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Ameren Missouri Program Year 2019 Annual EM&V Report

Volume 3: Business Portfolio Appendices

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Appendix A. Additional Methodology Detail

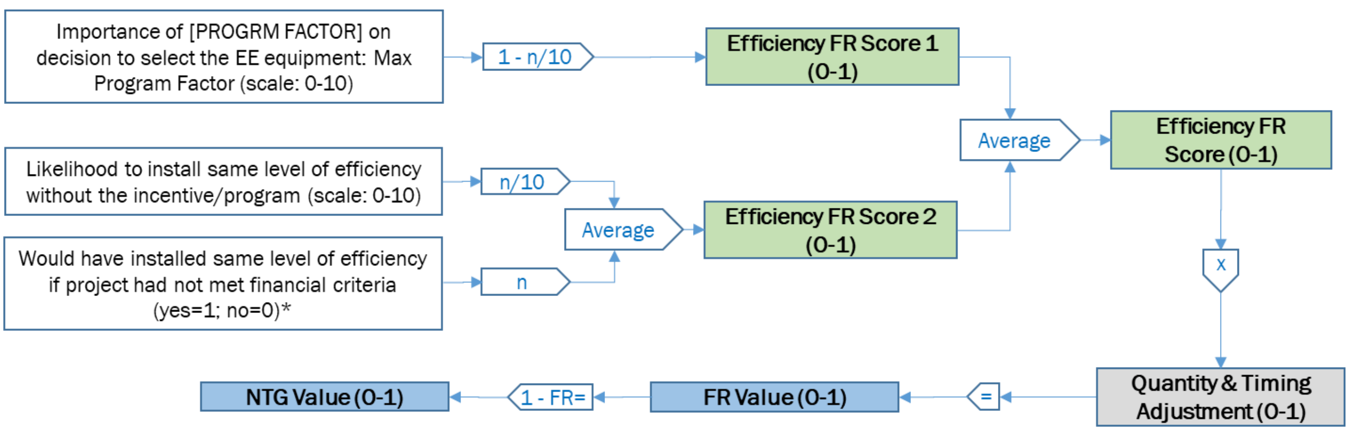
Respondent-Level Free Ridership Methodology

This section outlines our approach for calculating respondent-level free ridership (FR) values for the BizSavers programs, based on responses to questions in the participant online survey/interviews. The approach estimates program influence on project efficiency and applies an adjustment to reflect program influence on the quantity and timing of installed equipment. We used the following calculations:

- FR Value = [(Efficiency Score 1 + Efficiency Score 2) ÷ 2] x Quantity and Timing Adjustment Factor
- NTG Value = 1 – FR Value

Figure A-1 presents a diagram of the FR algorithm used for this evaluation.

Figure A-1. Overview of Free-Ridership Algorithm



**Asked of those who rated importance of financial criteria >7 and indicated that the incentive caused the project to meet their financial criteria*

The following subsections describe the questions and algorithms used to estimate respondent-level FR values.

Program Influence on Project Efficiency

The participant online surveys/interviews included a series of questions to determine the influence of the program on the efficiency level of the incented project. Based on these questions, we developed two FR efficiency scores for each respondent, which were then averaged to calculate the respondent's overall Efficiency FR Score. FR scores can range from 0 to 1, where 0 means no FR (i.e., full credit for the program) and 1 means full FR (i.e., no credit for the program).

The overall Efficiency FR Score is the average of the following two sub-scores:

- **Efficiency FR Score 1 – Rating of program factors.** Respondents were asked to rate (on a scale of 0 to 10) the importance of several program and non-program factors on their decision to select energy efficient equipment rather than a less efficient alternative. The Efficiency FR Score 1 is based on the maximum rating given to any of the program factors and was calculated as:[1]

1 – (Maximum Program Factor Rating ÷ 10)

- **Efficiency FR Score 2 – Counterfactual.** Average of ES2a and ES2b:
  - **ES2a. Likelihood to install same level of efficiency without the incentive/program:** Respondents were asked to rate (on a scale of 0 to 10) the likelihood that they would have installed equipment with the same level of efficiency without the program. This score was calculated as:

    Likelihood to install without the incentive/program ÷ 10

  - **ES2b. Would participant have selected the same energy efficient equipment if it hadn't met their financial criteria:** This question was only asked of respondents who rated the importance of financial criteria greater than 7 and indicated that the incentive caused the project to meet or exceed their financial criteria. For all other respondents, the Efficiency FR Score 2 only uses the first measurement of the counterfactual (i.e., ES2a). This score was calculated as:

    Yes = 1; No = 0

For the free ridership analyses of the Standard, Custom, and SBDI programs, we made an additional adjustment to the Efficiency FR Score 2. Because both measurements of the counterfactual (e.g., ES2a and ES2b) focused on the incentive,[2] respondents may have over-estimated their likelihood to select the same efficiency level if other program factors, such as trade allies or program materials, were more important than program incentives in their decision making. We therefore developed an adjustment factor, by dividing the maximum rating of all program factors by the rating of the incentive, that reflects the importance of other program factors relative to the importance of the incentive. We divided the Efficiency FR Score 2 by this adjustment factor. In cases where the incentive was the most important factor, this adjustment factor was equal to 1.0, i.e., no adjustment.

It should be noted that use of a second measurement of the counterfactual (ES2b) and the additional adjustment to the Efficiency FR Score 2 are departures from the originally anticipated methodology. These two components were added following review of the first wave of survey responses for the Standard and Custom programs, which showed a number of inconsistent responses to the two original measurements of program influence on efficiency (i.e., rating of program factors and the first counterfactual, ES2a), suggesting that the two measurements may be capturing slightly different concepts or may be misunderstood by respondents.

Since the second measurement of the counterfactual (ES2b) was not part of the first wave of the Standard/Custom survey, we developed an adjustment factor for Wave 1 respondents that reflects the relationship, for Wave 2 respondents, between the overall Efficiency FR Score 2 and the first measurement of the counterfactual (ES2a). This adjustment factor was developed separately for participants in the Standard and Custom programs and applied to their ES2a score.

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[1] Several factors asked about in the survey can be considered either a program factor or a non-program factor, depending on the response to a follow-up question: previous experience with this type of equipment, financial criteria, expected energy savings.

[2] The survey question was phrased: "Without the incentives from Ameren Missouri's BizSavers program, what is the likelihood that the equipment you selected and installed would have had the same efficiency level?" Note that this adjustment was not necessary for the New Construction Program as the counterfactual question was asked in terms of the program, not the incentive.

Quantity and Timing Adjustment Factor

In addition to influencing the efficiency of a project, the program can affect the quantity and timing of the installed energy efficient equipment.[3] Because decisions about measure quantity and installation timing are often correlated, we calculated a combined "Quantity and Timing Adjustment Factor." This factor ranges from 0 to 1, where a lower value means a greater quantity and timing adjustment, i.e. more credit to the program. As shown in Figure A-1, the Quantity and Timing Adjustment Factor is multiplied by the Efficiency FR Score to derive the FR Value.

To develop the Quantity and Timing Adjustment Factor, the survey first asked respondents how much of the installed energy efficient equipment would have been installed at the same time without the program. Only the quantity that would not have been installed at the same time was eligible to receive the quantity and timing credit.

Respondents were then asked if they would have installed the remaining quantity later and, if so, how much later. The response, expressed as the number of months the program accelerated the project, was translated into a timing adjustment, using the following formula:[4]

Timing Adjustment = 1 – (# Months Accelerated – 6) ÷ 42

Substituting the midpoint of the response for # Months Accelerated results in the following adjustments:

- Same time: 1.0
- Up to 6 months later: 1.0
- 7–12 months later: 0.93
- 1–2 years later: 0.71
- 2–3 years later: 0.43
- 3–4 years later: 0.14
- More than 4 years later: 0.0
- Don't know/Refused: Average of valid responses from other respondents

The timing adjustment can range from 0 to 1. A smaller adjustment value means a greater reduction in FR, because the program resulted in a greater acceleration of the project.

The Quantity and Timing Adjustment Factor is then calculated by multiplying the percentage of the project that would not have been installed at the same time without the program by the timing adjustment and adding this product to the percentage of the project that would have been installed at the same time without the program. We used the following formula for this calculation:

Quantity and Timing Adjustment Factor =

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[3] For some measures, the concept of quantity may not be applicable. For projects with those measures, we will skip questions about quantity and set the quantity adjustment factor to 1.0, i.e., no FR adjustment is applied.

[4] The timing adjustment is capped at 1.0, i.e., if the *# Months Accelerated* is 6 months or less, the adjustment is equal to 1.0 and no adjustment is applied.

*(% Not Installed at Same Time * Timing Adjustment) + % Installed at Same Time*

If the respondent did not provide valid responses to the initial quantity question (i.e., an "unsure" response to the question: "*Without the incentives from Ameren Missouri's BizSavers program, would you have installed the same quantity of energy efficient equipment in <INSTALLDATE> or would you have installed less?*"), we used the following rules to assign a Quantity and Timing Adjustment Factor:

1. For all SBDI respondents and Standard/Custom Wave 2 respondents:
   a. If the respondent indicated that the availability of the BizSavers program somewhat or significantly changed either the quantity or the timing of their project, we assigned a Quantity and Timing Adjustment Factor equal to the average of valid responses from other respondents.
   b. If the respondent indicated that the availability of the BizSavers program changed neither the quantity nor the timing of their project, we assigned a Quantity and Timing Adjustment Factor of 1.0 (i.e., no reduction in FR).
2. For Standard/Custom Wave 1 respondents: We assigned the average Quantity and Timing Adjustment Factor across all other respondents, including Wave 1 and Wave 2 (including factors of 1.0, i.e., no adjustment).

It should be noted that questions about whether and how the program changed plans with respect to efficiency, quantity, and timing were added following review of the first wave of survey responses for the Standard and Custom programs, in an attempt to collect additional information in the case of inconsistent responses. As such, this information was not available for Wave 1 respondents.

Market Partner Spillover Methodology

The objective of the market partner spillover (MPSO) analysis was to determine the program's influence on non-incented installations of energy-efficient measures by market partners during the evaluation period. As discussed in the body of Volume 3, we used an online survey of market partners to gather data for this analysis. We identified SO candidates through questions asked in the survey and determined savings for qualifying projects to develop a quantitative estimate of SO, relative to total program savings. The method captures SO as reported by market partners, which may include SO at participant facilities and at non-participant facilities.

The remainder of this section details our methods of determining if a market partner qualifies for SO savings and of quantifying SO savings. Note that question numbers throughout this section refer to questions in the market partner online survey for the Standard and Custom programs.

Market Partner Eligibility for Spillover

The market partner online survey asked a series of questions to determine if any high-efficiency installations completed by respondents outside of the program qualified as SO. We considered non-incented high-efficiency installations of equipment by market partners to be SO if all four conditions listed in Table A-1 were met.

Table A-1. Market Partner Spillover Qualifiers

Qualifier	Description	Conditions to Satisfy Qualifier
1	Since participating in the BizSavers programs, the market partner's total volume of high-efficiency installations that did not receive an incentive increased.	*PI1e = 2 or 3 AND PI1f = 2 or 3*
2	The market partner rated the program as important to this increase.	*PI3f = 8, 9, or 10*
3	The market partner installed at least some high-efficiency equipment that did not receive an incentive.	*TA1c > 0% OR (TA1c = 998 AND TA2a = 1 AND (TA2b > 0 OR "Unsure"))*
4	The open-ended response about why customers with high-efficiency projects did not receive an incentive did not contradict findings from other qualifiers that the non-incented high-efficiency installations can be considered SO.	*TA4b does not contradict that the non-incented high-efficiency installations can be considered SO.*

Estimation of Spillover Savings for Individual Market Partners

For respondents who met the four qualifying conditions outlined above, SO savings were considered to be equal to a portion of the savings of their non-incented, high-efficiency installations. SO (in kWh) for each qualifying market partner respondent (i) is calculated using Equation A-1. Data inputs to this formula are from the online survey and the program tracking database; they are further described below.

Equation A-1

$$\text{MPSO Respondent}_i = \left(\frac{\text{Savings from Program Database}_i}{\text{\% Efficient Installations that Received Incentive}_i} - \text{Savings from Program Database}_i \right) * \text{\% Influenced by Program}_i * \text{Size Adjustment}_i$$

Percentage of Efficient Installations That Received Incentive

We used survey questions TA1b and TA1c (the percentage of their total equipment installations in PY2019, in terms of revenue, that was high efficiency with and without an incentive) to determine the share of efficient installations that received an incentive (Equation A-2).

Equation A-2

$$\text{\% of Efficient Installations That Received Incentive} = \frac{TA1b}{TA1b + TA1c}$$

Respondent who were not able to provide a valid response to question TA1 were asked if any of their customers installed high-efficiency equipment that did not receive a BizSavers Program incentive during PY2019 (Q.TA2a), and if so, how many projects (Q.TA2b). We then used Equation A-3 to determine the percentage of efficient installations that received an incentive.

Equation A-3

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

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.

Percentage Influenced by Program

We used responses to survey question TA3, as shown in Table A-2, to determine the share of non-incented, high-efficiency installations that were strongly influenced by the program's activities in 2019.

Table A-2. Share of Projects Strongly Influenced by the activities of the BizSavers Program in 2019

Response	Analysis Value
All projects (100%)	100%
Most projects (80% to 99%)	90%
The majority of projects (60% to 79%)	70%
About half of projects (40% to 59%)	50%
Some projects (20% to 39%)	30%
Few projects (1% to 19%)	10%
No projects (0%)	0%
Unsure	*Not applicable in this evaluation*

Size Adjustment

High-efficiency projects that did not receive an incentive could be of a different size compared to those that did receive an incentive. For respondents who provided valid responses to the share of revenue from incented and non-incented high-efficiency equipment (Q.TA1), a size adjustment is not necessary since that question is asked in terms of revenues and thus embeds any size differential. However, a size adjustment is necessary for respondents who did not provide a valid response to Q.TA1 and for whom the share of non-incented high-efficiency equipment was developed based on the number of projects (Q.TA2a/b). For these respondents, we adjusted the average size of their projects in the program tracking database up or down, using responses to survey questions RS1a, RS1b, and RS1c, as shown in Table A-3.

Table A-3. Size Adjustment for Non-Incented, High-Efficiency Installations

Non-incented, high efficiency projects are … compared to incented ones (RS1a)	How much smaller/larger? (RS1b/RS1c)	Analysis Adjustment Value
Smaller	Less than a quarter of the size	12.5%
	A quarter of the size	25%
	Half the size	50%
	Three-quarters of the size	75%
	More than three-quarters of the size	87.5%

Non-incented, high efficiency projects are ... compared to incented ones (RS1a)	How much smaller/larger? (RS1b/RS1c)	Analysis Adjustment Value
	Unsure	*Not applicable in this evaluation*
About the Same Size	n/a	100%
Larger	Less than one-and-a-quarter times the size	112.5%
	One-and-a-quarter times the size	125%
	One-and-a-half times the size	150%
	One-and-three-quarters times the size	175%
	Twice the size	200%
	More than twice the size	200.0%
	Unsure	*Not applicable in this evaluation*
Unsure		*Not applicable in this evaluation*

Estimation of Program-Level Spillover Savings

To estimate the SO savings for all market partners, respondent-level results were extrapolated using the three steps described below.

