BizSavers Program Evaluation Report

PY2018 Long-Lead Projects Volume I of II

March 2019 - February 2020

Prepared For:

Ameren Missouri

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1. Executive Summary

This report presents the energy and demand savings for the PY2018 long-lead projects evaluated in the Standard Program, Custom Program, New Construction Program, and the Retro-Commissioning Program. Projects approved during the PY2018 program year, but not completed within the program year, were eligible for continuation under the MEEIA Cycle 2 to Cycle 3 transition plan for a period of two additional years. This report for the PY2018 long lead projects completed from March 1, 2019 through February 29, 2020, does not include the energy and demand savings from base PY2018 period of projects completed from March 1, 2018 through February 28, 2019. This relatively small population of evaluated projects, (approximately 3% of the PY2018 population in expected energy savings), extends the previous evaluation effort with additional sampling applied to determine project ex post gross and ex post net savings.

The impact evaluation, measurement and verification (EM&V) for the first year of the two-year plan is completed by ADM Associates, Inc. The demand-side management (DSM) programs are implemented by TRC Energy Services (formerly Lockheed Martin Energy Solutions). The electric distribution and transmission utility is Ameren Missouri. The primary evaluation activities are listed in the following paragraphs.

The evaluation team collected data for the evaluation through review of program materials, project level engineering desk reviews, and a survey of additional program participants.

The sample design was based on all PY2018 projects and sampled projects, that is, the long lead projects and the projects evaluated in the PY2018 Biz Savers EM&V Report, to estimate first year program savings with +/-10% statistical error at a 90% level of confidence. Table 1-1 summarizes the population of long-lead projects and the additional sample points needed to achieve the desired level of statistical precision.

Table 1-1 Long-Lead Projects Population and Sample Summary

Program	*PY2018 long lead projects completed*	*Additional sampled projects*
Custom	29	0
Standard	30	0
New Construction	10	2
RCx	2	1
Total	54	0

Note: Some projects receive incentives through multiple programs leading to the sum of program projects exceeding the total number of projects.

The evaluation team reviewed the sampling and results for the four BizSavers programs from the PY2018 evaluation that had additional long-lead projects to develop the sampling

plan. Based on that analysis, the evaluation team concluded that adding three additional projects to the PY2018 sample, two for New Construction and one for the Retro-Commissioning Program, would enable the estimation of savings with the desired confidence and precision.

The actual statistical precision of energy savings estimates is ±7.3% for the Custom Program, ±5.0% for the Standard Program, ±9.9% for New Construction, ±8.7% for Retro-Commissioning Program.

Table 1-2 Sample Statistical Precision by Program

Program	*Statistical Precision*
Custom	7.3%
Standard	5.0%
New Construction	9.9%
Retro-Commissioning	8.7%

Analysts performed ex post gross kWh energy savings calculations for each sampled project. The evaluation team used the additional project-level realization rates within the larger PY2018 sample to estimate the energy savings associated with non-sampled measures.

ADM completed a net program impact analysis to determine what portion of gross energy savings and demand reductions achieved by participants in the program are attributable to the effects of the program. Net savings are equal to gross savings, minus free ridership, plus participant spillovers and non-participant spillovers.

$$Net\ Savings = Gross\ Savings - Free\text{-}ridership + (SO_{part} + SO_{non\text{-}part})$$

The evaluation team surveyed decision maker contacts for the long-lead projects for use in estimating net program savings to supplement the main PY2018 survey results.

Table 1-3 provides a summary of the EM&V data collection efforts. The table lists data sources used for the evaluation, the data collection method, the dates during which data collection and/or analysis was performed, the research objectives, and the type of analysis performed (qualitative vs. quantitative).

Table 1-3 Summary of BizSavers Long-Lead EM&V Data Collection Efforts

Data Source	*Method*	*Dates*	*Key Research Topics*	*Analysis Type*
Post-install sample engineering reviews (3)	Engineering Desk Review	March 2019 to February 2020	Verify measure installation and collect end use metering data	Quantitative and Qualitative

Data Source	*Method*	*Dates*	*Key Research Topics*	*Analysis Type*
Participants, all programs (7)	Online survey	April to May 2020	Decision making	Quantitative and Qualitative

Table 1-4 provides a summary of the PY2018 long-lead projects' evaluated energy savings of the portfolio of BizSavers Programs. The table presents the ex ante kWh, ex post gross kWh, and ex post net kWh energy savings along with the net to gross ratio.

Table 1-4 Summary of Energy Savings for BizSavers Programs Long-Lead Projects

Program Component	*Ex Ante kWh Savings*	*Ex Post Gross kWh Savings*	*Gross kWh Savings Realization Rate*	*Ex Post Net kWh Savings*	*Estimated Net-to-Gross Ratio*
Custom	3,377,004	3,338,155	99%	2,824,973	85%
Standard	5,209,650	4,522,313	87%	4,517,726	100%
New Construction	1,279,339	1,147,579	90%	1,075,319	94%
Retro-Commissioning	1,245,261	1,166,091	94%	1,166,091	100%
Total	11,111,254	10,174,138	92%	9,584,110	94%

Table 1-5 summarizes the PY2018 ex post peak kW savings. The table presents the ex ante peak kW, ex post gross peak kW, and ex post net peak kW savings.

