. Social Media (Facebook, Twitter)
19. Some other way **[SPECIFY:_____]**
98. Don't Know
99. (Skipped)

B. All HVAC Measures - Purchase Patterns and Decision-making

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED. MEASURE-SPECIFIC PURCHASE PATTERN AND DECISION-MAKING QUESTIONS WILL BE ADDRESSED IN EACH MEASURE'S SECTION

B1. What was the primary reason you purchased a new **[MEASURETYPE]**? **[SELECT ONE RESPONSE]**

1. To replace broken equipment
2. To replace aging equipment
3. To improve the comfort of my home
4. To improve the safety of my home
5. The purchase was part of a larger home renovation
6. The equipment is for a newly constructed home
7. To save money on energy costs
8. To help the environment
9. Some other reason, please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

C. ALL HVAC Measures - Participation Process – Contractors

ASK ALL PARTICIPANTS

C1. How did you select the contractor who installed your system? **[RANDOMIZE ORDER, CHECK ALL THAT APPLY]**

1. I have used this contractor before
2. The contractor approached me directly
3. Ameren website
4. The contractor was referred to me by a family member, friend, or colleague
5. Online advertisement
6. I saw contractor's marketing materials
7. I saw contractor's newspaper/TV/radio advertisement
8. Through business owners in my neighborhood or network
9. Yellow pages
10. Angie's List or similar consumer information source
11. Better Business Bureau
12. Some other way, please specify **[SPECIFY:_____]**

98. Don't Know
98. (Skipped)

C2. [**ASK IF C1 = 8, 9, 10, 11, 12**] Did you specifically seek out a contractor who participated in the program in order to receive a rebate for your equipment?

1. Yes
2. No

98. Don't know
99. (Skipped)

C3. **[ASK IF C2=1]** How difficult was it to find a contractor that participated in the program?

1. Not difficult at all
2. Not too difficult
3. Somewhat difficult
4. Very difficult

98. Don't know
99. (Skipped)

D. All HVAC Measures – Participant Satisfaction

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

D1. How satisfied are you with the contractor you worked with?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D2. **[ASK IF D1 = 1, 2, 3 OR 4]** Why are you **[RATING FROM D1]** with the contractor?
[RECORD RESPONSE:_____]

D3. How satisfied are you with the time it took to receive your rebate in the mail?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D4. How satisfied are you with the performance of your new **[MEASURETYPE]**?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D5. **[ASK IF D4 = 1, 2, 3 OR 4]** Why are you **[RATING FROM D4]** with the performance of your new **[MEASURETYPE]**?

[RECORD RESPONSE:_____]

D6. Thinking about your overall satisfaction with Ameren Missouri's Heating and Cooling Program, would you say you are:

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

D7. **[ASK IF D8 = 1, 2, 3 OR 4]** Why are you **[RATING FROM D8]** with Ameren Missouri's Heating and Cooling Program?

[RECORD RESPONSE:_____]

D8. Would you recommend Ameren Missouri's Heating and Cooling Program to friends or family members?

1. Yes
2. No
98. Don't Know
99. (Skipped)

D9. What suggestions, if any, do you have for improving the program?

1. Specify suggestions: **[RECORD RESPONSE:_____ _____]**
2. No suggestions

E. Spillover Questions

E1. Since participating in the Heating and Cooling program, have you added any other energy-efficient products in your home or had any other energy-related services performed that were not discounted through Ameren?

1. Yes
2. No [**SKIP TO I1**]
98. Don't Know [**SKIP TO I1**]
99. (Skipped) [**SKIP TO I1**]

E2. **[IF E=1]** Please select the energy-efficient products or services that you purchased (and installed, if applicable) since your experience with Ameren's Heating and Cooling program. **[RANDOMIZE ORDER, CHECK ALL THAT APPLY]**

1. Home/building audit
2. Recycled a refrigerator or freezer
3. Constructed an Energy Star New Home
4. Light fixtures or ceiling fan
   a. How many of these are currently installed in your home? [**SPECIFY:** _____]
5. Efficient refrigerator
6. Efficient freezer
7. Efficient clothes washer
8. Efficient dishwasher
9. Efficient room air conditioner
   b. How many? [**SPECIFY:** _____]
10. Energy efficient electronics (e.g. TV, DVD, computer)
11. Efficient dehumidifier
12. Efficient water heater
13. Efficient showerheads
    c. How many of these are currently installed in your home? [**SPECIFY:** _____]
14. Efficient faucet aerators
    d. How many of these are currently installed in your home? [**SPECIFY:** _____]
15. Central air conditioner
16. Air source heat pump
17. Geothermal heat pump
18. Heat pump water heater
19. Programmable (but not "smart") thermostat
20. Learning or "smart" thermostat
21. Insulation
22. Windows
23. Solar panels
24. Other items
    e. Please specify: [**SPECIFY:** _____]

98. Don't Know
99. (Skipped)

E3. **[ASK if E2 = 21 OR 22]** How many square feet of [**INSULATION/WINDOWS**] did you have installed?

1. [**RECORD NUMERIC RESPONSE:**_____]
98. Don't Know
99. (Skipped)

E4. **[ASK if E2 = 21 OR 22]** In what location in your home was [**WERE**] the [**INSULATION/WINDOWS**] installed?

1. [**RECORD RESPONSE:**_____]
98. Don't Know
99. (Skipped)

E5. [**ASK ONCE FOR EACH ITEM CHECKED IN E2**] Why did you choose to purchase or install the items listed below? [**INSERT TABLE OF CHECKED RESPONSES FROM E2**]

1. **[RECORD RESPONSE]**:_____
98. Don't Know
99. (Skipped)

E6. Did you receive a rebate, discount, or tax credit for any of the items listed below? [**INSERT TABLE OF CHECKED RESPONSES FROM E2**]

1. Yes
2. No
98. Don't Know
99. (Skipped)

E7. [**ASK FOR EACH ITEM WHERE E6 = 1**] What organizations paid the rebates, discounts or tax credits for the items listed below? [**INSERT TABLE OF CHECKED RESPONSES FROM E11**]

1. [**RECORD RESPONSE:**_____]
98. Don't Know
99. (Skipped)

E8. [**FOR MEASURES INCLUDED IN THE PROGRAM, ASK FOR EACH ITEM WHERE E6= 2**] Why didn't you apply for a rebate from Ameren for the purchase of your [E2 **RESPONSE**]?