Step 1: Respondent SO Rate

We first developed the Respondent SO Rate by dividing the sum of estimated SO savings of all respondents by the total Standard and Custom program savings of all respondents (Equation A-4).

Equation A-4

$$\textit{Respondent SO Rate} = \frac{\textit{Respondent SO Savings}}{\textit{Respondent Program Savings}}$$

Step 2: Total MPSO Savings

We then applied the Respondent SO Rate calculated in Equation A-4 to Standard and Custom program savings associated with all market partners, including those who did not respond to the survey (Equation A-5). This calculation derives Total MPSO Savings (in MWh).

Equation A-5

$$\textit{Total MPSO Savings} = \textit{Respondent SO Rate} * \textit{All Market Partner Program Savings}$$

Step 3: Program MPSO Rate

Lastly, we estimated the Program MPSO Rate by dividing the Total MPSO Savings (in MWh), developed in Equation A-5, by total Standard and Custom ex post gross savings (in MWh), including savings from projects completed without a market partner (Equation A-6). This step is necessary to allow for the Program MPSO Rate to be applied to the program as a whole, instead of only to projects completed by a market partner.

Equation A-6

$$\text{Program MPSO Rate} = \frac{\text{Total MPSO Savings}}{\text{All Program Savings}}$$

Appendix B. Desk Review and Onsite Reports: Standard Incentive Program

Site ID: 7002

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7002 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	222	222	114	50	2,596	1.04	111,648	-	38,353	34%
4061000-Lighting redesign	-	378	90	59	159	5,919	1.04	62,802	-	49,198	78%
Total								**174,450**		**87,551**	**50%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} xWatts_{post}\right) xHOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} xWatts_{post}\right) xHOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (ranging from 2,596 to 5,919) are fewer than the annual hours of operation used to calculate ex ante savings (7,344). Multiple areas within the facility were infrequently used with typical hours per week provided by the building tenant. The ex ante hours appear to be based on a work week of 5 days/24 hours plus 1 day/ 9 hours with no holidays. The area with the highest AHOU totaled 6,581 hours.

A heating and cooling interactive factor of 1.04, applicable to a heated, air-conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex-ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 50%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7002 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	174,450	87,551	50%	16.63
Total		**174,450**	**87,551**	**50%**	**16.63**

Site ID: 7004

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7004 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060310- Halogen BR/R 45W replaced with LED 13W	800150	2	2	65	10	2,675	1.08	384	-	318	83%
4060714- Fluorescent T8 replaced with LED Type B	800850	2	2	292	72	2,392	1.00	1,542	-	1,053	68%
4060811- Fluorescent T12 replaced with LED retrofit Kit	800900	1	1	138	43	2,392	1.00	333	-	227	68%
4060814- Fluorescent T12 replaced with LED Type B	800900	51	51	164	48	3,510	1.08	20,737	-	22,429	108%
		6	6	72	30	2,675	1.08	883	-	728	82%
4060912- Interior HID replaced with LED Lamp direct-wired	800300	64	64	455	115	2,226	1.00	82,065	-	48,439	59%
Total								**105,944**		**73,194**	**69%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The ex ante energy savings for the sixth line item in the table above was mis-calculated within the application. The error occurred within the HID to LED tab in version 6.0.1 where an additional savings was added. The issue was discussed with the implementer. The correct ex ante savings should have been 75,903 instead of 82,065.

The annual lighting hours of operation verified during the M&V site visit for the fourth line item in the above table (3,510) are greater than the annual hours of operation used to calculate ex ante savings (3,276). There were a few 24/7 fixtures in the area pointed out by the tenant. The remaining measures had hours (ranging from 2,226 to 2,675) which were less than the ex ante hours estimate (ranging from 3,260 to 3,276). There was varying usage with typical hours per week provided by the building tenant. In addition, a few newly installed measures were not in use (nor had they ever been) because there was adequate other lighting per the tenant.

A heating and cooling interactive factor of 1.08, applicable to a heated, air-conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings for the first, fourth, and fifth line items and 1.00 for the unconditioned warehouses. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 69%. The ex ante energy savings estimate was premised on overestimated energy savings for one measure, higher heating and cooling interactive factor for three measures, as well as higher annual lighting operating hours for four of the line items.

Site 7004 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	105,944	73,194	69%	13.90

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Total		**105,944**	**73,194**	**69%**	**13.90**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7004 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	138	128	203
			164	128	15,468
			72	64	589
Total					**16,260**

Site ID: 7005

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7005 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060610-Fluorescent T5 replaced with LED Fixture	800800	162	142	360	174	7,390	1.00	269,305	-	248,394	92%
4060911-Interior HID replaced with LED fixture	800300	271	271	455	174	7,390	1.00	610,134	-	562,758	92%
Total								**879,439**		**811,152**	**92%**

The additional savings for the occupancy sensors that were mounted to the new lighting fixtures, are in the following table

Site 7005 Lighting Controls Savings and Algorithm Inputs

Measure Name	TRM	Qty	Watts Controlled	HOU Pre	TRM Savings Factor	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
Fixture Mounted Occupancy Controls	2.8.11	162	142	7,390	0.24	1.00	105,433	-	59,614	57%
	2.8.11	271	174	7,390	0.24	1.00	201,213		135,062	67%
Total							**306,647**		**194,676**	**63%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The ex ante energy savings for this project was determined by the implementer using baseline hours of 7,488 and efficient hours of 3,500. The implementer stated this was due to Occupancy Sensors being installed but were not directly incentivized. The ex ante energy savings for the lighting measures wer based on annual hours of use of 7,488 for lighitng only savings of 879,439. The occupancy controls were included with the LED fixture, so the savings are included for the Standard lighting measure.

The annual lighting hours of operation verified during the M&V site visit (7,390) are fewer than the annual hours of operation used to calculate the base ex ante savings (7,488). The building tenant provided typical hours per week and the holiday schedule.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned warehouse in St. Louis was used in the ex post analysis. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 85%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for the lighting measure as well as including the savings for controls based on a full reduction of the lighting hours of use from 7,488 to 3,500 hours. The ex post savings applied the Ameren Missouri savings factor of 24% to the new fixture energy usage and the baseline hours.

Site 7005 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	1,186,085	1,005,828	85%	191.07
Total		**1,186,085**	**1,005,828**	**85%**	**191.07**

Site ID: 7008

Data Collection

The participant received Standard and Custom lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7008 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060611-Fluorescent T5 replaced with LED retrofit Kit	800800	20	20	234	80	2,340	1.09	7,711	-	7,856	102%
		217	217	234	80	7,488	1.09	267,750	-	272,755	102%
4060711-Fluorescent T8 replaced with LED retrofit kit	800850	3	3	221	80	7,488	1.09	3,390	-	3,452	102%
		1	1	114	42	2,340	1.09	180	-	184	102%
		2	2	114	37	2,340	1.09	386	-	393	102%
		3	3	114	36	7,488	1.09	1,875	-	1,910	102%
		8	8	114	25	3,120	1.09	2,375	-	2,421	102%
		11	11	88	37	7,488	1.09	4,494	-	4,579	102%
		3	3	59	25	2,340	1.09	255	-	260	102%
		14	14	59	21	2,340	1.09	1,332	-	1,357	102%
		21	21	59	18	2,340	1.09	2,156	-	2,196	102%
		410	410	59	25	3,120	1.09	46,538	-	47,407	102%
		8	8	59	26	7,488	1.09	2,114	-	2,155	102%
		27	27	59	21	7,488	1.09	8,220	-	8,374	102%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		13	13	59	25	7,488	1.09	3,541	-	3,608	102%
		17	17	59	25	7,488	1.09	4,631	-	4,718	102%
		8	8	56	18	3,120	1.09	1,015	-	1,034	102%
		18	18	32	18	7,488	1.09	2,019	-	2,057	102%
4060811- Fluorescent T12 replaced with LED retrofit Kit	800900	4	4	138	42	2,340	1.09	962	-	979	102%
		1	1	82	21	3,120	1.09	203	-	207	102%
Total								**361,148**	-	**367,902**	**102%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (ranging from 2,340 – 7,488) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7008 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	361,148	367,902	102%	69.86
Total		**361,148**	**367,902**	**102%**	**69.86**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7008 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	82	64	146.2
			138	128	877.4
Total					**1,024**

Site ID: 7009

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7009 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060320-Halogen MR-16 35W replaced with LED 20W	800200	25	24	50	7	8,760	1.00	5,057	-	9,478	187%
4060330-Halogen PAR 48W replaced with LED 2W	800250	20	20	75	11	5,852	1.00	5,982	-	7,491	125%
4060814-Fluorescent T12 replaced with LED Type B	800900	382	382	82	24	3,287	1.00	103,551	-	72,819	70%
		18	18	82	14	5,601	1.00	5,720	-	6,856	120%
Total								**120.310**	-	**96,644**	**80%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the third line item above (3,287) are fewer than the annual hours of operation used to calculate ex ante savings (4,368). The remaining measures had annual hours of operation (ranging from 5,601 to 8,760) that are greater than ex ante hours (4,368). The hours of use per installation areas were provided by the tenant.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 80%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects for the facility and overestimated annual hours for the majority of the installed measures.

Site 7009 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	120,310	96,644	80%	18.36
Total		**120,310**	**96,644**	**80%**	**18.36**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7009 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	82	64	50,220
			82	64	5,041
Total					**55,261**

Site ID: 7011

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7011 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060713-Fluorescent T8 replaced with LED Type A/B	800850	88	88	172	108	3,389	1.11	-	-	27,147	
		1255	1123	114	36	4,017	1.11	405,157	-	456,567	113%
		260	246	88	36	2,303	1.11	56,085	-	35,846	64%
		28	28	88	54	3,650	1.11	-	-	3,857	
4060813-Fluorescent T12 replaced with LED Type A/B		45	45	164	36	2,605	1.11	21,571	-	16,654	77%
Total								**482,813**	-	**540,072**	**111%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} xWatts_{post}\right) xHOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} xWatts_{post}\right) xHOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The first line item in the table above were 6 Lamp fixtures and the fourth line item were additional 3 Lamp fixtures. The base and efficient number of lamps were confirmed with the building tenant. The quantities of the remaining line items were also verified coinciding with the total overall installed quantity of lamps matching those purchased.

The annual lighting hours of operation verified during the M&V site visit for the second- and fourth-line items (4,007 and 3,650, respectively) are greater than the annual hours of operation used to calculate ex ante savings (3,500). The areas had various hours which also included several continuous usage fixtures (24/7). The typical hours per week was provided by the building tenant. The remaining measures had annual hours of operation (ranging from 2,303 to 3,389) that are less than ex ante hours (3,500). The majority of these areas were in offices with fewer hours, again provided by the tenant.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned hospital in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 111%. The ex ante energy savings estimate was premised on underestimated heating and cooling interactive factor for the facility type and the annual lighting operating hours were greater for 48% of the installed lamps.

Site 7011 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	482,813	540,072	111%	101.46
Total		**482,813**	**540,072**	**111%**	**101.46**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7011 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2020	164	112.6	9,967
Total					**9,967**

Site ID: 7012

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7012 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	20	20	194	107	4,365	1.08	9,309	-	8,203	88%
		6	6	194	107	4,053	1.08	2,793	-	2,285	82%
		147	147	194	95	4,458	1.08	77,859	-	70,064	90%
		6	6	99	34	4,053	1.08	2,183	-	1,707	78%
		2	2	99	34	4,365	1.08	728	-	613	84%
		2	2	99	34	4,053	1.08	728	-	569	78%
		1	1	99	34	4,053	1.08	364	-	285	78%
		2	2	99	34	4,053	1.08	728	-	569	78%
		1	1	99	34	4,053	1.08	364	-	285	78%
		1	1	99	34	4,053	1.08	364	-	285	78%
		1	1	99	34	4,053	1.08	364	-	285	78%
		1	1	99	34	4,365	1.08	364	-	306	84%
		1	1	99	34	4,365	1.08	364	-	306	84%
		2	2	99	34	4,365	1.08	728	-	613	84%
		14	14	50	32	5,621	1.08	1,348	-	1,530	113%
		4	4	50	26	259	1.08	514	-	27	5%

		80	80	26	13	4,365	1.08	5,564	-	4,903	88%
Total								**104,666**	-	**92,833**	**89%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The actual efficient wattage for the fourth through the fourteenth line items in the table above (34W) is greater than the ex ante savings wattage (31W). The product spec sheets confirm the wattage.

The annual lighting hours of operation verified during the M&V site visit for the fifteenth line item (5,621) are greater than the annual hours of operation used to calculate ex ante savings (5,000). The building tenant provided typical hours per week and stated the number of continuous use fixtures. The remaining measures have various usages with annual hours of operation (ranging from 259 – 4,458) that are less than ex ante hours (5,000), again provided by the tenant.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 89%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for 95% of the installed measures and underestimated wattage for 5% of the measures.

Site 7012 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	104,666	92,833	89%	17.63
Total		**104,666**	**92,833**	**89%**	**17.63**

Site ID: 7013

Data Collection

The participant received a Standard incentive from Ameren Missouri for adding variable frequency drives (VFD) to process chiller pumps in a manufacturing facility to control the water flow.

During the site verification visit, the model nameplates were collected, the cooling load characteristics, the manufacturing plant operating schedule and how the pump was controlled before the VFD installation project. The system did not trend data, so a one time power measurement was obtained for the motor.

Analysis Results

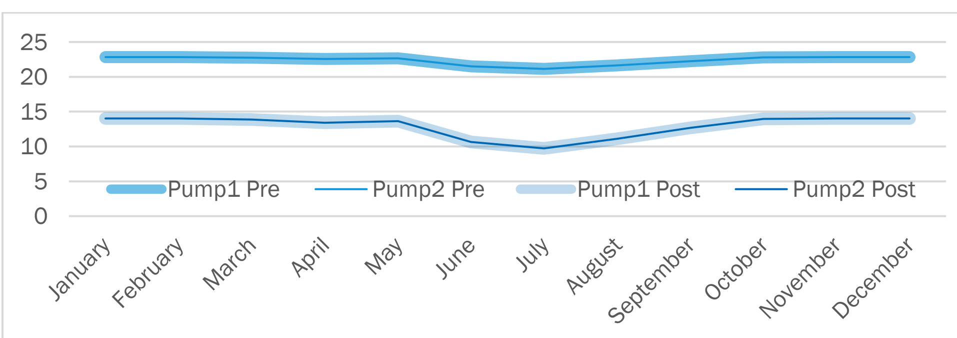
The savings for the evaluated measures from the incentivized VFD controls are presented in the following table.

Site 7013 VFD Savings and Bin Model Inputs

Measure Name	TRM	Qty	HP	Avg Speed (hz)	Pre control	Post control	Duty	Ex Ante (kWh)	Ex Post Gross (kWh)	RR_{kWh}
4080310-VFD for chilled water pump	803100	2	60	47	Full	VFD	Primary	154,752	165,779	107%
Total								**154,752**	**165,779**	**107%**

An hourly bin analysis was modeled for the two chilled water pumps in the manufacturing facility. The first dataset was with the pumps running at full speed, then with the VFD control. The pump load was based on the one-time-power reading and the frequency displayed on the VFD panel. The power curve for the pumps with and without VFD control was obtained from the Uniform Methods Project. There is a small increase in chilled water flow with temperature. When the outdoor temperature is over 80F, the site runs an additional trim pump, with the baseline pump continuing to run near full power, and the VFD modeled controlled pump, reducing speed and the load.

