EVERGREEN ECONOMICS

Independent EM&V Audit of the Ameren Missouri PY2019 Program Evaluations

Final Report

July 2, 2020

MichaelsEnergy

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1 Executive Summary and Audit Conclusions

In 2019, Ameren Missouri began implementing its Missouri Energy Efficiency Investment Act (MEEIA) Cycle 3 DSM Programs (Case No. EO-2018-00211). The MEEIA Cycle 3 Programs covered in this audit include:

- **Residential Lighting –** The Residential Lighting Program is designed to increase sales and awareness of ENERGY STAR qualified LED lighting products. The target market consists of all residential customers within the Ameren Missouri service territory. The Lighting Program is delivered through two channels including upstream (via retail partners) and the Ameren Missouri Online Store.
- **Heating and Cooling (HVAC) –** The HVAC program obtains energy and demand savings through improvements in the operating performance of existing residential cooling units or replacement of central air conditioning (CAC) units and heat pumps.
- **Home Energy Reports (HER) –** The HER Program was designed to promote changes in energy consumption behaviors that result in reduced electricity usage. The target market consists of residential customers in the Ameren Missouri service territory. In PY2019, the implementer, Uplight, organized HER participants into three waves of treatment and control customers. Wave 3 launched in PY2019, and treatment customers in this wave received their first HERs beginning in late April and early May 2019.
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- **Energy Efficient Kits (EE Kits) –** The Energy Efficiency Kits program is designed to increase customer awareness of the benefits of high-efficiency products, educate residential customers about energy consumption in their homes, and offer information, products, and services to residential customers to encourage cost-effective energy savings. Energy efficiency kits and education materials are delivered to customers through an educational channel that targets, but is not limited to, sixth-grade students. Measures included in the kits include bathroom faucet aerators, dirty filter alarm, kitchen faucet aerator, LED bulbs, low-flow showerhead, and pipe insulation.
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properties that have three or more tenant units and receive electric service from Ameren Missouri.

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- **Single-Family Low Income –** The Residential Single-Family Low-Income Program, formerly known as the CommunitySavers Program, was introduced in PY2019 and is designed to provide whole-home energy efficiency upgrades that result in long-term energy savings and bill reduction opportunities to low-income Ameren Missouri customers living in single family properties. The program leverages three channels (1) the single-family neighborhoods channel; (2) the mobile home park channel; and (3) the Low-Income Efficiency Housing Grant channel.
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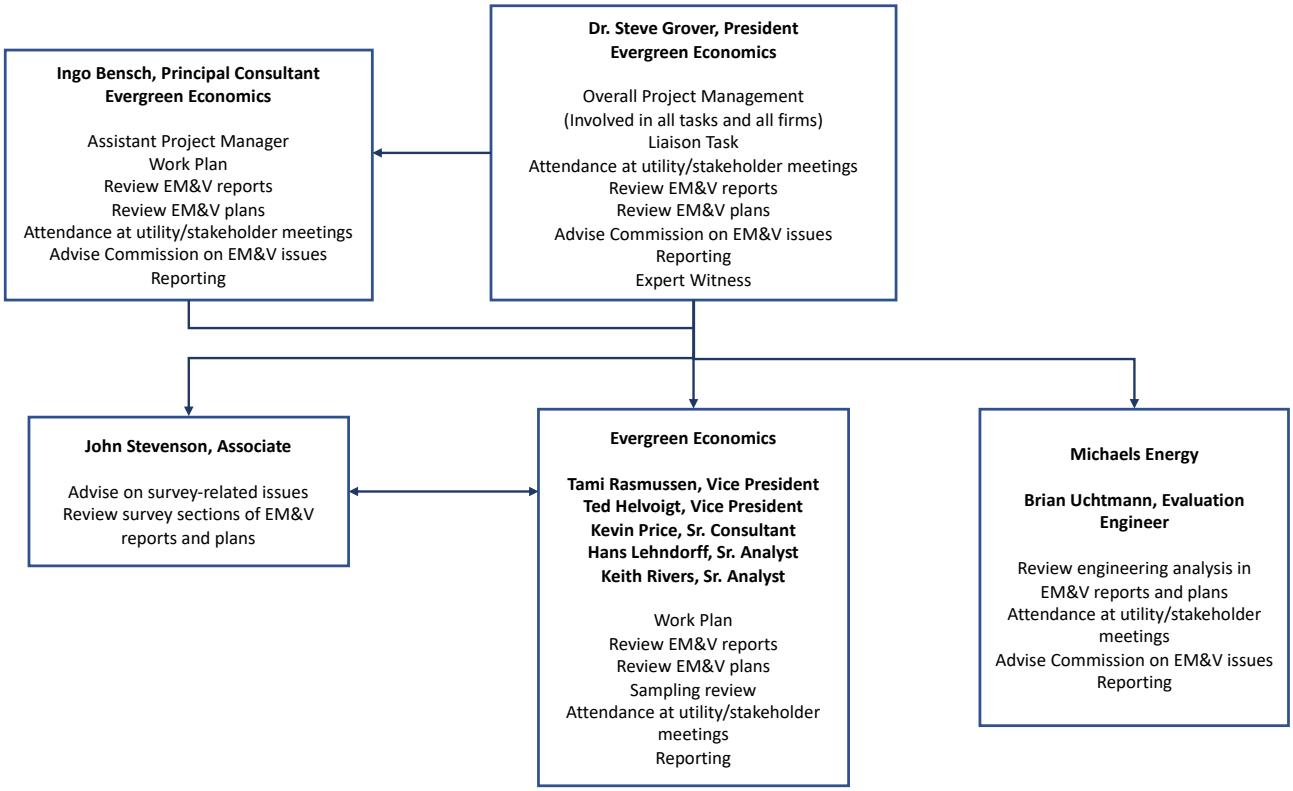
- **BizSavers –** Designed to help businesses identify and implement energy saving projects, the BizSavers Program includes the Custom, Standard, New Construction, Retro-Commissioning, and Small Business Direct Install programs.
- **Demand Response –** The residential and Business Demand Response programs are designed to control the cooling load with the help of smart thermostats to achieve peak demand savings and energy savings.

Ameren Missouri contracted with Opinion Dynamics and its subcontractors (Guidehouse, ADM Associates, Pammer Research, Sustainable Design & Behavior, Morgan Marketing Partners, and Washington University in St. Louis) to conduct comprehensive impact and process evaluations of Ameren Missouri's energy efficiency portfolio for Program Year 2019 (PY2019).

In 2019, the Missouri Public Service Commission (PSC) contracted with the Evergreen Economics team to serve in the capacity of Independent Auditor to review the evaluation, measurement, and verification (EM&V) work undertaken by the Opinion Dynamics evaluation team. Figure 1 shows the audit team members and organization, the individual team members by firm, and the associated audit responsibilities.

Figure 1: Evergreen Audit Team Organization



The audit team is required to review program evaluation activities and provide comments on compliance with 4 CSR 240-22.070(8) and the overall quality, scope, and accuracy of the program evaluation reports, as well as recommendations to improve the evaluation and reporting process.

A review of the PY2019 evaluation indicates that all evaluation reports are well written, complete, and meet the minimum requirements for impact and process evaluations stipulated in 4 CSR 240-22.070(8). These reports are also generally consistent with the best practices established for the industry.

During the course of the audit, we have identified several areas where we believe the evaluations can be improved, and these recommendations are detailed below.

Audit Conclusions and Recommendations

Lighting EUL Assumptions

One important issue discussed during the evaluation was the effective useful life (EUL) values used for commercial lighting impacts, as these were increased significantly for PY2019. It is important to understand the effect these changes have on the final demand savings and performance incentive payments, and so they are documented here in the

audit report. We believe that this is an area that needs further discussion as the reasons for the EUL changes are not supported by any independent evaluation research.

The claimed energy and demand savings for commercial lighting, and the associated cost benefit analysis for this program, uses the implementer supplied EUL values instead of the values contained in the Technical Reference Manual (TRM). The decision to use the implementer EUL values rather than the TRM EUL values is not unreasonable per-se, but more justification should be provided for making this change. There is no support for making this shift provided in the evaluation report, other than to note that the new values were adopted. The net effect is to move approximately half of the lighting savings from the <10 year EUL bin to the 10-14 year and 15+ year EUL bins.

The Business Portfolio report (Section 3.2.2) references a memo that provided the impetus for this change, titled *Ameren Missouri MEEIA 2019-21 Energy, PCDR, and EUL Methodology* (January 30, 2019). The audit team reviewed this memo, in addition to information provided by Opinion Dynamics during a stakeholder call on May 28, 2020, and follow-up data provided in an email to the stakeholder group on June 3, 2020.

The following chart was provided in the June 3, 2020 email. Assuming that the Missouri TRM cap of 15 years is ignored and only the 50,000 hour LED life is used, then only about 3 percent of the Biz Savers lighting installation energy savings would fall into the 15+ year EUL bucket. The demand savings would be in the same approximate range, even if they are not directly proportional to the claimed kWh.

Comparison of EUL Bins (1st Yr Ex Post Gross MWh)

	Ex Post Analysis Bin			
TRM Bin	<10	10-15	15+	TOTAL
<10	-	5,568	33,545	39,113
10-15	-	15,177	18,376	33,554
15+	-	-	2,208	2,208
TOTAL	-	20,745	54,130	74,875

Table 3-2 from the Business Portfolio evaluation is included below:

Table 3-2. PY2019 Standard Savings Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Goal/Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	76,553	94.0%	71,972	84.2%	60,622	29,220	207%
Demand Savings (MW)	14.69	97.7%	14.36	84.2%	12.10	6.10	198%
Last Year Demand Savings							
< 10 EUL (MW)	-	n/a	-	n/a	-	0.55	0%
10-14 EUL (MW)	4.28	94.4%	4.04	84.2%	3.40	2.70	126%
15+ EUL (MW)	10.41	99.1%	10.32	84.2%	8.69	2.84	306%

If the EULs from the TRM are used, then distribution of savings for the Standard program would shift significantly lower, as shown in Table 1.

Table 1: Change in Commercial Lighting MW Impacts Due to EUL Assignments

EUL Bin	TRM EULs (MW)	Evaluation EULs (MW)	Difference
<10 years	6.32	0	-6.32
10-14 years	5.42	3.40	-2.02
15+ years	0.36	8.69	8.33
Performance Incentive	**$510,651**	**$1,242,407**	**$731,757**

Absent the single decision to extend lighting EULs, the PY2019 Standard program savings would have come in well below targets. In the June 3, 2020 email, the evaluators noted that they conducted an independent assessment of the EUL analysis and found that it was not unreasonable, but there was no comparison with what values are used in other regions.

For residential lighting, the EUL values were shifted between the draft and final evaluation reports, apparently in response to Ameren MO's strong recommendation in their draft report comments that the midlife adjustments relating to the EISA standards be removed. This may be considered a policy decision by the evaluation team, but the comparison between the two versions is shown below in Table 2.

Table 2: Change in Residential Lighting EUL Between Draft and Final Reports

EUL Bin	Draft Report (MW)	Final Report (MW)	Difference
<10 years	0.65	1.71	1.06
10-14 years	0	0	0
15+ years	1.88	8.03	6.15
Performance Incentive	**$204,726**	**$874,443**	**$669,717**

The end result of both of these decisions is to shift a large around of the commercial. And residential lighting demand savings into the 15+ year EUL bin.

A separate potential issue is the process used to review the new EULs, as the order of the steps taken can result in significantly different EUL values. Consider the following two examples. In their June 3 email, Opinion Dynamics says that it reviewed the implementer EULs and that they appear to be more consistent with the PY2019 tracking data. To do this, it appears that they followed these steps:

Step 1 (Divide): For lighting type XYZ, calculate a new EUL for each project:

Project 1: Lighting Type XYZ operates 8,760 hours per year. Assume LED lasts 50,000 Hours. EUL = 50,000/8,760 = 5.7 years

Project 2: Lighting Type XYZ operates 2,000 hours per year. Assume LED lasts 50,000 Hours. EUL = 50,000/2,000 = 25 years

Step 2 (Average): Deem a new EUL for lighting type XYZ:

New EUL = average of 5.7 and 25 = ***15.35 years*** (goes into the 15+ year bin)

An alternative and equally valid approach would be to first calculate an average hours of use (HOU) for each lighting type and then do the division to determine the EUL. This process is as follows:

Step 1 (Average): For lighting type XYZ, calculate the average HOU:

Project 1: Lighting Type XYZ operates 8,760 hours per year.

Project 2: Lighting Type XYZ operates 2,000 hours per year.

Average HOU = (8,760 + 2,000)/2 = 5,380 hours

Step 2 (Divide): Deem a new EUL for lighting type XYZ:

Average light has an HOU of 5.380, LED lasts for 50,000 hours:

New EUL = 50,000/5,380 = ***9.3 years*** (goes into the <10 year bin)

From the same underlying data, two very different EULs can be derived simply by rearranging the order of the averaging and division. If this second approach had been used, it would have likely provided more support for keeping the original TRM values.

This is not simply an academic exercise, as these shifts in EUL have a substantial impact on the Ameren MO performance incentives, and therefore more justification is needed for using these values in the future. As summarized in Table 3-1 of the Portfolio Summary Report, for every MW of savings in the 15+ EUL bin, the incentive is $108,897, and every MW in the 10-14 Year EUL bin is $87,086. It appears then that the shift to the higher EUL values for both residential and commercial lighting has resulted in an increase of approximately $1.4 million in performance incentive payments to Ameren MO.

This is a subject that needs to be researched more thoroughly as part of the PY2020 evaluation in order to justify the longer EULs, rather than simply adopting the implementer values.

Recommendation: Conduct additional research in the PY2020 evaluation to support the longer lighting EULs. Absent sufficient justification, we recommend that the lighting EULs from the most current Illinois TRM be used in the future if the EULs in the MO TRM values are considered outdated.

Recommendation: Standardize the lighting EULs statewide across the Ameren MO and Evergy programs, as there is no compelling reason why these should be different across utilities.

Lighting Elasticity Model

There are several issues relating to the net impact analysis for the Residential Lighting program that came up in our review. We discuss them below and provide a recommendation for an improved model for use in future evaluations of this program.

For PY2019, Opinion Dynamics uses both a lighting elasticity model and the results of intercept surveys to estimate free ridership for this program. Free ridership is estimated separately using both methods and then the results are averaged to determine the final free ridership rate. In the report, Opinion Dynamics discusses the pros and cons of both methods and ultimately determines that both methods are equally appropriate in this application.

The critical difference here is that the elasticity model relies on observed market behavior (revealed preference data) while the intercept surveys rely on stated preference data. It is generally accepted among economists that (all else equal) revealed preference data are preferred to stated preference data, as they reflect actual choices in the market place where consumers have considered all the characteristics of the available choices and then made a real-life decision.

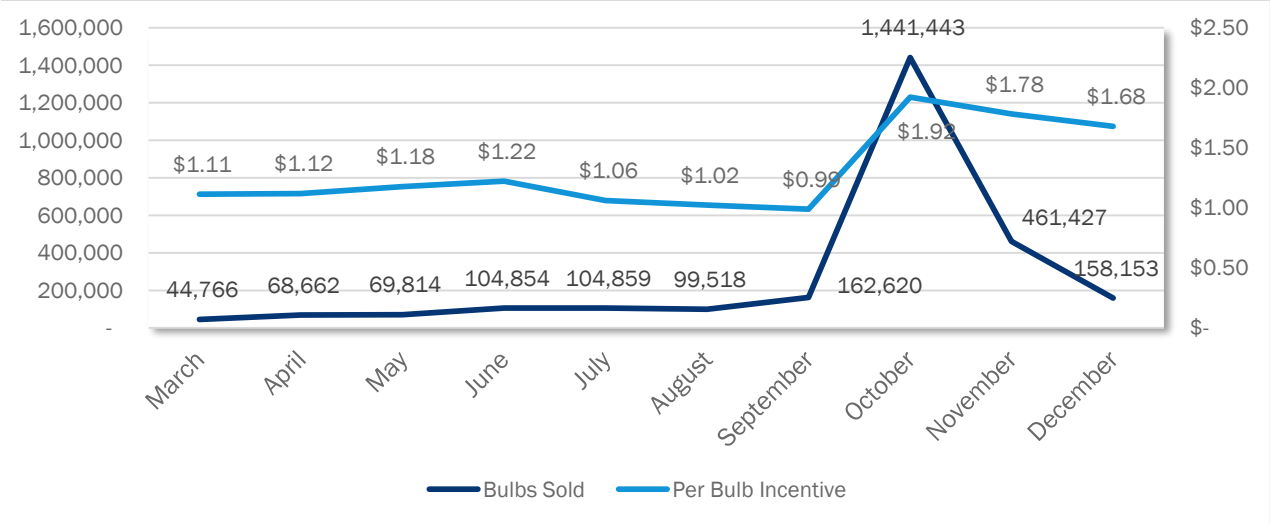
In criticizing the elasticity model, Opinion Dynamics makes the point that the model is being used to extrapolate to consumer demand beyond the price ranges where the data were collected. While the model is used to do a modest extrapolation (extending demand to the case where the rebate equals zero), there is no compelling reason to believe that the shape of the demand curve is significantly different between say a $4 price and a $6 price. In other words, if any bias exists in the extrapolation, it is likely to be small.

A separate weakness noted by Opinion Dynamics is omitted variable bias, as they assert that the elasticity model does not account for program marketing, product placement, advertising, signage, etc. In fact, these are all determinants of demand and are reflected in the shape of the demand curve. The sensitivity to price is determined (the key objective of the modeling exercise) in part by these other program factors and therefore are not omitted from the model.

Finally, Opinion Dynamics asserts that the "theory underlying the model is that any lift in sales due to price reductions is a shift in sales from a less efficient product to an LED, which may or may not be the case given all the alternative products on the market." (Appendix A, p. 24). In fact, the availability of substitutes (less efficient LED or otherwise) is another factor determining the shape of the demand curve and therefore is incorporated in the elasticity model.