1. **[RECORD RESPONSE]**:_____
98. Don't Know
99. (Skipped)

E9. How important was your participation in the Ameren program on your decision to purchase or install the [**E2 RESPONSE**]? [**INSERT TABLE OF CHECKED RESPONSES FROM E2**]

1. Not at all important
2. Not too important
3. Somewhat important
4. Very important
98. Don't Know
99. (Skipped)

E10. **[ASK FOR EACH CHECKED ITEM FROM E2]** Prior to purchasing or installing the items listed below, had you heard or read about the benefits of installing this equipment from [***your contractor, Ameren, or Ameren's Act on Energy campaign***]?

	Yes (1)	No (2)	Don't know (98)
[INSERT 1st CHECKED RESPONSE FROM E2]			
[INSERT 2nd CHECKED RESPONSE FROM E2]			
[INSERT 3rd CHECKED RESPONSE FROM E2]			
[INSERT 4th CHECKED RESPONSE FROM E2]			

E11. How important was the information the contractor or Ameren provided about the energy efficiency or money saving benefits of in your decision to purchase or install the items listed below? **[INSERT TABLE OF ALL "YES" RESPONSES FROM E10]**

1. Not at all important
2. Not too important
3. Somewhat important
4. Very important
98. Don't Know
99. (Skipped)

F. Central Air Conditioner Questions

ASK QUESTIONS OF PARTITIPANTS THAT HAVE INSTALLED CENTRAL AIR CONDITIONERS

F1. Did you install your central air conditioner in a newly constructed home or in an existing home?

1. Newly constructed home
2. Existing home
99. (Skipped)

F2. Do you have any of the following currently installed in addition to your new efficient air conditioner at your home? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Window air conditioner unit(s)
3. Ground Source Heat Pump
4. Ductless Heat Pump
5. Standard-efficiency air conditioner
6. Room air conditioner unit(s)
7. Another high-efficiency air conditioner
8. Room air conditioners
9. Space heater(s)
10. High-efficiency gas furnace
11. Standard-efficiency gas furnace
12. High-efficiency electric furnace
13. Standard-efficiency electric furnace
14. Baseboard electric system

98. Don't Know
99. (Skipped)

F3. At what point did you determine the exact air conditioner you wanted to buy?

1. I knew which model I wanted before calling a contractor
2. I decided after the contractor provided me with options

98. Don't Know
99. (Skipped)

F4. Which factors were important in your decision to purchase the specific equipment you selected? Please select all that apply. **[CHECK ALL THAT APPLY]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. Other, Please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

F5. **[ASK IF MORE THAN ONE RESPONSE IS CHECKED IN F4]** If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific equipment you selected? **[ONLY SHOW RESPONSES CHECKED IN F4; SELECT ONE RESPONSE]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. **[INSERT "OTHER SPECIFY" RESPONSE FROM F4]**
98. Don't Know
99. (Skipped)

F6. What type of thermostat do you use to control your heating and cooling equipment?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

F7. Did you install this thermostat when you installed your new air conditioning system?

1. Yes
2. No
98. Don't Know
99. (Skipped)

F8. **[ASK IF F7=1]** What type of thermostat did you have before installing the new thermostat?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

F9. What type of cooling system did you replace and remove when installing your new efficient air conditioning system?

1. Nothing
2. Window air conditioning unit(s)
3. Air source heat pump
4. Room air conditioning unit(s)
5. Ground source heat pump
6. Central air-conditioning
7. Other **[SPECIFY:_____]**
8. I kept my cooling system
9. I didn't have a cooling system
98. Don't Know
99. (Skipped)

G. Heat Pumps

ASK OF PARTICIPANTS WHO HAVE INSTALLED HEAT PUMPS

G1. Did you install your heat pump in a newly constructed home or in an existing home?

1. Newly constructed home
2. Existing home
99. (Skipped)

G2. For what purpose did you install your heat pump?

1. Primarily heating
2. Primarily cooling
3. Both heating and cooling
98. Don't Know
99. (Skipped)

G3. What type of heating system did you replace and remove before you installed the heat pump?

1. Electric forced air furnace
2. Electric baseboard heat
3. Ground source heat pump
4. Air Source Heat Pump
5. Gas heating system (boiler, furnace)
6. Other **[SPECIFY:_____]**
7. I kept my previous heating system
8. Nothing – this is new construction

98. Don't Know
99. (Skipped)

G4. What type of cooling system did you replace and remove before you installed the heat pump?

1. Window air conditioning unit(s)
2. Room air conditioning unit(s)
3. Air Source Heat Pump
4. Ground Source Heat Pump
5. Central air conditioning system
6. Other **[SPECIFY:_____]**
7. I kept my previous cooling system
8. I didn't have a cooling system

98. Don't Know
99. (Skipped)

G5. Do you have any of the following currently installed in addition to your new heat pump at your home? **[INDICATE ALL THAT APPLY]**

1. Air Source Heat Pump
2. Window air conditioner unit(s)
3. Ground Source Heat Pump
4. Ductless Heat Pump
5. Standard-efficiency air conditioner
6. Room air conditioner unit(s)
7. Another high-efficiency air conditioner
8. Space heater(s)
9. High-efficiency gas furnace
10. Standard-efficiency gas furnace
11. High-efficiency electric furnace
12. Standard-efficiency electric furnace
13. Baseboard electric system
14. None of the above
98. Don't Know
99. (Skipped)

G6. What type of thermostat do you use to control your heating and cooling equipment?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

G7. Did you install this thermostat when you installed your new heat pump?

1. Yes
2. No
98. Don't Know
99. (Skipped)

G8. **[IF G7=1]** What type of thermostat did you have before installing the new thermostat?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

G9. **[IF MEASURETYPE=ASHP]** Why did you choose to install an air source heat pump?

1. I wanted a higher efficiency electric heating system
2. I wanted a high-efficiency cooling system
3. It is more "green" than any other heating/cooling options
4. I wanted to reduce fossil fuel consumption
5. I wanted to save money on my utility bills
6. I wanted to take advantage of Ameren's rebate
7. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

G10. **[IF MEASURETYPE=GSHP]** Before you selected your **[MEASURETYPE]**, did you consider installing an air source heat pump?

1. Yes
2. No

98. Don't Know
99. (Skipped)

G11. **[IF MEASURETYPE=GSHP]** Why did you specifically choose to install a ground source heat pump?