Table 1-5 Summary of Peak Demand Savings for BizSavers Programs Long-Lead Projects

Program Component	*Ex Ante Peak kW Savings*	*Ex Post Gross Peak kW Savings*	*Gross kW Savings Realization Rate*	*Ex Post Net Peak kW Savings*
Custom	1,445.66	1,438.80	100%	1,208.90
Standard	988.66	858.25	87%	857.39
New Construction	353.49	307.86	87%	288.15
Retro-Commissioning	775.03	732.59	95%	732.59
Total	3,562.85	3,337.50	94%	3,087.04

Table 1-6 lists the evaluated program year energy savings by program for this evaluation period from March 2019 to February 2020, along with the status of the remaining projects in the pipeline.

Table 1-6 Evaluated Program Year and Long Lead Project Pipeline Status

Project Completion	*Standard Ex Ante kWh*	*Custom Ex Ante kWh*	*New Construction Ex Ante kWh*	*RCx Ex Ante kWh*	*Total Ex Ante kWh*
Completed March 2019-Feb 2020	5,209,650	3,377,004	1,279,339	1,245,261	11,111,254
Installed or Completed Q1 2020	-	949,368	8,407,747	-	9,357,115
Committed	3,677,170	339,650	4,063,781	-	8,080,601
Discontinued	561,185	101,238	5,775,024	326,592	6,764,039

Table 1-7 lists the incentives paid and program administrative cost for the evaluated program year, which is 44% of the long lead project budget. Also, listed are projects installed or completed in the next evaluation period for 32% of the budget, along with the remaining projects at the Committed Milestone which may reach completion, requiring 23% of the budget. The completed projects and potential completed projects will have used 99% of the PY2018 Long Lead Project's budget based on the offered incentive.

Table 1-7 Evaluated Program Year Costs with Project Pipeline Costs

Period	*Incentives*	*Administrative Cost*	*Budget*
Completed March 2019-Feb 2020	$1,148,192	$618,021	44%
Installed or Completed Q1 2020	$779,112*	$514,820*	32%
Committed	$592,587*	$323,138*	23%

*Actual incentives and administrative costs may vary until project achieves Completion Milestone

2. Introduction

This report presents the results of the impact evaluation of long-lead projects completed through the BizSavers Custom, Standard, New Construction, and Retro-Commissioning Programs. The long-lead projects were initiated during PY2018 and completed during the period of March 2019 through February 2020.

Table 2-1 Summary of PY2018 Long Lead Project Activity

Program Component	*Number of Projects*	*Ex Ante kWh Savings*	*Ex Ante Peak kW Savings*
Custom	29	3,377,004	1,445.66
Standard	30	5,209,650	988.66
New Construction	10	1,279,339	353.49
Retro-Commissioning	2	1,245,261	775.03
Total	54	11,111,254	3,562.85

2.1 Long-Lead Project Trends in PY2019

The following figures summarize activity of the long-lead projects during the program year.

Figure 2-1 plots the Custom Program ex ante energy savings by project completion month and cumulative energy savings through the program year. Many of the Custom program projects just required a few more months beyond the PY2018 period for completion.

Figure 2-1 Custom Program Ex Ante kWh Savings by Project Completion Month

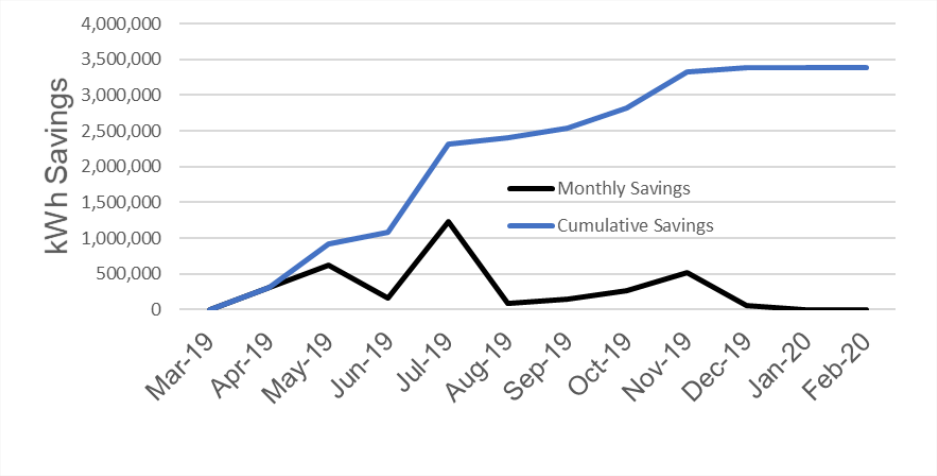


Figure 2-2 plots the Standard Program ex ante energy savings by project completion month and cumulative ex ante energy savings through the program year. Similar as for Custom, many projects finished in the early months, then tapered off.