A far more likely chance for bias occurs from extrapolating the results of the intercept survey. With the intercepts, the data are collected in October to December – a period where the program activity is greatest and therefore customers are more likely to report the influence of the program (Opinion Dynamics also acknowledges this as a potential weakness of the intercept survey approach). Figure 3-1 from the report (p. 41) is copied below, which shows the large spike in sales during October when the promotions were occurring. It is likely that bias is introduced (i.e., the free ridership estimate is lower than it should be) by using the intercept data from months of the highest program activity and extrapolating to the rest of the year. The elasticity model, in contrast, uses data from the entire year and therefore provides a more accurate picture of consumer preferences over time.

Figure 3-1. PY2019 Lighting Program Upstream Channel Bulb Sales and Average Per Bulb Incentive by Month



We have made these points before in our original comments on the evaluation plan and in earlier criticisms of the other stated preference methods used by Cadmus to estimate net impacts for the lighting program. To reiterate, actual market data should be preferred to stated preference data when both are available for estimating free ridership.

In the comparison of their free ridership result, Opinion Dynamics compares their number with several evaluations (p. 22, Table 13) and concludes that their number is within the range of these other studies. While it is true that these numbers are somewhat similar, the range shown is quite broad. More importantly, the studies cited do not provide a valid comparisons as they are not all utilizing an elasticity model. The California LED study is a discrete choice model based on stated preference data, where the type of data and model specification are both completely different than the elasticity model. Similarly, the Duke Energy study utilizes a discrete choice model, not an elasticity model.

It is unclear from the graphs in the appendices (Figure 2, 3, and 4) how these model results were ultimately used since the axes are not labeled and the graphs do not appear to be showing the normal tradeoff between price and quantity demanded. It may be that the elasticity calculations are extended beyond the portion of the demand curve where the rebate equals zero, which may be distorting the elasticity estimate unnecessarily.

As a more general issue, we believe that there is a better elasticity model specification to be used for the lighting program, one that may improve the free ridership result. As an alternative to the Opinion Dynamics model, we recommend using a Poisson specification that is better equipped to handle the lighting sales data. The Poisson model is preferable to standard ordinary least squares (OLS) regression because the response variable (i.e., bulb sales) only takes on non-negative values. The OLS regression model is generally not an

appropriate choice because it fails to account for the limited possible values of the response variable. While there are other models that account for limitations of count data (e.g., negative binomial), the Poisson model is the most commonly used approach

The generalized log-linear Poisson model is specified as:

$$Ln(\mu_i) = x_i'\beta$$

Where, μ_i is the mean of the individual bulb sales across retailers and sales periods. An expanded version of this model is:

$$Ln(Bulb\ Sales_{kit}) = \beta_0 + \beta_1(Rebated\ Price_{kit}) + \beta_k(Bulb\ Char_k)$$

Where,

$Ln(Bulb\ Sales_{kit})$ is the natural logarithm of the average number of bulb type *k* sold each day by retailer *i* in time period *t*.

$Rebated\ Price_{kit}$ is the price after rebate for bulb type *k* sold by retailer *i* in period *t*.

$Bulb\ Char_k$ is an array of characteristics of the LED bulb, such as lumens and watts.

We have used the Poisson model specification most recently in New Mexico and have estimated free ridership in the range of 0.29 to 0.37 for several utilities. The same model specification was used by Navigant in the recent evaluations of the KCP&L Residential Lighting programs, which resulted in a free ridership of approximately 0.41. Given these applications, we believe that this model might actually lower the free ridership estimate for the Ameren MO program in the future relative to Opinion Dynamics' current elasticity model.

Recommendation: In future evaluations, use only a lighting elasticity model with a negative binomial or Poisson specification to estimate free ridership. The elasticity model results should not be combined with the intercept survey results in future years. The intercept survey can still be used to estimate spillover as this is beyond the capability of the elasticity model.

Spillover

The audit team has previously noted our concerns regarding the imprecision of the spillover estimates based on trade allies or other market actor interviews, and have commented on for both the evaluation plan and earlier drafts of the evaluation report. Our concerns remain, and so these comments are repeated below.

Trade Ally Spillover

Page 49 of the Residential Appendix notes that:

> Trade allies also named several non-program factors that contributed to the uptick in their energy efficiency-related business practices, including increased customer interest, manufacturer rebates, tax rebates, increasing affordability of high-efficiency equipment.

These are mostly reasons for counting these installations as free riders, not spillover.

Only five trade allies ended up with projects that could be counted as spillover, and they are only able to provide approximate estimates of the number of jobs, size adjustments, influence due to the program, share of revenue coming from nonparticipant jobs, etc. The end result is an estimate of trade ally spillover that is very imprecise and based on a small number of responses. It is still unclear how this estimate avoids double counting with participant spillover, or possibly even the direct program impacts given how imprecise the estimate is of non-incented energy efficient installations.

Market Partner Spillover (MPSO)

Page 60 of the Business Portfolio Report states:

> Notably, all five market partners who qualified for SO named exterior lighting as program-influenced non-incented measures they installed, and all five noted that the installations were completed without an incentive because incentives were not available. One of these market partners noted that they would install a lot more exterior LED lighting, if incentives were still available.

As we have commented in past years, we do not believe that spillover should be counted for measures that are not eligible for the program. In this case, given the reasons provided by the market partners, these projects are more accurately considered as free riders and should not be included in any spillover calculations.

Page 5 of the Business Portfolio Appendix has the following equation and text:

$$\textit{\% of Efficient Installations That Received Incentive} = \frac{\textit{Number of Projects from Program Database}}{\textit{TA2b + Number of Projects from Program Database}}$$

> If the respondent was unable to provide an answer for TA2a or TA2b, we assumed the percentage of high efficiency equipment that did not receive a BizSavers Program incentive was equal to the average percentage among all respondents.

If the market partner cannot provide an answer to these questions, then they should be dropped from the MPSO calculation – they should not be assigned an average value from the other respondents for individual questions just so they can remain in the spillover

calculation. This calculation is already imprecise as it uses a small number of respondents to extrapolate to the entire market, and imputing values just adds to the imprecision.

Recommendation: For the reasons stated above, we recommend that the MPSO and trade ally spillover components be dropped from all of the net impact calculations.

HVAC Early Replacement vs Replace on Burnout

Another issue that the audit team has raised in prior audits is the high incidence of projects that are categorized as early replacements instead of replace-on-burnout. It appears from the evaluation report that approximately 90 percent of the residential CAC units are categorized as early replacement, but there is no any information on how the evaluation verified these claims. During the evaluation Opinion Dynamics did review the tracking data, and of the 9,921 projects they recategorized 234 (2.4 percent) from early replacement to replace-on-burnout. For comparison, in its June 3 follow-up email Opinion Dynamics reported that only 76 percent of the projects in the tracking data had information showing the temperature drop across the coil, which is the program requirement to be considered an early replacement. As a point of reference, the IL TRM v.7, which was used as the reference for the per-unit CAC savings, assumes that only 14 percent of the measures are early replacement by default. This shift to more early replacements results in a substantial increase in claimed savings for this program.

The evaluation report also recommends loosening the requirements for qualifying as an early replacement job. As noted in our earlier comments, we disagree with this suggestion as we believe that the criteria used are already too lax and are leading to unrealistically high amounts of savings for these units.

Recommendation: Future evaluation work should be done to verify more rigorously whether or not units are early replacements based on the program eligibility rules in place for PY2019. We do not recommend that the program rules be loosened in PY2020 as recommended in the evaluation report.

Code Changes Related to ECM Furnace Fans

As noted in our earlier comments, the ECM fan motor measure has been superseded by code. This measure contributed approximate 23 percent of the savings for the HVAC program. ECM fans manufactured after July 3, 2019, are essentially required to be ECMs, per federal code 10 CFR 430.32(y).

Recommendation: We recommend that this measure be dropped as an eligible measure beginning in PY2020.

The remainder of this report summarizes the results from the PY2019 evaluations, to provide context for the audit recommendations.

2 Introduction

The Missouri Energy Efficiency Investment Act (MEEIA) was passed in 2009, launching a new era for energy efficiency programs in Missouri. The Missouri Public Service Commission (the PSC) adopted four administrative rules (4 CSR 240-3.163, 4 CSR 240-3.164, 4 CSR 240-20.093 and 4 CSR 240-20.094) referred to as "MEEIA rules") to implement MEEIA.[1] MEEIA directs the PSC to permit electric corporations to implement PSC-approved demand side management (DSM) programs, with a goal of achieving cost-effective demand-side savings.

In 2009, the State of Missouri and Ameren Missouri reached an agreement to create Ameren Missouri's suite of residential and commercial energy efficiency programs, which began in 2013 as MEEIA Cycle 1. The MEEIA Cycle 1 programs ended on December 31, 2015 for Ameren Missouri (Case No. EO-2012-0142). In early 2016, the PSC approved MEEIA Cycle 2 DSM programs for Ameren Missouri (Case No. EO-2015-0055). All Cycle 2 programs were implemented no later than the second quarter of 2016, and ended by February 28, 2019.[2] In 2019, Ameren Missouri began implementing its Missouri Energy Efficiency Investment Act (MEEIA) Cycle 3 DSM Programs (Case No. EO-2018-00211).

The MEEIA Cycle 3 programs covered in this audit include:

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[1] The PSC is currently in the process of revising the MEEIA rules.
[2] Some Cycle 2 long-lead projects are expected to continue after February 28, 2019, as a result of the PSC's July 20, 2017 *Order Approving Stipulation and Agreement*.

- **Energy Efficient Products (EEP) –** This program is designed to raise customer awareness of the benefits of high-efficiency products and to educate residential customers to save energy cost-effectively. Four measures were included in PY2019 including advanced thermostats, tier 2 power strips, variable speed pool pumps, and heat pump water heaters.
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- **Demand Response –** The residential and Business Demand Response programs are designed to control the cooling load with the help of smart thermostats to achieve peak demand savings and energy savings.

To ensure that programs comply with Missouri's rules regarding electric utility resource planning, the PSC has long-term resource planning rules that contain requirements for impact evaluations and process evaluations. The goal of the impact and process evaluations is "to develop the information necessary to evaluate the cost-effectiveness and improve the design of existing and future demand-side programs and demand-side rates, to improve the forecasts of customer energy consumption and responsiveness to demand-side programs and demand-side rates and to gather data on the implementation costs and load impacts of demand-side programs and demand-side rates for use in future cost-effectiveness screening and integrated resource analysis."[3]

Key requirements of the evaluations as outlined in 4 CSR 240-22.070(8) include the following:

- Utilities are expected to complete annual full process and impact evaluations for each DSM program.
- At a minimum, impact evaluations should
    1. "develop methods of estimating the actual load impacts of each demand-side program" using one or both of the following methods:
        a. "Comparisons of pre-adoption and post-adoption loads of program participants, corrected for the effects of weather and other intertemporal differences"; and
        b. "Comparisons between program participants' loads and those of an appropriate control group over the same time period".
    2. "develop load-impact measurement protocols that are designed to make the most cost-effective use of the following types of measurements, either individually or in combination: monthly billing data, load research data, end-use load metered data, building and equipment simulation models, and survey responses or audit data on appliance and equipment type, size and efficiency levels, household or business characteristics, or energy-related building characteristics".
    3. Develop protocols to collect data regarding demand-side program market potential, participation rates, utility costs, participant costs and total costs.
- At a minimum, process evaluations should address the following five questions:

[3] 4 CSR 240-22.070(8) Evaluation of Demand-Side Programs and Demand–Side Rates

1. What are the primary market imperfections that are common to the target market segment?
2. Is the target market segment appropriately defined or should it be further subdivided or merged with other segments?
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 segment?
4. Are the communication channels and delivery mechanisms appropriate for the target segment?
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?

Ameren Missouri contracted with Opinion Dynamics and its subcontractors (Guidehouse, ADM Associates, Pammer Research, Sustainable Design & Behavior, Morgan Marketing Partners, and Washington University in St. Louis) to conduct comprehensive impact and process evaluations of Ameren Missouri's energy efficiency portfolio for Program Year 2019 (PY2019).

In 2019, the PSC contracted with Evergreen Economics and Michaels Energy (the Evergreen team) to serve in the capacity of EM&V Auditor to review program evaluation activities. The audit involved verifying compliance with 4 CSR 240-22.070(8) in addition to assessing the overall quality, scope, and accuracy of the program evaluation reports. The following report presents the Evergreen team's review of the Ameren Missouri program evaluations for program year 2019 (PY2019).

To conduct this review, the Evergreen team conducted the following activities:

- Reviewed each program's evaluation report in its entirety, including impact, process, and cost effectiveness methodologies and results;
- Reviewed the evaluation survey instruments and responses (where available) to confirm that the methodologies used were reasonable and consistent with best practices and that reported findings aligned with the data collected; and
- Reviewed specific evaluation tools and methodologies used for calculating program savings, including selected measure-level savings calculations, and survey methods for developing net program impacts.

3 Impact Evaluation Summary

This section summarizes the key findings and recommendations from the impact evaluations of Ameren Missouri's low-income, residential, and business energy efficiency program portfolio.

3.1 Summary of Impact Evaluation Methods and Results

The evaluation teams conducted an array of impact evaluation approaches summarized by program below.

Single Family Low-Income

The Residential Single-Family Low-Income Program is a new program in PY2019 (formerly known as the CommunitySavers Program), designed to provide whole-home energy efficiency upgrades to low-income customers living in single family properties. The program includes three participation channels: (1) the single-family neighborhoods channel; (2) the mobile home park channel; and (3) the Low-Income Efficiency Housing Grant channel.

In PY2019, Opinion Dynamics used customer feedback from an online survey to evaluate various aspects of the Singe Family Low-Income program. Opinion Dynamics estimated gross savings for most program measures using engineering algorithms established in the Missouri Statewide Technical Reference Manual (TRM). Opinion Dynamics then compared the deemed per-unit savings, provided in the Ameren Missouri TRM, to the gross savings estimates.

Multifamily Low-Income

In PY2019, Ameren Missouri launched a revised program called the Multifamily Low-Income (MFLI) Program, designed to offer a one-stop-shop approach to assist owners and operators of multifamily low- income properties to overcome barriers to completing comprehensive retrofits. PY2019 evaluation activities for the MFLI Program included reviewing program materials and the program tracking database, an impact evaluation, and interviews with program manager and implementation staff.

Due to lower than expected program participation in PY2019, the evaluation team rescheduled the customer satisfaction, customer characterization and property manager interviews activities to PY2020.

Business Social Services Program

The Business Social Services (BSS) Program is a new program in PY2019, designed to promote the installation of energy-efficient technologies in social service organizations by removing barriers such as high upfront cost, lack of financing, lack of knowledge, and lack of time and resources to investigate energy efficiency opportunities.

The evaluation team conducted interviews with both program participants and service providers. Participant interviews included the following topics: the assessment of interactions with Service Providers, participant satisfaction, and barriers to making additional energy efficiency improvements that could result in greater savings. Service Provider interviews included the following topics: perceived barriers to energy efficiency and program participation among BSS customers, and recommendations for program improvements.

Finally, Opinion Dynamics also conducted engineering desk reviews in PY2019 to verify that the program-tracking database correctly reflected the installed measure(s), including measure type, measure quantity, and key inputs into the savings algorithm such as baseline and efficient wattages, hours of use, waste heat and interactive factors, and heating penalties.

Residential Lighting Program

In PY2019, the Lighting Program provided incentives through two channels: upstream, through retail partners, and through the Ameren Missouri Online Store. Opinion Dynamics used customer feedback from two online surveys (the first administered in October 2019, which covered program activity from March to July 2019, and the second administered in January 2020, which covered program activity from August to November 2019) to evaluate various aspects of the Efficient Products Program.

The evaluation team also conducted in-store intercept customer interviews, shelf stocking surveys (in order to collect information on bulb availability and pricing), and interviews with retail and manufacturer representatives.

Efficient Products Program

In PY2019, the Efficient Products Program provided downstream mail-in, email, and online rebates for the following measures:

- Advanced thermostats
- Tier 2 power strips
- ENERGY STAR-certified variable-speed pool pumps
- ENERGY STAR-certified heat pump water heaters (HPWHs)

A total of 6,703 rebates were delivered to Ameren Missouri participants for the Efficient Products Program in PY2019.

Using the Vision database,[4] Opinion Dynamics reviewed program-tracking data to identify variables needed for the impact calculations. Similar to the Lighting Program, Opinion Dynamics used customer feedback from two online surveys to evaluate various aspects of the Efficient Products Program.

Participant survey feedback included program participation, satisfaction with marketing, and overall customer satisfaction. Opinion Dynamics estimated gross savings for most program measures using engineering algorithms established in the Efficient Products Evaluation Plan and the Missouri Statewide Technical Reference Manual (TRM). Opinion Dynamics then compared the deemed per-unit savings, provided in the Ameren Missouri TRM, to the gross savings estimates.

Heating Ventilation and Air Conditioning (HVAC) Program

For the impact evaluation, Opinion Dynamics began reviewing program-tracking data that had been recorded in the Vision database in order to identify variables necessary for impact calculations. To calculate verified gross energy and demand savings, Opinion Dynamics used engineering algorithms and the Missouri Statewide Technical Reference Manual (TRM).

Furthermore, customers were asked to complete three surveys throughout PY2019. These surveys sought to verify measure installation, as well as measure participant satisfaction with program processes, the installed HVAC measure, trade ally interactions, and program informational materials. Similarly, trade allies who had completed at least one project through the program in PY2019 were asked to complete an online survey that gathered trade ally feedback on program requirements, processes, and design, including satisfaction with trade ally training and program materials and resources.