1. It is the most efficient possible option
2. It is more "green" than any other heating/cooling option
3. To save money on my heating and cooling bills
4. Our property is ideal for installation of ground well/ground loops
5. Ground loops were already present on our property
6. To replace my existing ground-source heat pump
7. To increase the resale value of my home
8. It provides more heat at low outdoor temperatures than an air source heat pump
9. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

G12. **[IF MEASURETYPE=DUCTLESS HP]** Why did you specifically choose to install a ductless heat pump?

1. I wanted to install a Heat Pump but I did not have the duct work to install other types of heat pumps
2. It was the easiest way to install a Heat Pump at my home
3. To save money on my heating and cooling bills
4. To increase the resale value of my home
5. I wanted a higher efficiency electric heating system
6. I wanted a high-efficiency cooling system
7. It is more "green" than any other heating/cooling options
8. Other **[SPECIFY:_____]**

98. Don't Know
99. (Skipped)

G13. At what point did you determine the exact model and brand of heat pump that you wanted to buy?

1. I knew which model I wanted before calling a contractor
2. I decided after the contractor provided me with option

98. Don't Know
99. (Skipped)

G14. Which factors were important in your decision to purchase the specific model and brand you selected? Please select all that apply. **[CHECK ALL THAT APPLY]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. Other, Please specify: **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

G15. **[ASK IF MORE THAN ONE RESPONSE IS CHECKED IN G14]** If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific model and brand you selected? **[ONLY SHOW RESPONSES CHECKED IN G14; SELECT ONE RESPONSE]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. **[INSERT "OTHER SPECIFY" RESPONSE FROM G14]**
98. Don't Know
99. (Skipped)

H. Furnace Fan Questions

ASK OF PARTICIPANTS WHO INSTALLED ONLY ECM MEASURE – NO OTHER MEASURE

H1. What type of heating system do you have?

1. Air Source Heat Pump
2. Electric furnace
3. Gas furnace
4. Ground Source Heat Pump
5. Other [**SPECIFY:**_____]
99. (Skipped)

H2. What type of cooling system do you have?

1. Air Source Heat Pump
2. Ground Source Heat Pump
3. Central air conditioner
4. Window air conditioner(s)
5. Other [**SPECIFY:**_____]
6. None
99. (Skipped)

H3. Your new furnace fan (with a high efficiency variable speed motor for your heating and cooling system) is able to vary speed to change the airflow that your heating and cooling system delivers. Did your previous fan have this ability?

1. Yes
2. No
98. Don't Know
99. (Skipped)

H4. Why did you decide to install a new furnace fan? **[INDICATE ALL THAT APPLY]**

1. My previous fan motor stopped working (i.e., unit failed)
2. My previous fan motor but was having problems
3. I was unsatisfied with the airflow
4. To take advantage of the rebate
5. Maintenance contract / Regularly scheduled check up
6. To keep my air conditioner running efficiently
7. To save energy
8. To lower my energy bill, save money on bills
9. It didn't cost much
10. Reminded by Ameren Missouri advertising
11. Reminded by advertising other than Ameren Missouri
12. Recommended by a family or friend
98. Don't Know
99. (Skipped)

H5. What type of thermostat do you use to control your heating and cooling equipment?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

H6. Did you install this thermostat when you installed your new furnace fan?

1. Yes
2. No
98. Don't Know
99. (Skipped)

H7. **[IF H6=1]** What type of thermostat did you have before installing the new thermostat?

1. Manual thermostat
2. Programmable thermostat
3. Smart thermostat (may be called learning thermostat)
98. Don't Know
99. (Skipped)

H8. Do you operate your fan in "continuous" mode to circulate air?

1. Yes
2. No
98. Don't Know
99. (Skipped)

H9. **[IF H8=1]** Can you estimate the average number of hours per day it is set to "continuous" for each season?

1. Spring/fall: ___ [0-24]
2. Summer: _____[0-24]
3. Winter: _____ [0-24]
98. Don't Know
99. (Skipped)

H10. **[IF H8=1]** Would you say the time you operate your fan in circulation mode has…

1. Increased?
2. Decreased?
3. Stayed the same?
98. Don't Know
99. (Skipped)

H11. **[IF H10=1 OR 2]** Can you estimate the hours of [**INCREASE/DECREASE**] for each season?

1. Spring/fall: [**SPECIFY:**_____0-24]
2. Summer: [**SPECIFY:**_____0-24]
3. Winter: [**SPECIFY:**_____0-24]
98. Don't Know
99. (Skipped)

H12. At what point did you determine the exact model and brand you wanted to buy?

1. I knew which model I wanted before calling a contractor
2. I decided after the contractor provided me with options
98. Don't Know
99. (Skipped)

H13. Which factors were important in your decision to purchase the specific model and brand you selected? Please select all that apply. **[CHECK ALL THAT APPLY]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. Other, Please specify: **[SPECIFY: _____]**
98. Don't Know
99. (Skipped)

H14. **[ASK IF MORE THAN ONE RESPONSE IS CHECKED IN G14]** If you had to choose just one, which factor would you say was the most important in your decision to purchase the specific model and brand you selected? **[ONLY SHOW RESPONSES CHECKED IN H13; SELECT ONE RESPONSE]**

1. Price
2. Quality/reputation
3. Cost savings on energy bills
4. The store representative recommended it to me
5. My contractor or installer recommended it to me
6. It qualified for an Ameren Missouri rebate
7. It had specific features I was looking for
8. Impact on the environment
9. It was available when I needed it
10. **[INSERT "OTHER SPECIFY" RESPONSE FROM H13]**
98. Don't Know
99. (Skipped)

I. Satisfaction with Ameren Missouri

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

I1. Thinking about your overall experiences with Ameren Missouri as your utility, how satisfied would you say you are with Ameren Missouri?

1. Very satisfied
2. Somewhat satisfied
3. Not too satisfied
4. Not satisfied at all
98. Don't Know
99. (Skipped)

I2. **[ASK IF J1= 1, 2, 3 OR 4]** Why are you "[**RATING FROM I1**]" with Ameren Missouri as your utility?
[RECORD RESPONSE:_____]

I3. Based on your experience with the Heating and Cooling Program, would you say your satisfaction with Ameren Missouri has:

1. Increased
2. Stayed about the same, or
3. Decreased?
98. Don't Know
99. (Skipped)

J. All HVAC Participants Customer Demographics

ASK QUESTIONS OF ALL PARTICIPANTS, REGARDLESS OF WHAT TYPE OF MEASURE THEY HAVE INSTALLED.