Figure 2-2 Standard Program Ex Ante kWh Savings by Project Completion Month

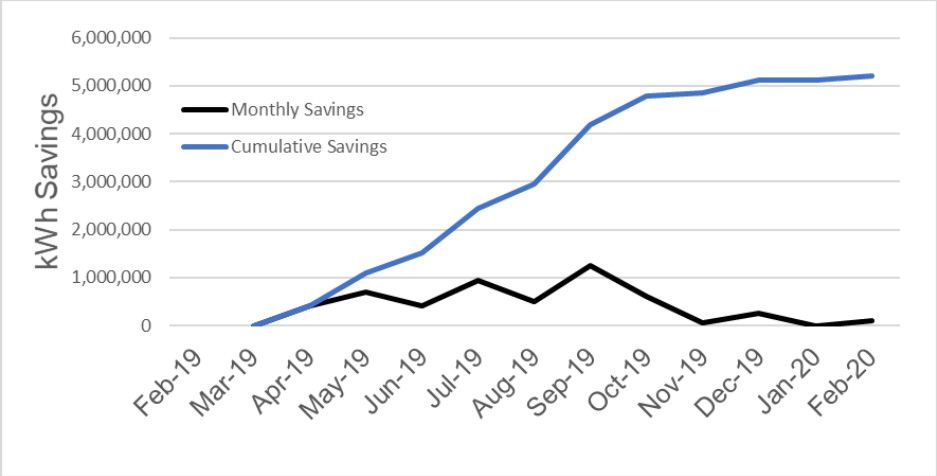


Figure 2-3 displays the ex ante program energy savings by month as well as cumulatively for the New Construction Program. These projects have a longer life cycle, with most finishing in the later part of the program year.

Figure 2-3 New Construction Ex Ante kWh Savings by Project Completion Month

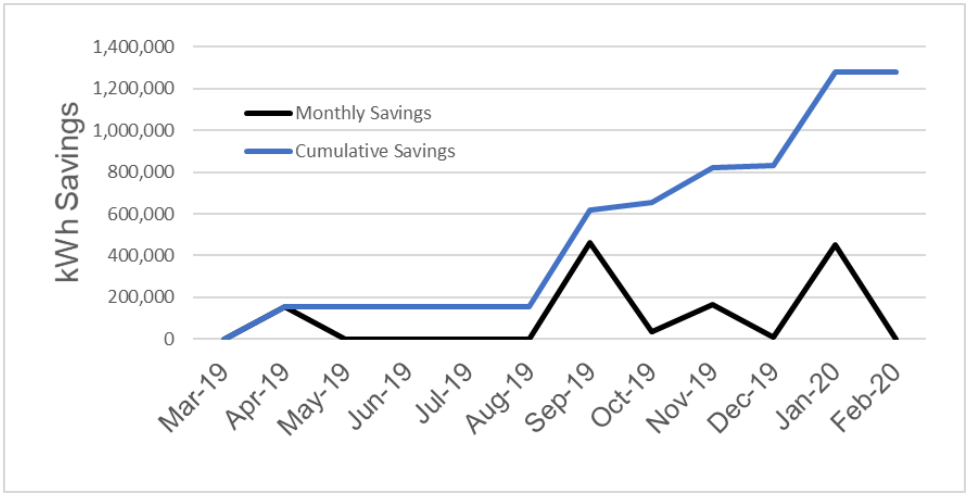
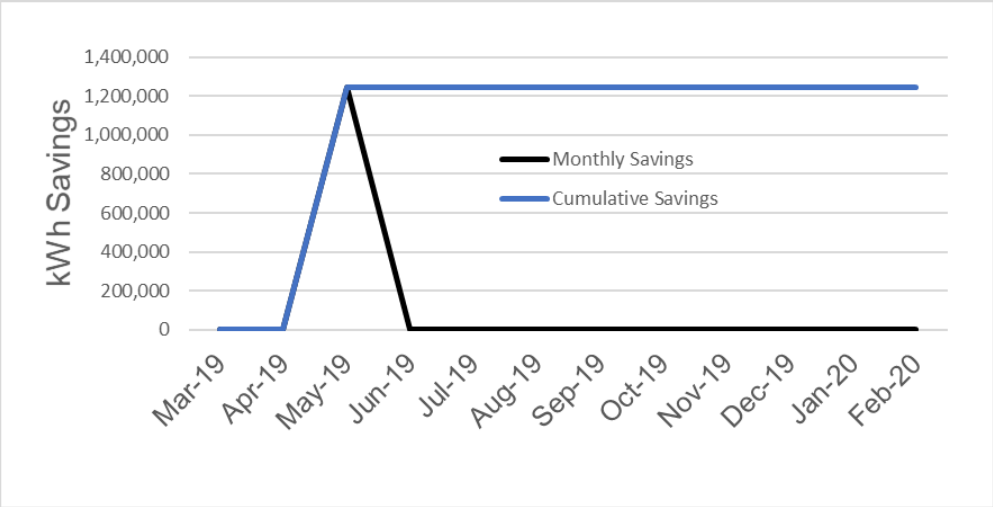


Figure 2-4 indicates that two RCx projects were completed for the program year.

Figure 2-4 Retro-Commissioning Ex Ante kWh Savings by Project Completion Month



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3. Estimation of Ex Post Gross Savings

This chapter addresses the estimation of ex post gross kWh savings and ex post gross peak kW savings associated with BizSavers measures installed through long-lead projects. The long-lead projects were initiated during PY2018 and completed during the period of March 2019 through February 2020.

ADM performed impact analyses in accordance with evaluation requirement in Missouri 20 CSR 4240-20.093 Demand-Side Programs Investment Mechanism and 20 CSR 4240-20.094 Demand-Side Program and following the evaluation tasks in the Stipulation and Agreement Regarding Cycle 2 Transition Plan, filed as EO-2015-0055.