Appliance Recycling Program

The primary goal of the Residential Appliance Recycling Program is to promote the retirement and recycling of inefficient refrigerators, freezers, dehumidifiers, and room air conditioners from households by offering turn-in incentives, free pickup of working equipment, and information on the operating costs of inefficient units. The program also provides participants with energy-efficient kits that contain LEDs and hot water measures, such as faucet aerators and low flow showerheads.

Program implementers used a regression-based analysis to calculate the total PY2019 ex-post gross savings. Opinion Dynamics used feedback from a participant survey to evaluate various aspects of the Appliance Recycling Program.

[4] The Vision database is the Ameren Missouri demand side management program tracking system.

Energy Efficiency Kits Program

Ameren implemented the PY2019 Energy Efficiency Kits program, which provides energy efficiency kits through an educational channel that primarily targets schools. The school kits provide participating teachers with classroom curriculum and energy savings kits to distribute to their students. The kits contain various home energy efficient products, including one energy-efficient showerhead, one energy-efficient kitchen faucet aerator, one energy-efficient bathroom faucet aerator, one dirty filter alarm, one kitchen faucet aerator, one low flow showerhead, three feet of pipe insulation, and four LEDs.

In PY2019, the evaluation team conducted a participant survey to collect self-reported values to update the following savings equation inputs: measure in-service rates, household occupancy, percentage of homes with electric hot water heaters, and leakage out of the Ameren Missouri territory. These measure-specific equations and variables sourced from the Ameren TRM were then used to estimate *ex-ante* savings for each measure in the kits.

Home Energy Reports Program

Using a randomized sample of customers, program implementers assigned customers to a treatment group and to a control group. Five home energy reports, which contained information about customers' home energy consumption, were mailed to the treatment group, with the hope that this would motivate participants to adopt energy-saving home improvements and behaviors. Energy savings were estimated using a lagged dependent variable regression model that utilized data from both the treatment and control groups.

Multifamily Market Rate Program

The Multifamily Market Rate (MFMR) Program was introduced in PY2019 as a new offering designed to provide a one-stop-shop approach to assist owners and operators of multifamily Market Rate properties to overcome barriers to completing comprehensive retrofits. PY2019 evaluation activities for the MFMR Program included reviewing program materials and the program tracking database, an impact evaluation, and interviews with program manager and implementation staff.

To calculate verified gross energy and demand savings, Opinion Dynamics used engineering algorithms and the Missouri Statewide Technical Reference Manual (TRM). However, after conducting an engineering analysis on the program database, the evaluation team could not recalculate program savings or verify all input values, due to incomplete program data lacking critical calculation parameters and references.

Standard and Custom Incentive Programs

The Standard and Custom programs are designed to promote energy awareness and installation of energy-efficient technologies or services by providing incentives to offset the higher cost associated with completing these projects.

Opinion Dynamics conducted multiple online surveys with both business customers and market partners. The business customer survey covered a range of topics, including sources of program information, the application process, educational materials, barriers to energy efficiency and participation in the program, participant satisfaction, and free ridership and participant spillover. Similarly, the market partner survey collected data to support the market partner spillover analysis and provide process-related and market-level insights. These surveys were used to calculate the net-to-gross ratios for PY2019.

Additionally, Opinion Dynamics completed engineering desk reviews and on-site verification, in order to verify that the program-tracking database correctly reflected the installed measure(s), including equipment types, efficiencies, quantities, hours of operation, and other information needed to estimate gross savings using TRM-based algorithms.

Retro-Commissioning Program

The Retro-Commissioning Program (RCx program) helps participants with benchmarking existing building system performance levels, identifying operating system performance optimization improvements, and providing financial incentives to support implementation of program recommendations. The most common optimization measures involve compressed air, refrigeration, and building systems.

Opinion Dynamics conducted interviews with program managers and implementers before and after the program to inform evaluation planning and analysis. In addition, the evaluation team conducted engineering desk reviews and on-site verifications, reviewing supporting project documentation for all projects to ensure that original data were correctly entered from invoices and other documentation.

New Construction Program

The New Construction Program is designed to promote cost-effective, energy efficient design in nonresidential new construction and major renovation projects. In PY2019, participants could choose from three types of energy efficiency incentives: installed interior lighting, custom measures, and whole building performance modeling.

Opinion Dynamics completed in-depth interviews with program participants about their decision to include energy-efficient measures in their project and how their experience with the New Construction Program may or may not have influenced this decision. The evaluation team also conducted engineering desk reviews to review and verify savings assumptions.

Small Business Direct Install (SBDI) Program

The SBDI Program is designed to promote the installation of energy-efficient technologies in small businesses by removing barriers such as high upfront cost, lack of financing, lack of knowledge, and lack of time and resources to investigate energy efficiency

opportunities. In PY2019, the measures included in the program were lighting and smart thermostats.

Opinion Dynamics conducted an online survey with Ameren Missouri SBDI customers that covered a range of topics, including sources of program information, barriers to energy efficiency and participation in the program, participant satisfaction, and free ridership and participant spillover. The team also conducted in-depth interviews with SBDI Service Providers in PY2019 to collect data to support the process analysis, covering topics such as experiences with the program, satisfaction with the program, sales practices, and recommendations for improvements.

Finally, Opinion Dynamics also conducted engineering desk reviews to verify that the program-tracking database correctly reflects the installed measure(s), including measure type, measure quantity, and key inputs into the savings algorithm such as baseline and efficient wattages, hours of use, waste heat and interactive factors, and heating penalties.

3.1.1 Portfolio Level Findings

In this section, we provide a summary of the energy savings goals and accomplishments across Ameren Missouri's PY2019 energy efficiency program portfolio, as reported by the evaluation teams.

Table 3 and Table 4 show Ameren Missouri's energy efficiency targets, *ex ante* gross values, *ex post* gross values, the *ex post* net savings (evaluated) and net achievement compared to the targets for energy savings (kWh) and demand reductions (kW), respectively. To ensure clarity, these terms are defined as follows:

- **PSC-Approved Targets:** Annualized savings targets for the residential and commercial and industrial (C&I) sectors.
- ***Ex Ante* Gross Savings:** Annualized savings reported by Ameren Missouri or calculated using tracked program activity and the Ameren Missouri TRM savings values.
- ***Ex Post* Gross Savings:** Annualized savings calculated and provided by the evaluation team.
- ***Ex Post* Net Savings:** *Ex post* gross savings multiplied by the net-to-gross ratio, accounting for free ridership, participant spillover, and non-participant spillover.
- **Net-to-Gross (NTG) Ratio:** *Ex post* net savings divided by *ex post* gross savings.

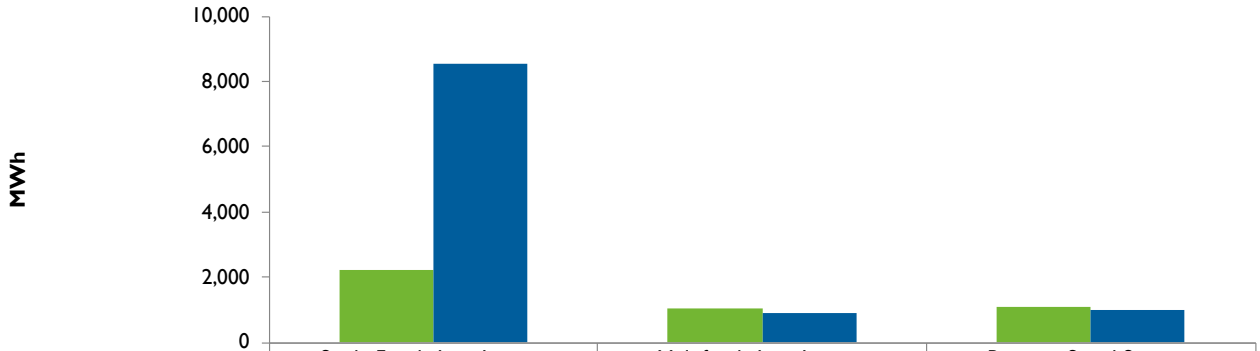
Table 3: Ameren Missouri Portfolio Energy Savings in PY2019, MWh

Program	PSC – Approved Targets	*Ex Ante* Gross Savings	*Ex Post* Gross Savings	*Ex Post* Net Savings	NTG Ratio	% of Target Reached
Single Family Low-Income	8,556	2,272	2,222	2,222[5]	100%	26%
Multifamily Low-Income	900	1,366	1,053	1,053	100%	117%
Business Social Services	987	1,072	1,106	1,106	100%	112%
Total Low-Income Portfolio	**10,443**	**4,710**	**4,382**	**4,382**	**100%**	**42%**
Lighting	12,659	86,553	98,634	62,818	64%	496%
Efficient Products	8,222	4,981	4,922	4,170	85%	51%
HVAC	44,361	39,647	38,531	29,275	76%	66%
Appliance Recycling	2,358	2,028	2,074	1,242	60%	53%
Energy Efficiency Kits	6,551	6,280	5,512	4,274	78%	65%
Home Energy Reports	35,250	-	-	15,241	-	43%
Multifamily Market Rate	2,292	2,240	1,731	1,558	90%	68%
Total Residential Portfolio	**111,693**	**141,729**	**151,405**	**118,579**	**68%**	**106%**
Standard	29,220	76,553	71,972	60,622	84.2%	207%
Custom	34,247	16,807	16,427	14,441	87.9%	42%
Retro-Commissioning	2,679	1,086	1,324	1,324	100.0%	49%
New Construction	3,349	2,626	1,959	1,549	79.0%	46%
Small Business Direct Install	8,702	6,385	6,181	5,427	87.8%	62%
Total C&I Portfolio	**78,197**	**103,457**	**97,865**	**83,364**	**85.2%**	**107%**
Total	**200,333**	**249,896**	**253,652**	**206,325**	**81.3%**	**103%**

[5] Page 9 of Portfolio Summary lists this value as 2,095. However, the Portfolio Summary still sums up total *ex post* net value to 4,382. Page 201 of the Residential Portfolio lists the *ex post* net savings as 2,222, which makes all of the math correct.

The low-income portfolio did not meet the target savings goal, achieving 42 percent of the net savings target. While the Multifamily Low-Income and Business Social Services programs surpassed their savings targets, the Single Family Low-Income program (i.e., the program with the highest savings target) only achieved 26 percent of its savings target (Figure 2).

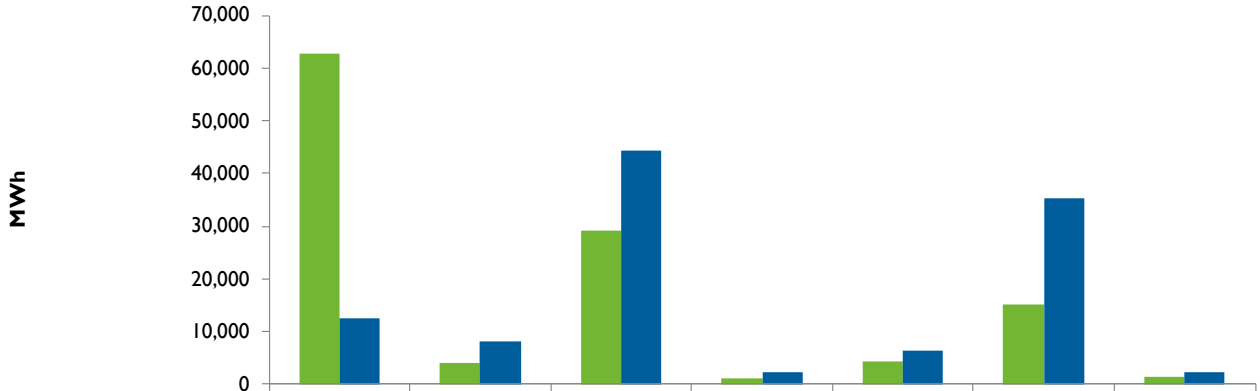
Figure 2: Low-Income Programs Planned and Evaluated Savings: PY2019 MWh



	Single Family Low-Income	Multifamily Low-Income	Business Social Services
MWh ExPost Net Savings	2,222	1,053	1,106
MWh 2019 Target Savings	8,556	900	987

In contrast, the residential portfolio surpassed the target savings goal, achieving 106 percent of the net savings target. The Lighting program had the highest savings relative to its target, meeting 496 percent of its target goal. However, all other residential programs missed their targets, with the lowest program achieving 43 percent of the target goal (the Home Energy Reports program; Figure 3).

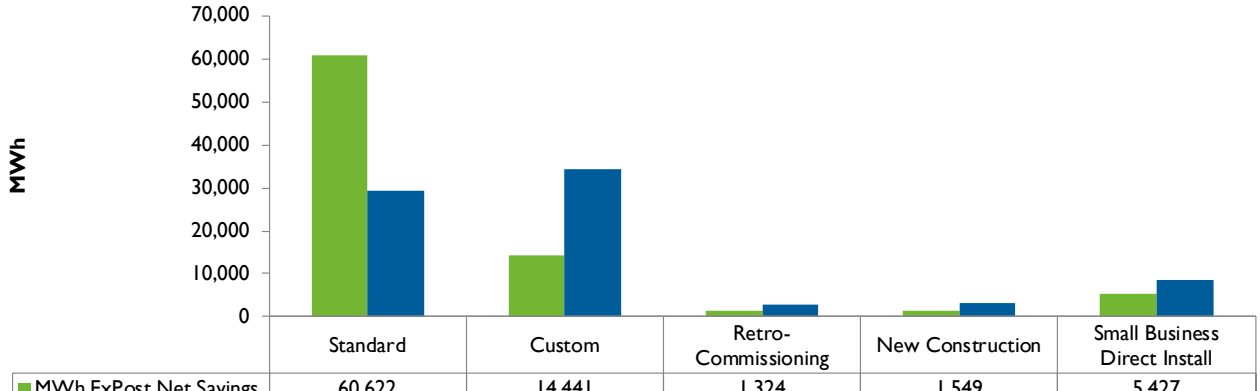
Figure 3: Residential Programs Planned and Evaluated Savings: PY2019 MWh



	Lighting	Efficient Products	HVAC	Appliance Recycling	Energy Efficiency Kits	Home Energy Reports	Multifamily Market Rate
MWh ExPost Net Savings	62,818	4,170	29,275	1,242	4,274	15,241	1,558
MWh 2019 Target Savings	12,659	8,222	44,361	2,358	6,551	35,250	2,292

The 2019 C&I portfolio surpassed its approved targets, achieving 107 percent of the net savings target. Of the five PY2019 program areas, the Standard program surpassed its energy savings target, achieving 207 percent of its goal. However, similar to the residential portfolio, all other C&I programs did not meet their targets, with the lowest program achieving 42 percent of the target goal (the Custom program; Figure 4).

Figure 4: C&I Programs Planned and Evaluated Savings: PY2019 MWh



	Standard	Custom	Retro-Commissioning	New Construction	Small Business Direct Install
MWh ExPost Net Savings	60,622	14,441	1,324	1,549	5,427
MWh 2019 Target Savings	29,220	34,247	2,679	3,349	8,702

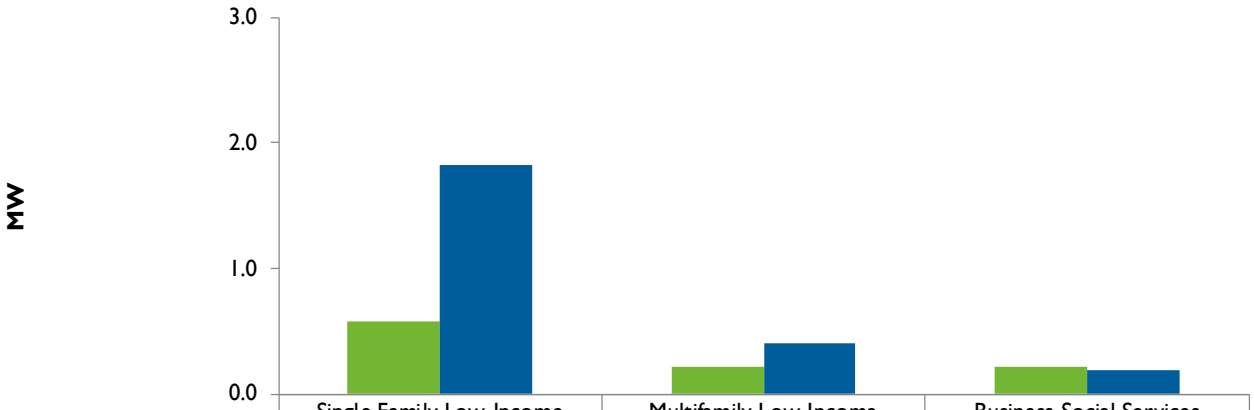
Table 4 displays approved targets for demand savings.

Table 4: Summary of PSC-Approved Targets for Demand Savings, MW

Program	PSC – Approved Targets	*Ex Ante* Gross Savings	*Ex Post* Gross Savings	*Ex Post* Net Savings	NTG Ratio	% of Target Reached
Single Family Low-Income	1.83	0.57	0.58	0.58	100%	31%
Multifamily Low-Income	0.40	0.26	0.22	0.22	100%	54%
Business Social Services	0.19	0.21	0.22	0.22	100%	113%
Total Low-Income Portfolio	**2.42**	**1.04**	**1.01**	**1.01**	**100%**	**42%**
Lighting	1.89	13.02	15.30	9.74	64%	515%
Efficient Products	2.14	1.57	1.57	1.25	80%	58%
HVAC	23.28	22.15	23.54	16.75	71%	72%
Appliance Recycling	0.34	0.32	0.29	0.16	54%	46%
Energy Efficiency Kits	1.16	1.22	1.03	0.82	79%	70%
Home Energy Reports	16.43	NA	NA	7.10	NA	43%
Multifamily Market Rate	0.67	0.34	0.26	0.23	90%	34%
Total Residential Portfolio	**45.91**	**38.62**	**41.98**	**36.05**	**69%**	**79%**
Standard	6.10	14.69	14.36	12.10	84.2%	198%
Custom	9.89	8.71	8.34	7.33	87.9%	74%
Retro-Commissioning	0.98	0.67	0.84	0.84	100.0%	86%
New Construction	0.89	0.63	0.51	0.42	81.2%	47%
Small Business Direct Install	1.51	1.21	1.22	1.07	87.8%	71%
Total C&I Portfolio	**19.37**	**25.91**	**25.27**	**21.76**	**86.1%**	**112%**
Total	**67.70**	**65.57**	**68.26**	**58.82**	**86.2%**	**87%**

The low-income portfolio did not reach its demand savings targets, achieving 42 percent of target savings. While the Business Social Services program achieved 113 percent of its target goal, the Single Family and Multifamily programs met 31 percent and 54 percent of their target goals respectively (Figure 5).