We are almost finished! There are just a few final questions about your home that will help us with our analysis.

J1. Is the energy used in your home . . .

1. All electric,
2. Natural gas and electric,
3. Some other combination of energy sources?
98. Don't Know
99. (Skipped)

J2. Is your hot water heater electric or gas?

1. Electric
2. Gas
98. Don't Know
99. (Skipped)

J3. Which of the following best describes your home or residence? **[SELECT ONE RESPONSE]**

1. Single-family home (not a duplex, townhome, or apartment)
2. Manufactured or modular home
3. Mobile home
4. Row house or townhome
5. Two or three family attached residence
6. Apartment with four or more units
7. Condominium
8. Other **[SPECIFY: _____]**

98. Don't Know
99. (Skipped)

J4. Do you own or rent this residence?

1. Own
2. Rent

98. Don't Know
99. (Skipped)

J5. Approximately how many square feet of living space does your home have? Don't include the basement unless it is a space that you consider "lived in".

1. Less than 1,000 square feet
2. 1,000 to less than 1,500 square feet
3. 1,500 to less than 2,000 square feet
4. 2,000 to less than 2,500 square feet
5. 2,500 to less than 3,000 square feet
6. 3,000 or more square feet

98. Don't Know
99. (Skipped)

J6. When was your home built?

1. After 2008
2. 2005-2008
3. 2001-2004
4. 1980-2000
5. Before 1980

98. Don't Know
99. (Skipped)

J7. Counting yourself, how many people normally live in your household on a full-time basis? Please include everyone who lives in your home, whether or not they are related to you, and exclude anyone just visiting or children who may be away at college or in the military.

1. Please enter a number: **[RECORD NUMERIC RESPONSE:_____]**
2. I prefer not to answer this question

99. (Skipped)

End of survey message for those who get to last page of the survey (eligible for drawing): Those are all of our questions! Click to the next page to verify your information for the prize drawing. **[CONTINUE TO SWEEPSTAKES VERIFICATION]**

Termination for non-aware or ineligible ECM (eligible for drawing): That is all of our questions. You are eligible to enter the prize drawing. **[CONTINUE TO SWEEPSTAKES VERIFICATION]**

Termination for HVAC employee screen (eligible for drawing): We are not surveying households where somebody works with heating and cooling equipment about this program. However, you are still eligible to enter the prize drawing. **[CONTINUE TO SWEEPSTAKES VERIFICATION]**

Termination for Ameren employee screen (not eligible for drawing): We are not surveying Ameren Missouri employee households about this program. We appreciate your participation and thank you for your time. **[TERMINATE]**

J8. As a token of our appreciation, you are eligible to participate in a random drawing to win one of five $100 gift cards that we are awarding to Ameren Missouri customers who take this survey (see details below).

No purchase necessary to enter to win. Must be 18 years or older to participate or win. The odds of winning are dependent upon the number of persons participating in the drawing. The drawing starts on August 31, 2016 and ends on February 28, 2017. Winners will be randomly selected on March 15, 2017. Visit Ameren.com/Sweepstakes for official rules, odds of winning and entry details. Sponsor: Ameren Missouri.

How would you like to receive your gift card if you win the drawing?

1. Mail the gift card to me:
   [PLEASE PROVIDE YOUR NAME AND ADDRESS:_____]
2. Send me an "e-card" gift certificate by email:
   [PLEASE PROVIDE YOUR EMAIL ADDRESS:_____]
3. I do not want to participate in the drawing.

99. (Skipped)

Closing message for respondents who enter drawing:

We appreciate your participation and thank you for your time.
Prize winners will be randomly selected on March 15, 2017.
Visit Ameren.com/Sweepstakes for official rules, odds of winning and entry details.
Sponsor: Ameren Missouri.

Closing message for respondents who decline to enter drawing:

This completes the survey. We appreciate your participation and thank you for your time.