Site 7013 Pre and Post Chiller Pump Power



The ex post peak demand savings were determined by the Motor End Use coincident factor. The ex post End Use and ex ante End Use both identified the Motor CF factor, as the pump operates year round.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The next table presents the energy savings achieved by the measure evaluated for this site along with the peak demand savings. The peak demand kW reduction is 22.86 kW

Site 7013 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Motors	154,752	165,779	107%	22.86
Total		**154,752**	**165,779**	**107%**	**22.86**

Site ID: 7014

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7014 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060712-Fluorescent T8 replaced with LED Type A	800850	21	21	175	90			9,071	-		
		90	90	124	60			29,275	-		
		595	595	114	60			163,301	-		
		9	9	114	60	4,187	1.08	2,471	-	2,198	89%
		30	30	114	60	2,107	1.08	8,234	-	3,687	45%
		5	5	114	60	1,337	1.08	1,647	-	390	24%
		26	26	114	60			7,136	-		
		7	7	88	45	4,862	1.08	1,530	-	1,581	103%
		42	42	88	45	3,729	1.08	-	-	7,273	
		20	20	59	30	2,164	1.08	2,948	-	1,355	46%
		6	6	59	30	2,614	1.08	885	-	491	55%
		1	1	59	30	365	1.08	147	-	11	7%
		1	1	59	30	4,862	1.08	147	-	152	103%
		4	4	59	30	4,862	1.08	590	-	609	103%
		180	180	59	30	4,862	1.08	-	-	27,411	
		1190	1190	59	30	4,899	1.08	-	-	182,604	

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		54	54	59	30	4,862	1.08	-	-	8,223	
Total								227,382	-	235,986	104%

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The table above depicts the lighting fixtures installed at the facility. Line items one - three, and seven were not represented within the store. The post analysis added lines nine, and fifteen - seventeen to capture all fixtures. The post linear footage of installed lamps matches the base linear footage.

The annual lighting hours of operation verified during the M&V site visit for the fourth – sixth, and ninth - twelfth line items (ranging from 365 – 4,187) are fewer than the annual hours of operation used to calculate ex ante savings (4,750). These measures were installed within offices, storage rooms, and areas with fewer hours than the main store with the typical hours per week provided by the building tenant. The remaining measures had annual hours of operation (ranging from 4,862 – 4,899) that are greater than ex ante hours (4,750), again provided by the tenant.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7014 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	227,382	235,986	104%	44.83
Total		**227,382**	**235,986**	**104%**	**44.83**

Site ID: 7016

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7016 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060912-Interior HID replaced with LED Lamp direct-wired	800300	15	15	1080	280	8,760	1.09	112,478	-	114,581	102%
Total								**112,478**	-	**114,581**	**102%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (8,760) correspond with the annual hours of operation used to calculate ex ante savings. The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor of 1.09, applicable to another type of facility which is heated, air conditioned in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7016 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	112,478	114,581	102%	21.76
Total		**112,478**	**114,581**	**102%**	**21.76**

Site ID: 7019

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7019 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	43	40	88	50	6,727	1.08	16,722	-	12,961	78%
4060911-Interior HID replaced with LED fixture	800300	24	24	364	103	6,570	1.00	29,358	-	41,154	140%
Total								**46,080**	-	**54,116**	**117%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the first line item above (6,727) are fewer than the annual hours of operation used to calculate ex ante savings (8,760). The store hours per week were provided by the building tenant with only 2 fixtures continuously used (24/7) for security. The remaining measure, LED fixtures replacing HID, has annual hours of operation (6,570) that are greater than ex ante hours (4,380), again provided by the tenant.

A heating and cooling interactive factor of 1.08, applicable to a heated, air-conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned portion of the car wash. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 117%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for the second measure.

Site 7019 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	46,080	54,116	117%	10.28
Total		**46,080**	**54,116**	**117%**	**10.28**

Site ID: 7020

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7020 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	48	48	227	86	2,148	1.04	21,725	-	15,120	70%
		136	136	82	21	2,440	1.04	26,630	-	21,050	79%
Total								**48,355**	-	**36,170**	**75%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (2,148) are fewer than the annual hours of operation used to calculate ex ante savings (3,000). The facility has typical work hours per week (8.5 hours/5 days) provided by the building tenant.

A heating and cooling interactive factor of 1.04, applicable to a heated, air-conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 75%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive factor.

Site 7020 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	48,355	36,170	75%	6.87
Total		**48,355**	**36,170**	**75%**	**6.87**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7020 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	82	57	10,937.6
			227	114	3,002.5
Total					**13,940.1**

Site ID: 7022

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7022 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060310-Halogen BR/R 45W replaced with LED 13W	800150	1	1	75	9	1,538	1.09	147	-	110	75%
4060330-Halogen PAR 48W replaced with LED 2W	800250	13	13	75	19	453	1.09	1,874	-	356	19%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	46	46	29	16	426	1.09	1,821	-	275	15%
		43	43	29	10	264	1.09	2,250	-	233	10%
		2	2	29	10	1,538	1.09	80	-	63	79%
4060714-Fluorescent T8 replaced with LED Type B	800850	4	4	114	58	782	1.09	500	-	189	38%
		102	101	59	28	620	1.09	7,121	-	2,137	30%
Total								**13,793**	**-**	**3,363**	**24%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (ranging from 260 – 1,538) are fewer than the annual hours of operation used to calculate ex ante savings (2,086). The various areas are infrequently used with a typical hours per week provided by the building tenant.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility type of other in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 24%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7022 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	13,793	3,363	24%	0.64
Total		**13,793**	**3,363**	**24%**	**0.64**

Site ID: 7023

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7023 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060610-Fluorescent T5 replaced with LED Fixture	800800	25	25	234	150	8,760	1.00	19,630	-	18,396	94%
4060911-Interior HID replaced with LED fixture	800300	25	25	1080	150	8,760	1.00	201,756	-	203,670	101%
		25	22	455	150	8,760	1.00	70,418	-	70,737	100%
Total								**291,804**	-	**292,803**	**100%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (8,760) are greater than the annual hours of operation used to calculate ex ante savings (ranging from 8,110 – 8,736). The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned site in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 100%.

Site 7023 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	291,804	292,803	100%	55.62
Total		**291,804**	**292,803**	**100%**	**55.62**

Site ID: 7025

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7025 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060715-Fluorescent T8 replaced with LED Type C	800850	101	101	114	58	8,760	1.08	53,015	(4,459)	49,051	93%
		2	2	88	29	8,760	1.08	1,106	(93)	1,023	93%
		9	9	59	29	8,760	1.08	2,532	(213)	2,341	92%
		1	1	59	29	8,760	1.08	281	(24)	260	93%
		5	5	59	29	6,658	1.08	1,406	(90)	989	70%
		8	8	59	29	8,760	1.08	2,250	(189)	2,082	93%
		1	1	59	29	8,760	1.08	281	(24)	260	93%
		10	10	59	29	8,760	1.08	2,812	(237)	2,601	93%
		2	2	59	29	8,760	1.08	563	(47)	521	92%
		2	2	59	29	8,760	1.08	563	(47)	521	92%
		16	16	59	29	8,760	1.08	6,748	(378)	4,163	62%
		21	21	32	14	8,760	1.08	3,544	(298)	3,278	92%
		21	21	32	14	8,760	1.08	3,544	(298)	3,278	92%
Total								**78,645**	-	**70,368**	**89%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the

waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The post analysis quantity for the eleventh line item in the table above (16) is less than the ex ante savings quantity (24).

The annual lighting hours of operation verified during the M&V site visit (8,760) corresponds with the annual hours of operation used to calculate ex ante savings. The typical hours were confirmed with the site tenant.

A heating and cooling interactive factor of less than 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 89%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects and an overestimated quantity for one measure.

Site 7025 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	78,645	70,368	89%	14.58
Total		**78,645**	**70,368**	**89%**	**14.58**

Site ID: 7027

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7027 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060912-Interior HID replaced with LED Lamp direct-wired	800300	24	24	114	24	8,760	1.08	20,245	(1,703)	18,732	93%
Total								**20,245**	**(1,703)**	**18,732**	**93%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (8,760) correspond with the annual hours of operation used to calculate ex ante savings. The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned other type of facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 93%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7027 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	20,245	18,732	93%	3.88
Total		**20,245**	**18,732**	**93%**	**3.88**

Site ID: 7028

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7028 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060410-Incand Exit Sign replaced with LED 5W	800750	23	23	30	3	8,760	1.04	5,821	-	5,658	97%
4060911-Interior HID replaced with LED fixture	800300	160	160	455	135	8,760	1.04	479,908	-	466,452	97%
Total								**485,729**	-	**472,110**	**97%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (8,760) correspond with the annual hours of operation used to calculate ex ante savings. The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7028 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	485,729	472,110	97%	89.68
Total		**485,729**	**472,110**	**97%**	**89.68**

Site ID: 7029

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7029 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060810-Fluorescent T12 replaced with LED fixture	800900	6	6	164	40	52	1.04	2,388	-	40	2%
4060911-Interior HID replaced with LED fixture	800300	8	8	455	142	776	1.00	8,038	-	1,943	24%
Total								**10,426**	-	**1,983**	**19%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (52 and 776, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,000). The areas infrequently use the lighting with typical hours per week provided by the building tenant.

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings for the first line item in the table above and 1.00 for the unconditioned portion of the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 19%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive effects.

Site 7029 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	10,426	1,983	19%	0.38
Total		**10,426**	**1,983**	**19%**	**0.38**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7029 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	28
Total					**28**

Site ID: 7030

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7030 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710- Fluorescent T8 replaced with LED fixture	800850	1	1	248	51	5,110	1.08	1,156	-	1,087	94%
		1	1	248	51	5,110	1.08	1,156	-	1,087	94%
		1	1	248	51	5,110	1.08	1,156	-	1,087	94%
		138	138	124	37	5,983	1.08	70,399	-	77,576	110%
		14	14	59	20	5,110	1.08	3,201	-	3,013	94%
		1	1	16	11	5,110	1.08	30	-	28	93%
4060711- Fluorescent T8 replaced with LED retrofit kit		3	3	88	25	5,110	1.08	1,109	-	1,043	94%
		1	1	88	25	2,920	1.08	369	-	199	54%
		5	5	88	25	5,110	1.08	1,847	-	1,738	94%
		22	22	59	15	5,110	1.08	5,676	-	5,342	94%
		12	12	59	27	5,110	1.08	2,251	-	2,119	94%
		12	12	59	15	5,110	1.08	2,168	-	2,914	134%
		3	3	59	15	4,015	1.08	774	-	572	74%
		31	31	59	23	4,015	1.08	6,544	-	4,839	74%
		12	12	59	27	5,110	1.08	2,251	-	2,119	94%
		2	2	59	27	5,110	1.08	376	-	353	94%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		4	4	59	27	5,110	1.08	750	-	706	94%
		1	1	59	27	4,015	1.08	187	-	139	74%
Total								**101,400**	-	**105,963**	**105%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the fourth and twelfth line items in the above table (5,983 and 5,110, respectively) are greater than the annual hours of operation used to calculate ex ante savings (5,480 and 3,836, respectively). The areas used typical store hours per week with the fourth measure also having several fixtures with continuous use. The building tenant provided the hours of use per area within the facility. The remaining measures had annual hours of operation (ranging from 2,920 – 5,110) that are fewer than ex ante hours (5,110), again provided by the tenant.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned portion of the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 105%.

Site 7030 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	101,400	105,963	105%	20.13
Total		**101,400**	**105,963**	**105%**	**20.13**

Site ID: 7031

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7031 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060410-Incand Exit Sign replaced with LED 5W	800750	8	8	40	2	8,760	1.08	2,850	(240)	2,876	93%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	12	12	43	10	608	1.08	1,186	(22)	260	20%
4060810-Fluorescent T12 replaced with LED fixture	800900	25	25	263	48	3,854	1.08	16,610	(1,865)	22,375	123%
Total								**20,646**	**(2,126)**	**25,511**	**124%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the second line item in the table above (608) are fewer than the annual hours of operation used to calculate ex ante savings (2,888). The areas are infrequently used with a typical hours per week provided by the building tenant. The third measure, LED fixtures replacing T12s, has annual hours of operation (3,854) that are greater than ex ante hours (2,888), again provided by the tenant. The majority of this measure was installed within the main sales floor where the store is open continuously (24/7). The ex ante savings annual hours considered the facility being open approximately 8 hours/7 days a week.

A heating and cooling interactive factor of under 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 124%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for one measure.

Site 7031 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	20,646	25,511	124%	4.85
Total		**20,646**	**25,511**	**124%**	**4.85**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7031 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	43	13.4	27
		2024	263	112.6	6,723
Total					**6,750**

Site ID: 7032

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7032 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	657	657	92	36	3,317	1.06	143,298	(39,054)	90,313	63%
Total								**143,298**	**(39,054)**	**90,313**	**63%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The quantity posted on the application (657) was less than the actual quantity (675) of three lamp fixtures. The last two numbers were transposed during the application process. The correct quantity (675) produces the overall lamps installed, delivered, and invoiced (2,025). The Ex Ante (kWh) savings would have been (147,224) greater with the correct quantity.

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (3,317) are fewer than the annual hours of operation used to calculate ex ante savings (3,640). The typical hours per week provided by the building tenant.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned large office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 63%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and an overestimated heating and cooling interactive factor.

Site 7032 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	143,298	90,313	63%	24.58
Total		**143,298**	**90,313**	**63%**	**24.58**

Site ID: 7033

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7033 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814- Fluorescent T12 replaced with LED Type B	800900	225	225	164	30	2,216	1.08	67,102	-	72,157	108%
		40	40	82	30	2,216	1.08	-	-	4,978	
		34	34	82	30	2,216	1.08	-	-	4,231	
Total								**67,102**	-	**81,367**	**121%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified through secondary sources (2,216) are greater than the annual hours of operation used to calculate ex ante savings (2,080).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned education building in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 121%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site 7033 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	67,102	81,367	121%	15.46
Total		**67,102**	**81,367**	**121%**	**15.46**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7033 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	52,772
			82	64	3,255
			82	64	2,767
Total					**58,793**

Site ID: 7034

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7034 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	35	35	52.5	8	3,900	1.14	6,499	-	6,925	107%
		20	20	52.5	8	8,760	1.14	8,342	-	8,888	107%
4060714-Fluorescent T8 replaced with LED Type B	800850	608	608	88	31.5	3,900	1.14	139,545	-	152,729	109%
		8	8	56	30	3,900	1.14	868	-	925	107%
4060814-Fluorescent T12 replaced with LED Type B	800900	86	86	138	86	3,900	1.14	18,662	-	19,883	107%
Total								**173,916**	-	**189,349**	**109%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)}=\left(Qty_{pre} x\ Watts_{pre}-Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident}=kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (ranging from 3,900 – 8,760).