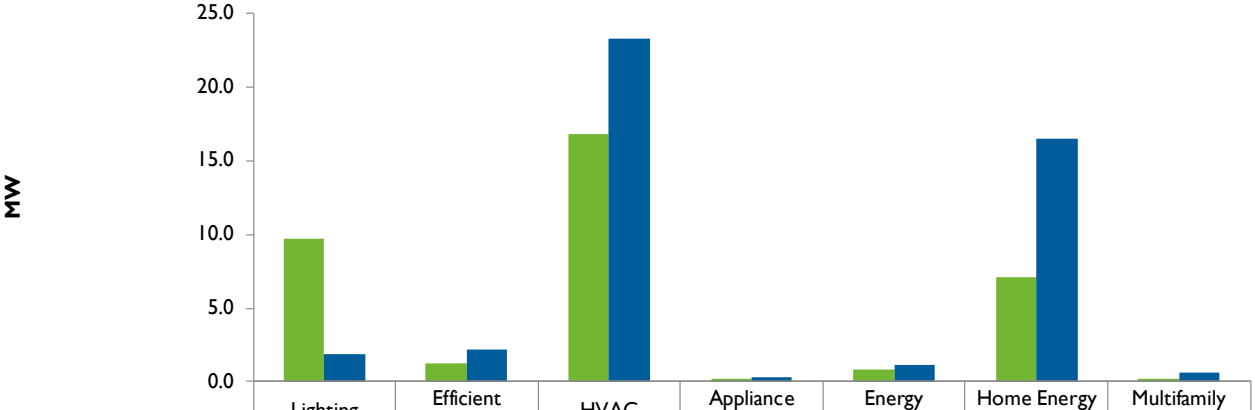
Figure 5: Low-Income Programs Planned and Evaluated Savings: PY2019 MW



	Single Family Low-Income	Multifamily Low-Income	Business Social Services
MW ExPost Net Savings	0.58	0.22	0.22
MW 2019 Target Savings	1.83	0.4	0.19

Similarly, the residential portfolio did not reach its demand target, achieving 79 percent of target savings. The Lighting program performed best, achieving 515 percent of its demand goals. However, all other residential programs did not meet their target savings, with the lowest program achieving 34 percent of savings targets (the Multifamily Market Rate program; Figure 6).

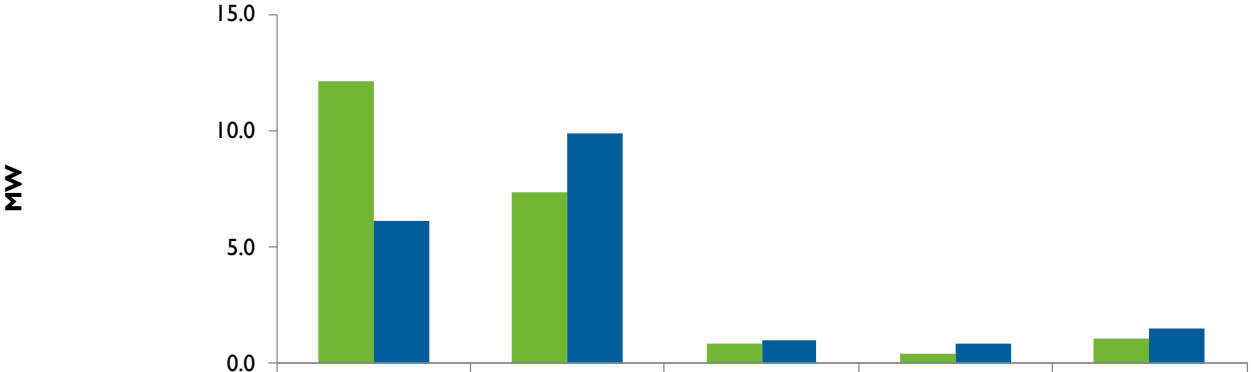
Figure 6: Residential Programs Planned and Evaluated Savings: PY2019 MW



	Lighting	Efficient Products	HVAC	Appliance Recycling	Energy Efficiency Kits	Home Energy Reports	Multifamily Market Rate
MW ExPost Net Savings	9.74	1.25	16.75	0.16	0.82	7.1	0.23
MW 2019 Target Savings	1.89	2.14	23.28	0.34	1.16	16.43	0.67

In contrast, the 2019 C&I portfolio surpassed its demand target, achieving 112 percent of its target demand savings. Similar to energy savings (MWh), the Standard Program performed the best, achieving 198 percent of its target savings. The rest of the C&I programs did not meet their demand targets, with the lowest program achieving 47 percent of its demand target (the New Construction program; Figure 7).

Figure 7: C&I Programs Planned and Evaluated Savings: PY2019 MW

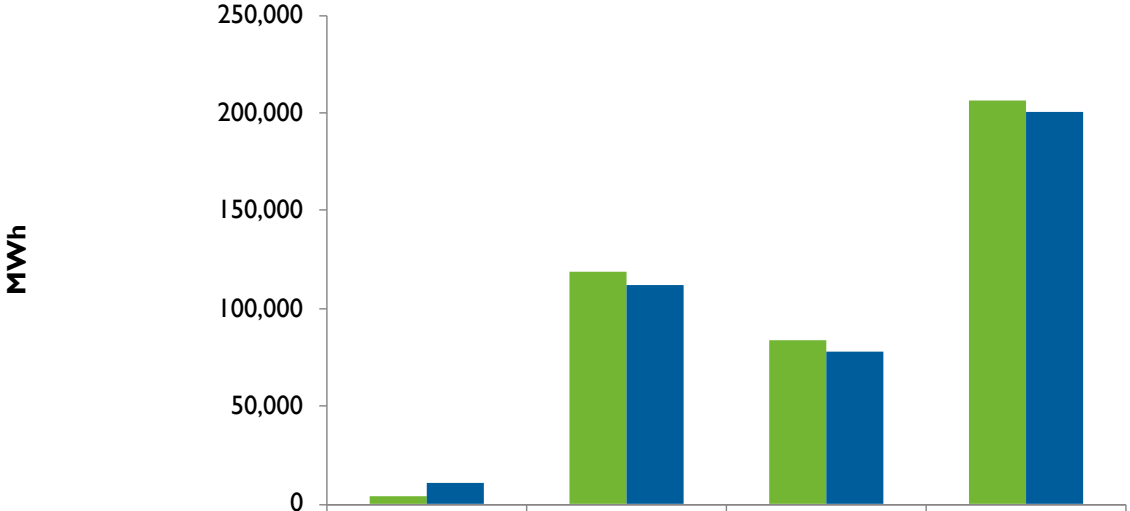


	Standard	Custom	Retro-Commissioning	New Construction	Small Business Direct Install
MW ExPost Net Savings	12.1	7.33	0.84	0.42	1.07
MW 2019 Target Savings	6.1	9.89	0.98	0.89	1.51

The following figures present summaries of program achievements in comparison with program goals**.** Figure 8 and Figure 9 display the PY2019 energy and demand savings targets and achievements by sector, as reported by evaluators.

The PY2019 portfolio had a target energy savings goal of 200,333 MWh and actual net savings of 206,325 MWh, equating to approximately 103 percent of the program year energy goal. The Residential and C&I programs outperformed their energy savings goals, achieving 106 percent and 107 percent of their targets respectively, while the Low-Income program did not meet its goal, reaching 42 percent of their target (Figure 8).

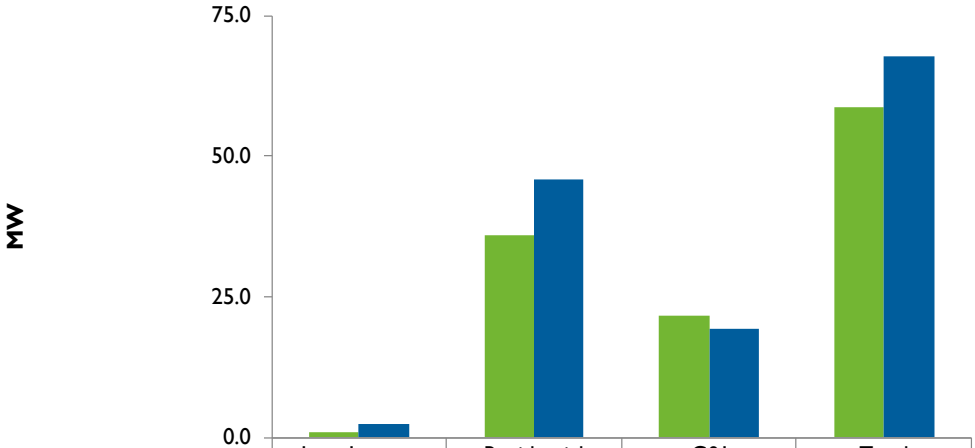
Figure 8: Energy Savings and Achievements by Sector: PY2019 MWh



	Low Income	Residential	C&I	Total
MWh ExPost Net Savings	4,382	118,579	83,364	206,325
MWh 2019 Target Savings	10,443	111,693	78,197	200,333

Finally, PY2019 had a target demand savings goal of 67.70 MW and actual net savings of 58.82 MW, equating to approximately 87 percent of the year's demand goal. The C&I program was the only program to surpass its savings goal, meeting 112 percent of target savings. In contrast, the low income and residential programs did not meet their goals, with 42 percent and 79 percent of their targets met respectively (Figure 9).

Figure 9: Demand Savings Targets and Achievements by Sector: PY2019 MW



	Low Income	Residential	C&I	Total
MW ExPost Net Savings	1.01	36.05	21.76	58.82
MW 2019 Target Savings	2.42	45.91	19.37	67.7

4 Process Evaluation Summary

This section summarizes key methods and findings from the PY2019 process evaluations of Ameren Missouri's low-income, residential and business energy efficiency program portfolio.

In general, the audit team found that the process evaluations were thorough and followed best practices established for the industry. As noted below, the process evaluations were generally able to provide substantive answers to the required CSR questions.

4.1 Summary of Process Evaluation Methods and Alignment with Missouri CSR Minimum Requirements

The low-income, residential, and C&I program evaluations adopted a wide range of process evaluation methods. Table 5 below summarizes the process evaluation methods applied for each program.

Table 5: Process Evaluation Method Summary

Program	Methods	Description
Residential Lighting	Tracking System Review	Reviewed implementer's tracking system to ensure that data required for the evaluation was being collected and reported appropriately.
	Program Manager & Implementer Interviews	Conducted one interview in September with program staff to gain detailed information on the step-by-step operational conditions and implementation efforts to gain an understanding of program design and delivery.
	Program Material Review	Reviewed program marketing and outreach plans and materials to inform evaluation activities.
	Participant Surveys	Completed online surveys with 189 customers that purchased lighting through Ameren Missouri's Online Store to inform gross savings (e.g., in-service rate), NTG (FR and PSO), and yield process-related insights. Conducted 416 interviews with customers purchasing lighting products at 11 participating retail stores to estimate program FR, PSO, and NPSO, leakage, and residential versus commercial usage of program lighting, and yield process-related insights.
	Lighting Shelf Stocking Study	Visited eight unique retail locations to gather information about lighting product availability and

Program	Methods	Description
		pricing to monitor changes in the lighting market that could impact program design. Conducted a web scraping study to collect information about lighting product availability and pricing to monitor changes in the lighting market that could impact program design.
Heating and Cooling	Program Manager & Implementer Interviews	Conducted one interview with program staff to gain a detailed understanding of program design and delivery.
	Program Material Review	Reviewed all program materials to inform evaluation activities.
	Program Theory/Logic Model Review	Reviewed implementer's program theory/logic model to understand program activities and their expected outputs and outcomes, including expected impacts on the market.
	Tracking System Review	Reviewed implementer's tracking system to ensure that the data required for the evaluation is being collected.
	Participant Survey	Conducted three waves of online surveys with program participants to collect data to inform NTG (free ridership and participant spillover) and yield process-related insights.
	Participant Trade Ally Survey	Conducted an online survey with trade allies to inform NTG (trade ally spillover) and yield process-related insights.
Home Energy Reports	Program Manager & Implementer Interviews	Conducted interviews (1) before program launch to inform evaluation planning and (2) in the middle of PY2019 to understand program staff's perspective on program performance.
	Program Material Review	Reviewed available program materials to inform evaluation activities.
	Program Theory/Logic Model Review	Reviewed implementer's program theory/logic model to understand program activities and their expected outputs and outcomes, including expected impacts on the market.
	Tracking System Review	Reviewed implementer's tracking system to ensure that the data required for the evaluation is being collected.

Program	Methods	Description
	Participant Survey	Collected data through a web survey from treatment and control customers to assess participant satisfaction, awareness of Ameren Missouri programs, changes in behavior in response to HERs, and gather suggestions to improve customer engagement.
Energy Efficient Products	Program Manager & Implementer Interviews	Conduct interviews towards the end of PY2019 to understand program staff's perspective on program performance.
	Program Material Review	Review all program materials to inform evaluation activities.
	Program Theory/Logic Model Review	Review the implementer's program theory/logic model to understand program activities and their expected outputs and outcomes, including expected impacts on the market.
	Tracking System Review	Review the implementer's tracking system to ensure that data required for the evaluation is being collected.
	Participant Survey	Collect data to inform gross impact analysis (e.g., in-service rates), NTG (i.e., free ridership and participant spillover), and yield process-related insights
Energy Efficiency Kits	Program Manager & Implementer Interviews	Conducted interviews (1) before program launch to inform evaluation planning and (2) towards the end of PY2019 to understand program staff's perspective on program performance.
	Program Material Review	Review all program materials to inform evaluation activities.
	Program Theory/Logic Model Review	Review the implementer's program theory/logic model to understand program activities and their expected outputs and outcomes, including expected impacts on the market.
	Tracking System Review	Review the implementer's tracking system to ensure that data required for the evaluation is being collected.
	Participant Survey	Collect data to inform gross impact analysis (e.g., in-service rates), NTG (i.e., free ridership and participant spillover), and yield process-related insights

Program	Methods	Description
Multifamily Market Rate	Program Manager & Implementer Interviews	Conducted interviews (1) before program launch to inform evaluation planning and (2) towards the end of PY2019 to understand program staff's perspective on program performance.
	Program Material Review	Review all program materials to inform evaluation activities.
	Program Theory/Logic Model Review	Review the implementer's program theory/logic model to understand program activities and their expected outputs and outcomes, including expected impacts on the market.
	Tracking System Review	Review the implementer's tracking system to ensure that data required for the evaluation is being collected.
Appliance Recycling	Program Manager & Implementer Interviews	Conducted interviews (1) before program launch to inform evaluation planning and (2) towards the end of PY2019 to understand program staff's perspective on program performance.
	Program Material Review	Review all program materials to inform evaluation activities.
	Program Theory/Logic Model Review	Review the implementer's program theory/logic model to understand program activities and their expected outputs and outcomes, including expected impacts on the market.
	Tracking System Review	Review the implementer's tracking system to ensure that data required for the evaluation is being collected.
	Participant Survey	Collect data to inform gross impact analysis (e.g., in-service rates), NTG (i.e., free ridership and participant spillover), and yield process-related insights
Low-Income	Program Manager & Implementer Interviews	Conducted interviews (1) before program launch to inform evaluation planning and (2) towards the end of PY2019 to understand program staff's perspective on program performance.
	Program Material Review	Review all program materials to inform evaluation activities.
	Program Theory/Logic Model Review	Review the implementer's program theory/logic model to understand program activities and their expected outputs and outcomes, including expected impacts on the market.

Program	Methods	Description
	Tracking System Review	Review the implementer's tracking system to ensure that data required for the evaluation is being collected.
	Participant Survey	Collect data to inform gross impact analysis (e.g., in-service rates), NTG (i.e., free ridership and participant spillover), and yield process-related insights

The Public Service Commission set minimum requirements for the program process evaluations in 4 CSR 240-22.070(9).[6] At a minimum, process evaluations should answer the following five key questions:

- **Question 1:** What are the primary market imperfections common to the target market segment?
- **Question 2:** Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?
- **Question 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?
- **Question 4:** Are the communication channels and delivery mechanisms appropriate for the target market segment?
- **Question 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?

In general, the evaluations provided substantive, updated responses to the five key questions that are clearly linked to the most recent evaluation findings. Each program evaluation provided a response to all five questions, and the full text response to these questions is provided as Appendix A to this report.

[6] *Rules of Department of Economic Development, Division 240 - Public Service Commission, Chapter 22 - Electric Utility Resource Planning*. 2011. https://www.sos.mo.gov/cmsimages/adrules/csr/current/4csr/4c240-22.pdf

5 Review of Cost-Effectiveness Calculations

The Evergreen team reviewed low-income, residential and commercial summary findings from the portfolio reports and the appropriate DSMore output files. This process involved reviewing the low-income, residential and commercial program DSMore aggregate files to confirm that calculations were performed correctly. This review was similar to those conducted in prior audits, with specific tasks including the following:

- Confirm that the reported program summary values matched those in the DSMore results file;
- Confirm that the reported costs matched the costs included in the DSMore input files (both incentive and overhead);
- Report current (PY2019) program results and compare against previous year results (PY2018).