NONPARTICIPANT SURVEY RESPONSES

Measure Information					Criterion A: Familiarity with at least one Ameren Missouri program, rebate, or discount			Criterion B: At least one element of Ameren's program marketing and outreach motivated them to adopt the measure						Criterion C: They had a valid reason for considering the adopted measure energy efficient		Criterion D: For a like measure, they had not received a rebate from Ameren, and had not already tried to receive a rebate from Ameren, and they stated a valid reason for not applying for an Ameren rebate		Criterion E: They had a valid reason for deciding to install the measure		Criterion F: The adopted measure generated electric savings, not gas savings				Meeting all criteria
ID	Measure ID	Measure	Like or Non-like	Web or Phone Survey	C2. Have you seen or heard of the Ameren Missouri energy efficiency programs?	C10. Are you aware that Ameren Missouri offers rebates and discounts for energy-saving equipment in your home?	Criterion A met? (Yes to C2 or C10)	QG12_A. Information about energy savings from Ameren's marketing, or bill-insert	QG12_C. Information from colleagues or friends who installed energy efficient equipment and received a rebate from Ameren	QG12_D. Past participation in an Ameren rebate program	QG12_E. Information from the energy assessment conducted at your home through Ameren	Criterion B met for 50% savings? (Max rating was 3)	Criterion B met for 100% savings? (Max rating was 4)	QG4. How do you know the measure is energy efficient?	Criterion C met? (qualitative assessment)	QG9. Why you didn't apply for rebate?	Criterion D met? (qualitative assessment)	QG6/QG7. Why did you adopt this measure?	Criterion E met? (qualitative assessment)	Cooling System	Heating System	Water Heating Fuel	Criterion F met? (depends on the measure)	Meeting all criteria
CAD000163256	G203	Efficient room air conditioner	Like	Phone	No	Yes	TRUE	4	Refused	Refused	Refused	FALSE	TRUE	The retailer/dealer/contractor told me it was	TRUE	beacuase I don't know how efficient it is	TRUE	because it was free and I didn't have any choice	FALSE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002669018	G208	Efficient kitchen faucet aerators	Like	Phone	Yes	Yes	TRUE	4	2	0	0	FALSE	TRUE	Galloons per minute used	TRUE	Not worth hassle.	TRUE	Part of the replacement of the faucet.	TRUE	Central air conditioner	Electric baseboard heat	Electric	TRUE	TRUE
CAD002723284	G208	Efficient kitchen faucet aerators	Like	Phone	Yes	Yes	TRUE	1	4	0	0	FALSE	TRUE	It's ENERGY STAR-certified	TRUE	Did not feel it was necessary	TRUE	Save Water	TRUE	Central air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002723284	G220	Learning or "smart" thermostat	Like	Phone	Yes	Yes	TRUE	3	1	0	0	TRUE	FALSE	NA		Same Reason; Did not feel it was necessary	TRUE	87 yr old mother who screws it up all of the time.	TRUE	Central air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002698885	G203	Efficient room air conditioner	Like	Phone	Yes	Yes	TRUE	3	3	0	0	TRUE	FALSE	It's ENERGY STAR-certified	TRUE	I wasn't sure my equipment qualified	TRUE	the one we had was too small	TRUE	Window or wall air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002175073	G207	Efficient showerheads	Like	Phone	Yes	No	TRUE	4	4	0	0	FALSE	TRUE	BOX SAID SO	TRUE	DIDN'T KNOW THE PROGRAM WAS AVAILABLE.	TRUE	IT WAS THE ONE I LIKED	TRUE	Central air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002788370	G207	Efficient showerheads	Like	Phone	Yes	Yes	TRUE	1	1	0	0	FALSE	FALSE	It does good and lowers the bill	TRUE	Just forgot about it	TRUE	To save energy	TRUE	Window or wall air conditioner	Gas furnace/boiler	Electric	TRUE	FALSE
CAD000196966	G203	Efficient room air conditioner	Like	Phone	Yes	Yes	TRUE	3	1	0	1	TRUE	FALSE	Just from what the paper work says.	TRUE	I didn't buy it through a contractor, I picked it up myself.	TRUE	Because it is the hottest room in the house and we wanted that it would cool the room off sooner.	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	TRUE
CAD002203571	G208	Efficient kitchen faucet aerators	Like	Phone	Yes	Yes	TRUE	2	3	0	2	TRUE	FALSE	Word of mouth.	TRUE	Time consumption.	TRUE	Conserve energy.	TRUE	None	Electric furnace	Electric	TRUE	TRUE
CAD002413700	G225	Efficient clothes washer	Non-like	Phone	No	Yes	TRUE	2	2	2	2		FALSE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002413700	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	No	Yes	TRUE	2	2	2	2		FALSE	NA				It was more precise.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD002421391	G229	Efficient Windows	Non-like	Phone	Yes	Yes	TRUE	4	3	1	1		TRUE	The retailer/dealer/contractor told me it was	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	TRUE
CAD002530620	G224	Efficient freezer	Non-like	Phone	No	Yes	TRUE	4	4	4	0		TRUE	It's ENERGY STAR-certified	TRUE			NA		Air-source heat pump	Electric furnace	Electric	TRUE	TRUE

Measure Information					Criterion A: Familiarity with at least one Ameren Missouri program, rebate, or discount			Criterion B: At least one element of Ameren's program marketing and outreach motivated them to adopt the measure						Criterion C: They had a valid reason for considering the adopted measure energy efficient		Criterion D: For a like measure, they had not received a rebate from Ameren, and had not already tried to receive a rebate from Ameren, and they stated a valid reason for not applying for an Ameren rebate		Criterion E: They had a valid reason for deciding to install the measure		Criterion F: The adopted measure generated electric savings, not gas savings				Meeting all criteria
ID	Measure ID	Measure	Like or Non-like	Web or Phone Survey	C2. Have you seen or heard of the Ameren Missouri energy efficiency programs?	C10. Are you aware that Ameren Missouri offers rebates and discounts for energy-saving equipment in your home?	Criterion A met? (Yes to C2 or C10)	QG12_A. Information about energy savings from Ameren's marketing, or bill-insert	QG12_C. Information from colleagues or friends who installed energy efficient equipment and received a rebate from Ameren	QG12_D. Past participation in an Ameren rebate program	QG12_E. Information from the energy assessment conducted at your home through Ameren	Criterion B met for 50% savings? (Max rating was 3)	Criterion B met for 100% savings? (Max rating was 4)	QG4. How do you know the measure is energy efficient?	Criterion C met? (qualitative assessment)	QG9. Why you didn't apply for rebate?	Criterion D met? (qualitative assessment)	QG6/QG7. Why did you adopt this measure?	Criterion E met? (qualitative assessment)	Cooling System	Heating System	Water Heating Fuel	Criterion F met? (depends on the measure)	Meeting all criteria
CAD002530620	G301	Removed a refrigerator or freezer	Non-like	Phone	No	Yes	TRUE	4	4	4	0		TRUE	NA				It was using up space and it was old.	TRUE	Air-source heat pump	Electric furnace	Electric	TRUE	TRUE
CAD002339649	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	No	Yes	TRUE	4	4	0	0		TRUE	NA				was already installed when I moved in.	TRUE	Central air conditioner	[DO NOT READ] DON'T KNOWElectric	Electric	TRUE	TRUE
CAD002339649	G302	Scheduled an air conditioner tune-up	Non-like	Phone	No	Yes	TRUE	3	4	0	0		TRUE	NA				because my air conditioner would be running but not blowing out anything.	TRUE	Central air conditioner	[DO NOT READ] DON'T KNOWElectric	Electric	TRUE	TRUE
CAD002779787	G301	Removed a refrigerator or freezer	Non-like	Phone	Yes	Yes	TRUE	3	Don't know	0	0		FALSE	NA				no longer needed it	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD002779787	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	Yes	TRUE	2	Don't know	0	0		FALSE	NA				usefull	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD002551087	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	No	Yes	TRUE	1	1	0	0		FALSE	NA				NO SENSE TO PAY FOR ENERGY WHEN NOBODY AT HOME TO USE IT.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD002551087	G225	Efficient clothes washer	Non-like	Phone	No	Yes	TRUE	3	2	0	0		FALSE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002419453	G302	Scheduled an air conditioner tune-up	Non-like	Phone	No	Yes	TRUE	Refused	Refused	0	0		FALSE	NA				To maintain it through the hot season.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002419453	G225	Efficient clothes washer	Non-like	Phone	No	Yes	TRUE	3	4	0	0		TRUE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	TRUE
CAD002419453	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	No	Yes	TRUE	Refused	Refused	0	0		FALSE	NA				Save money.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD002281843	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	No	TRUE	4	2	0	0		TRUE	NA				So I could reduce my bill	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	TRUE