Section 3.1 describes the methodology used for estimating ex post gross energy and demand impacts. Section 3.2 presents the results of the effort to estimate savings for BizSavers program M&V samples.

3.1 Methodology for Estimating Gross Savings

The program gross energy and demand savings are determined by evaluating a sample of individually completed projects receiving incentives that is statistically significant. The evaluation team reviewed the population of PY2018 and PY2018 long-lead projects to develop an additional sample of long-lead projects to estimate first year program savings with +/-10% statistical error at a 90% level of confidence.

3.1.1 Sampling Plan

The sample design for long-lead projects was developed to estimate first year Program savings with +/-10% statistical error at a 90% level of confidence. Table 3-1 summarizes the population of long-lead projects and the additional sample points needed to achieve the desired level of statistical precision.

Table 3-1 Long-Lead Projects Population and Sample Summary

Program	*Number of Projects in the Population*	*Long-Lead Sample*
Custom	29	0
Standard	30	0
New Construction	10	2
RCx	2	1
Total	54	0

Note: Some projects receive incentives through multiple programs leading to the sum of program projects exceeding the total number of projects.

The basis for the estimation of savings for the programs is a ratio estimation procedure that allows the measured and verified (M&V) sample to, with a specific statistical precision,

explain the annual ex post gross savings for all completed projects. The sampling statistical precision for each program is shown in Table 3-2. The Custom Program sample facilitated estimation of energy savings with statistical precision of 7.3%, while the precision of the Standard Program sample is 5.0%. The sampling precision of the New Construction Program sample is 9.9%, while the precision of the Retro-Commissioning Program is 8.7%.

Table 3-2 Sample Statistical Precision by Program

Program	*Statistical Precision*
Custom	7.3%
Standard	5.0%
New Construction	9.9%
Retro-Commissioning	8.7%

3.1.2 Review of Documentation

After the sample selection, ADM obtained project documentation from the tracking database maintained by Ameren Missouri's program implementation contractor. ADM analysts then reviewed this documentation and other program materials that were relevant to the evaluation effort.

The available documentation (e.g., audit reports, savings calculation work papers, invoices, etc.) for each incentivized measure was reviewed, with attention given to the calculation procedures and documentation for ex ante energy saving estimates. The reviewed documentation for all selected projects included program forms, databases, invoices, product spec sheets, reports, billing system data, weather data, and any other potentially useful data. Examination of each application to determine whether the following types of information is included:

- Documentation for the equipment changed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information
- Documentation for the new equipment installed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information
- Information about the savings calculation methodology, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations

If there was uncertainty regarding a project or incomplete project documentation, then ADM staff contacted the implementation contractor to seek further information to ensure the development of an appropriate project-specific M&V plan.

3.1.3 Verification Procedures

Due to the evolving COVID-19 situation, ADM completed desk reviews to verify the savings achieved by the long-lead projects in lieu of onsite visits. Desk reviews were completed with review of all project documentation, comparison to previous projects implemented at the same site, and collection of utility billing data. These projects were supplemented to the PY2018 evaluation sample, which were all verified by on-site visits.

3.1.4 Procedures for Estimating kWh Savings from Measures Installed through the Program

The method ADM employs to determine ex post gross impacts depends on the types of measures implemented. Categories of long lead project measures include the following:

- Lighting
- HVAC

The activities specified in Table 3-3 were used to estimate gross savings for each sample unit (project or measure). The gross realization rates represent the ratio of ex post gross savings to ex ante gross savings. Estimates of program-level gross savings were then aggregated by applying a ratio estimation procedure in which achieved savings levels estimated for the sample units are statistically extrapolated to the program-level ex ante savings.

Table 3-3 Typical Methods to Determine Savings for Custom Measures

Type of Measure	*Method to Determine Savings*
Lighting	Reference to data on wattages of newly-installed measures, hours-of-use data obtained project documents and published operating hours, with baseline data informed by applicable standards or pre-existing equipment characteristics.
HVAC (including packaged units, chillers, cooling towers, controls/EMS)	Whole Building Analysis with weather data and utility billing data

also conducted an analysis of sites with relatively high or low gross realization rates to determine the reasons for the discrepancy between ex ante and ex post energy savings. Volume II of this report presents information on the results of this analysis at the site-level, and the program- and portfolio-level analysis results are presented in section 3.2 of this document.

1.1.1.3. Method for Analyzing Savings from Lighting Measures

Lighting measures examined include retrofits of existing fixtures, lamps and/or ballasts with energy efficient fixtures, lamps, or LED lamps/drivers. These types of measures reduce demand, while not affecting operating hours. Participants often complete retrofit

projects in combination with the installation of lighting control measures, such as motion sensors or daylight controls. Controls reduce the operating hours and/or current passing thorough the connected fixture or group of fixtures.

Analyzing the savings from such lighting measures requires data for retrofitted fixtures on (1) baseline wattages and post-retrofit wattages and (2) hours of operation before and after the retrofit. Hours of operation are typically determined based on metered data collected after measure installation for a sample of fixtures. The additional long lead sample annual hours of use were estimated by each usage area from project documents and published operating hours. Usage areas are locations within a facility with comparable average operating hours. For industrial customers, expected usage areas include production, warehouse, and office areas.