Confirm summary values reported matched the values in the DSMore results files

The Evergreen team reviewed the reported summary cost-effectiveness values, as well as the net lifetime benefit and cost of conserved energy values to confirm the reported values matched the DSMore aggregate file results. The review consisted of checking all five cost-effectiveness tests for both the residential and commercial portfolio files. The Evergreen team did not find any errors between the reported values and DSMore files.

Confirm that the reported costs matched the costs input into the DSMore cost-effectiveness input files (both incentive and overhead);

The Evergreen team reviewed the costs reported in each DSMore aggregate file for each program and compared them against the reported costs in the evaluation reports. No discrepancies were found.

Table 6 presents the total net lifetime benefits from low-income, residential and commercial programs reported in the PY2019 EM&V reports and compares the current year net benefits to previously reported PY2018 net benefits totals. Residential programs showed an increase in the total net benefits, with the Residential Lighting Program showing a significant increase in benefits relative to 2018. The Commercial programs showed a decrease in total net benefits with all of the Business Programs reporting significant decreases. Overall there was a decrease in net lifetime benefits between 2018 and 2019.

Table 6: Net Lifetime Benefits per Program

Program	Net UCT Lifetime Benefit (Reported) 2018	Net UCT Lifetime Benefit (Reported) 2019
Single Family - LI	N/A	-$1,720,901
Multifamily - LI	N/A	-$1,354,537
Business Social Services	N/A	$27,100
Lighting	$3,578,373	$32,131,284
Efficient Products	$2,426,318	$572,584
Heating and Cooling	$29,573,393	$9,704,986
Appliance Recycling	N/A	-$164,377
Energy Efficiency Kits	$2,293,834	$1,394,794
Home Energy Reports	$1,152,239	-$1,034,217
Multifamily Market Rate	N/A	-$120,858
Residential DR	N/A	$947,483
Business Standard	$89,136,901	$26,039,009
Business Custom	$45,344,680	$9,668,141
Retro-Commissioning	$4,615,618	$1,230,398
New Construction	$11,830,564	$596,069
Small Business Direct Install	$7,493,718	$2,143,668
Business DR	N/A	27,871,840

Table 7 compares the results of the four cost effectiveness tests between PY2018 and PY2019.[7]

[7] SCT results were calculated as part of the evaluation; however, they are excluded from the table below because they are equivalent to TRC results due to two factors: 1) Ameren Missouri does not included non-energy impacts in cost-effectiveness testing, and 2) Ameren Missouri uses the same planning assumptions for both tests, including the discount rate.

Table 7: Cost Effectiveness Test Results

Program	UCT		TRC		RIM		PCT	
	2018	2019	2018	2019	2018	2019	2018	2019
Single Family - LI	N/A	0.44	N/A	0.54	N/A	0.27	N/A	3.62
Multifamily - LI	N/A	0.32	N/A	0.42	N/A	0.21	N/A	5.34
Business Social Services	N/A	1.04	N/A	2.42	N/A	0.44	N/A	8.11
Lighting	2.77	5.52	2.76	15.57	0.37	0.55	N/A	N/A
Efficient Products	1.16	1.37	1.07	0.96	0.33	0.46	5.15	2.80
Heating and Cooling	2.34	1.78	1.36	1.76	0.54	0.57	3.08	4.63
Appliance Recycling	N/A	0.73	N/A	0.79	N/A	0.30	N/A	26.06
Energy Efficiency Kits	2.77	2.60	2.85	2.62	0.39	0.50	N/A	8.24
Home Energy Reports	1.32	0.44	1.32	0.44	0.33	0.26	N/A	N/A
Multifamily Market Rate	N/A	0.86	N/A	1.12	N/A	0.33	N/A	8.23
Residential DR*	N/A	1.11	N/A	1.11	N/A	0.98	N/A	N/A
Business Standard	3.73	3.92	1.92	2.92	0.48	0.64	4.50	5.90
Business Custom	3.77	3.49	1.21	1.92	0.63	1.05	2.12	2.02
Retro-Commissioning	4.37	6.78	4.78	5.74	0.83	1.45	8.75	5.63
New Construction	4.00	2.56	0.95	1.43	0.61	0.71	1.63	2.16
Small Business Direct Install	2.37	2.94	1.67	2.79	0.44	0.61	4.03	5.57
Business DR*	N/A	3.34	N/A	3.34	N/A	3.25	N/A	N/A

*Includes lifetime costs and benefits of Demand Response programs over a 10-year effective useful life.

6 Conclusions and Recommendations

Based on our PY2019 audit activities, we offer the following conclusions and recommendations for future evaluation research.

Lighting EUL Assumptions

One important issue discussed during the evaluation was the effective useful life (EUL) values used for commercial lighting impacts, as these were increased significantly for PY2019. It is important to understand the effect these changes have on the final demand savings and performance incentive payments, and so they are documented here in the audit report. We believe that this is an area that needs further discussion as the reasons for the EUL changes are not supported by any independent evaluation research.

The claimed energy and demand savings for commercial lighting, and the associated cost benefit analysis for this program, uses the implementer supplied EUL values instead of the values contained in the Technical Reference Manual (TRM). The decision to use the implementer EUL values rather than the TRM EUL values is not unreasonable per-se, but more justification should be provided for making this change. There is no support for making this shift provided in the evaluation report, other than to note that the new values were adopted. The net effect is to move approximately half of the lighting savings from the <10 year EUL bin to the 10-14 year and 15+ year EUL bins.

The Business Portfolio report (Section 3.2.2) references a memo that provided the impetus for this change, titled *Ameren Missouri MEEIA 2019-21 Energy, PCDR, and EUL Methodology* (January 30, 2019). The audit team reviewed this memo, in addition to information provided by Opinion Dynamics during a stakeholder call on May 28, 2020, and follow-up data provided in an email to the stakeholder group on June 3, 2020.

The following chart was provided in the June 3, 2020 email. Assuming that the Missouri TRM cap of 15 years is ignored and only the 50,000 hour LED life is used, then only about 3 percent of the Biz Savers lighting installation energy savings would fall into the 15+ year EUL bucket. The demand savings would be in the same approximate range, even if they are not directly proportional to the claimed kWh.

Comparison of EUL Bins (1st Yr Ex Post Gross MWh)

	Ex Post Analysis Bin			
TRM Bin	<10	10-15	15+	TOTAL
<10	-	5,568	33,545	39,113
10-15	-	15,177	18,376	33,554
15+	-	-	2,208	2,208
TOTAL	-	20,745	54,130	74,875

Table 3-2 from the Business Portfolio evaluation is included below:

Table 3-2. PY2019 Standard Savings Summary

	Ex Ante Gross	Gross RR	Ex Post Gross	NTGR	Ex Post Net	Goal/Target Net	% of Goal/Target
First Year Savings							
Energy Savings (MWh)	76,553	94.0%	71,972	84.2%	60,622	29,220	207%
Demand Savings (MW)	14.69	97.7%	14.36	84.2%	12.10	6.10	198%
Last Year Demand Savings							
< 10 EUL (MW)	-	n/a	-	n/a	-	0.55	0%
10-14 EUL (MW)	4.28	94.4%	4.04	84.2%	3.40	2.70	126%
15+ EUL (MW)	10.41	99.1%	10.32	84.2%	8.69	2.84	306%

If the EULs from the TRM are used, then distribution of savings for the Standard program would shift significantly lower, as shown in Table 1.

Table 8: Change in Commercial Lighting MW Impacts Due to EUL Assignments

EUL Bin	TRM EULs (MW)	Evaluation EULs (MW)	Difference
<10 years	6.32	0	-6.32
10-14 years	5.42	3.40	-2.02
15+ years	0.36	8.69	8.33
Performance Incentive	**$510,651**	**$1,242,407**	**$731,757**

Absent the single decision to extend lighting EULs, the PY2019 Standard program savings would have come in well below targets. In the June 3, 2020 email, the evaluators noted that they conducted an independent assessment of the EUL analysis and found that it was not unreasonable, but there was no comparison with what values are used in other regions.

For residential lighting, the EUL values were shifted between the draft and final evaluation reports, apparently in response to Ameren MO's strong recommendation in their draft report comments that the midlife adjustments relating to the EISA standards be removed. This may be considered a policy decision by the evaluation team, but the comparison between the two versions is shown below in Table 2.

Table 9: Change in Residential Lighting EUL Between Draft and Final Reports

EUL Bin	Draft Report (MW)	Final Report (MW)	Difference
<10 years	0.65	1.71	1.06
10-14 years	0	0	0
15+ years	1.88	8.03	6.15
Performance Incentive	**$204,726**	**$874,443**	**$669,717**

The end result of both of these decisions is to shift a large around of the commercial. And residential lighting demand savings into the 15+ year EUL bin.

A separate potential issue is the process used to review the new EULs, as the order of the steps taken can result in significantly different EUL values. Consider the following two examples. In their June 3 email, Opinion Dynamics says that it reviewed the implementer EULs and that they appear to be more consistent with the PY2019 tracking data. To do this, it appears that they followed these steps:

Step 1 (Divide): For lighting type XYZ, calculate a new EUL for each project:

Project 1: Lighting Type XYZ operates 8,760 hours per year. Assume LED lasts 50,000 Hours. EUL = 50,000/8,760 = 5.7 years

Project 2: Lighting Type XYZ operates 2,000 hours per year. Assume LED lasts 50,000 Hours. EUL = 50,000/2,000 = 25 years

Step 2 (Average): Deem a new EUL for lighting type XYZ:

New EUL = average of 5.7 and 25 = ***15.35 years*** (goes into the 15+ year bin)

An alternative and equally valid approach would be to first calculate an average hours of use (HOU) for each lighting type and then do the division to determine the EUL. This process is as follows:

Step 1 (Average): For lighting type XYZ, calculate the average HOU:

Project 1: Lighting Type XYZ operates 8,760 hours per year.

Project 2: Lighting Type XYZ operates 2,000 hours per year.

Average HOU = (8,760 + 2,000)/2 = 5,380 hours

Step 2 (Divide): Deem a new EUL for lighting type XYZ:

Average light has an HOU of 5.380, LED lasts for 50,000 hours:

New EUL = 50,000/5,380 = ***9.3 years*** (goes into the <10 year bin)

From the same underlying data, two very different EULs can be derived simply by rearranging the order of the averaging and division. If this second approach had been used, it would have likely provided more support for keeping the original TRM values.

This is not simply an academic exercise, as these shifts in EUL have a substantial impact on the Ameren MO performance incentives, and therefore more justification is needed for using these values in the future. As summarized in Table 3-1 of the Portfolio Summary Report, for every MW of savings in the 15+ EUL bin, the incentive is $108,897, and every MW in the 10-14 Year EUL bin is $87,086. It appears then that the shift to the higher EUL values for both residential and commercial lighting has resulted in an increase of approximately $1.4 million in performance incentive payments to Ameren MO.

This is a subject that needs to be researched more thoroughly as part of the PY2020 evaluation in order to justify the longer EULs, rather than simply adopting the implementer values.

Recommendation: Conduct additional research in the PY2020 evaluation to support the longer lighting EULs. Absent sufficient justification, we recommend that the lighting EULs from the most current Illinois TRM be used in the future if the EULs in the MO TRM values are considered outdated.

Recommendation: Standardize the lighting EULs statewide across the Ameren MO and Evergy programs, as there is no compelling reason why these should be different across utilities.

Lighting Elasticity Model

There are several issues relating to the net impact analysis for the Residential Lighting program that came up in our review. We discuss them below and provide a recommendation for an improved model for use in future evaluations of this program.

For PY2019, Opinion Dynamics uses both a lighting elasticity model and the results of intercept surveys to estimate free ridership for this program. Free ridership is estimated separately using both methods and then the results are averaged to determine the final free ridership rate. In the report, Opinion Dynamics discusses the pros and cons of both methods and ultimately determines that both methods are equally appropriate in this application.

The critical difference here is that the elasticity model relies on observed market behavior (revealed preference data) while the intercept surveys rely on stated preference data. It is generally accepted among economists that (all else equal) revealed preference data are preferred to stated preference data, as they reflect actual choices in the market place where consumers have considered all the characteristics of the available choices and then made a real-life decision.

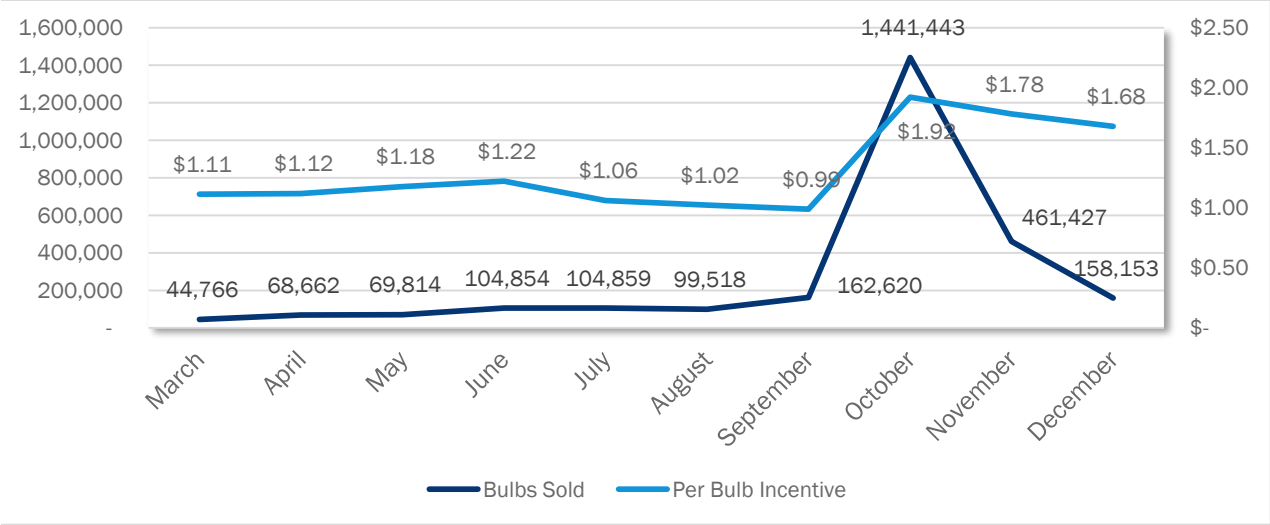
In criticizing the elasticity model, Opinion Dynamics makes the point that the model is being used to extrapolate to consumer demand beyond the price ranges where the data were collected. While the model is used to do a modest extrapolation (extending demand to the case where the rebate equals zero), there is no compelling reason to believe that the shape of the demand curve is significantly different between say a $4 price and a $6 price. In other words, if any bias exists in the extrapolation, it is likely to be small.

A separate weakness noted by Opinion Dynamics is omitted variable bias, as they assert that the elasticity model does not account for program marketing, product placement, advertising, signage, etc. In fact, these are all determinants of demand and are reflected in the shape of the demand curve. The sensitivity to price is determined (the key objective of the modeling exercise) in part by these other program factors and therefore are not omitted from the model.

Finally, Opinion Dynamics asserts that the "theory underlying the model is that any lift in sales due to price reductions is a shift in sales from a less efficient product to an LED, which may or may not be the case given all the alternative products on the market." (Appendix A, p. 24). In fact, the availability of substitutes (less efficient LED or otherwise) is another factor determining the shape of the demand curve and therefore is incorporated in the elasticity model.

A far more likely chance for bias occurs from extrapolating the results of the intercept survey. With the intercepts, the data are collected in October to December – a period where the program activity is greatest and therefore customers are more likely to report the influence of the program (Opinion Dynamics also acknowledges this as a potential weakness of the intercept survey approach). Figure 3-1 from the report (p. 41) is copied below, which shows the large spike in sales during October when the promotions were occurring. It is likely that bias is introduced (i.e., the free ridership estimate is lower than it should be) by using the intercept data from months of the highest program activity and extrapolating to the rest of the year. The elasticity model, in contrast, uses data from the entire year and therefore provides a more accurate picture of consumer preferences over time.

Figure 3-1. PY2019 Lighting Program Upstream Channel Bulb Sales and Average Per Bulb Incentive by Month



We have made these points before in our original comments on the evaluation plan and in earlier criticisms of the other stated preference methods used by Cadmus to estimate net impacts for the lighting program. To reiterate, actual market data should be preferred to stated preference data when both are available for estimating free ridership.

In the comparison of their free ridership result, Opinion Dynamics compares their number with several evaluations (p. 22, Table 13) and concludes that their number is within the range of these other studies. While it is true that these numbers are somewhat similar, the range shown is quite broad. More importantly, the studies cited do not provide a valid comparisons as they are not all utilizing an elasticity model. The California LED study is a discrete choice model based on stated preference data, where the type of data and model specification are both completely different than the elasticity model. Similarly, the Duke Energy study utilizes a discrete choice model, not an elasticity model.

It is unclear from the graphs in the appendices (Figure 2, 3, and 4) how these model results were ultimately used since the axes are not labeled and the graphs do not appear to be showing the normal tradeoff between price and quantity demanded. It may be that the elasticity calculations are extended beyond the portion of the demand curve where the rebate equals zero, which may be distorting the elasticity estimate unnecessarily.

As a more general issue, we believe that there is a better elasticity model specification to be used for the lighting program, one that may improve the free ridership result. As an alternative to the Opinion Dynamics model, we recommend using a Poisson specification that is better equipped to handle the lighting sales data. The Poisson model is preferable to standard ordinary least squares (OLS) regression because the response variable (i.e., bulb sales) only takes on non-negative values. The OLS regression model is generally not an

appropriate choice because it fails to account for the limited possible values of the response variable. While there are other models that account for limitations of count data (e.g., negative binomial), the Poisson model is the most commonly used approach

The generalized log-linear Poisson model is specified as:

$$Ln(\mu_i) = x_i'\beta$$

Where, μ_i is the mean of the individual bulb sales across retailers and sales periods. An expanded version of this model is:

$$Ln(Bulb\ Sales_{kit}) = \beta_0 + \beta_1(Rebated\ Price_{kit}) + \beta_k(Bulb\ Char_k)$$

Where,

$Ln(Bulb\ Sales_{kit})$ is the natural logarithm of the average number of bulb type *k* sold each day by retailer *i* in time period *t*.