Measure Information					Criterion A: Familiarity with at least one Ameren Missouri program, rebate, or discount			Criterion B: At least one element of Ameren's program marketing and outreach motivated them to adopt the measure						Criterion C: They had a valid reason for considering the adopted measure energy efficient		Criterion D: For a like measure, they had not received a rebate from Ameren, and had not already tried to receive a rebate from Ameren, and they stated a valid reason for not applying for an Ameren rebate		Criterion E: They had a valid reason for deciding to install the measure		Criterion F: The adopted measure generated electric savings, not gas savings				Meeting all criteria
ID	Measure ID	Measure	Like or Non-like	Web or Phone Survey	C2. Have you seen or heard of the Ameren Missouri energy efficiency programs?	C10. Are you aware that Ameren Missouri offers rebates and discounts for energy-saving equipment in your home?	Criterion A met? (Yes to C2 or C10)	QG12_A. Information about energy savings from Ameren's marketing, or bill-insert	QG12_C. Information from colleagues or friends who installed energy efficient equipment and received a rebate from Ameren	QG12_D. Past participation in an Ameren rebate program	QG12_E. Information from the energy assessment conducted at your home through Ameren	Criterion B met for 50% savings? (Max rating was 3)	Criterion B met for 100% savings? (Max rating was 4)	QG4. How do you know the measure is energy efficient?	Criterion C met? (qualitative assessment)	QG9. Why you didn't apply for rebate?	Criterion D met? (qualitative assessment)	QG6/QG7. Why did you adopt this measure?	Criterion E met? (qualitative assessment)	Cooling System	Heating System	Water Heating Fuel	Criterion F met? (depends on the measure)	Meeting all criteria
CAD002750636	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	2	3	0	0		FALSE	NA				the ac broke	TRUE	Central air conditioner	Gas furnace/boiler	[DO NOT READ] DON'T KNOW	TRUE	FALSE
CAD002439061	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	No	TRUE	Don't know	Don't know	0	Don't know		FALSE	NA				He checks in the summer time	TRUE	None	None	Electric	TRUE	FALSE
CAD002439061	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	No	TRUE	Don't know	Refused	0	3		FALSE	NA				No need to run it at night	TRUE	None	None	Electric	TRUE	FALSE
CAD002723284	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	4	1	0	0		TRUE	NA				So it works more efficiently.	TRUE	Central air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002276715	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	[DO NOT READ] DON'T KNOW	Yes	TRUE	3	4	0	0		TRUE	NA				Just too save more energy because we usually keep it at 60-63 during winter and 70-75 during the summer.	TRUE	Central air conditioner	Electric furnace	Gas	TRUE	TRUE
CAD002175073	G224	Efficient freezer	Non-like	Phone	Yes	No	TRUE	4	4	0	0		TRUE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002762688	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	No	TRUE	2	2	0	0		FALSE	NA				[DO NOT READ] DON'T KNOW		Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD002547137	G228	Efficient water heater (other than heat pump water heater)	Non-like	Phone	No	Yes	TRUE	1	1	0	0		FALSE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD000091720	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	3	2	0	2		FALSE	NA				just good practice, just operating efficiency	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002778413	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	No	TRUE	3	3	0	0		FALSE	NA				make sure it had plenty of freon in it , cleaned and serviced	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD002778413	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	No	TRUE	3	3	0	0		FALSE	NA				they just checked it while at my home , I didn't request it	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD000166644	G225	Efficient clothes washer	Non-like	Phone	Yes	Yes	TRUE	3	3	0	0		FALSE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Ground-source or geothermal heat pump	Electric	TRUE	FALSE

Measure Information					Criterion A: Familiarity with at least one Ameren Missouri program, rebate, or discount			Criterion B: At least one element of Ameren's program marketing and outreach motivated them to adopt the measure						Criterion C: They had a valid reason for considering the adopted measure energy efficient		Criterion D: For a like measure, they had not received a rebate from Ameren, and had not already tried to receive a rebate from Ameren, and they stated a valid reason for not applying for an Ameren rebate		Criterion E: They had a valid reason for deciding to install the measure		Criterion F: The adopted measure generated electric savings, not gas savings				Meeting all criteria
ID	Measure ID	Measure	Like or Non-like	Web or Phone Survey	C2. Have you seen or heard of the Ameren Missouri energy efficiency programs?	C10. Are you aware that Ameren Missouri offers rebates and discounts for energy-saving equipment in your home?	Criterion A met? (Yes to C2 or C10)	QG12_A. Information about energy savings from Ameren's marketing, or bill-insert	QG12_C. Information from colleagues or friends who installed energy efficient equipment and received a rebate from Ameren	QG12_D. Past participation in an Ameren rebate program	QG12_E. Information from the energy assessment conducted at your home through Ameren	Criterion B met for 50% savings? (Max rating was 3)	Criterion B met for 100% savings? (Max rating was 4)	QG4. How do you know the measure is energy efficient?	Criterion C met? (qualitative assessment)	QG9. Why you didn't apply for rebate?	Criterion D met? (qualitative assessment)	QG6/QG7. Why did you adopt this measure?	Criterion E met? (qualitative assessment)	Cooling System	Heating System	Water Heating Fuel	Criterion F met? (depends on the measure)	Meeting all criteria
CAD002193741	G301	Removed a refrigerator or freezer	Non-like	Phone	Yes	No	TRUE	4	4	0	1		TRUE	NA				cause the refridgerator went bad	FALSE	Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD002344338	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	3	1	0	1		FALSE	NA				I have someone come each spring	TRUE	[DO NOT READ] DON'T KNOW	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002289348	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	No	TRUE	4	4	0	0		TRUE	NA				we were gonna be gone for a coupkleof days	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	TRUE
CAD002688692	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	Yes	TRUE	Don't know	3	0	0		FALSE	NA				help save money	TRUE	Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD000490371	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	[DO NOT READ] DON'T KNOW	Yes	TRUE	3	3	0	0		FALSE	NA				we live in saint Louis and the weather fluctuates a lot and we don't need to use it	TRUE	Central air conditioner	[DO NOT READ] DON'T KNOWGas	Gas	TRUE	FALSE
CAD000490371	G229	Efficient Windows	Non-like	Phone	[DO NOT READ] DON'T KNOW	Yes	TRUE	4	4	0	0		TRUE	The retailer/dealer/contractor told me it was	TRUE			NA		Central air conditioner	[DO NOT READ] DON'T KNOWGas	Gas	TRUE	TRUE
CAD000490371	G302	Scheduled an air conditioner tune-up	Non-like	Phone	[DO NOT READ] DON'T KNOW	Yes	TRUE	4	4	0	0		TRUE	NA				just do it every year	TRUE	Central air conditioner	[DO NOT READ] DON'T KNOWGas	Gas	TRUE	TRUE
CAD002443279	G225	Efficient clothes washer	Non-like	Phone	No	Yes	TRUE	Don't know	2	0	4		TRUE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Electric furnace	Electric	TRUE	TRUE
CAD002443279	G302	Scheduled an air conditioner tune-up	Non-like	Phone	No	Yes	TRUE	2	1	0	3		FALSE	NA				Because we needed a new air conditioner so we bought a new one.	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD003392328	G226	Efficient dishwasher (exclude from NPSO because virtually all dishwashers on the market are ENERGYSTAR)	Non-like	Phone	No	Yes	TRUE	1	4	0	0		TRUE	It's ENERGY STAR-certified	TRUE			NA		Air-source heat pump	Gas furnace/boilerAir-source heat pump	Electric	TRUE	FALSE
CAD003392328	G301	Removed a refrigerator or freezer	Non-like	Phone	No	Yes	TRUE	4	4	0	0		TRUE	NA				it was old	TRUE	Air-source heat pump	Gas furnace/boilerAir-source heat pump	Electric	TRUE	TRUE