Annual energy savings for each sampled fixture/lamp is determined by the following formula:

$$kWh = Hours_{annual}\ x\ (Qty_{base}Watts_{base} - Qty_{eff}\ Watts_{eff})\ x\ HCIF\ x\ \frac{kW}{1000\ W}$$

The input values for this formula are determined through the following steps:

- Annual hours are estimated for each area and assigned to the fixture/lamp.
- The baseline quantity and efficient quantity are verified to purchase invoices and project documents.
- The baseline watts are compared to either TRM common fixture wattages or project documents. The efficient wattages are verified to the manufacturer specification sheets.
- For conditioned spaces, region-specific, building type-specific heating interaction factors (HIF) and cooling interaction factors (CIF) account for the energy impacts of implemented lighting measures on HVAC operation. The applied factors, were developed based on energy simulation of DEER eQUEST prototypical buildings, referencing Ameren Missouri service territory weather data and listed in BizSavers Evaluation Report Volume II, Chapter 4. The kWh heating and cooling interaction factor (HCIF) is calculated as 1 + *HIF* + *CIF*.

1.1.1.4. Method for Analyzing Savings from HVAC Measures

Savings estimates for the RCx project were determined by applying the IPMVP Option C, Whole Facility Measurement method. The baseline and efficient energy usage are compared to each other, after normalizing the energy data for billing days. The energy data is regressed to identify correlation with independent variables, such as weather and occupancy. A flag variable is also included in the regression, with a different value for the baseline and efficient period. The regression coefficients are updated to obtain statistical significance, and the whole model is tuned to produce a high relationship value.

3.1.5 Procedures for Estimating Peak kW Savings from Measures Installed through the Program

The system peak net demand (kW) savings for PY2018 long lead project measures are determined by factoring the first year annual energy savings by end use-specific energy-to-demand ratios. Table 3-4 shows the applicable business energy to peak demand factors, which are sourced from Appendix E to the *Non-Unanimous Stipulation and Agreement* in File No. EO-2015-0055.[1] The *Non-Unanimous Stipulation and Agreement* in File No. EO-2015-0055 states: "Only measures that are expected to deliver energy savings in 2023 and beyond are counted towards the demand goal in the EO included in Appendix A." ADM referenced the Ameren Missouri TRM for secondary data on measure EUL in order to assess whether or not measures are sufficiently long-lived to apply the stipulated energy-to-demand ratio to determine 2023-persistent kW savings.

Table 3-4 End-Use Category Energy to Peak Demand Factors

End Use	*Factor*
Air Comp	0.0001379439
Building Shell	0.0004439830
Cooking	0.0001998949
Cooling	0.0009106840
Exterior Lighting	0.0000056160
Heating	0.0000000000
HVAC	0.0004439830
Lighting	0.0001899635
Miscellaneous	0.0001379439
Motors	0.0001379439
Process	0.0001379439
Refrigeration	0.0001357383
Water Heating	0.0001811545

3.2 Results of Ex Post Gross Savings Estimation

To estimate ex post gross kWh savings and ex post gross peak kW reductions for the BizSavers programs, data was collected and analyzed for the samples identified in section 3.1.1. ADM analyzed the sample measure data using the methods described in section 3.1 to estimate project energy savings, peak kW reductions, and determine gross realization rates. In this section are the results of that analysis results. Note that detailed, site-level analysis methods and results are presented in Volume II of this report.

[1] https://www.efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=935982981

3.2.1 Ex Post Gross kWh Savings

Table 3-5 summarizes ex post gross energy savings of the PY2018 long-lead projects.

Table 3-5 Summary of Ex Post Gross Energy Savings

Program	*Ex Ante kWh Savings*	*Ex Post Gross kWh Savings*	*Gross kWh Savings Realization Rate*
Custom	3,377,004	3,338,155	99%
Standard	5,209,650	4,522,313	87%
New Construction	1,279,339	1,147,579	90%
RCx	1,245,261	1,166,091	94%
Total	11,111,254	10,174,138	92%

3.2.2 Ex Post Gross Peak kW Savings

Table 3-6 contains the ex post gross peak demand reductions of the PY2018 long-lead projects.

Table 3-6 Ex Ante and Ex Post Gross Peak Demand Savings

Program	*Ex Ante kWh Savings*	*Ex Post Gross kWh Savings*	*Gross kWh Savings Realization Rate*
Custom	1,445.66	1,438.80	100%
Standard	988.66	858.25	87%
New Construction	353.49	307.86	87%
RCx	775.03	732.59	95%
Total	3,562.85	3,337.50	94%

4. Estimation of Ex Post Net Savings

This chapter reports the results from estimating the net impacts of the program during program year where ex post net savings represent the portion of ex post gross savings by program participants that can be directly attributed to the effects of the program. Net savings estimated in this report equal gross savings, *minus* free ridership, *plus* participant spillovers, and non-participant spillovers.

The results of the analyses are based on the combine samples of survey responses collected as part of the PY2018 BizSavers evaluation and those collected from participants that completed PY2018 long-lead projects. The survey responses from both periods were combined because the long-lead projects were initiated in PY2018 and were completed under the PY2018 program guidelines. Thus, the long lead projects can be considered a part of the population of PY2018 projects.

4.1 Procedures Used to Estimate Net Savings

The evaluation team administered an online survey to decision-maker contacts who completed long-lead projects completed during the March 2019 – February 2020 period. The results of the analysis of these survey responses were integrated with the net-savings results for the PY2018 projects completed during the March 2018 – February 2019 Period.