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 109%.

Site 7034 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	173,916	189,349	109%	35.97
Total		**173,916**	**189,349**	**109%**	**35.97**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7034 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	52.5	18.9	1,696
		2022	52.5	18.9	2,177
		2024	138	128	16,059
Total					**19,932**

Site ID: 7035

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7035 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	24	24	114	40	2,805	1.09	5,330	-	5,430	102%
4060810-Fluorescent T12 replaced with LED fixture	800900	22	24	164	40	2,805	1.09	7,948	-	8,096	102%
		10	12	82	40	2,805	1.09	1,020	-	1,040	102%
Total								**14,298**	-	**14,566**	**102%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the

HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (2,805).

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned education facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7035 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	14,298	14,566	102%	2.77
Total		**14,298**	**14,566**	**102%**	**2.77**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7035 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	5,675
			82	64	489
Total					**6,164**

Site ID: 7036

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7036 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4061000-Lighting redesign		18	154	114	114	5,808	1.07	(96,351)	-	(96,351)	100%
		176	88	114	25	5,808	1.07	111,017	-	111,017	100%
		88	20	109	28	5,808	1.07	56,130	-	56,130	100%
		26	0	108	0	5,808	1.07	17,450	-	17,450	100%
		6	35	95	35	5,808	1.07	(4,071)	-	(4,071)	100%
		375	0	95	0	5,808	1.07	221,394	-	221,394	100%
		59	55	90	52	5,808	1.07	15,226	-	15,226	100%
		16	10	84	80	5,808	1.07	3,381	-	3,381	100%
		84	154	71	48	5,808	1.07	(8,874)	-	(8,874)	100%
		6	14	59	44	5,808	1.07	(1,628)	-	(1,628)	100%
		162	113	59	87	5,808	1.07	(1,697)	-	(1,697)	100%
		59	9	55	42	5,808	1.07	17,817	-	17,817	100%
		42	51	53	39	5,808	1.07	1,473	-	1,473	100%
		95	45	51	48	5,808	1.07	16,686	-	16,686	100%
		114	31	47	28	5,808	1.07	27,903	-	27,903	100%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		24	0	42	0	5,808	1.07	6,264	-	6,264	100%
		114	25	14	58	5,808	1.07	907	-	907	100%
		52	16	11	20	5,808	1.07	1,566	-	1,566	100%
		59	32	6	35	5,808	1.07	(4,760)	-	(4,760)	100%
Total								**379,834**	-	**379,834**	**100%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (5,808).

A heating and cooling interactive factor of 1.07, applicable to a heated, air conditioned supermarket in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned portion of the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 32%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours when the building was retrofitted for a new tenant.

Site 7036 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	379,834	379,834	100%	72.16
Total		**379,834**	**379,834**	**100%**	**72.16**

Site ID: 7037

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7037 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714- Fluorescent T8 replaced with LED Type B	800850	45	45	221	90	4,790	1.04	30,214	-	29,367	97%
Total								**30,214**	-	**29,367**	**97%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (4,790).

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7037 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	30,214	29,367	97%	5.58
Total		**30,214**	**29,367**	**97%**	**5.58**

Site ID: 7038

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7038 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060813-Fluorescent T12 replaced with LED Type A/B	800900	520	520	122	30	3,300	1.08	168,923	-	170,502	101%
		48	48	122	30	3,300	1.08	15,593	-	15,739	101%
		14	14	122	30	2,600	1.08	3,583	-	3,617	101%
		66	66	82	30	3,300	1.08	12,118	-	12,232	101%
		58	58	82	30	3,300	1.08	10,649	-	10,749	101%
		31	31	82	15	2,600	1.08	5,778	-	5,832	101%
		61	61	48	15	3,300	1.08	7,108	-	7,174	101%
		140	140	48	15	3,300	1.08	16,313	-	16,466	101%
		118	118	48	15	2,600	1.08	10,833	-	10,934	101%
Total								**250,899**	-	**253,244**	**101%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (3,300).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7038 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	250,899	253,244	101%	48.11
Total		**250,899**	**253,244**	**101%**	**48.11**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7038 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	122	96	122,316
			122	96	11,291
			122	96	2,595
			82	64	7,998
			82	64	7,028
			82	64	4,265
			48	32	3,696
			48	32	8,482
			48	32	5,633

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Total					173,304

Site ID: 7039

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7039 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	52	52	42	10	2,900	1.08	5,163	(1,013)	4,199	81%
4060614-Fluorescent T5 replaced with LED Type B	800800	1	1	234	25	2,900	1.08	648	(127)	528	81%
4060714-Fluorescent T8 replaced with LED Type B	800850	14	14	221	45	2,900	1.08	7,646	(1,501)	6,216	81%
		4	4	59	15	2,900	1.08	546	(107)	444	81%
4060814-Fluorescent T12 replaced with LED Type B	800900	22	22	164	39	2,900	1.08	9,147	(1,675)	6,938	76%
		45	45	138	43	2,900	1.08	13,265	(2,603)	10,786	81%
		12	12	82	15	2,900	1.08	2,495	(490)	2,028	81%
		2	2	74	12	2,900	1.08	384	(76)	312	81%
		20	20	72	15	2,900	1.08	3,537	(694)	2,876	81%
4060912-Interior HID replaced with	800300	1	1	455	75	2,900	1.08	1,179	(231)	959	81%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
LED Lamp direct-wired											
Total								**44,011**	**(8,517)**	**35,287**	**81%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (2,900).

A heating and cooling interactive factor of under 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 81%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7039 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	44,011	35,287	81%	8.32
Total		**44,011**	**35,287**	**81%**	**8.32**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7039 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	42	13.4	554
		2024	164	128	6,132
			138	128	11,980
			82	64	1,842
			74	96	526
			72	64	3,069
Total					**24,103**

Site ID: 7040

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7040 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060712-Fluorescent T8 replaced with LED Type A	800850	2	2	114	64	4,750	1.08	508	-	513	101%
		130	130	114	64	4,750	1.08	33,036	-	33,345	101%
		32	32	114	64	4,750	1.08	8,132	-	8,208	101%
		6	6	114	64	4,750	1.08	1,525	-	1,539	101%
		1	1	114	64	4,750	1.08	254	-	257	101%
		8	8	114	64	4,750	1.08	2,033	-	2,052	101%
		748	748	88	48	4,750	1.08	152,068	-	153,490	101%
		4	4	88	48	4,750	1.08	813	-	821	101%
		23	23	88	48	4,750	1.08	4,676	-	4,720	101%
		14	14	88	48	4,750	1.08	2,846	-	2,873	101%
		94	94	88	48	4,750	1.08	19,110	-	19,289	101%
		2	2	88	48	4,750	1.08	407	-	410	101%
		108	108	88	48	4,750	1.08	21,956	-	22,162	101%
		6	6	88	48	4,750	1.08	1,220	-	1,231	101%
		15	15	59	32	4,750	1.08	2,059	-	2,078	101%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		23	23	59	32	4,750	1.08	3,157	-	3,186	101%
Total								**253,800**	-	**256,172**	**101%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (4,750).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7040 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	253,800	256,172	101%	48.66
Total		**253,800**	**256,172**	**101%**	**48.66**

Site ID: 7041

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7041 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060320-Halogen MR-16 35W replaced with LED 20W	800200	38	38	50	7	4,368	1.14	7,637	-	8,137	107%
4060330-Halogen PAR 48W replaced with LED 2W	800250	95	85	75	11	4,368	1.14	28,931	-	30,823	107%
4060814-Fluorescent T12 replaced with LED Type B	800900	390	390	82	24	3,744	1.14	90,618	-	96,546	107%
Total								**127,185**	-	**135,506**	**107%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre}-Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident}=kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (3,744-4,368).

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 107%.

Site 7041 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	127,185	135,506	107%	25.74
Total		**127,185**	**135,506**	**107%**	**25.74**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7041 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	82	64	66,583
Total					**66,583**

Site ID: 7042

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7042 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060713-Fluorescent T8 replaced with LED Type A/B	800850	138	138	114	36	5,824	1.08	67,077	-	67,705	101%
		7	7	59	18	5,824	1.08	1,788	-	1,805	101%
4060813-Fluorescent T12 replaced with LED Type A/B	800900	1	1	82	36	5,824	1.08	287	-	289	101%
Total								**69,152**	-	**69,799**	**101%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the

HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (5,824).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 101%.

Site 7042 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	69,152	69,799	101%	13.26
Total		**69,152**	**69,799**	**101%**	**13.26**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7042 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	82	64	176
Total					**176**

Site ID: 7043

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7043 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060912-Interior HID replaced with LED Lamp direct-wired	800300	112	112	1080	450	3,920	1.09	295,957	-	301,489	102%
Total								**295,957**	-	**301,489**	**102%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (3,920).

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned portion of the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 102%.

Site 7043 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	295,957	301,489	102%	57.27
Total		**295,957**	**301,489**	**102%**	**57.27**

Site ID: 7044

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7044 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060812-Fluorescent T12 replaced with LED Type A	800900	30	30	82	30	4,500	1.14	7,511	(1,334)	8,003	89%
Total								**7,511**	**(1,334)**	**6,669**	**89%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (4,500).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 89%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7044 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	7,511	6,669	89%	1.52
Total		**7,511**	**6,669**	**89%**	**1.52**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7044 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	82	64	5,233
Total					**5,233**

Site ID: 7045

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7045 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4061000-Lighting redesign		214	115	455	265	6,462	1.04	462,535	-	449,567	97%
		36	15	360	265	6,462	1.04	62,125	-	60,384	97%
Total								**524,660**	-	**509,950**	**97%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (6,462).

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 97%.

Site 7045 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	524,660	509,950	97%	96.87
Total		**524,660**	**509,950**	**97%**	**96.87**

Site ID: 7046

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7046 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060814-Fluorescent T12 replaced with LED Type B	800900	8	8	164	60	3,390	1.11	3,018	(592)	2,539	84%
		2	2	82	30	3,390	1.11	378	(74)	317	84%
		2	2	82	15	3,390	1.11	486	(95)	409	84%
Total								**3,882**	**(762)**	**3,265**	**84%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (3,390).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 84%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7046 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	3,882	3,265	84%	0.77
Total		**3,882**	**3.265**	**84%**	**0.77**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7046 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	2,047
			82	64	256
			82	64	369
Total					**2,672**

Site ID: 7047

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7047 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060330-Halogen PAR 48W replaced with LED 2W	800250	24	24	75	14	4,000	1.08	6,266	(1,288)	5,036	80%
		24	24	75	14	4,000	1.08	6,266	(1,288)	5,036	80%
Total								**12,532**	**(2,577)**	**10,072**	**80%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (4,000).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned portion of the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 80%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7047 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	12,532	10,072	80%	2.40
Total		**12,532**	**10,072**	**80%**	**2.40**

Site ID: 7048

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7048 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060330-Halogen PAR 48W replaced with LED 2W	800250	14	14	65	11	2,607	1.04	2,109	(512)	1,538	73%
4060810-Fluorescent T12 replaced with LED fixture	800900	50	50	164	40	2,607	1.04	17,434	(4,202)	12,608	72%
		16	16	82	40	2,607	1.04	1,919	(455)	1,367	71%
4060911-Interior HID replaced with LED fixture	800300	96	96	455	150	3,787	1.04	118,645	(28,830)	86,489	73%
Total								**140,108**	**(34,000)**	**102,002**	**72%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (2,607 and 3,787).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 72%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7048 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	140,108	102,002	72%	25.84
Total		**140,108**	**102,002**	**72%**	**25.84**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7048 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	11,930
			82	64	1,041
Total					**12,971**

Site ID: 7049

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7049 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060330-Halogen PAR 48W replaced with LED 2W	800250	8	8	65	18	5,148	1.14	2,071	-	2,207	107%
		12	12	50	12	8,760	1.14	4,275	-	4,554	107%
		14	14	50	12	5,148	1.14	2,930	-	3,122	107%
4060711-Fluorescent T8 replaced with LED retrofit kit	800850	55	55	89	22	8,760	1.14	34,540	-	36,800	107%
		2298	2298	88	36	8,760	1.14	1,120,060	-	1,193,335	107%
		293	293	56	22	8,760	1.14	93,376	-	99,485	107%
		10	10	56	22	5,148	1.14	1,873	-	1,995	107%
4060714-Fluorescent T8 replaced with LED Type B		38	38	59	26	8,760	1.14	11,754	-	12,523	107%
4060715-Fluorescent T8 replaced with LED Type C		15	15	114	48	8,760	1.14	9,280	-	9,887	107%
		43	43	88	36	8,760	1.14	20,959	-	22,330	107%
		256	256	59	24	8,760	1.14	83,984	-	89,478	107%
		37	37	59	24	5,148	1.14	7,134	-	7,600	107%
		10	10	32	18	8,760	1.14	1,312	-	1,398	107%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060815-Fluorescent T12 replaced with LED Type C	800900	1	1	138	72	8,760	1.14	618	-	659	107%
Total								**1,394,166**	**-**	**1,485,372**	**107%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (5,148 and 8,760).

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross RR is 107%.

Site 7049 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	1,394,166	1,485,372	107%	282.17
Total		**1,394,166**	**1,485,372**	**107%**	**282.17**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7049 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	138	128	559
Total					**559**

Site ID: 7050

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7050 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060814-Fluorescent T12 replaced with LED Type B	800900	79	79	82	24	8,736	1.14	42,831	(400)	45,232	106%
		30	30	82	24	8,736	1.14	16,265	(152)	17,177	106%
		20	20	82	24	4,368	1.14	5,422	(51)	5,725	106%
		28	28	82	24	4,368	1.14	7,591	(71)	8,016	106%
		16	16	82	24	8,736	1.14	8,674	(81)	9,161	106%
		19	19	82	24	8,736	1.14	10,301	(96)	10,879	106%
		15	15	82	24	4,368	1.14	4,067	(38)	4,294	106%
		10	10	82	24	2,912	1.14	1,807	(17)	1,908	106%
Total								**96,958**	**(906)**	**102,392**	**106%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante hours (2,912 – 8,736).

A heating and cooling interactive factor of 1.14, applicable to an electric heated, air conditioned hotel in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned portion of the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 106%.

Site 7050 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	96,958	102,392	106%	19.62
Total		**96,958**	**102,392**	**106%**	**19.62**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7050 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	82	64	31,471
			82	64	11,951

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
			82	64	3,984
			82	64	5,577
			82	64	6,374
			82	64	7,569
			82	64	2,988
			82	64	1,328
Total					**71,240**

Site ID: 7051

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7051 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	2	2	45.45	11	6,400	1.08	472	-	476	101%
		3	3	42	9	6,400	1.08	678	-	684	101%
4060711-Fluorescent T8 replaced with LED retrofit kit	800850	6	6	59	30	6,400	1.08	1,192	-	1,203	101%
		22	22	164	50	6,400	1.08	17,175	-	17,335	101%
		3	3	164	50	6,400	1.08	2,342	-	2,364	101%
		182	182	133	30	6,400	1.08	128,373	-	129,572	101%
		5	5	122	50	6,400	1.08	2,465	-	2,488	101%
		15	15	82	30	6,400	1.08	5,341	-	5,391	101%
		9	9	82	30	6,400	1.08	3,205	-	3,235	101%
		1	1	82	30	6,400	1.08	356	-	359	101%
		3	3	56	40	6,400	1.08	329	-	332	101%
		12	12	48	30	6,400	1.08	4,109	-	1,493	36%
		9	9	48	30	6,400	1.08	1,109	-	1,120	101%
Total								**167,145**	**-**	**166,053**	**99%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The baseline quantity for the twelfth line item in the table above (12) is fewer than the ex ante savings quantity (21). The twelve other measures are a one to one upgrade and the invoiced quantity corresponds with the efficient installed quantities.