$Rebated\ Price_{kit}$ is the price after rebate for bulb type *k* sold by retailer *i* in period *t*.

$Bulb\ Char_k$ is an array of characteristics of the LED bulb, such as lumens and watts.

We have used the Poisson model specification most recently in New Mexico and have estimated free ridership in the range of 0.29 to 0.37 for several utilities. The same model specification was used by Navigant in the recent evaluations of the KCP&L Residential Lighting programs, which resulted in a free ridership of approximately 0.41. Given these applications, we believe that this model might actually lower the free ridership estimate for the Ameren MO program in the future relative to Opinion Dynamics' current elasticity model.

Recommendation: In future evaluations, use only a lighting elasticity model with a negative binomial or Poisson specification to estimate free ridership. The elasticity model results should not be combined with the intercept survey results in future years. The intercept survey can still be used to estimate spillover as this is beyond the capability of the elasticity model.

Spillover

The audit team has previously noted our concerns regarding the imprecision of the spillover estimates based on trade allies or other market actor interviews, and have commented on for both the evaluation plan and earlier drafts of the evaluation report. Our concerns remain, and so these comments are repeated below.

Trade Ally Spillover

Page 49 of the Residential Appendix notes that:

> Trade allies also named several non-program factors that contributed to the uptick in their energy efficiency-related business practices, including increased customer interest, manufacturer rebates, tax rebates, increasing affordability of high-efficiency equipment.

These are mostly reasons for counting these installations as free riders, not spillover.

Only five trade allies ended up with projects that could be counted as spillover, and they are only able to provide approximate estimates of the number of jobs, size adjustments, influence due to the program, share of revenue coming from nonparticipant jobs, etc. The end result is an estimate of trade ally spillover that is very imprecise and based on a small number of responses. It is still unclear how this estimate avoids double counting with participant spillover, or possibly even the direct program impacts given how imprecise the estimate is of non-incented energy efficient installations.

Market Partner Spillover (MPSO)

Page 60 of the Business Portfolio Report states:

> Notably, all five market partners who qualified for SO named exterior lighting as program-influenced non-incented measures they installed, and all five noted that the installations were completed without an incentive because incentives were not available. One of these market partners noted that they would install a lot more exterior LED lighting, if incentives were still available.

As we have commented in past years, we do not believe that spillover should be counted for measures that are not eligible for the program. In this case, given the reasons provided by the market partners, these projects are more accurately considered as free riders and should not be included in any spillover calculations.

Page 5 of the Business Portfolio Appendix has the following equation and text:

$$\textit{\% of Efficient Installations That Received Incentive} = \frac{\textit{Number of Projects from Program Database}}{\textit{TA2b + Number of Projects from Program Database}}$$

> If the respondent was unable to provide an answer for TA2a or TA2b, we assumed the percentage of high efficiency equipment that did not receive a BizSavers Program incentive was equal to the average percentage among all respondents.

If the market partner cannot provide an answer to these questions, then they should be dropped from the MPSO calculation – they should not be assigned an average value from the other respondents for individual questions just so they can remain in the spillover calculation. This calculation is already imprecise as it uses a small number of respondents to extrapolate to the entire market, and imputing values just adds to the imprecision.

Recommendation: For the reasons stated above, we recommend that the MPSO and trade ally spillover components be dropped from all of the net impact calculations.

HVAC Early Replacement vs Replace on Burnout

Another issue that the audit team has raised in prior audits is the high incidence of projects that are categorized as early replacements instead of replace-on-burnout. It appears from the evaluation report that approximately 90 percent of the residential CAC units are categorized as early replacement, but there is no any information on how the evaluation verified these claims. During the evaluation Opinion Dynamics did review the tracking data, and of the 9,921 projects they recategorized 234 (2.4 percent) from early replacement to replace-on-burnout. For comparison, in its June 3 follow-up email Opinion Dynamics reported that only 76 percent of the projects in the tracking data had information showing the temperature drop across the coil, which is the program requirement to be considered an early replacement. As a point of reference, the IL TRM v.7, which was used as the reference for the per-unit CAC savings, assumes that only 14 percent of the measures are early replacement by default. This shift to more early replacements results in a substantial increase in claimed savings for this program.

The evaluation report also recommends loosening the requirements for qualifying as an early replacement job. As noted in our earlier comments, we disagree with this suggestion as we believe that the criteria used are already too lax and are leading to unrealistically high amounts of savings for these units.

Recommendation: Future evaluation work should be done to verify more rigorously whether or not units are early replacements based on the program eligibility rules in place for PY2019. We do not recommend that the program rules be loosened in PY2020 as recommended in the evaluation report.

Code Changes Related to ECM Furnace Fans

As noted in our earlier comments, the ECM fan motor measure has been superseded by code. This measure contributed approximate 23 percent of the savings for the HVAC program. ECM fans manufactured after July 3, 2019, are essentially required to be ECMs, per federal code 10 CFR 430.32(y).

Recommendation: We recommend that this measure be dropped as an eligible measure beginning in PY2020.

Appendix A: Full Process Evaluation Responses to Minimum Question Requirements

The following appendix provides a summary of the detailed responses to minimum process evaluation requirement questions.

Table 10: Minimum Process Evaluation Questions

Issue Number	Question
Issue 1	What are the primary market imperfections common to the target market segment?
Issue 2	Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?
Issue 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?
Issue 4	Are the communication channels and delivery mechanisms appropriate for the target market segment?
Issue 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?

Table 11: Issue 1 - What are the primary market imperfections common to the target market segment?

Program	2018 Summary Response	2019 Summary Response
Single Family Low-Income (formerly known as Community Savers)	Multiple market imperfections were identified that may prevent low-income multifamily property owners from investing in energy efficiency improvements either through the CommunitySavers Program or outside of it. The identified market imperfections are: cost, geography, lack of property staff resources, and split incentives. Cost. The cost of energy efficient equipment is a barrier to completing efficiency improvements through the program and outside of it. Program staff that work with multifamily property owners and managers noted that cost is a barrier to efficiency improvements in the properties managed. It was noted that this is particularly the case for non-lighting measures. The cost of efficiency improvements was also noted as a barrier by three of the four respondents. Additionally, staff noted that some properties may be prevented from financing efficiency projects because of the terms of previous financing arrangements. Geography. Analysis of the program activity in comparison to the location of multifamily properties and lower income customers found that program activity was disproportionately concentrated in St. Louis and its surrounding suburbs. However, there was an increase in the share of projects completed in outer St. Louis suburbs from 10% of tenant units in PY2017 to 18% of units in PY2018. Insufficient Property Staff. Multifamily property operators may not have staff available to implement efficiency measures. Unlike prior years, none of the survey respondents cited this as a barrier. CommunitySavers is designed to minimize the time required by property managers and owners through the assistance provided by the account manager who will assist with program paperwork and the scheduling of the work completed.	Low-income households face multiple barriers to investing in energy efficiency either through Ameren Missouri programs or outside of them. Market imperfections include: • The high upfront cost of energy-efficient products relative to household capital and • Available credit, even when taking into account traditional utility program incentives, • Lack of access to traditional forms of information about energy efficiency programs, • Housing stock that may need health and safety improvements, which can preclude • Efficiency upgrades unless these issues are addressed first, and • Split incentives between property owners and renters, for those who rent their home.

Program	2018 Summary Response	2019 Summary Response
Multifamily Low-Income	This program was new in PY2019.	Market imperfections specific to the multifamily sector include 1) the split incentive for in-unit measures between property owners, managers, and residents, 2) awareness of the potential for saving money and energy through energy efficiency upgrades, 3) costs associated with energy efficiency upgrades, 4) knowledgeable staff available to install energy-efficient upgrades, and 5) the time investment to plan, budget and implement energy efficiency upgrades.
Lighting	LEDs continue to gain market share, but past survey results show that not all market segments are equally familiar with the technology; low-income, renter and multifamily populations show much lower saturation rates. LEDs also continue to be more expensive than other bulb types, especially for specialty bulb types, although prices have dropped substantially over the past three years.	• Market imperfections have historically been product availability, customer awareness of energy-efficient lighting options and benefits, and the higher cost of these products. • Product availability is no longer a barrier. LEDs are the most frequently stocked bulb at lighting retailers across all bulb types (i.e., standard, reflector, and specialty). • Customer awareness is a decreasing barrier. The vast majority of customers have LEDs installed in their homes. Two-thirds of customer light sockets also contain either a CFL or an LED. • LEDs still cost more than incandescents, but the price difference has narrowed. • Despite these positive signs of market progress, customer use of efficient bulbs varies by household income and use case (i.e., socket type). Lower-income customers have lower LED penetrations and efficient bulb saturation than other customers. Low- income customers are also more likely to purchase the lowest cost bulb rather than consider factors like energy efficiency. Sockets that take a standard bulb also have greater efficient bulb saturation than reflector or specialty sockets.
Efficient Products	As in prior years, less-efficient equipment is available at lower initial cost. High costs present a barrier to customers who may be unable to make large purchases. Additionally, customers may not factor in the long-term cost savings that would result from purchasing more-efficient equipment that can cost less to	The primary market imperfections for the REP Program are customer awareness of energy efficient product options and their benefits, and the higher price of efficient products. In terms of knowledge, many customers are not aware of energy efficiency and energy-

Program	2018 Summary Response	2019 Summary Response
	operate. New products coming to market, changes in retail prices, and other changes to retailer stocking practices can complicate communications regarding the benefits of more-efficient equipment.	efficient technologies. And even those that are aware are often not informed of actual energy savings opportunities available in their homes. For programs like the REP Program, customer awareness of the availability of the rebate is paramount. Customers need to either be proactive and search out the rebates, or they need to be informed of them via marketing or a contractor. Only 36% of residential customers were aware of the REP program, which limits participation. Other market imperfections are measure specific and generally apply to the market potential: • Only 4% of homes in the Ameren Missouri service territory have inground pools. This is a limited market and the product selection is largely driven by contractor recommendations. • While nearly every home has at least one thermostat, thermostats do not routinely fail, so customers will need another reason to replace existing thermostats. The desire for advanced technology is a factor driving advanced thermostat uptake. Thermostats have become a consumer product, and like other advanced technologies, many people appreciate and want the technology. Still, others do not and could view advanced thermostats as overly complicated or expensive. Greater customer awareness of new thermostat technology and its energy savings potential could help drive customers to advanced thermostats.
HVAC	The target market revealed a primary market imperfection: lack of consumer information about the cost-saving benefits of high-efficiency HVAC systems for cooling, electric heating, and expenses of a new HVAC unit. These imperfections can deter customers from purchasing high-efficiency and cost-savings equipment, even if costs are recovered over the equipment's life though lower operating costs.	The primary market imperfections include high upfront cost of high-efficiency HVAC equipment and a lack of customer awareness regarding the benefits of such systems (i.e., energy and utility bill savings). Trade allies play an important role in addressing these market imperfections by educating customers and promoting program incentives that reduce the cost of high-efficiency equipment so that is closer to the price of standard efficiency equipment.

Program	2018 Summary Response	2019 Summary Response
Appliance Recycling	This program was new in PY2019.	The primary market imperfection that the program addresses is residential customers' low impetus to remove old, inefficient refrigerators and freezers from the grid. Often customers will keep a spare refrigerator or freezer for secondary use or dispose of it in a way that it continues to be used as opposed to disposing of the appliance permanently.
Energy Efficiency Kits	The Energy Efficiency Kits Program target market segments did not change in PY18. First, the school-based kit delivery channel targeted Ameren Missouri electric customers, specifically those with electric water heating; however, inefficiencies resulted from the disconnect between school enrollment areas, Ameren Missouri's service territory, and households having electric water heating. For PY18, Cadmus identified that 13% of school kits were sent to households that received a kit in a previous year, and 3% of kits reached the same households in PY18 alone, due to more than one household member attending a participating school. Next, participants did not opt-in to the school-based kit delivery channel and may have lacked sufficient knowledge of the energy-saving benefits of measures provided through the school kits. Lastly, for the multifamily kit delivery channel, which targeted residential units in multifamily properties, there was a higher likelihood (than for single-family housing) that property owners would be responsible for paying the electricity bill; this may prevent tenants, who would use the high-efficiency household items, from experiencing direct benefits through their electricity bills.	The primary market imperfection that the program addresses is the lack of consumer awareness about (or the reluctance to purchase) the energy-saving kit items. The program addresses these two barriers to installation by providing the kit items free and educating the children (and, indirectly, household members) about the energy savings potential of installing the items. All potential housing stock characteristics may be included in kit product distribution due to the program being offered to all sixth-grade students. The 2019 residential baseline study results indicate shrinking opportunity for the standard LEDs included in the kit. Nearly 70% of light sockets that take a standard bulb contain an efficient bulb (either CFL or LED).LEDs also had a higher FR than other kit measures suggesting that many families were already using LEDs and would purchase them on their own. Faucet flow rate data from the baseline study indicate somewhat more opportunity for high-efficiency faucet aerators (39% of customers have aerators with flow rates greater than 2.2 GPM).
Home Energy Reports	In PY17, Cadmus found that nonparticipant Ameren Missouri customers reduced energy consumption at a similar rate as HER participants. Therefore, additional savings potential of energy education and behavior changes may be limited. The program is designed to address the market imperfection through education and motivation towards behavior change to save energy.	Survey responses from the treatment and control customers indicate that they have a general understanding of how behavioral changes lead to reductions in energy usage. A market imperfection common to both customer groups is a more nuanced awareness of how their actions to reduce energy consumption impact their utility bills. Reports sent through the HER Program are designed to address this market imperfection for treatment customers by providing them with information about energy efficiency program opportunities

Program	2018 Summary Response	2019 Summary Response
		and recommendations to modify behaviors to reduce energy consumption in their homes.
Multifamily Market Rate	This program was new in PY2019.	Market imperfections specific to the multifamily sector include 1) the split incentive for in-unit measures between property owners, managers, and residents, 2) awareness of the potential for saving money and energy through energy efficiency upgrades, 3) costs associated with larger non-lighting measure upgrades, 4) knowledgeable staff available to install energy-efficient upgrades, and 5) the time investment to plan, budget and implement energy efficiency upgrades.
BizSavers	One factor that would prevent Ameren Missouri customers from taking advantage of the BizSavers programs is not being aware of the programs. This year's evaluation found that somewhat less than half (41%) of nonparticipants were aware of the BizSavers program. By contrast, most of the evaluations in the past several years had found that about half of surveyed nonparticipants were aware of the programs (47% in PY2017). It is possible that awareness has not actually decreased since PY2017: the 95% confidence intervals for the PY2018 and PY2017 awareness estimates overlap, with the former going as high as 46% and the former going as low as 43%. Still, the best guess is that awareness has dipped at least slightly. Slightly decreased program awareness in the general customer population did not keep the program from achieving enough savings this program year to exceed most savings targets. However, starting the next program cycle with reduced awareness in the customer population may put the program at a disadvantage. Recall that the PY2016 evaluation found a very low program awareness rate (20%), assessed a few months after the end of the program's three-month suspension, possibly suggesting that maintaining program awareness depends on continuous program marketing, outreach, and trade ally engagement.	The primary market barriers to adoption of energy-efficient equipment in the business sector are lack of awareness of energy saving opportunities and programs, the high cost of energy efficiency equipment, access to financing or capital, and uncertainty about expected bill savings. Evaluation results show that barriers differ by business size. Small business customers are less aware of energy saving opportunities beyond lighting whereas medium and large businesses are more likely to see lack of access to financing as a barrier. The upfront costs of upgrades are a barrier for all businesses regardless of size.

Table 12: Issue 2 - Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?