The same procedures were used to estimate net savings for all the BizSavers programs. The following sub-sections describe the methodology used to estimate free ridership, participant spillover, and non-participant spillover.

4.1.1 Procedures Used to Estimate Free Ridership

Free riders are those program participants that would have installed the same energy efficiency measures without the program incentives. Net savings may be less than gross savings because of free ridership impacts, which arise to the extent that participants in a program would have adopted energy efficiency measures and achieved the observed energy changes even in the absence of the program. Conversely, net savings may be greater than gross savings due to energy savings spillovers or market transformation impacts attributable to the program. Participants or non-participants may implement energy efficiency measures due to the influence of the program, without receiving program incentives for implemented measures.

Survey response data collected from a sample of program participants was used to support the net-to-gross analysis. A copy of the survey instrument is presented in Volume II of this report. Based on review of this information, the preponderance of evidence regarding free ridership inclinations was used to attribute a customer's savings to free ridership.

Several criteria determine which portion of a participant's savings should be attributed to free ridership. The first criterion comes from the response to the following two questions:

- "Would you have been financially able to install the equipment or measures without the financial incentive from the BizSavers Program?"
- "To confirm, your organization would NOT have allocated the funds to complete a similar energy saving project if the program incentive was not available. Is that correct?"

Respondents answering "No" to the first question and "Yes" to the second question were considered to require program financial assistance to undertake the project and were not deemed to be free riders.

For decision makers who did not indicate a lack of financial ability to undertake energy efficiency projects without financial assistance from the program, three additional factors determined what percentage of savings is attributable to free ridership. The three factors were:

- Plans and intentions of the firm to install a measure even without support from the program.
- Influence that the program had on the decision to install a measure; and
- A firm's previous experience with a measure installed under the program.

For each of these factors, rules were applied to decision-maker survey responses to develop binary variables indicating whether a participant showed free ridership behavior.

The first step was to determine if a participant stated that his or her intention was to install an energy efficiency measure without the help of the program incentive. Two binary variables were constructed to account for customer plans and intentions: one, based on a more restrictive set of criteria that describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria (Definition 1) indicating customer plans and intentions that likely signify free ridership were as follows:

- The respondent answered "yes" to the following two questions: "Did you have plans to install the measure before participating in the program?" and "Would you have completed the [Equipment/Measure] project even if you had not participated in the BizSavers Program?"
- The respondent answered, "definitely would have installed" to the following question: "If the financial incentive from the BizSavers Program had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?"

- The respondent answered, “did not affect timing of purchase and installation” to the following question: “How did the availability of information and financial incentives through the BizSavers Program affect the timing of your purchase and installation of [Equipment/Measure]?”
- The respondent answered “no, the program did not affect level of efficiency that we chose for equipment” in response to the following question: “How did the availability of information and financial incentives through the BizSavers Program affect the level of energy efficiency you chose for [Equipment/Measure]?

The second, less restrictive criteria (Definition 2) indicating customer plans and intentions that likely signify free ridership were as follows:

- The respondent answered “yes” to the following two questions: “Did you have plans to install the measure before participating in the program?” and ““Would you have completed the [Equipment/Measure] project even if you had not participated in the BizSavers Program?”
- Either the respondent answered, “definitely would have installed” or “probably would have installed” to the following question: “If the financial incentive from the BizSavers Program had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?”
- Either the respondent answered “did not affect timing of purchase and installation” to the following question: “How did the availability of information and financial incentives through the BizSavers Program affect the timing of your purchase and installation of [Equipment/Measure]?” or the respondent indicated that while program information and financial incentives did affect the timing of equipment purchase and installation, in the absence of the program they would have purchased and installed the equipment within the next two years.
- The respondent answered “no, the program did not affect level of efficiency that we chose for equipment” in response to the following question: “How did the availability of information and financial incentives through the BizSavers Program affect the level of energy efficiency you chose for [Equipment/Measure]?

To summarize, the two definitions of plans differ in how restrictive the criteria are and how much free ridership is assigned based on the responses.

To meet the most restrictive definition (Definition 1), the respondent needed to state that they definitely would have implemented the measure in the absence of the program and that the program had no impact on timing. If these criteria are met, an initial assignment of full free ridership is made.

The second definition is less restrictive. To meet this definition, the respondent needed to state that the program definitely or probably would have implemented the measure

without the program. Additionally, they could have stated that either the program had no impact on timing or that the measure would have been implemented in the next two years. If these criteria are met, an initial assignment of 33% free ridership is made.

The second factor indicated if a customer reported that a recommendation from a program representative or past experience with the program was influential in the decision to install a particular piece of equipment or measure.

This criterion indicated that the program's influence lowers the likelihood of free ridership when either of the following conditions are true:

- The respondent answered, "very important" to the following question: "How important was previous experience with the BizSavers Program in making your decision to install [Equipment/Measure]?"
- The respondent answered "yes" to the following question: "Did a representative of the BizSavers Program recommend that you install [Equipment/Measure]?"

The third factor was based on whether a participant in the program indicated that he or she had previously installed an energy efficiency measure similar to one that they installed under the program without an energy efficiency program incentive during the last three years. A participant indicating that he or she had installed a similar measure is considered to have a higher likelihood of free ridership because respondents who report installing similar equipment without incentives may demonstrate a willingness to implement efficiency measures without program support.