The annual lighting hours of operation reference the ex ante savings hours (6,400).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 99%.

Site 7051 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	167,145	166,053	99%	31.54
Total		**167,145**	**166,053**	**99%**	**31.54**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7051 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	45.45	13.4	33
			42	13.4	91
		2024	164	128	11,861
			164	128	1,617
			133	96	83,027
			122	96	1,590
			82	64	3,525
			82	64	2,115
			82	64	235
			56	32	-
			48	32	166
			48	32	124
Total					**208,737**

Site ID: 7052

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7052 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060710-Fluorescent T8 replaced with LED fixture	800850	1	1	124	37	5,480	1.08	510	-	515	101%
		1	1	16	11	5,480	1.08	29	-	30	101%
		174	174	124	37	5,480	1.08	88,763	-	89,593	101%
		2	2	114	25	5,480	1.08	1,043	-	1,053	101%
		4	4	88	25	5,480	1.08	1,478	-	1,491	101%
		4	4	88	25	5,480	1.08	1,478	-	1,491	101%
		6	6	88	25	5,480	1.08	2,216	-	2,237	101%
		11	11	59	15	5,480	1.08	2,839	-	2,865	101%
		4	4	59	15	5,480	1.08	1,031	-	1,042	101%
		1	1	59	20	5,480	1.08	228	-	231	101%
		9	9	59	27	5,480	1.08	1,688	-	1,704	101%
		2	2	59	27	5,480	1.08	376	-	379	101%
		2	2	59	27	5,480	1.08	376	-	379	101%
		1	1	59	27	3,836	1.08	131	-	133	101%
		3	3	59	27	5,480	1.08	563	-	568	101%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
		45	45	59	23	5,480	1.08	9,498	-	9,588	101%
Total								**112,247**	**-**	**115,657**	**101%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (5,480).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7052 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	112,247	115,657	101%	21.52
Total		**112,247**	**115,657**	**101%**	**21.52**

Site ID: 7053

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7053 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411- Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	40	40	43	8.5	1,500	1.14	2,119	-	2,359	111%
4060714- Fluorescent T8 replaced with LED Type B	800850	64	64	114	42	2,300	1.14	11,341	-	12,080	107%
		834	834	88	32	2,300	1.14	114,939	-	122,431	107%
		133	133	59	21	2,300	1.14	12,438	-	13,249	107%
		10	10	32	11	2,300	1.14	517	-	551	107%
4060814- Fluorescent T12 replaced with LED Type B	800900	44	44	72	15	2,300	1.14	6,172	-	6,575	107%
4060910- HID replaced with LED fixture	800300	65	65	455	178	3,000	1.14	66,709	-	61,573	92%
Total								**214,235**	**-**	**218,818**	**102%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage for the first measure in the table above (8.5W) is less than the efficient ex ante savings wattage (9W).

The annual lighting hours of operation verified during the M&V site visit (ranging from 1,500 – 3,000) correspond with the annual hours of operation used to calculate ex ante savings. The typical hours per week provided by the building tenant.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7053 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	214,235	218,818	102%	41.57
Total		**214,235**	**218,818**	**102%**	**41.57**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings. In addition omni directional lamps and their equivalent CFL wattages are listed.

Site 7053 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	43	13.4	335
		2024	72	32	1,961
Total					**2,296**

Site ID: 7058

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7058 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060340-Halogen A-Lamp > 28 W replaced with LED Lamp	800050	225	225	43	11	6,441	1.14	67,487	-	52,866	78%
4060614-Fluorescent T5 replaced with LED Type B	800800	165	165	54	19	8,760	1.14	102,355	-	57,671	56%
4060714-Fluorescent T8 replaced with LED Type B	800850	16	16	114	56	4,823	1.14	8,698	-	5,103	59%
		160	160	59	28	5,474	1.14	46,490	-	30,950	67%
		3	3	59	28	4,823	1.14	872	-	511	59%
Total								**225,902**	-	**147,101**	**65%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post})xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The quantity of the second line item in the table above verified during the M&V site visit (165) is fewer than the quantity used to calculate ex ante savings (312).

The annual lighting hours of operation verified during the M&V site visit for the second measure (8,760) correspond with the annual hours of operation used to calculate ex ante savings. The remaining measures had annual lighting hours (ranging from 4,823 – 6,441) which are fewer than the ex ante savings hours (8,760). The building tenant provided the typical hours per week for each area within the facility.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned apartment in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 65%. The ex ante energy savings estimate was premised on an overestimated installed quantity and overestimated annual lighting operating hours for the majority of the facility.

Site 7058 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	225,902	147,101	65%	27.94
Total		**225,902**	**147,101**	**65%**	**27.94**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for omni directional and their equivalent CFL wattage with the post midlife shift energy savings.

Site 7058 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	43	13.4	3,965
Total					**3,965**

Site ID: 7065

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7065 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060713-Fluorescent T8 replaced with LED Type A/B	800850	8	8	124	60	6,419	1.09	3,647	-	3,582	98%
		133	133	124	60	6,419	1.09	60,622	-	59,554	98%
		102	102	124	60	6,419	1.09	46,492	-	45,673	98%
		34	34	124	60	6,419	1.09	15,498	-	15,224	98%
		4	4	124	60	3,021	1.09	855	-	843	99%
		2	2	124	60	77	1.09	35	-	11	31%
		12	12	124	60	5,569	1.09	5,470	-	4,662	85%
		5	5	124	60	5,569	1.09	2,279	-	1,943	85%
		17	17	124	60	6,419	1.09	7,749	-	7,612	98%
		4	4	124	60	6,419	1.09	1,709	-	1,791	105%
		16	16	124	60	6,419	1.09	7,293	-	7,164	98%
		53	53	59	30	3,021	1.09	5,131	-	5,060	99%
		24	24	59	30	2,685	1.09	3,444	-	2,037	59%
		13	13	59	30	3,021	1.09	1,258	-	1,241	99%
		4	4	59	30	3,021	1.09	574	-	382	67%
		29	29	59	30	308	1.09	469	-	283	60%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		9	9	59	30	3,021	1.09	1,723	-	859	50%
		6	6	59	30	6,419	1.09	1,239	-	1,217	98%
		8	8	59	30	1,542	1.09	645	-	390	60%
		2	2	59	30	5,569	1.09	413	-	352	85%
Total								**165,545**	-	**159,880**	**97%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The base and efficient wattages for rows thirteen, fifteen, and seventeen in the table above (59W and 30W) are fewer than the wattages used to calculate the ex ante savings estimate (88W and 45W). The baseline fixtures were confirmed by the building tenant and employees to have been 2-Lamp fixtures and never 3-Lamp as stated on the application.

The annual lighting hours of operation verified during the M&V site visit (ranging from 77 – 6,419) are fewer than the annual hours of operation used to calculate ex ante savings (ranging from 260 – 6,656). The typical hours per week for each area of the facility was provided by the building tenant.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7065 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	165,545	159,880	97%	30.37
Total		**165,545**	**159,880**	**97%**	**30.37**

Site ID: 7067

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant’s website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7067 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060330-Halogen PAR 48W replaced with LED 2W	800250	24	24	75	10	2,777	1.14	4,636	-	4,939	107%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	19	19	60	8	200	1.14	139	-	147	106%
4060614-Fluorescent T5 replaced with LED Type B	800800	0	0	59	15	2,777	1.14	262	-	-	0%
4060714-Fluorescent T8 replaced with LED Type B	800850	343	343	114	40	2,777	1.14	75,420	-	80,354	107%
		97	97	88	30	2,777	1.14	16,717	-	17,811	107%
		340	340	59	20	2,777	1.14	39,401	-	41,978	107%
		4	4	32	18	2,777	1.14	166	-	177	107%
		2	2	32	10	2,777	1.14	131	-	139	106%
4060911-Interior HID	800300	44	44	455	150	2,777	1.14	39,877	-	42,485	107%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
replaced with LED fixture											
Total								176,749	-	188,030	106%

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The third line item in the table above was not invoiced and efficient not installed. Trade ally was contacted and confirmed the findings.

The annual lighting hours of operation referenced the ex ante savings hours (ranging from 200 – 2,777).

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned secondary educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 106%.

Site 7067 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	176,749	188,030	106%	35.72

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Total		176,749	188,030	106%	35.72

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7067 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	60	13.4	23
Total					23

Site ID: 7068

Data Collection

The participant received Standard incentives from Ameren Missouri for replacing sixteen rooftop HVAC units with efficient units.

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. For an alternate method to validate the TRM savings algorithm, a weather billing regression was also performed.

Analysis Results

The savings for the evaluated measures to replace the HVAC rooftop units are presented in the following table.

Site 7068 Rooftop HVAC savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Eff	Post Eff	EFLH	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051910-HVAC packaged <65,000 BTU		3	3	13	17		4,626	4,489	98%
4051911-HVAC packaged 135-240,000 BTU	803250	1	1	11.2	12 12.5	1,053	2,306	7,848	340%
4051912-HVAC packaged 240-760000 BTU		12	12	11	12		50,544	120,961	239%
Total							**57,476**	**133,298**	**232%**

The baseline was determined as a replace on fail type, using the St Louis County local building code as the minimum efficient point, but utilized a more recent building code that provides the baseline in terms of both the EER and IEER for units with capacities of 135,000 BTU. The higher IEER baseline for this standard was matched to the AHRI ratings of 20 and 20.2 for the new rooftop units.

Site 7068 Ex ante and Ex Post Efficiency Ratings

Measure Name	Ex Ante Efficiency	Units	Ex Post Efficiency	Units	RR
4051910-HVAC packaged <65,000 BTU	19.5 20.2	SEER	19.5 20.2	SEER	98%
4051911-HVAC packaged 135-240,000 BTU	12.7	EER	20.2	IEER	340%
4051912-HVAC packaged 240-760000 BTU	12	EER	20	IEER	239%

The annual energy savings were calculated using the TRM based algorithm below for each pair of pre and post units

$$kWh_{savings} = \left(\frac{1}{SEER_{pre}} - \frac{1}{SEER_{post}}\right) xEFLH_{cooling} x \ Capacity \ x \ \frac{1 \ kWh}{1{,}000 \ Wh}$$

The ex post savings of 133,298 was factored by the CF value for the Cooling End use by the formula:

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x \ \ CF$$

The ex post energy savings of 133,298 kWh were higher than the ex ante savings of 57,746 using the same method to determine the savings. There were thirteen of these rooftop units over 135,000 BTU which were identified as Ultra High Efficiency by the manufacturer, with high IEER part load efficiencies.

The regression for billing kWh data with normalized heating and cooling degree days support the project reaching the expected savings. Although the billing regression obtained an R square statistic of 0.95, and significant factors with CCD and a Pre/Post flag of less than 0.05 p-statistic value, the savings method was not chosen due to the limited months with cooling degree days. The project energy and peak demand savings are listed in the following table.

Site 7068 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Cooling	57,476	133,298	232%	52.34
Total		**57,476**	**133,298**	**232%**	**52.34**

Site ID: 7072

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7072 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060611-Fluorescent T5 replaced with LED retrofit Kit	800800	321	321	56	31	4,238	1.08	36,064	(7,142)	29,586	82%
4060711-Fluorescent T8 replaced with LED retrofit kit	800850	88	88	59	23	4,238	1.08	14,236	(2,819)	11,680	82%
		115	115	56	30	4,238	1.08	13,437	(2,661)	11,023	82%
		1142	1142	56	31	4,238	1.08	128,304	(25,407)	105,259	82%
4060712-Fluorescent T8 replaced with LED Type A		40	40	59	36	4,238	1.08	4,134	(819)	3,392	82%
		292	292	59	36	4,238	1.08	30,183	(5,977)	24,760	82%
		131	131	32	18	4,238	1.08	8,241	(1,632)	6,762	82%
		335	335	32	18	4,238	1.08	21,077	(4,174)	17,291	82%
Total								**255,676**	**(50,631)**	**209,753**	**82%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (4,238) are greater than the annual hours of operation used to calculate ex ante savings (4,200). The typical hours per week provided by the building tenant.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 82%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7072 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	255,676	209,753	82%	49.46
Total		**255,676**	**209,753**	**82%**	**49.46**

Site ID: 7074

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7074 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060911- Interior HID replaced with LED fixture	800300	28	28	1080	183	5,606	1.09	117,385	-	153,484	131%
Total								**117,385**	-	**153,484**	**131%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (5,606) are greater than the annual hours of operation used to calculate ex ante savings (4,368). The typical hours per week provided by the building tenant.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 131%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site 7074 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	117,385	153,484	131%	29.16
Total		**117,385**	**153,484**	**131%**	**29.16**

Site ID: 7075

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7075 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060713-Fluorescent T8 replaced with LED Type A/B	800850	22	22	114	66	1,884	1.11	4,219	-	2,208	52%
		13	13	88	50	1,884	1.11	646	-	1,033	160%
		2	2	56	35	1,884	1.11	119	-	88	74%
Total								**4,984**	-	**3,329**	**67%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The ex post quantities for the first- and second-line items in the table above (22 and 13, respectively) differ from the ex ante savings quantities (31 and 6, respectively). The building tenant and employees confirmed the efficient lamps per fixture matched the baseline lamps per fixture.

The annual lighting hours of operation verified during the M&V site visit (1,884) are fewer than the annual hours of operation used to calculate ex ante savings (2,650). The typical hours per week provided by the building tenant. The ex ante appears to include Fridays and every Saturday in the work schedule which is not accurate.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 67%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and a difference in installed quantities.

Site 7075 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	4,984	3,329	67%	0.63
Total		**4,984**	**3,329**	**67%**	**0.63**

Site ID: 7076

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7076 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060611- Fluorescent T5 replaced with LED retrofit Kit	800800	44	44	360	85	7,021	1.14	110,930	-	96,845	87%
4060711- Fluorescent T8 replaced with LED retrofit kit	800850	101	101	221	85	7,021	1.14	125,928	-	109,940	87%
		4	4	221	85	7,021	1.14	4,987	-	4,354	87%
		1	1	114	42	7,021	1.14	660	-	576	87%
		4	4	114	33	3,057	1.14	2,970	-	1,129	38%
		52	52	88	33	3,057	1.14	13,936	-	9,966	72%
		48	48	88	33	7,021	1.14	24,202	-	21,130	87%
		2	2	59	21	3,057	1.14	370	-	265	72%
		139	139	59	21	7,021	1.14	48,424	-	42,276	87%
		8	8	59	17	8,760	1.14	3,081	-	3,355	109%
		8	8	59	21	7,021	1.14	2,787	-	2,433	87%
4060910- HID replaced with LED fixture	800300	13	13	1080	200	7,021	1.14	89,843	-	96,557	107%
Total								**491,083**	-	**433,853**	**88%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The ex ante savings estimate for the last item in the table above (89,843) is greater than the actual ex ante calculation (85,196). There was an error within the application v.6.1.0 for the tab HID to LED where an additional savings was applied. The error was relayed to the implementer.