Program	2018 Summary Response	2019 Summary Response
Single Family Low-Income (formerly known as Community Savers)	The target market is appropriately defined. The program targets subsidized multifamily properties and properties with tenants residing in non-subsidized housing with an income of at or below 200% federal poverty level. Because providing services to the low-income multifamily market requires a sufficiently specialized set of outreach and project implementation processes, maintaining the focus on this market with dedicated staff resources to serving is preferable to merging with resources serving other markets. Staff noted that the program offered in the third cycle of the Missouri Energy Efficiency Investment Act would target low-income customers living in single family and in manufactured/mobile homes.	Ameren Missouri has defined the target customer market as occupants of single family housing who live in areas where most residents have an annual income at or below 80% if AMI. This criterion is aligned with low-income program eligibility criteria in other states and should not be merged with any other income-based market segments. Additionally, the program's community-driven channels each target a specific housing stock subsegment (single family and mobile homes). This helps to target community and measure selection, as well as audits and measure installation assumptions, but the program and implementer should consider that: The program is set up to serve one type of housing at a time. Still, implementation experience shows many neighborhoods have mixed housing stock (including single family, small multifamily, and mobile homes). Notably, Ameren Missouri is formally pursuing a change in program eligibility requirements through the 11-step stakeholder process, asking to serve not only detached homes and duplexes but also attached dwellings of 4 or fewer units. Ultimately, this could help the program serve a larger share of homes per neighborhood, but also calls for a need to clarify when to serve small multifamily (i.e., 3- and 4-unit dwellings) through the Multifamily low-income vs Single Family low-income programs. Additionally, 23% of Ameren Missouri's single family low-income households rent their home compared to just 5% of non low-income single family residents. In PY2019 implementers found it took more effort to enroll rental properties due to the extra step of gaining landlord approval after already spending time encouraging the tenant's interest. Single family rental properties should remain in the target segment due to the split-incentive market barrier, but it would be worth examining US Census data on the share of renters in proposed PY2020 neighborhoods to

Program	2018 Summary Response	2019 Summary Response
		appropriately define budgets and timeframes by neighborhood. In some towns, mobile homes are clustered together in private parks or neighborhoods, while in others they are mixed in with other types of housing. Implementers found the private parks easier to serve given that park owners or managers are a built-in community champion. Mobile home-specific outreach makes the most sense for private parks.
Multifamily Low-Income	This program was new in PY2019.	Yes, the target market is appropriately defined as a building including three or more units with Ameren Missouri electric service. This program addresses multifamily property needs, both common area and in-unit upgrades.
Lighting	The program targets the entire residential lighting market, but, in PY18, has concentrated on stocking and incentives for general-purpose bulbs in discount retailers. The program continues to work with mainstream big box retailers in addition to specialty retailers to stock and discount specialty bulbs.	• The target market for the Residential Lighting Program is all residential customers within Ameren Missouri service territory. • The program targets low-income customers by engaging discount stores that do not typically sell lighting such as St. Vincent De Paul, Salvation Army, Goodwill, and Habitat Restore. These stores tend to serve lower income customers. By bringing low-cost LEDs into these stores, the program attempted to reach customers it may not reach through other participating retailers. Still, nearly 90% of program-discounted bulbs were sold at large warehouse, big box, and DIY retailers though the upstream channel. • Given the high level of efficient bulb socket saturation among non-low-income customers, the program could benefit from a more targeted design. Truly subdividing the market into low-income versus non-low-income and using tailored program designs for each customer segment would be appropriate.
Efficient Products	The program continues to appropriately target all residential customers who purchase qualified energy-saving items for use in their homes. Increasing crossover between participants who apply for Heating and Cooling program rebates and smart thermostat rebates could eventually lead to a	Officially (per MEEIA III), the target market for the REP Program is all residential customers within the Ameren Missouri service territory. However, when the measure mix is considered (heat pump water heaters, pool pumps, and advanced thermostats), the actual market is predominantly homeowners. That said, virtually

Program	2018 Summary Response	2019 Summary Response
	merging of those segments, although to date most thermostat replacements do not involve HVAC replacement, and Heating and Cooling participants who applied for smart thermostat rebates appear very similar to Efficient Products participants who applied for thermostat rebates without replacing HVAC equipment.	all residences (even rentals) could benefit from advanced Tier 2 power strips. Obviously, some measures like pool pumps should be targeted at residences with pools, but no further subdivision seems needed.
HVAC	The target market did not change from prior years, and was defined as customers living in single-family homes, multifamily buildings of four units or fewer, or row houses. This market definition continues to be appropriate for a residential Heating and Cooling program designed to encourage property owners to choose high-efficiency equipment.	The HVAC Program's target market segment includes single family and multifamily residential homeowners with central cooling systems that are older or in need of replacement due to their operating conditions. The HVAC Program's overall target market segment is appropriately defined. The program also targets and claims incrementally higher savings for early replacement/early retirement projects. A project is considered ER if the trade ally 1) verifies that the outdoor compressor was in working condition and 2) the unit produces a measured temperature drop across the indoor coil (measuring entering and leaving temperature). While these requirements are important in establishing that a unit is operational, it is not sufficient for determining if the equipment provides adequate cooling, or if the program has induced the early retirement of the equipment. Rather, ER should be determined based on the customers' intentions before their involvement with a trade ally/program, in addition to the operating condition of the existing unit.
Appliance Recycling	This program was new in PY2019.	Yes. Opinion Dynamics conducted a residential baseline study in 2019 that found that 37% of residents have a secondary refrigerator, an additional 8% have a third refrigerator, and 39% report the presence of a stand-alone freezer. This indicates ample opportunity to achieve savings by removing these additional appliances from the grid. Participant survey responses indicate 29% of recycled appliances were primary units, which, in the absence of the program, a customer might retain for secondary use. Regarding appliance age, baseline data indicates that there are very few existing appliances of vintages earlier than 1990 (1% of primary refrigerators, 10% of secondary

Program	2018 Summary Response	2019 Summary Response
		refrigerators, and 12% of secondary freezers). Participant survey data indicate that 36% of recycled units are of vintages earlier than 1990. Thus, the program is successfully motivating the recycling of these units.
Energy Efficiency Kits	The school-based delivery channel's target market segment is appropriately defined. The multifamily delivery channel target market segment may benefit from becoming broader. The school-based delivery channel's target market segment consists of schools within Ameren Missouri's service territory. For the multifamily delivery channel, the target market segment consists of Ameren Missouri customers living in multifamily units that use electric water heating or are Ameren Missouri Natural Gas customers. The school-based delivery channel's educational component is designed to lessen the market imperfection of inadequate information or knowledge regarding energy-savings benefits from high-efficiency household items. To reduce the market imperfection of paying for gas saving measures of non-Ameren Missouri customers, Ameren Missouri co-delivered school kits with a natural gas provider in PY17, and then expanded this approach to include it Ameren Missouri Natural Gas in PY18. This improved Ameren Missouri's ability to better target its customers. Similarly, the multifamily kits delivery channel became co-delivered with Ameren Missouri Natural Gas in PY18, but its limited natural gas service area did not overlap with sufficient numbers of new multifamily properties. At the same time, co-delivery with the natural gas provider having a more applicable service territory was abandoned, and identifying additional qualified properties continued to limit program participation. These considerations suggest that the program may benefit from redefining the target market segment to be more inclusive.	Yes. The program targets residential customers with children in the sixth grade. The intent is to increase awareness of energy efficiency and Ameren Missouri's energy efficiency programs and achieve energy savings through the installation of kit items. However, the program does distribute kits in schools that are near Ameren Missouri's territory border so that 28% of kits went to households that are not Ameren Missouri customers.
Home Energy Reports	To improve the program cost-effectiveness, we recommend Ameren Missouri continue to seek opportunities to improve its messaging and offerings towards increasing savings.	The PY2019 target market requires modification if Ameren Missouri wants to maximize program savings. Three waves of customers were included in the HER Program in PY2019, and the two legacy waves were appropriately defined.

Program	2018 Summary Response	2019 Summary Response
		The program implementer included the top two quartiles in terms of energy consumption in the program from the legacy waves. These customers were virtually all single family customers. The newest wave that joined the program in PY2019 was by far the largest. Unlike the legacy waves, the program implementer did not explicitly exclude multifamily customers, and therefore close to 25% of the treated customers fell into this category. Since multifamily customers generally have lower baseline consumption than their single family counterparts, their potential to reduce their energy consumption is smaller and, therefore, may not result in similar energy savings. In the future, if Ameren Missouri includes multifamily customers for equity reasons, it should explicitly state this as a program goal. Otherwise, Ameren Missouri should target single family customers with the highest baseline consumption in the following year to generate greater savings from the program.
Multifamily Market Rate	This program was new in PY2019.	Yes, the target market is appropriately defined as a building including three or more units with Ameren Missouri electric service. This program addresses multifamily property needs, both common area, and in-unit upgrades.
BizSavers	In general, the BizSavers Program does a good job of reaching all parts of the nonresidential market: for most building end uses, the distribution of program participants matches relatively well with the distribution of businesses in the population. Evaluation findings continue to support the establishment of the SBDI Program to serve small businesses, with savings in the 2M-rate class now at or above par with electric usage for several years in a row since the program's establishment. Surveyed nonparticipants indicated moderate-to-high likelihood of agreeing to schedule a walk-through assessment if approached by an SBDI Service Provider.	Ameren Missouri's BizSavers portfolio serves businesses of varying sizes and sectors. The SBDI Program recognizes the unique challenges of small businesses though small businesses can still participate in the Standard or Custom Programs if the offerings are a better match to customer needs. The current target audience for the SBDI Program is commercial electric customers that are classified as Small General Service Rate 2(M). This covers a wide range of market segments. The SBDI Program is generally serving the majority of the market segments existing in the General Service Rate 2(M), although participation has been concentrated in a few segments (office, retail, warehouse). The new Business Social Services Program serves nonprofit organizations that provide services to the low-income public. The PY2019

Program	2018 Summary Response	2019 Summary Response
		program was small in scope, with 31 projects completed by 14 organizations that offer a mix of family, social, and healthcare services. Given the small participation and targeted outreach strategy to-date, insights into the reach of the program and appropriateness of market segmentation are limited but are expected to increase as the program matures. The SBDI program appears to have been successful in serving renters, a frequently underserved market segment by business portfolios. According to program tracking data renters accounted for 38% of PY2019 SBDI Program participants, which tracks well with Ameren Missouri's business customers overall (36% are renters) according to market research in support of Ameren Missouri's 2019 potential study.

Table 13: Issue 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?

Program	2018 Summary Response	2019 Summary Response
Single Family Low-Income (formerly known as Community Savers)	The program offers measures that cover all major multifamily in-unit end-use needs: lighting, appliances, space cooling and heating, and water heating. Additionally, the Standard and SBDI incentives available for common areas cover lighting, commercial refrigeration and kitchen equipment, and pool pumps. Building envelope and other improvements are eligible for Custom incentives. Participant survey respondents did not identify any additional measures that should be included in the program. Ninety percent of participant survey respondents were aware of the common area incentives stated that these incentives completely met their needs for efficiency improvements.	Opinion Dynamics' recent baseline study of residential Ameren Missouri customers shows that low-income households tend to have lower-efficiency products in their home than their non low-income counterparts, including efficient lighting. These results are consistent with findings from around the United States. The program's mix of end use measures appropriately reflects these needs. The program offers measures that cover major single family and mobile home energy saving needs, including building envelope, HVAC and thermostats, refrigeration, lighting, domestic hot water, and plug load. Additionally, the program cross-promotes opportunities for additional savings through the Ameren Missouri HVAC program. That said, implementation experience has already identified and made changes to measure eligibility criteria that need refinement to best reflect the housing stock among the target market, including mobile home insulation, refrigerator efficiency, and air conditioning efficiency.
Multifamily Low-Income	This program was new in PY2019.	Yes, the program offers measures that cover all major multifamily common area and in- unit end use needs: lighting, space cooling and heating, insulation, and water heating. The tracking data indicated that only 1% of participating customers installed both tenant and common area upgrades at their property. This indicates that there may be an opportunity for educating customer to take advantage of the "one-stop-shop" program offered.
Lighting	Yes. The program continues to offer a diverse array of bulb models that meet most household lighting needs. The program has included an increasing number of reflector bulb types in recent years since saturation is lower for these bulbs, and savings opportunities are greater.	Standard bulbs are the most commonly used bulb in customer homes and have long been the focus of the Residential Lighting Program. This focus made sense when socket saturation of efficient bulbs was low across all use cases. But now that nearly 70% of light sockets that take a standard bulb contain an efficient bulb, the time is right to shift the program's focus to LED reflector and specialty bulbs, which cost more and lag in use. An exception is the low-income customer segment, as noted previously. Low-

Program	2018 Summary Response	2019 Summary Response
		income customers could still use support increasing their use of all efficient bulb types, including standard bulbs.
Efficient Products	Yes, for measures that are cost-effective. It is increasingly challenging to offer a wide-variety of residential end-uses that are also cost-effective. For equipment other than smart thermostats, the program rebates solely require that equipment has been ENERGY STAR-certified (i.e., the only requirement is energy efficiency). For smart thermostats, equipment is limited to the necessary technological features (i.e., it must be a "learning" model with geofencing capabilities) and includes the most popular models in this emerging market. The program includes rebates for a variety of equipment targeting a variety of end-uses (water heating, air conditioning, swimming pools, heating) that were cost-effective. The program does not offer rebates for kitchen or laundry appliances because current market offerings would not produce savings cost effectively. Other cost-effective end-use technologies are targeted through other programs.	The REP Program currently offers only four measures: (1) advanced thermostats, (2) Tier 2 power strips, (3) heat pump water heaters, and (4) pool pumps. When one considers the diversity of energy-consuming items in the typical residence (the target market), a very wide range of other end use measures appear potentially applicable to the REP Program. Of course, cost-effectiveness and overlap with other programs needs to be considered.
HVAC	The program targeted the heating and cooling end use appropriately. Within this end use, measures offered a range of energy-saving heating and cooling technologies, available at different price points to customers. The program also correctly accounts for market and federal codes changes in its program design, phasing out program offerings when they are no longer effective under evolved market conditions.	The HVAC Program offers incentives for heating and cooling equipment at various efficiency levels. The HVAC Program also correctly accounts for market and federal code changes, phasing out offerings (i.e., ECMs) when they are no longer effective under evolved market conditions. With the removal of ECMs as a program offering, Ameren Missouri should consider including other end use technologies such as high-efficiency water heaters. Based on the trade ally survey, about a fifth (22%) of respondents reported that in addition to HVAC, their companies are specialized in plumbing and hot water heating services. As such, Ameren Missouri could leverage its existing trade ally network to recruit contractors who already sell/install high-efficiency water heating equipment.
Appliance Recycling	This program was new in PY2019.	Yes. The program allows refrigerators or freezers to be recycled, along with window air conditioners and/or dehumidifiers at the same time. Two percent of recycled appliances were

Program	2018 Summary Response	2019 Summary Response
		dehumidifiers and room air conditioners (4% total), demonstrating there is a market, albeit small, for these additional measures to be recycled. Customers did not mention requests for additional measures to be included in the program.
Energy Efficiency Kits	The two kit delivery channels appropriately identified a range of easily installed, low-cost measures that serve as the core of kit programs. Cadmus compared the school-based kit delivery channel and the multifamily-kit delivery channel to similar utility programs to establish whether the kit contents represented standard practice or if other measures could be considered. The Ameren Missouri school kits included a range of lightweight measures that students could bring home and easily install. Compared to five other school kit programs, Ameren Missouri's school kits contained all of the most common measures (e.g., light bulbs, showerheads, aerators, a filter alarm), with the exception of an LED night light, which five other benchmarked programs offered. Compared to other programs, Ameren Missouri's multifamily kit delivery channel contained most of the common measures provided by utilities (all four benchmarked programs offered LED or CFL bulbs, showerheads, and kitchen and bathroom aerators to multifamily units), along with measures typically not offered by other similar programs (e.g., LED bulbs, pipe wrap). In PY18, the multifamily kits were customized to include additional showerheads and bathroom faucet aerators for one additional bathroom, which better reflected the diversity of needs.	Yes. Since the residential customer end use technologies can vary so widely in age, make, model, and pre-existing efficiencies, kit programs like this, in particular, must carefully weigh the cost of included items and the potential for the items not to be installed by the customer. Survey results indicate the following installation rates: at least one LED bulb (88%), hot water pipe insulation (56%), showerhead (54%), bathroom faucet aerator (48%), furnace filter whistle (44%), and kitchen faucet aerator (40%). Customer responses indicate a desire to avoid wasting items. Faucet aerators appear to be the most likely to "not fit," and adaptors have been requested for inclusion in the kits by customers for this so that more may be utilized.
Home Energy Reports	This program does not incent end-use measures directly but does use tips in the HER reports to promote energy saving behaviors and measure installations for a diverse set of end-uses. The tips target energy savings that could result from behaviors including changing settings on clothes washers, water heaters, and thermostats, as well as replacing existing lighting with more efficient LED lighting, installing smart or programmable thermostats, and installing air sealing or insulation.	The main form of treatment for customers is the HER. The HERs reflect the diversity of end use energy service needs of residential homes, which is the target market. They include information related to the last 13 months of electric consumption, load that is disaggregated by home area, as well as comparisons of monthly energy usage to similar homes. Reports also include customized tips aimed at modifying behavior related to the installation of LED lighting to replace less efficient lighting, installing programmable or advanced thermostats, and adjusting the way customers

Program	2018 Summary Response	2019 Summary Response
		operate their washers/dryers, dishwashers, and HVAC equipment. In addition, HERs include information about applicable energy efficiency rebate programs that may lead customers to retrofit aging inefficient equipment.
Multifamily Market Rate	This program was new in PY2019.	Yes, the program offers measures that cover all major multifamily common area and in- unit end use needs: lighting, appliances, space cooling and heating, insulation, and water heating. The tracking data indicated that only 4.3% of participating customers installed both tenant and common area upgrades at their property. This indicates that there may be an opportunity for educating customer to take advantage of the "one-stop-shop" program offered.
BizSavers	Participant surveys and interviews showed satisfaction with the range of program-eligible equipment, delivery time for ordered equipment, and the quality of the equipment and the installation. The evaluation identified several measure-specific findings. A variety of analyses of project tracking data provide evidence that the Energy Management System (EMS) pilot program, introduced in PY2016 to help non-profit and other tax-exempt entities install EMS, has had a positive effect on EMS projects and savings in the current program year. Specifically, it appears to have reduced the decline in EMS projects and savings compared to what might have occurred without the pilot. This suggests the EMS pilot program has met certain end-use needs. In the current program year, the implementer introduced some changes to incentive structures to promote certain measure types. One such change was a large increase in the incentive for cooling measures. Analysis of project tracking data suggests that this change may have stimulated more cooling projects and savings, increasing the overall amount of demand savings. Another change was to allow lighting fixture replacements to be made with Standard incentives, whereas previously they could be	Evaluation results found participants were relatively dissatisfied with the breadth of measure offerings. In some cases, participants and market partners were dissatisfied with the list of eligible measures and in other cases they indicated low incentives rendered an officially eligible measure effectively ineligible. Standard and Custom Program participants reported relatively low levels of satisfaction with the range of equipment that is eligible for incentives from Ameren Missouri, with only 61% and 55% of participants reporting being "very satisfied". Market partners revealed similar levels of dissatisfaction with measure eligibility, and most frequently suggested adding outdoor lighting to the list of available measures. In PY2019, the SBDI Program only dealt with lighting. Because it is designed as a Fast-Track, direct install program, it may be that the ability to add other measures is limited. However, HVAC measures are being added in PY2020, which suggests there are likely other opportunities for additional measures that would meet the needs of small business customers. While the BSS Program offers a range of measures across different technologies, the program was almost exclusively focused on lighting measures in PY2019. Our evaluation

Program	2018 Summary Response	2019 Summary Response
	made only with Custom incentives. Surveyed trade allies were largely in favor of this change because it increased the speed and reduced the complication of making such replacements. A class of measure types that may warrant attention in the future are lighting controls. The number of projects with lighting control measures, such as occupancy sensors, daylight sensors, and other dimming controls, declined sharply in PY2018 from previous years, possibly because of a perceived decrease in the value of controlling lighting as highly efficient LEDs become more pervasive. A large opportunity exists for increased penetration of lighting controls. Four out of five surveyed nonparticipants reported no lighting controls in their buildings. Those who have controls were twice as likely to report plans for more controls than those without controls, which suggests high satisfaction with controls among those who have them. Program staff reportedly has had discussions about how to drive Ethernet-controlled lights and more integration with building controls. Finally, it should be noted that about one in five surveyed trade allies commented on the need for exterior lighting incentives – these were unsolicited open-ended comments, and so they may represent a higher percentage of all trade allies.	found that incentive levels for non-lighting equipment appear to be insufficient to induce adoption in this market segment. One Service Provider noted that he was unable to complete any of the scoped non-lighting projects due to incentive levels. If measure uptake for a broader mix of end use technologies is desired, the program may need to revisit incentive levels for non-lighting measures (balancing the potentially high cost relative to achievable savings against other, non-financial objectives).