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ID	Measure ID	Measure	Like or Non-like	Web or Phone Survey	C2. Have you seen or heard of the Ameren Missouri energy efficiency programs?	C10. Are you aware that Ameren Missouri offers rebates and discounts for energy-saving equipment in your home?	Criterion A met? (Yes to C2 or C10)	QG12_A. Information about energy savings from Ameren's marketing, or bill-insert	QG12_C. Information from colleagues or friends who installed energy efficient equipment and received a rebate from Ameren	QG12_D. Past participation in an Ameren rebate program	QG12_E. Information from the energy assessment conducted at your home through Ameren	Criterion B met for 50% savings? (Max rating was 3)	Criterion B met for 100% savings? (Max rating was 4)	QG4. How do you know the measure is energy efficient?	Criterion C met? (qualitative assessment)	QG9. Why you didn't apply for rebate?	Criterion D met? (qualitative assessment)	QG6/QG7. Why did you adopt this measure?	Criterion E met? (qualitative assessment)	Cooling System	Heating System	Water Heating Fuel	Criterion F met? (depends on the measure)	Meeting all criteria
CAD003392328	G228	Efficient water heater (other than heat pump water heater)	Non-like	Phone	No	Yes	TRUE	4	4	0	0		TRUE	It's ENERGY STAR-certified	TRUE			NA		Air-source heat pump	Gas furnace/boilerAir-source heat pump	Electric	TRUE	TRUE
CAD000148252	G301	Removed a refrigerator or freezer	Non-like	Phone	No	Yes	TRUE	4	4	0	0		TRUE	NA				[DO NOT READ] DON'T KNOW		Central air conditioner	Electric furnace	Electric	TRUE	TRUE
CAD002577182	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	No	TRUE	1	1	0	3		FALSE	NA				to get the coil cleaned, there's always a lot of dirt that gets in there	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000413427	G302	Scheduled an air conditioner tune-up	Non-like	Phone	No	Yes	TRUE	3	1	0	1		FALSE	NA				to make it morwe eefficient	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD000413427	G225	Efficient clothes washer	Non-like	Phone	No	Yes	TRUE	2	1	0	Refused		FALSE	what itr sauid	TRUE			NA		Central air conditioner	Electric furnace	Electric	TRUE	FALSE
CAD000413427	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	No	Yes	TRUE	Refused	4	0	Don't know		TRUE	NA				saves money	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	TRUE
CAD002794146	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	No	TRUE	2	1	0	0		FALSE	NA				for when im not home I adjust it to a lower temp	TRUE	Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD002794146	G225	Efficient clothes washer	Non-like	Phone	Yes	No	TRUE	1	1	0	0		FALSE	The retailer/dealer/contractor told me it was	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000381277	G225	Efficient clothes washer	Non-like	Phone	No	Yes	TRUE	4	4	0	4		TRUE	Marked on the sticker.	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	TRUE
CAD002788370	G228	Efficient water heater (other than heat pump water heater)	Non-like	Phone	Yes	Yes	TRUE	4	4	0	0		TRUE	It lowers the bill	TRUE			NA		Window or wall air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002788370	G224	Efficient freezer	Non-like	Phone	Yes	Yes	TRUE	4	3	0	0		TRUE	It lowers the bill	TRUE			NA		Window or wall air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD002557560	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	No	TRUE	4	4	0	4		TRUE	NA				just trying not to use as much energy, turn it down when i go to bed and dont let it go past 60	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	TRUE
CAD002277386	G229	Efficient Windows	Non-like	Phone	Yes	No	TRUE	3	3	0	0		FALSE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE

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CAD002531208	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	3	1	0	1		FALSE	NA				well its saves money in the long run and if theres problems they find them.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002531208	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	Yes	TRUE	3	Don't know	0	2		FALSE	NA				to save money	TRUE	Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD000233264	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	No	Yes	TRUE	Don't know	3	0	3		FALSE	NA				Because my wife likes it colder at night.	TRUE	Central air conditioner	Gas furnace/boiler	[DO NOT READ] DON'T KNOW	FALSE	FALSE
CAD002674741	G301	Removed a refrigerator or freezer	Non-like	Phone	Yes	No	TRUE	3	1	0	1		FALSE	NA				I have gotten a new one	TRUE	Central air conditioner	[DO NOT READ] DON'T KNOWElectric	Electric	TRUE	FALSE
CAD000304876	G301	Removed a refrigerator or freezer	Non-like	Phone	Yes	Yes	TRUE	3	3	0	2		FALSE	NA				Because we needed a new fridge, and when I chose it, I needed it to be energy efficient.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000304876	G225	Efficient clothes washer	Non-like	Phone	Yes	Yes	TRUE	3	3	0	2		FALSE	It has a sign that says high effiecny, it was highly detailed.	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000304876	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	3	2	0	2		FALSE	NA				It was for the air quality.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000047136	G224	Efficient freezer	Non-like	Phone	Yes	Yes	TRUE	4	4	0	4		TRUE	The retailer/dealer/contractor told me it was	TRUE			NA		Central air conditioner	Ductless or mini-split heat pump	Electric	TRUE	TRUE
CAD000315574	G302	Scheduled an air conditioner tune-up	Non-like	Phone	No	Yes	TRUE	3	3	0	3		FALSE	NA				It was part of the purchase agreement, that they service it once every year	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000315574	G228	Efficient water heater (other than heat pump water heater)	Non-like	Phone	No	Yes	TRUE	3	3	0	2		FALSE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE

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CAD000302905	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	No	Yes	TRUE	2	1	0	1		FALSE	NA				there was so sense in havoing it run all day	TRUE	Central air conditioner	Gas furnace/boiler	Electric	FALSE	FALSE
CAD000302905	G302	Scheduled an air conditioner tune-up	Non-like	Phone	No	Yes	TRUE	3	1	0	4		TRUE	NA				casue I have a regusular tune up every summer for the heat. time track	TRUE	Central air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE
CAD000302905	G304	Other action	Non-like	Phone	No	Yes	TRUE	1	1	0	1		FALSE	NA				it was vented properly and the whole thing blew it. destroyed it.	TRUE	Central air conditioner	Gas furnace/boiler	Electric	TRUE	FALSE
CAD002203571	G225	Efficient clothes washer	Non-like	Phone	Yes	Yes	TRUE	2	3	0	2		FALSE	Word of mouth	TRUE			NA		None	Electric furnace	Electric	TRUE	FALSE
CAD000243723	G225	Efficient clothes washer	Non-like	Phone	Yes	Yes	TRUE	3	2	0	0		FALSE	I read the information	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000243723	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	Don't know	Don't know	0	0		FALSE	NA				Because you should do that every season, its better for the air conditioner to catch things in the beginning rather than it go haywire in the middle of the season.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000432783	G230	Additional insulation	Non-like	Phone	No	Yes	TRUE	1	Don't know	0	0		FALSE	NA				NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000369716	G228	Efficient water heater (other than heat pump water heater)	Non-like	Phone	Yes	Yes	TRUE	3	2	0	0		FALSE	It's ENERGY STAR-certified	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	FALSE	FALSE
CAD000369716	G301	Removed a refrigerator or freezer	Non-like	Phone	Yes	Yes	TRUE	2	2	0	0		FALSE	NA				it was burning up.	FALSE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002337612	G229	Efficient Windows	Non-like	Phone	[DO NOT READ] DON'T KNOW	Yes	TRUE	3	2	1	0		FALSE	The retailer/dealer/contractor told me it was	TRUE			NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE

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CAD002622738	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	Yes	TRUE	4	4	0	0		TRUE	NA				Well we don't need it hot in the house and night and when we are not at home it doesn't need to run at all.	TRUE	[DO NOT READ] DON'T KNOW	[DO NOT READ] DON'T KNOWElectric	Electric	TRUE	TRUE
CAD002419821	G303	Programmed thermostat to reduce usage (either at night or during the day when people are not home)	Non-like	Phone	Yes	Yes	TRUE	Refused	4	0	0		TRUE	NA				Its just a matter of economy I have always done it.	TRUE	Window or wall air conditioner	Gas furnace/boiler	Gas	TRUE	TRUE
CAD002646472	G302	Scheduled an air conditioner tune-up	Non-like	Phone	Yes	Yes	TRUE	3	Refused	0	0		FALSE	NA				just part of an agreement we have with the air conditioner people	TRUE	Central air conditioner	Electric furnace	Gas	TRUE	FALSE
CAD002646472	G301	Removed a refrigerator or freezer	Non-like	Phone	Yes	Yes	TRUE	Refused	Refused	0	0		FALSE	NA				It was broken	FALSE	Central air conditioner	Electric furnace	Gas	TRUE	FALSE
CAD002565360	G230	Additional insulation	Non-like	Phone	No	Yes	TRUE	1	4	1	0		TRUE	NA				NA		Central air conditioner	Electric baseboard heat	Electric	TRUE	TRUE
CAD002277386	G230	Additional insulation	Non-like	Phone	Yes	No	TRUE	2	3	0	0		FALSE	NA				NA		Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD000047136	G230	Additional insulation	Non-like	Phone	Yes	Yes	TRUE	4	4	0	4		TRUE	NA				NA		Central air conditioner	Ductless or mini-split heat pump	Electric	TRUE	TRUE
CAD002698885	G210	Insulation	Non-like	Phone	Yes	Yes	TRUE	3	3	0	0		FALSE	The retailer/dealer/contractor told me it was	TRUE			to replace the old stuff	TRUE	Window or wall air conditioner	Gas furnace/boiler	Electric	TRUE	FALSE
CAD002565360	G210	Insulation	Non-like	Phone	No	Yes	TRUE	1	4	1	0		TRUE	because the more insulation you have the warmer it is, otherwise its going out the walls	TRUE			[DO NOT READ] DON'T KNOW		Central air conditioner	Electric baseboard heat	Electric	TRUE	TRUE
CAD000381277	G221	Programmable (but not "smart") thermostat	Non-like	Phone	No	Yes	TRUE	4	4	0	4		TRUE	NA				[DO NOT READ] DON'T KNOW		Central air conditioner	Gas furnace/boiler	Gas	TRUE	TRUE
CAD002413700	G221	Programmable (but not "smart") thermostat	Non-like	Phone	No	Yes	TRUE	3	3	3	1		FALSE	NA				Its the one that came with the home and the cost.	TRUE	Central air conditioner	Gas furnace/boiler	Gas	TRUE	FALSE
CAD002175073	G202	Efficient refrigerator	Non-like	Phone	Yes	No	TRUE	3	4	0	0		TRUE	The retailer/dealer/contractor told me it was	TRUE			IT WAS THE ONE I LIKED	TRUE	Central air conditioner	Gas furnace/boiler	Electric	TRUE	TRUE

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CAD002193741	G202	Efficient refrigerator	Non-like	Phone	Yes	No	TRUE	4	3	0	Don't know		TRUE	It's ENERGY STAR-certified	TRUE			Just cause we needed one	TRUE	Central air conditioner	Electric furnace	Electric	TRUE	TRUE