The annual lighting hours of operation verified during the M&V site visit for the tenth and twelfth line items (8,760 and 7,021, respectively) are greater than the annual hours of operation used to calculate ex ante savings (8,568 and 6,960, respectively). The remaining measures have hours of operation (ranging from 3,057 – 7,021) which are fewer than the ex ante hours (ranging from 4,554 – 8,568). The typical hours per week for each area of the facility was provided by the building tenant.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 88%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for most of the measures.

Site 7076 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	491,083	433,853	88%	82.35
Total		**491,083**	**433,853**	**88%**	**82.35**

Site ID: 7077

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7077 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411- Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	46	46	43	11	1,415	1.11	2,014	-	2,312	115%
4060714- Fluorescent T8 replaced with LED Type B	800850	326	326	114	30	2,729	1.11	93,102	-	82,961	89%
		106	106	59	30	2,729	1.11	10,261	-	9,313	91%
		60	60	28	15	2,418	1.11	2,604	-	2,094	80%
Total								**107,981**	-	**96,680**	**90%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the

HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The quantity for the second line item in the table above (326) is fewer than the quantity used to calculate ex ante savings (332). There were 6 fixtures within the facility that had not been retrofitted which the building tenant confirmed.

The annual lighting hours of operation verified during the M&V site visit for the first line item (1,420) are greater than the annual hours of operation used to calculate ex ante savings (1,320). The remaining measure have annual hours (ranging from 2,418 – 2,729) which are fewer than the hours used to calculate the ex ante savings (3,120). The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 90%.

Site 7077 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	107,981	96,680	90%	18.37
Total		**107,981**	**96,680**	**90%**	**18.37**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7077 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	43	13.4	173
Total					**173**

Site ID: 7078

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7078 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060610-Fluorescent T5 replaced with LED Fixture	800800	40	40	120	32	4,729	1.14	15,066	-	18,977	126%
		2	2	120	32	4,153	1.14	753	-	833	111%
Total								**15,819**	-	**19,810**	**125%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (ranging from 4,153 – 4,729) are greater than the annual hours of operation used to calculate ex ante savings (4,000). The typical hours per week provided by the building tenant per usage area.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned secondary education facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 125%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site 7078 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	15,819	19,810	125%	3.76
Total		**15,819**	**19,810**	**125%**	**3.76**

Site ID: 7079

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7079 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	84	84	59	24	3,168	1.09	12,080	(2,235)	7,918	66%
Total								**12,080**	**(2,235)**	**7,918**	**66%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the first line item (3,168) are fewer than the annual hours of operation used to calculate ex ante savings (3,840). The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 66%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive effects.

Site 7079 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	12,080	7,918	66%	1.93
Total		**12,080**	**7,918**	**66%**	**1.93**

Site ID: 7080

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7080 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714- Fluorescent T8 replaced with LED Type B	800850	1019	1019	114	29	3,339	1.14	337,347	-	329,649	98%
Total								**337,347**	-	**329,649**	**98%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (3,339) are fewer than the annual hours of operation used to calculate ex ante savings (3,640). The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 98%.

Site 7080 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	337,347	329,649	98%	62.62
Total		**337,347**	**329,649**	**98%**	**62.62**

Site ID: 7082

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7082 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060912-Interior HID replaced with LED Lamp direct-wired	800300	6	6	455	125	2,265	1.04	4,562	(1,166)	3,499	77%
Total								**4,562**	**(1,166)**	**3,499**	**77%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (2,265) are fewer than the annual hours of operation used to calculate ex ante savings (2,304). The area is infrequently used with a typical hours per week provided by the building tenant.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 77%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive effects.

Site 7082 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	4,562	3,499	77%	0.89
Total		**4,562**	**3,499**	**77%**	**0.89**

Site ID: 7083

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7083 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060340-Halogen A-Lamp > 28 W replaced with LED Lamp	800050	1430	1430	43	9	728	1.14	304,893	-	40,351	13%
Total								**304,893**	-	**40,351**	**13%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The baseline measure was not a Halogen 60W but an Incandescent A-line 60W. The site tenant provided A-line lamps in storage as evidence and stated no Halogens were ever used in the fixtures. The baseline wattage in the ex post savings analysis (43W) represents an A-line 60W lamp and not the Halogen wattage in the application (60W).

The quantity verified during the M&V site visit installed (1,430) is fewer than the quantity used to calculate ex ante savings (1,552). The site contact confirmed the installation quantity by providing an installation floor plan. The number of lamps per apartment type was confirmed during the site visit. There were several boxes of efficient lamps in storage.

The annual lighting hours of operation verified during the M&V site visit (728) are fewer than the annual hours of operation used to calculate ex ante savings (3,600). The post saving analysis used the Ameren Missouri TRM hours for a residence. The survey of actual residents and their use of the installed measures was less than the TRM hours.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned apartment in St. Louis, was applied to the ex post lighting energy. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 13%. The ex ante energy savings estimate was premised on overestimated baseline wattage, overestimated installed quantity, and overestimated annual lighting operating hours.

Site 7083 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	304,893	40,351	13%	7.67
Total		**304,893**	**40,351**	**13%**	**7.67**

Site ID: 7084

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7084 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	26	26	164	21	2,171	1.11	8,020	(1,695)	7,263	91%
		3	3	72	36	708	1.11	232	(16)	69	30%
Total								**8,252**	**(1,711)**	**7,332**	**89%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (2,171) are greater than the annual hours of operation used to calculate ex ante savings (2,000). The typical hours per week were provided by the building tenant. The remaining measure has annual hours of operation (708) that are fewer than ex ante hours (2,016), again provided by the tenant. This measure was installed in an infrequently used conference room.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 89%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects and overestimated annual lighting operating hours for one measure.

Site 7084 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	8,252	7,332	89%	1.72
Total		**8,252**	**7,332**	**89%**	**1.72**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7084 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	6,703
			72	64	66
Total					**6,769**

Site ID: 7085

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7085 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	4	4	114	37	4,202	1.08	1,583	(285)	1,113	70%
		6	6	59	30	4,202	1.08	893	(161)	629	70%
		24	24	32	19	4,202	1.08	1,602	(288)	1,128	70%
4060711-Fluorescent T8 replaced with LED retrofit kit		277	277	114	37	5,101	1.08	109,546	(23,938)	93,576	85%
		14	14	114	37	4,202	1.08	5,537	(996)	3,896	70%
		4	4	114	37	4,202	1.08	1,583	(285)	1,113	70%
		28	28	114	53	5,211	1.08	10,965	(1,958)	7,654	70%
		43	43	114	46	4,202	1.08	15,019	(2,703)	10,566	70%
		1	1	59	37	4,202	1.08	112	(20)	80	71%
		5	5	59	23	4,202	1.08	924	(166)	651	70%
		13	13	46	16	4,202	1.08	2,003	(361)	1,409	70%
Total								**149,767**	**(31,161)**	**121,815**	**81%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The quantity of the seventh line item in the table above (28) is fewer than the quantity used to calculate the ex ante savings (35). The building tenant confirmed there no fixtures removed from the area.

The annual lighting hours of operation verified during the M&V site visit for the fourth- and seventh-line items in the table above (5,101 and 5,211, respectively) are greater than the annual hours of operation used to calculate ex ante savings (4,800). The typical hours per week were provided by the building tenant. The remaining measures had annual hours of operation (4,202) that are less than ex ante hours (4,800), again provided by the tenant.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 81%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects, overestimated annual lighting operating hours for a portion of the project, and a greater installed quantity for one measure.

Site 7085 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	149,767	121,815	81%	29.06
Total		**149,767**	**121,815**	**81%**	**29.06**

Site ID: 7086

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7086 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	48	48	114	68	2,727	1.11	7,088	-	6,683	94%
		10	10	59	34	3,845	1.11	803	-	1,067	133%
4060911-Interior HID replaced with LED fixture	800300	23	21	455	200	2,727	1.00	20,111	-	17,084	85%
Total								**28,002**	-	**24,834**	**89%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the second line item in the table above (3,845) are greater than the annual hours of operation used to calculate ex ante savings (3,000). The area had 20% of the measure with continuous usage, with a typical hours per week provided by the building tenant. The remaining measures had annual hours of operation (2,727) that are less than ex ante hours (3,000), again provided by the tenant.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 89%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for the majority of the project.

Site 7086 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	28,002	24,834	89%	4.72
Total		**28,002**	**24,834**	**89%**	**4.72**

Site ID: 7087

Data Collection

The participant received Standard incentives from Ameren Missouri for replacing a rooftop HVAC unit and a freezer for a fast food store renovation.

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. Operating schedules, holiday schedules and temperature setpoints were noted.

Analysis Results

The savings for the evaluated measures to replace the HVAC rooftop units are presented in the following table.

Site 7087 Rooftop HVAC and Refrigeration savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Eff	Post Eff	EFLH	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051910-HVAC packaged <65,000 BTU	800850	1	1	13	17.1	1,053	1,165	1,165	100%
4100222-Energy Star Freezer	800850	1	1	3.3	2.0	8,760	2,306	851	65%
Total							**2,473**	**2,016**	**81%**

The baseline for the rooftop HVAC unit was determined as a replace on fail type, using the Federal DOE minimum equipment efficiency of 13 SEER for split and packaged DX units under 65,000 BTU.The annual energy savings were calculated using the TRM based algorithm below with the SEER pre and post values, full load cooling hours and capacity.

$$kWh_{savings} = \left(\frac{1}{SEER_{pre}} - \frac{1}{SEER_{post}}\right) x EFLH_{cooling} x \ Capacity \ x \ \frac{1 \ kWh}{1{,}000 \ Wh}$$

The Energy Star freezer was observed working at above freezing temperatures of 36F, which the model plate confirmed the unit was actually a medium-temp cooler. The Energy Star attribution was not able to be confirmed, as this model was not found in the Energy Star website search. Although, the Energy Star certification is primarily consumer appliances, the manufacturer does have similar products certified. As the Energy Star rating could not be confirmed, the ES calculator was not used to determine the savings. The savings were determined by the algorithm:

$$kWh_{savings} = Volt \ x \ (Amps_{pre} - Amps_{post}) x \ Pf \ x \ Duty \ \ x \ 8760 \ x \frac{1 \ kW}{1000 \ W}$$

Where the line volts, amps, and hours of use were obtained from the site visit. The duty cycle of 65% was listed in the Department of Energy Study for typical compressor duty. The amps for the new efficient unit was provided by the model plate. The amps for the baseline was determined by a less efficient unit from the same manufacturer with the same cooling capacity and a less efficient refrigerant.

The ex post energy savings were factored by the CF for the Cooling End Use (HVAC) and the Refrigeration End Use (refrigerator).

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The ex post savings were equal to the ex ante energy savings for the rooftop HVAC unit, as both used the TRM savings algorithm. The ex post energy savings of 851 kWh was less than the ex ante savings of 2,306 as the unit was a refrigerator and could not be confirmed as Energy Star rated.

Site 7087 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Cooling	1,165	1,165	100%	1.06
	Refrigeration	1,308	851	65%	0.12
Total		**2,473**	**2,016**	**81%**	**1.18**

Site ID: 7088

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7088 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	25	25	114	40	4,234	1.09	6,388	-	8,538	134%
		38	38	59	20	4,234	1.09	5,117	-	6,840	134%
4060814-Fluorescent T12 replaced with LED Type B	800900	100	100	164	40	4,234	1.09	42,816	-	57,227	134%
		60	60	82	20	4,234	1.09	12,845	-	17,168	134%
4060911-Interior HID replaced with LED fixture	800300	13	13	455	150	4,234	1.09	12,388	-	18,299	148%
4060912-Interior HID replaced with LED Lamp direct-wired		30	30	455	100	4,234	1.09	33,275	-	49,150	148%
Total								**112,829**	-	**157,221**	**139%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified through secondary sources (4,234) are greater than the annual hours of operation used to calculate ex ante savings (ranging from 2,920 – 3,227).

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 139%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling effects.

Site 7088 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	112,829	157,221	139%	29.87
Total		**112,829**	**157,221**	**139%**	**29.87**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7088 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	40,613
			82	64	12,184
Total					**52,796**

Site ID: 7089

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7089 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060713-Fluorescent T8 replaced with LED Type A/B	800850	162	162	114	36	5,475	1.08	74,025	-	74,717	101%
		11	11	59	18	5,475	1.08	2,642	-	2,667	101%
Total								**76,667**	-	**77,383**	**101%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the hours of operation used to calculate ex ante savings (5,475). The hours were consistent with hours found in secondary sources.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings a. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7089 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	76,667	77,383	101%	14.70
Total		**76,667**	**77,383**	**101%**	**14.70**

Site ID: 7092

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7092 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	120	120	88	42	3,128	1.08	23,626	-	18,648	79%
		150	150	88	42	3,128	1.08	29,532	-	23,310	79%
		150	150	88	42	3,128	1.08	29,532	-	23,310	79%
4060814-Fluorescent T12 replaced with LED Type B	800900	9	9	164	56	3,128	1.08	4,160	-	3,284	79%
		9	9	164	56	3,128	1.08	4,160	-	3,284	79%
		16	16	164	56	3,128	1.08	7,396	-	5,838	79%
		2	2	82	28	3,128	1.08	462	-	365	79%
		10	10	82	28	3,128	1.08	2,311	-	1,824	79%
		16	16	82	28	3,128	1.08	3,698	-	2,919	79%
4060912-Interior HID replaced with LED Lamp direct-wired	800300	12	12	455	150	2,000	1.08	7,832	-	7,906	101%
Total								**112,709**	-	**90,686**	**80%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the last item in the table above corresponds with the annual hours of operation used to calculate ex ante savings (2,000). The remaining measures have annual hours of use (3,128) with fewer hours than the ex ante hours (4,000). The hours were confirmed through secondary sources.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 80%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7092 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	112,709	90,686	80%	17.23
Total		**112,709**	**90,686**	**80%**	**17.23**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7092 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	2,189

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
			164	128	2,189
			164	128	3,892
			82	64	243
			82	64	1,216
			82	64	1,946
Total					**11,675**

Site ID: 7094

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7094 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	91	91	59	30	2,600	1.09	7,341	(1,647)	5,832	79%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	130	130	138	44	2,600	1.09	33,996	(7,625)	27,006	79%
		11	11	72	20	2,600	1.09	1,591	(357)	1,264	79%
4060814-Fluorescent T12 replaced with LED Type B		33	33	164	30	2,600	1.09	12,302	(2,759)	9,773	79%
		15	15	164	30	2,600	1.09	5,592	(1,254)	4,442	79%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060911- Interior HID replaced with LED fixture	800300	25	25	455	150	2,600	1.09	21,213	(4,758)	16,851	79%
Total								**82,035**	**(18,401)**	**65,168**	**79%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (2,600).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 79%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7094 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	85,035	65,168	79%	15.88