Table 14: Issue 4 - Are the communication channels and delivery mechanisms appropriate for the target market segment?

Program	2018 Summary Response	2019 Summary Response
Single Family Low-Income (formerly known as Community Savers)	The communication and delivery channels are appropriate to the target market segment. Staff used a variety of approaches to promote the program incentives including direct outreach to property managers and owners, working with community groups and apartment associations, and working with Ameren Missouri trade allies to promote the program incentives. Staff reported that the outreach and marketing efforts in PY2018 were similar to the approaches used in other years. During the year, six email newsletters and six postcard mailings were sent to multifamily properties. Staff continued to engage in direct outreach to property managers. Staff also continued to make presentations to neighborhood associations. Among those participants that had not received common area, the share of participant survey respondents who reported that they were aware of common area incentives increased from 15% in PY2016, to 83% in PY2017, to 100% in PY2018. Additionally, 67% of respondents aware of the common area incentives reported that they were very likely to complete a common area project at the property.	The communication and delivery channels are appropriate to the target market segment. Staff used a variety of community-centric approaches to promote the program, including through community groups and mobile home park owners; conducting direct outreach to residents through neighborhood canvassing; holding meet-and-greet events with community leaders in popular community gathering places like restaurants; and working with Ameren Missouri to identify community non-profits serving low-income areas who could distribute efficient products to their constituents. These approaches are appropriate for the target market segment because they work around traditional time, geographic, and other barriers to learning about energy efficiency and the availability of utility-sponsored programs. That said, the level of personalized effort and outreach central to neighborhoods approaches necessarily slows the program's progress towards serving large numbers of homes per year. Because PY2019 was the inaugural launch year, we recommend reviewing how well these channels and mechanisms worked at-scale in PY2020. For the Housing Grant channel, the program is targeting the right kind of organizations who are prepared to distribute and install energy efficiency measures outside of a neighborhood "blitz" approach. However, according to the implementer, this channel tended to focus on urban areas in PY2019, as Ameren Missouri identified several of the partners through their existing connections, and the program did not have a specific budget spending goal—together suggesting that the program has the resources to serve additional untapped areas of potential need and savings. To fully serve the target market through this program, the program should focus on organization recruitment in 2020 with the goals of expanding the number of actively participating organizations, enrolling organizations specifically prepared to complete eligible direct installation (such as more

Program	2018 Summary Response	2019 Summary Response
		Community Action Agencies), and enrolling organizations serving rural communities.
Multifamily Low-Income	This program was new in PY2019.	For this initial program year launch, the primary communication channel used was one- on-one contact between customers and implementation staff. The program does have a more varied marketing and communication plan they intend to employ in future program years, which includes conferences, promotional, and networking events.
Lighting	Yes. The program uses in-store and online marketing and makes discounts available in a variety of retail channels, including Do-It-Yourself (DIY), mass merchandise, dollar stores, community retailers (such as Goodwill), grocery stores, and other retailers.	For the upstream channel, the program used in-store and out of store marketing. Our evaluation found that in-store marketing was the primary driver of sales. Given the nature of the product, marketing at the point-of-purchase is appropriate. Program implementers added new discount retailers to the program increase the focus on low-income customers. This was an effective strategy that the program should continue and even expand, if possible. In turn, the program should reduce its emphasis on sales of standard bulbs at non-discount stores. The Online Store accounted for less than 1% of program sales and savings. With the growing customer reliance on online shopping more generally, the Online Store has unrealized potential. The channel is particularly useful for targeted marketing to underserved customers, which is more difficult to do through the mass market upstream channel.
Efficient Products	Yes. Customers may purchase qualified items from any retailer, within or outside of Ameren Missouri's service territory. Online purchases are also eligible for rebates, and Ameren Missouri's implementer has offered smart thermostats to customers through Ameren Missouri's online store since PY17, with a discount applied to the purchase price rather than a mailed rebate check. Ameren Missouri markets the program directly through a variety of channels and through the several large national retail chains that serve differing, broad, cross-sections of the population. Reviews of program marketing materials found Ameren Missouri follows marketing best practices.	In PY2019, program marketing activities included TV/radio ads, social media ads, paid search optimization, e-mail campaigns, including rebate information on energy statements or Home Energy Reports, and location-based ads and promotions. Most participants who purchased products through the Online Store learned about the program through direct communication from Ameren Missouri or the Ameren Missouri website. Mass marketing does not appear to have been that effective. Customers who purchased pool pumps pool pumps and heat pump water heaters were more likely to learn about the program through a contractor than other communication channels. Increasing outreach to contactors to

Program	2018 Summary Response	2019 Summary Response
		increase their involvement with the program could increase participation for these measures.
HVAC	Heating and Cooling communication and program delivery mechanisms did not change from prior years and continued to be appropriate for the target market. Contractors serve as a critical interface with participants and can provide important, timely program information while customers are engaged in the decision-making process. The program also conducts broader marketing efforts to provide customers with information to encourage them to replace their existing equipment before it experiences problems.	The HVAC Program is primarily driven by trade allies, and a majority of participants (68%) report having first heard about the program through trade allies. Ameren Missouri also promotes the HVAC Program through other forms of outreach, including e-mails, newsletters, bill inserts, Ameren Missouri website, home energy reports, and mass media advertising. Collectively, these channels are effectively reaching the target market segment and are, therefore, the appropriate communication and delivery mechanisms. Notably, the HVAC Program is the most well-known program of all Ameren Missouri residential programs, with 60% of general population survey respondents reporting awareness of the program. We found even higher awareness among the program's target market. Homeowners who have replaced their cooling system within the past three years are more likely to be aware of the HVAC Program than other homeowners (76% compared to 61%).
Appliance Recycling	This program was new in PY2019.	Yes. Ameren Missouri primarily advertises this program through bill inserts and direct e- mail campaigns, and physical collateral is the primary mechanism responding participants report hearing about the program.
Energy Efficiency Kits	For school kits, communication flowed to and from Ameren Missouri, the implementers (ICF and NEF), school administrators and teachers, and students and families. Communication between these groups was clear and appropriate for the delivery channel. For the multifamily kits, communication flowed to and from Ameren Missouri, ICF, the property managers, and their tenants. According to Cadmus' interviews with stakeholders, communication channels and delivery mechanisms for the multifamily delivery channel were appropriate.	Yes, though adjustments could be made to better align the program with teachers' unique needs. The program provides teachers with teaching materials, student education worksheets, the kit materials, and installation instructions. While program satisfaction is very high, the most frequent suggestion for program improvement from the teachers is a preference for being provided with an electronic version of all paper materials prior to receiving the kits so that they could print only the materials they would use and reduce the waste from un-used printed materials.
Home Energy Reports	Yes. The communication channel for HER reports includes mailing paper reports and emailing electronic reports (eHER reports were added in PY18). Other similar utility	The communication channels and delivery mechanisms are appropriate for the target market, given that a majority of survey respondents are satisfied with the way they

Program	2018 Summary Response	2019 Summary Response
	programs combine these channels as well as supplementing with web portals to engage customers more often and in more depth, which may result in deeper savings. Ameren Missouri plans to send mailed HER and emailed eHER reports to all customers in the program and to launch a web portal in PY19 for the HER program.	receive HERs, and with the information they contain. Additionally, the HERs make customers aware of the energy efficiency programs Ameren Missouri offers. Late in PY2019, Ameren Missouri also launched an online portal that provides similar information as the HERs, but on a continual basis. These forms of communication are used to inform customers about how much energy they use as well as about equipment upgrade opportunities and behavioral changes they can make to reduce electricity usage.
Multifamily Market Rate	This program was new in PY2019.	For this initial program year launch the primary communication channel used was one- on-one contact between customers and implementation staff. The program does have a more varied marketing and communication plan they intend to employ in future program years, which includes conferences, promotional, and networking events.
BizSavers	The program implementer continued using a wide range of marketing outreach channels and methods to reach end-use customers and service providers (e.g., contractors, vendors, and distributors), including targeted outreach to decision makers representing customer account aggregates or "towers." Program staff reported continued efforts at targeting outreach to specific industries. This year's targeted efforts involved development of website infographics with industry-focused information on energy use, energy-saving tips, program savings, and program contact information. This industry-focused effort is follow-on to an effort targeting schools in PY2017, which produced results in the current program year. Another newly reported outreach activity is an effort to capitalize on a new St. Louis ordinance requiring benchmarking on all buildings above a certain size. The business development team identified owners of buildings above the threshold, helped them benchmark the buildings, and then steered them to the incentive program. Project	According to market research in support of Ameren Missouri's 2019 potential study, awareness of Ameren Missouri BizSavers Programs is relatively low among the target market. Just over one-third of customers (36%) are aware of the programs offered. Medium and large businesses are much more likely to be aware of Ameren Missouri BizSavers Programs than small businesses (60% compared to 33%). These results suggest that additional communication or delivery of messages through alternative channels is needed for small businesses. Ameren Missouri focuses most of its outreach on trade allies rather than direct communication with business customers, which can be seen in the large percentage of participants who learned of the program through a contractor (83% for Custom Program participants and 77% for Standard Program participants). While it is important that contractors are aware of Ameren Missouri programs and are enlisted as program advocates, direct customer outreach could support trade allies by increasing interest in programs among business customers.

Program	2018 Summary Response	2019 Summary Response
	tracking data suggest this effort so far may have had some limited effect.	

Table 15: Issue 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?

Program	2018 Summary Response	2019 Summary Response
Single Family Low-Income (formerly known as Community Savers)	Staff noted that some properties have difficulty securing financing for more costly projects such as building envelope improvements. The program should consider exploring offering on-bill financing as an alternative means for properties to arrange on-bill financing.	PY2019 participants are satisfied with their program experience and received a variety of measures in their homes. As noted above, the program may want to consider additional methods to achieving more savings per community by overcoming split incentives in single family rental housing (to serve more homes) and should continue to validate the match between measure eligibility criteria by carefully observing on-the- ground housing stock (to provide more savings per home). With one year of implementation complete, it is early in this program's lifecycle and the program should focus on executing strategies to refine the existing delivery model. At this stage, some of the delivery challenges appear to reflect the process of launching a new program more so than problems with the program's design and ability to overcome barriers or promote customer acceptance. For example, implementers have discussed working with Ameren Missouri upfront to define all of the communities to be served each year, at the beginning of the year—reducing midyear transition time between communities and enabling greater delivery efficiency. Once the logistics are streamlined, the program may be able to step back to reassess what components are truly working well vs. which may need revision.
Multifamily Low-Income	This program was new in PY2019.	Ameren Missouri can consider promoting Green Leases. Green Leases are contracts between landlords and tenant(s) that negotiate the mutual benefit of installing energy-efficient or green measures in shared buildings. For shared buildings, owners are burdened with green upgrade costs, while tenants benefit from

Program	2018 Summary Response	2019 Summary Response
		lower operating costs. Without green leases, there is little incentive for owners to make green upgrades. Green leases are designed to allow both parties financial benefits and incentives, and multifamily building types are ideal buildings. The rate of customer acceptance and implementation is currently above expectations, as the program met goals despite implementation delays.
Lighting	Residential survey results from PY17 indicated that income and homeownership served as the strongest predictors of whether a customer uses LEDs. These factors strongly point to price and availability by retailer channel continuing as the primary barriers to LED uptake.	Price is the remaining market imperfection, but much more so for low-income customers. The program should continue its partnerships with low-income retailers that do not traditionally sell lighting and other retailers in low-income neighborhoods. Customers have been slower to adopt reflector and specialty efficient lighting, in part because the previous product, CFLs, was expensive and did not meet customer expectations. LEDs are a superior product and price have fallen, but they still cost more than incandescent. The program could do more to increase adoption by focusing program budget on non-standard products.
Efficient Products	Program promotions that provide program and energy education can help to overcome market imperfections. Timing product promotions so that they coincide with seasons of high use for a given measure also helps implementation. Adjusting program incentives in response to market changes, and for the purpose of reallocating budget to more cost-effective measures, also improves implementation. In PY18 program incentives were unchanged from PY17, however the program implementer reduced marketing efforts from previous years in order to conserve budget so that the program would be able to continue paying incentives through the end of the three-year program cycle.	Customers seem largely satisfied with both the Online Store and mail-in channels. However, increased participation can likely be attained by expanding the breadth of measures rebated under the program, focusing additional marketing efforts on contractors, and increasing general customer awareness of the energy efficiency opportunities as well as available rebates.
HVAC	The program could adjust marketing materials to focus on the long-term cost savings benefits of replacing inefficient heating and cooling equipment prior to experiencing issues. Additionally, the program could reduce customers' initial barriers regarding purchasing equipment by increasing incentives or providing financing options.	Even though the program offers various marketing support for trade allies (e.g., co-op marketing program, account manager, market collateral, and co-branded materials), almost half of trade allies (48%) said they do not use any of the program marketing support. Since trade allies play such an important role in promoting and delivering the HVAC Program,

Program	2018 Summary Response	2019 Summary Response
		we recommend that Ameren Missouri and their implementation team work directly with trade allies to better understand the format, content, and features of marketing materials that trade allies would be more likely to use. A deeper understanding of what is needed by the HVAC technicians who are out in the field and interacting with customers face-to-face will enable the program to develop more effective promotional and educational materials to increase the sale of high-efficiency equipment.
Appliance Recycling	This program was new in PY2019.	Ameren Missouri can annually revisit program assumptions regarding the percent of equipment in residential use that was manufactured prior to 1990, and percent of equipment recycled that is primary versus secondary. Based on the success of this program, the current incentive is satisfactory and results in participation. The time from scheduling to pick up is the primary reported participant concern, however, and Ameren Missouri could work with the program implementer to reduce the timeline between scheduling and pickup either via a more accurate and reliable interface where customers can schedule their own pickup, or providing greater quantity of available pickup times during the most popular pickup days.
Energy Efficiency Kits	For the school delivery channel, the evaluation analysis found that school kits' distribution may experience inefficiencies due to households with more than one eligible child receiving more than one kit. Adding further gas partnership to the school kits delivery channel continued to reduce the inefficiency of providing kits to households not using electricity from Ameren Missouri to heat their water. For the multifamily delivery channel, the delivery channel reduced the problem of incentivizing property managers to install energy-efficient measures by providing free measures. In PY18, the program maintained 100% installation for measures distributed to property managers for multifamily properties. The multifamily delivery channel further maximized the participation of qualified properties by offering additional showerheads and bathroom faucet aerators for units having two bathrooms.	Some participants suggest an opt-in system could reduce waste and increase adoption rates. Also, adding adapters to the faucet aerators so they fit a greater range of faucets. Ameren Missouri is considering adding residential and business kit distribution channels to further address the market imperfections for households without school-aged children.

Program	2018 Summary Response	2019 Summary Response
Home Energy Reports	In contrast to PY17, in PY18 Cadmus found that HER treatment group customers with lower energy consumption were able to save as much as customers with higher energy consumption (both in absolute value or relative percentages). Therefore, Cadmus recommends Ameren Missouri try to identify what changes could be driving the expanded participation and continue those messages or approaches.	HERs increased awareness of energy saving opportunities. Treatment customers were more likely to be aware of energy savings opportunities compared to control customers (64% compared to 53%). However, a higher percentage of treatment customers reported feeling like they do not have control over the amount of household energy that is used relative to control customers. Since treatment customers receive HERs, Ameren Missouri should consider providing information about how much energy various end uses and behavioral changes are projected to save for the average home. One potential way to communicate this is to monetize the energy savings so that treatment customers gain some understanding of how much money they can save by replacing old equipment and/or making changes to how they use energy.
Multifamily Market Rate	This program was new in PY2019.	Ameren Missouri can consider promoting Green Leases. Green Leases are contracts between landlords and tenant(s) that negotiate the mutual benefit of installing energy efficient or green measures in shared buildings. For shared buildings, owners are burdened with green upgrade costs, while tenants benefit from lower operating costs. Without green leases, there is little incentive for owners to make green upgrades. Green leases are designed to allow both parties financial benefits and incentives, and multifamily building types are ideal buildings. The rate of customer acceptance and implementation is currently above expectations, as the program met goals despite implementation delays.
BizSavers	As indicated above, the BizSavers program met or exceeded all savings targets and has done a good job of delivering the program to all segments of the nonresidential market.	• Continue to expand the slate of program-eligible measures. Outdoor lighting is the only one that arose as a specific recommendation, but others likely offer potential. • Revisit incentive levels to improve the uptake of non-lighting measures. • Continue to expand the network of trade allies and Service Providers, focusing on increasing the diversity of services offered and market segments targeted. • Increase customer-focused, strategic, targeted marketing to customers.