The criteria indicating that previous experience may signify a higher likelihood of free ridership are as follows:

- The respondent answered "yes" to the following question: "Before participating in the BizSavers Program, had you installed any equipment or measure similar to [Incentivized Equipment/Measure] at your facility?"
- The respondent answered "yes, purchased energy efficient equipment but did not apply for financial incentive." to the following question: "Has your organization purchased any energy efficient equipment in the last three years for which you did not apply for a financial incentive through the BizSavers Program?"

The four sets of rules just described were used to construct four different indicator variables that address free ridership behavior. For each customer, a free ridership value was assigned based on the combination of variables. With the four indicator variables, there were 12 applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 4-1 shows these values. A free ridership score of 100% indicates total free ridership, and a free ridership score of 0% indicates no free ridership.

ADM recognizes that there are potential survey respondent biases, including social desirability bias, which may impact self-report data. The free ridership assessment methodology employed by ADM is constructed with the intention of mitigating those impacts by asking a *series* of questions in assessing the likelihood of free ridership. Additionally, decision maker responses and project documentation were reviewed to assess the reasonableness of free ridership estimates developed using the methodology described above, and to ensure that reported free ridership estimates account for available data regarding the decision-making process.

Table 4-1 Free Ridership Scores for Combinations of Indicator Variable Responses

Indicator Variables				*Free Ridership Score*
Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 1)	*Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 2)*	*BizSavers Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	
Y	N/A	Y	Y	100%
Y	N/A	N	N	100%
Y	N/A	N	Y	100%
Y	N/A	Y	N	67%
N	Y	N	Y	67%
N	Y	Y	Y	33%
N	N	N	Y	33%
N	Y	N	N	33%
N	Y	Y	N	0%
N	N	N	N	0%
N	N	Y	N	0%
N	N	Y	Y	0%

4.1.2 Procedures Used to Estimate Participant Spillover

ADM used two data sources for calculation of program participant spillover: the TRC (formerly LM) measure-level spillover report and participant self-reported spillover from the participant survey. The TRC measure-level spillover report includes all measures that were flagged as an “Installed Spillover Measure.” Generally, the non-incented measures were small components of a broader project comprised of incentivized measures. The spillover ex ante savings estimates were reviewed by ADM and determined to be reasonable and aligned with ex ante savings estimates for incentivized measures. The savings were calculated as equal to the ex ante savings of the non-incented measure, factored by 1) the project-specific gross realization and 2) the project-specific non-free ridership rate [(Ex Post Gross kWh - Free Ridership Ex Post kWh) / Ex Post Gross kWh].

The second source of participant spillover was additional measures installed without incentives identified by decision makers that completed the online participant survey. Survey respondents provided information on the installation of additional equipment implemented without a program incentive, including information on the program's influence on the decision to the install the additional equipment, and information on the measure specifications used to estimate the energy saving impacts of the equipment.

Specifically, respondents were asked:

- Since participating in the BizSavers Program has your organization installed any ADDITIONAL energy efficiency measures at this facility or at your other facilities within Ameren Missouri's service territory that did NOT receive incentives through Ameren Missouri's BizSavers Program?

Customers who indicated "yes" were identified as potential spillover candidates. Potential spillover candidates were also asked to identify the type of additional equipment installed and provide information about the equipment for use in estimating energy savings. For each type of equipment that respondents reported installing, respondents were asked the following two questions to assess if any savings resulting from the additional equipment installed were attributable to the program:

- [SP1] How important was your experience with the BizSavers Program in your decision to install this [EQUIPMENT TYPE], using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"
- [SP2] If you had not participated in the BizSavers Program, how likely is it that your organization would still have installed this [EQUIPMENT TYPE], using a 0 to 10 scale, where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

A spillover score was developed based on these responses as follows:

Spillover Score = Average(SP1, 10-SP2)

The energy savings of equipment installations associated with a spillover score of greater than five were attributed to the program.

The energy savings of the spillover measures were estimated using the deemed values from the Ameren Missouri TRM.

Survey respondent net savings were adjusted based on the reported spillover savings. All cases of spillover identified, were from the survey of participants who completed projects during the March 2018 – February 2019 period. That is, the evaluation team found no additional cases of spillover identified by decision makers who completed the survey and also implemented long-lead projects during the March 2019 – February 2020 period. To extrapolate spillover savings to non-survey respondents, a spillover ratio was calculated as follows:

Spillover Ratio = Sum of Sample Reported Spillover/ Sum of Sample Ex Post Gross Savings

4.1.3 Procedures Used to Estimate Non-Participant Spillover

The evaluation team assessed PY2018 non-participant spillover energy savings through data collected via trade ally surveys. The data collection and analysis were completed as a part of the evaluation of the March 2018 – February 2019 activity and applied to the analysis of program activity inclusive of the long-lead projects.

Using the data and results of the PY2018 non-participant spillover study, the evaluation team developed program specific non-participant spillover ratios by dividing program non-participant spillover by ex post gross savings. The ratios applied were as follows.

Table 4-2 Non-Participant Spillover Ratios Applied to Long-Lead Projects

Program	*Non-Participant Spillover Ratios*
Custom	0.015%
Standard	1.350%
New Construction	0.000%
RCx	0.000%

4.2 Results of Net Savings Estimation

The procedures described in the preceding section were used to estimate net-to-gross ratios for the BizSavers Program for the PY2018 long-lead projects. The following subsections detail the results of the free ridership and spillover analyses.