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Total		**85,035**	**65,168**	**79%**	**15.88**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7094 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	138	128	30,947
			72	64	1,372
			164	128	9,165
			164	128	4,166
Total					**45,650**

Site ID: 7095

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7095 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	87	87	124	60	2,211	1.00	12,059	-	12,312	102%
4060814-Fluorescent T12 replaced with LED Type B	800900	218	218	164	72	2,211	1.00	43,435	-	44,349	102%
		256	256	138	60	2,211	1.00	43,244	-	44,154	102%
Total								**98,738**	**-**	**100,815**	**102%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ CF$$

The annual lighting hours of operation verified during the M&V site visit (2,211) are greater than the annual hours of operation used to calculate ex ante savings (2,024). The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7095 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	98,738	100,815	102%	19.15
Total		**98,738**	**100,815**	**102%**	**19.15**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7095 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	26,995
			138	128	38,493
Total					**65,488**

Site ID: 7096

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7096 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	2	2	60	9	3,400	1.08	240	(63)	180	75%
4060710-Fluorescent T8 replaced with LED fixture	800850	1	1	114	25	2,080	1.08	198	(52)	148	75%
		63	63	88	25	2,080	1.08	8,834	(2,312)	6,604	75%
		310	310	59	25	2,080	1.08	23,458	(6,138)	17,539	75%
4060714-Fluorescent T8 replaced with LED Type B		2	2	175	63	520	1.08	124	(33)	93	75%
		2	2	160	50	520	1.08	122	(32)	92	75%
		559	559	114	21	2,600	1.08	144,629	(37,847)	108,133	75%
		6	6	114	42	2,600	1.08	1,202	(314)	899	75%
		14	14	114	42	3,400	1.08	3,667	(960)	2,742	75%
		15	15	114	21	2,080	1.08	3,105	(812)	2,321	75%
		16	16	114	21	2,080	1.08	3,312	(867)	2,476	75%
		6	6	114	21	2,250	1.08	1,343	(352)	1,004	75%
		65	53	88	21	2,400	1.08	11,831	(3,096)	8,845	75%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		3	3	88	32	520	1.08	93	(24)	70	75%
		114	114	59	21	520	1.08	2,411	(631)	1,802	75%
		30	30	59	21	520	1.08	633	(166)	474	75%
		58	58	59	21	3,400	1.08	8,019	(2,098)	5,995	75%
		4	4	59	21	3,400	1.08	552	(145)	413	75%
		14	14	56	14	2,080	1.08	1,309	(342)	978	75%
		3	3	32	11	2,600	1.08	175	(46)	131	75%
		6	6	32	11	2,250	1.08	303	(79)	227	75%
4060814-Fluorescent T12 replaced with LED Type B	800900	12	12	164	21	2,250	1.08	4,131	(1,081)	3,089	75%
		2	2	164	21	2,080	1.08	637	(167)	476	75%
		3	3	122	21	520	1.08	168	(44)	126	75%
		64	64	82	21	520	1.08	2,172	(568)	1,624	75%
		5	5	82	21	520	1.08	169	(44)	127	75%
Total								**222,837**	**(58,313)**	**166,608**	**75%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (ranging from 520 – 3,400). The hours are representative of multiple use areas within a school.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 75%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7096 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	222,837	166,608	75%	42.73
Total		**222,837**	**166,608**	**75%**	**42.73**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7096 Measures with Midlife Savings

<table>
<tr><th>Program</th><th>End Use Category</th><th>Midlife Baseline Shift Year</th><th>Baseline Watts Pre Shift</th><th>Baseline Watts Post Shift</th><th>Ex Post Gross (kWh)</th></tr>
<tr><td rowspan="6">Standard</td><td rowspan="6">Lighting</td><td>2022</td><td>60</td><td>13.4</td><td>32</td></tr>
<tr><td rowspan="5">2024</td><td>164</td><td>128</td><td>3,120</td></tr>
<tr><td>164</td><td>128</td><td>481</td></tr>
<tr><td>122</td><td>96</td><td>126</td></tr>
<tr><td>82</td><td>64</td><td>1,546</td></tr>
<tr><td>82</td><td>64</td><td>121</td></tr>
<tr><td>Total</td><td colspan="4"></td><td>5,426</td></tr>
</table>

Site ID: 7097

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7097 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060320-Halogen MR-16 35W replaced with LED 20W	800200	37	37	50	7	3,170	1.14	7,457	-	5,750	77%
4060614-Fluorescent T5 replaced with LED Type B	800800	50	50	234	100	3,170	1.14	31,400	-	24,212	77%
		22	22	96	39	3,775	1.14	5,878	-	5,397	92%
		19	19	32	13	3,775	1.14	1,692	-	1,554	92%
4060714-Fluorescent T8 replaced with LED Type B	800850	1553	1553	114	48	3,775	1.14	480,367	-	441,100	92%
		139	139	88	36	3,775	1.14	33,874	-	31,106	92%
		117	117	59	24	3,775	1.14	19,192	-	17,623	92%
		11	11	32	18	3,775	1.14	722	-	663	92%
		48	48	32	12	3,775	1.14	4,499	-	4,131	92%
		87	87	23	12	3,775	1.14	4,484	-	4,118	92%
		35	35	16	9	3,775	1.14	1,148	-	1,054	92%
4060814-Fluorescent T12	800900	765	765	164	48	3,775	1.14	415,889	-	381,893	92%
		31	31	145	86	3,775	1.14	8,572	-	7,871	92%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
replaced with LED Type B		105	105	82	24	3,775	1.14	28,541	-	26,208	92%
		103	103	72	30	3,775	1.14	20,274	-	18,617	92%
4060912-Interior HID replaced with LED Lamp direct-wired	800300	11	11	199	80	4,380	1.14	6,135	-	6,536	107%
Total								**1,070,124**	**-**	**977,833**	**91%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation for the last line item in the table above (4,380) corresponds with the annual hours of operation used to calculate ex ante savings. These were installed in the lobby. The post analysis reduced the remaining measures with hours (3,775) fewer than the ex ante hours (4,380). Review of implementer photos show empty offices and only one photo with an employee, Evening and weekend drive by of the building revealed the lighting off which confirms less usage than 12 hours/ 7days.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 91%.

Site 7097 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	1,070,124	977,833	91%	185.75
Total		**1,070,124**	**977,833**	**91%**	**185.75**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7097 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	263,374
			145	128	5,603
			82	64	18,075
			72	64	15,071
Total					**302,123**

Site ID: 7098

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7098 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060410-Incand Exit Sign replaced with LED 5W	800750	8	8	30	2	8,760	1.08	2,100	-	2,119	101%
4060810-Fluorescent T12 replaced with LED fixture	800900	6	8	227	36	2,028	1.08	2,689	-	2,352	87%
		35	35	164	36	2,028	1.08	11,218	-	9,812	87%
		10	9	164	36	2,028	1.08	3,296	-	2,882	87%
Total								**19,303**	-	**17,166**	**89%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified through secondary sources for the first line item in the table above (8,760) correspond with the annual hours of operation used to calculate ex ante savings. The remaining measures have annual hours of operation (2,028) which are fewer than the hours used to calculate ex ante savings (2,340). It appears the ex ante hours included a 7day work week which is inaccurate.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings and 1.00 for the unconditioned portion of the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 89%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for most of the measures.

Site 7098 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	19,303	17,166	89%	3.26
Total		**19,303**	**17,166**	**89%**	**3.26**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7098 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
			227	196	1,945
Standard	Lighting	2024	164	128	7,053
			164	128	2,094
Total					**11,091**

Site ID: 7099

Data Collection

The participant received Standard incentives from Ameren Missouri for replacing wall mounted thermostats with learning technology smart thermostats.

During the desk review of this project, the product specifications, purchase invoice and Final Application were reviewed. Data was collected for the tonnage of the HVAC controlled equipment and building permits reviewed to determine if the units had a recent replacement to inform the applicable baseline.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7099 Smart Thermostat Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Type	Post Type	Deemed (kWh/ton)	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4052410-Learning/Smart thermostat	803050	3	3	Manual or Programmable	Smart	205	2,259	2,259	100%
Total							**2,259**	**2,259**	**100%**

The annual savings were determined by factoring the cooling tons of the three units by the TRM deemed savings factor of 205 kWh/ton. The efficiency or age of the controlled HVAC units could not be determined from available data, so the deemed value based on a SEER of 10 was accepted.

The peak coincident kW savings were calculated using the algorithm below, with the Cooling Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The following table lists the ex post gross savings of 2.05 kW, equal to the ex ante savings, as the same TRM based savings algorithm was applied.

Site 7099 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Cooling	2,259	2,259	100%	2.05
Total		**2,259**	**2,259**	**100%**	**2.05**

Site ID: 7100

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7100 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060614-Fluorescent T5 replaced with LED Type B	800800	372	372	468	200	2,827	1.00	399,389	-	281,841	71%
Total								**399,389**	-	**281,841**	**71%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified by secondary sources (2,827) are fewer than the annual hours of operation used to calculate ex ante savings (3,744). The facility is unoccupied so TRM hours for a warehouse were used.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 71%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive effects.

Site 7100 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	399,389	281,841	71%	53.54
Total		**399,389**	**281,841**	**71%**	**53.54**

Site ID: 7101

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7101 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	30	30	114	56	4,000	1.14	7,447	-	7,934	107%
Total								**7,447**	-	**7,934**	**107%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the annual hours of operation used to calculate ex ante savings (4,000).

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned secondary educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 107%.

Site 7101 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	7,447	7,934	107%	1.51
Total		**7,447**	**7,934**	**107%**	**1.51**

Site ID: 7102

Data Collection

The participant received Standard incentives from Ameren Missouri for replacing eleven rooftop HVAC units with efficient units.

During the engineering desk review, the equipment capacities, quantity and efficiencies were verified. For an alternate method to validate the TRM savings algorithm, a weather billing regression was also performed.

Analysis Results

The savings for the evaluated measures to replace the HVAC rooftop units are presented in the following table.

Site 7102 Rooftop HVAC savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre SEER	Post SEER	EFLH	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051910-HVAC packaged <65,000 BTU	803250	3	3	13	17	1,053	2,516	2,516	100%
4051911-HVAC packaged 65-135,000 BTU		4	4	11.2	12 12.5		7,339	7,339	100%
4051912-HVAC packaged 135-240000 BTU		4	4	11	12		3,239	3,239	100%
Total							**13,094**	**13,094**	**100%**

The annual energy savings were calculated using the TRM based algorithm below for each pair of pre and post units. The baseline was determined as a replace on fail type, using the St Louis County local building code as the minimum efficient equipment.

$$kWh_{savings} = \left(\frac{1}{SEER_{pre}} - \frac{1}{SEER_{post}}\right) xEFLH_{cooling} x\ Capacity\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The EER for both the pre and post were used for units over 65,000 BTU, and the SEER for under 65,000 BTU.

The ex post savings of 13,094 was factored by the CF value for the Cooling End use by the formula:

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The ex ante and ex post energy savings of 13,094 kWh are equal, as well as the peak demand savings of 11.92 kW. As the project was completed late in the Summer, the number of months with a cooling load was limited. The regression for billing kWh data with normalized heating and cooling degree days support the project reaching the expected savings. Although the billing regression obtained an R square statistic of 0.94, and significant factors with CCD and a Pre/Post flag of less than 0.05 p-statistic value, the savings method was not chosen due to the limited months with cooling degree days. The project energy and peak demand savings are listed in the following table.

Site 7102 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Cooling	13,094	13,094	100%	11.92
Total		**13,094**	**13,094**	**100%**	**11.92**

Site ID: 7103

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7103 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060911- Interior HID replaced with LED fixture	800300	20	20	455	171	4,200	1.04	25,526	-	24,810	97%
		11	11	455	161	4,200	1.04	14,534	-	14,126	97%
Total								**40,060**	-	**38,936**	**97%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the annual hours of operation used to calculate ex ante savings (4,200).

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7103 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	40,060	38,936	97%	7.40
Total		**40,060**	**38,936**	**97%**	**7.40**

Site ID: 7104

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7104 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	5	5	164	60	8,000	1.11	4,451	-	4,618	104%
		12	12	82	30	8,000	1.11	5,341	-	5,541	104%
Total								**9,792**	-	**10,159**	**104%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced he annual hours of operation used to calculate ex ante savings (8,000).

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned hospital in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7104 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	9,792	10,159	104%	1.93
Total		**9,792**	**10,159**	**104%**	**1.93**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7104 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	3,019
			82	64	3,623
Total					**6,642**

Site ID: 7105

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7105 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060810-Fluorescent T12 replaced with LED fixture	800900	14	14	164	36	2,600	1.04	4,986	-	4,846	97%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	8	8	138	44	2,600	1.04	2,092	-	2,033	97%
		4	4	138	44	8,736	1.04	3,514	-	3,416	97%
		41	5	82	22	2,600	1.04	9,047	-	8,793	97%
		98	98	82	22	8,736	1.04	54,963	-	53,422	97%
		36	36	82	22	2,600	1.04	6,009	-	5,841	97%
4060911-Interior HID replaced with LED fixture	800300	3	3	455	100	8,736	1.04	9,955	-	9,676	97%
Total								**90,566**	**-**	**88,028**	**97%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the annual hours of operation used to calculate ex ante savings (ranging from 2,600 – 8,760).

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7105 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	90,566	88,028	97%	16.72
Total		**90,566**	**88,028**	**97%**	**16.72**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7105 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	3,483
			138	128	1,817
			138	128	3,053
			82	64	6,798
			82	64	37,396
			82	64	4,088

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Total					56,635

Site ID: 7106

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7106 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	8	8	175	69	3,000	1.14	2,722	-	2,900	107%
		572	560	114	46	3,000	1.14	126,628	-	134,912	107%
		21	21	114	46	3,000	1.14	4,584	-	4,884	107%
		25	25	59	34	3,000	1.14	2,006	-	2,138	107%
4060814-Fluorescent T12 replaced with LED Type B	800900	7	7	138	86	3,000	1.14	1,168	-	1,245	107%
		25	25	56	18	3,000	1.14	3,050	-	3,249	107%
Total								**140,158**	**-**	**149,327**	**107%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation the annual hours of operation used to calculate ex ante savings (3,000).

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned secondary educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 107%.

Site 7106 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	140,158	149,327	107%	28.37
Total		**140,158**	**149,327**	**107%**	**28.37**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7106 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	138	128	1,005
			56	32	1,197
Total					**2,202**

Site ID: 7107

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7107 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060712-Fluorescent T8 replaced with LED Type A	800850	95	95	114	60	2,880	1.11	13,466	-	16,400	122%
		10	10	114	60	2,880	1.11	1,762	-	1,726	98%
Total								**15,228**	-	**18,126**	**119%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage in the above table (60W) is less than the ex ante savings wattage (68W). The invoice and specifications state 15W lamps were installed within 4-Lamp fixtures.