4.2.1 Results of Estimation of Free Ridership

The data used to assign free ridership scores were collected through a customer survey of 545 customer decision makers for projects completed during PY2018 and responses from another seven customers that completed long-lead projects. The results of the two separate net savings studies were combined because the long lead projects were initiated during PY2018 and were completed under those guidelines.

For purposes of adjusting gross savings to account for free ridership, the gross savings of projects associated with decision makers that were surveyed by ADM were adjusted by that decision makers specific free-ridership *score (Gross Savings * (1 – Free Ridership Score))*. Gross savings of projects associated with decision makers that were *not* surveyed by ADM were adjusted by the program-level free ridership score using data collected during PY2018 and during the long-lead project evaluation period. For the

programs for which free ridership research was conducted, Table 4-3 below provides a summary of the program-level free ridership.

Table 4-3 Percent of Ex Post Net kWh Savings Associated with Free-Ridership

Program Component	*Percent of kWh Savings Associated with Free Ridership*
Custom	16.6%
Standard	2.6%
New Construction	6.3%
Retro-Commissioning	0.0%
Total	7.3%

As a sensitivity analysis, ADM compared the above free ridership results to the results had analysis been limited to long-lead projects. For each program, the free ridership results would have been lower if the analysis was limited to the long-lead projects only.

Program Component	*Percent of kWh Savings Associated with Free Ridership (PY2018 and PY2018 Long-Lead Samples)*	*Percent of kWh Savings Associated with Free Ridership (PY2018 Long-Lead Samples Only)*
Custom	16.6%	6.7%
Standard	2.6%	0.0%
New Construction	6.3%	.0%
Retro-Commissioning	0.0%	.0%
Total	7.3%	2.2%

Table 4-4 summarizes the number of responses for each of the free ridership categories developed from the indicator variables. We note that none of the respondents who were assigned 0 free ridership based on the financial ability screened would have been assigned free ridership had the screen not been in place.

Table 4-4 Count of Responses by Free Ridership Score

Indicator Variables				*Free Ridership Score*	*Count of Responses*
Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 1)	*Had Plans and Intentions to Install Measure without BizSavers Program? (Definition 2)*	*BizSavers Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*		
Y	N/A	Y	Y	100%	0
Y	N/A	N	N	100%	1
Y	N/A	N	Y	100%	0
Y	N/A	Y	N	67%	0
N	Y	N	Y	67%	0
N	Y	Y	Y	33%	0
N	N	N	Y	33%	0
N	Y	N	N	33%	0
N	Y	Y	N	0%	3
N	N	N	N	0%	4
N	N	Y	N	0%	0
N	N	Y	Y	0%	0

4.2.2 Results of Estimation of Spillover Energy Savings

PY2018 spillover energy impacts were assessed from program participants and non-participants. Table 4-5 summarizes the result. The results presented were developed from analysis and data collected for the evaluation of the March 2018 – February 2019 period and applied to the PY2018 program activity, inclusive of the long-lead projects. New Construction and Retro Commissioning all have zero Non-Participant Spillover, as the identified installed lighting spillover products were attributed to similar measures within the Standard and Custom programs.

Table 4-5 Summary of Spillover kWh Energy Savings

Program Component	*Spillover Total*	*Participant Spillover (Tracked)*	*Participant Spillover (Survey)*	*Non-Participant Spillover*
Custom	42,300	13,663	28,147	491
Standard	112,474	0	54,131	61,043
New Construction	0	0	0	0
Retro-Commissioning	0	0	0	0
Total	154,775	13,663	79,578	61,534

4.3 Ex Post Net kWh Savings

Table 4-6 summarizes the program-level ex post net kWh savings along with associated net-to-gross ratios.

Table 4-6 Summary of Free Ridership, Spillover, and Net kWh Savings by Program

Program	*Estimated Free Ridership*	*Spillover*	*Ex Post Gross kWh Savings*	*Ex Post Net kWh Savings*	*Net-to-Gross Ratio*
Custom	555,482	42,300	3,338,155	2,824,973	85%
Standard	117,061	112,474	4,522,313	4,517,726	100%
New Construction	72,260	0	1,147,579	1,075,319	94%
Retro-Commissioning	0	0	1,166,091	1,166,091	100%
Total	744,804	154,775	10,174,138	9,584,110	94%

Table 4-7 below provides the free-ridership and spillover values as a percent of ex post net kWh savings. At the portfolio level, kWh savings associated with free ridership represents 7.3% of total ex post gross kWh savings. Additionally, at the portfolio level, spillover kWh savings represents 1.5% of the total ex post gross kWh savings.

Table 4-7 Summary of Free Ridership and Spillover as Percent of Ex Post Gross kWh

Program Component	*Ex Post Net kWh Savings*	*Estimated Free Ridership*	*FR as a % of Ex Post Gross kWh*	*Spillovers*	*SO as a % of Ex Post Gross kWh*
Custom	2,824,973	555,482	16.6%	42,300	1.3%
Standard	4,517,726	117,061	2.6%	112,474	2.5%
New Construction	1,075,319	72,260	6.3%	0	0.0%
Retro-Commissioning	1,166,091	0	0.0%	0	0.0%
Total	9,584,110	744,804	7.3%	154,775	1.5%