The annual lighting hours of operation for the first line item in the table above referenced the annual hours of operation used to calculate ex ante savings (2,880). The remaining measures hours were reduced to coincide those hours. The facility is unoccupied.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 119%. The ex ante energy savings estimate was premised on overestimated efficient wattage and underestimated heating and cooling interactive effects.

Site 7107 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	15,228	18,126	119%	3.44
Total		**15,228**	**18,126**	**119%**	**3.44**

Site ID: 7108

Data Collection

The participant received Standard incentives from Ameren Missouri for replacing wall mounted thermostats with learning technology smart thermostats.

During the desk review of this project, the product specifications, purchase invoice and Final Application were reviewed. Data was collected for the tonnage of the HVAC controlled equipment and building permits reviewed to determine if the units had a recent replacement to inform the applicable baseline.

Analysis Results

The savings and algorithm inputs for the evaluated measures from the incentivized thermostats are presented in the following table.

Site 7108 Smart Thermostat Savings and Algorithm Inputs

Measure Name	TRM	Qty	Pre Thermostat	Post	SEER	Capacity (tons)	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4052410-Learning/Smart thermostat	803050	3	Manual or Programmable	Smart	13.0	5	3,080	2,369	77%
Total							**3,080**	**2,369**	**77%**

The TRM based savings factor of 0.1625 was applied in the algorithm below. The efficiency of the rooftop units was determined to be at least an SEER of 13.0 and not the ex ante value of 10.0, based on data obtained from the St Louis County building permit searchable website for rooftop units installed 3 years after the DOE mandate for an SEER of 13.0 for packaged and split HVAC units under 65,000 BTUh.

$$kWh_{savings} = \frac{1}{SEER} x EFLH_{cooling} x\ Capacity\ x\ SF x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Cooling Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The following table lists the ex post gross savings of 2,369 kWh, with a realization rate of 77% and the peak demand of 2.16 kW reduction. The difference is the ex post usage of additional data to determine the efficiency of the load controlled by the smart thermostats.

Site 7108 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Cooling	3,080	2,369	77%	2.16

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Total		3,080	2,369	77%	2.16

Site ID: 7109

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7109 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060310-Halogen BR/R 45W replaced with LED 13W	800150	12	12	65	9	2,884	1.14	2,157	-	2,209	102%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	24	24	60	9.5	2,884	1.14	2,465	-	2,564	104%
4060712-Fluorescent T8 replaced with LED Type A	800850	120	120	88	39	2,884	1.14	18,875	-	19,332	102%
4060712-Fluorescent T8 replaced with LED Type A		10	10	56	30	2,884	1.14	835	-	855	102%
Total								**24,332**	-	**24,961**	**103%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage for the second line item in the table above (9.5W) is less than the wattage used to calculate ex ante savings (10W). The invoice and specifications confirm the efficient wattage.

The annual lighting hours of operation (2,884) are fewer than the annual hours of operation used to calculate ex ante savings (3,000). Unable to confirm the annual hours of use due to the site being unoccupied the TRM hours for an office was used.

A heating and cooling interactive factor of 1.14, applicable to a heated, air-conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 103%.

Site 7109 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	24,332	24,961	103%	4.74
Total		**24,332**	**24,961**	**103%**	**4.74**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for omni directional and their equivalent CFL wattage with the post midlife shift energy savings.

Site 7109 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	60	13.4	308
Total					**308**

Site ID: 7110

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7110 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	70	32	292	240	2,736	1.14	37,546	-	39,799	106%
		200	127	114	57.1	2,736	1.14	45,789	-	48,495	106%
		62	40	114	35	2,736	1.14	16,678	-	17,679	106%
		35	35	114	57.1	2,736	1.14	5,871	-	6,212	106%
		148	148	88	31.4	2,736	1.14	24,823	-	26,127	105%
		222	74	88	37.2	2,736	1.14	45,073	-	52,347	116%
Total								**175,780**	**-**	**190,659**	**108%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the

HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattages for the second, fourth, fifth, and sixth line items in the table above (57.1W, 57.1W, 31.4W, and 37.2W) are greater than the wattages used to calculate ex ante savings (57W, 57W, 31W, and 35W). The wattages were confirmed during the M&V site visit, invoices, and specifications.

The annual lighting hours of operation verified during the M&V site visit (2,736) are fewer than the annual hours of operation used to calculate ex ante savings (2,750).

A heating and cooling interactive factor of 1.14, applicable to a heated, air-conditioned secondary educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 108%.

Site 7110 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	175,780	190,659	108%	36.22
Total		**175,780**	**190,659**	**108%**	**36.22**

Site ID: 7111

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7111 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	28	28	164	36	3,048	1.11	11,689	-	12,126	104%
Total								**11,689**	-	**12,126**	**104%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the annual hours of operation used to calculate ex ante savings (3,048).

A heating and cooling interactive factor of 1.11, applicable to a heated, air-conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7111 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	11,689	12,126	104%	2.30
Total		**11,689**	**12,126**	**104%**	**2.30**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings.

Site 7111 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2024	164	128	8,715
Total					**8,715**

Site ID: 7122

Data Collection

The participant received a Standard incentive from Ameren Missouri for adding variable frequency drives (VFD) to chiller pumps to control the speed and reduce the load.

Originally sampled as a desk review, a site visit for another project enabled the additional collection of data for the VFD operation. During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the sequencing of the pumps. The building management system computer (BMS) was reviewed to verify the modulation of the pumps, determine the lead/lag operating schedule, and to view trended data.

Analysis Results

The savings for the evaluated measures from the incentivized VFD controls are presented in the following table.

Site 7122 Retrofit Savings and Model Inputs

Measure Name	TRM	Qty	HP	Avg Speed (hz)	Pre control	Post control	Duty	Ex Ante (kWh)	Ex Post Gross (kWh)	RR_{kWh}
4080310-VFD for chilled water pump	803100	2	40	46	Constant	VFD	Lead /Lag	103,168	45,636	44%
Total								**103,168**	**45,636**	**44%**

The chilled water pumps were added to an eQuest building simulation software model for a prototypical school with St Louis Lambert Airport weather data. Two runs were completed, the first with a motor starter pump control, and calibrated with prior year weather data. The second run considered the two pumps operating in a lead/lag rotation, as indicated on the BMS trend data. A third run substituted the prior year weather data with TMY3 data to determine the first year energy savings. As the chiller pump operates for space cooling, the End Use for Cooling was assigned to determine the CF factor and peak demand savings. The ex post peak savings were determined by the Motor End Use coincident factor.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The next table presents the energy savings achieved by the measure evaluated for this site along with the peak demand savings. The overall gross realization rate for the energy savings is 44%, and the realization rate for the peak demand kW is 292%. The ex ante energy savings estimate was premised with the primary pump operating similarly to the backup pump, and a Motor End Use.

Site 7122 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR_{kWh}	Ex Post Gross (kW)	RR_{kW}
Standard	Cooling	103,168	45,636	44%	41.56	292%

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR_{kWh}	Ex Post Gross (kW)	RR_{kW}
Total		103,168	45,636	44%	41.56	292%

Site ID: 7123

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7123 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	RR
4060714-Fluorescent T8 replaced with LED Type B	800850	446	200	32	14	5,500	1.09	67,513	-	68,775	102%
		2373	1500	32	18	5,500	1.09	287,988	-	293,371	102%
		2725	2400	32	15	5,500	1.09	301,312	-	306,944	102%
		2621	2600	32	15	5,500	1.09	264,072	-	269,008	102%
		4400	3800	32	15	5,500	1.09	493,163	-	502,381	102%
		600	300	32	14	5,500	1.09	88,275	-	89,925	102%
		4700	3500	32	15	5,500	1.09	576,142	-	586,911	102%
		5156	3300	32	15	5,500	1.09	679,670	-	692,375	102%
		975	725	32	15	5,500	1.09	119,612	-	121,848	102%
		875	625	32	18	5,500	1.09	98,574	-	100,416	102%
Total								**2,976,321**	**-**	**3,031,953**	**102%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The annual lighting hours of operation verified during previous M&V site visits correspond with the annual hours of operation used to calculate ex ante savings (5,500).

A heating and cooling interactive factor of 1.09, applicable to a heated, air-conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7123 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	2,976,321	3,031,953	102%	575.96
Total		**2,976,321**	**3,031,953**	**102%**	**575.96**

Site ID: 7124

Data Collection

The participant received Standard incentives from Ameren Missouri for adding variable frequency drives (VFD) to chiller pump motors.

During the engineering desk review, the specification sheets, product invoice, and ex ante calculations were reviewed. This data was also aggregated with the chiller pump trend data collected during a previous site visit.

Analysis Results

The savings for the evaluated measures from the incentivized VFDs are presented in the following table.

Site 7124 Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Qty	HP	Pre control	Post control	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4080310-VFD pump for chilled water	803100	3	25	Curve	VFD	96,720	33,865	35%
Total						**96,720**	**33,865**	**35%**

The chilled water pumps were added to the chiller load bin data from the ex ante modeled data in the software program Trane myIPLV. The program modeled the multi chiller plant, along with historical operating data to determine the load for each chiller and the hours operating at the load. The ex post updated the dataset with the pump volume operating at a standard rate of 2.4 gpm/ton for pumps operating at constant speed, with variable head. The next set of data modeled a variable flow system with the new VFDs. The difference in the models resulted in 33,865 energy savings.

Site 7124 Pre and Post Models - Chiller Pump Load

Chiller Load (%)	Tons	Hours	Chillers ON	Pre Pump Load (%)	Post Pump Load (%)	Pre Model (kWh)	Post Model (kWh)
25	300	2221	1	88	26	34,473	10,145
50	600	770	2	88	56	23,912	15,219
75	900	749	2	88	83	23,247	21,938
94	1128	197	2	90	97	6,284	6,748
100	1200	0					
Total						**87,916**	**54,051**

The ex ante End Use of Motors, was revised in the following calculation to Cooling to estimate the peak demand savings. The model provided by the trade ally along with previously obtained chiller trend data for the chiller plant, confirmed the Cooling End Use.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The next table presents the energy savings achieved by the measure evaluated for this site along with the peak demand savings. The overall gross realization rate for the energy savings is 35%, and the realization rate for the peak demand kW is 231%. The ex ante energy savings estimate was determined by the TRM deemed savings per controlled horsepower, which appears based on a single pump operating. The chiller plant meets the load with up to two chillers and the third chiller as a backup.

Site 7124 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR_{kWh}	Ex Post Gross (kW)	RR_{kW}
Standard	Cooling	96,720	33,865	35%	30.84	231%
Total		**96,720**	**33,865**	**35%**	**30.84**	**231%**

Site ID: 7125

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7125 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	700	700	221	85	6,000	1.08	611,184	-	616,896	101%
		32	32	124	94	6,000	1.08	6,163	-	6,221	101%
		41	41	114	52	6,000	1.08	16,320	-	16,472	101%
		60	60	88	30	6,000	1.08	22,342	-	22,550	101%
4060711-Fluorescent T8 replaced with LED retrofit kit		462	352	59	22	6,000	1.08	125,280	-	126,451	101%
Total								**781,289**	-	**788,590**	**101%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation secondary sources (6,000) and correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7125 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	781,289	788,590	101%	149.80
Total		**781,289**	**788,590**	**101%**	**149.80**

Site ID: 7126

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7126 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	750	750	221	85	6,000	1.08	654,840	-	660,960	101%
		32	32	124	94	6,000	1.08	6,163	-	6,221	101%
		43	43	114	52	6,000	1.08	17,116	-	17,276	101%
		60	60	88	30	6,000	1.08	22,342	-	22,550	101%
		10	10	59	26	6,000	1.08	2,119	-	2,138	101%
4060711-Fluorescent T8 replaced with LED retrofit kit		505	345	59	22	6,000	1.08	142,556	-	143,888	101%
Total								**845,136**	-	**853,034**	**101%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)}=\left(Qty_{pre}x\ Watts_{pre}-Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident}=kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation referenced secondary sources (6,000) and correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7126 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	845,136	853,034	101%	162.05
Total		**845,136**	**853,034**	**101%**	**162.05**

Site ID: 7127

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7127 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060710-Fluorescent T8 replaced with LED fixture	800850	695	695	221	85	6,000	1.08	637,159	-	612,490	96%
		32	32	160	94	6,000	1.08	14,237	-	13,686	96%
		53	53	88	30	6,000	1.08	20,722	-	19,920	96%
4060711-Fluorescent T8 replaced with LED retrofit kit		418	327	59	22	6,000	1.08	122,161	-	113,193	93%
Total								**794,279**	-	**759,288**	**96%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage for the last measure in the table above (22W) is greater than the wattage used to calculate ex ante savings (20W). The specifications confirm the higher wattage

The annual lighting hours of operation referenced secondary sources (6,000) are fewer than the annual hours of operation used to calculate ex ante savings (6,300). Secondary sources confirmed the typical weekly hours of use.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 96%.

Site 7127 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	794,279	759,288	96%	144.24
Total		**794,279**	**759,288**	**96%**	**144.24**

Site ID: 7128

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7128 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060340-Halogen A-Lamp > 28 W replaced with LED Lamp	800050	16	16	75	9	2,211	1.00	2,892	-	2,335	81%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	3	3	43	6	2,211	1.00	296	-	245	83%
4060614-Fluorescent T5 replaced with LED Type B	800800	2	2	192	39	2,211	1.00	655	-	677	103%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	102	102	164	30	2,211	1.00	29,250	-	30,223	103%
		5	5	82	30	2,211	1.00	556	-	575	103%
		1	1	82	12	2,211	1.00	150	-	155	103%
4060814-Fluorescent T12 replaced with LED Type B		4	4	164	24	2,211	1.00	1,198	-	1,238	103%
4060911-Interior HID	800300	2	2	1080	80	2,211	1.00	5,671	-	4,423	78%
		2	2	1100	100	2,211	1.00	5,671	-	4,423	78%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
replaced with LED fixture		50	50	1080	100	2,211	1.00	138,940	-	108,351	78%
		3	3	455	60	2,211	1.00	3,360	-	2,620	78%
Total								**188,639**	-	**155,265**	**82%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the third through seventh line items in the table above (2,211) are greater than the annual hours of operation used to calculate ex ante savings (2,000). The annual hours of operation for the remaining measures (2,211) are fewer that the ex ante hours (2,650). The typical hours per week were provided by the building tenant.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 82%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects and overestimated annual lighting operating hours for approximately 40% of the project.

Site 7128 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	188,639	155,265	82%	29.50
Total		**188,639**	**155,265**	**82%**	**29.50**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift energy savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7128 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	75	24.8	559
			43	13.4	49
		2024	164	128	22,104
			82	64	376
			82	64	115
Total					**23,203**

Site ID: 7129

Data Collection

The participant received Standard incentives from Ameren Missouri for adding variable frequency drives (VFD) to fluid chiller pump motors and building heat pump loop at two buildings.

During the site verification visit, the model nameplate data was collected, along with pump trend data from the Building Management System (BMS) computer. Also, building occupancy schedules, and capacities of the heat pump loads were noted. A one-time power measurement for the VFD power will used to estimate the pump load. As the pumps supply water to heat pumps for both heating and cooling, seasonal differences were noted.

Analysis Results

The savings for the evaluated measures from the incentivized VFDs are presented in the following table.

Site 7129 Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Qty	HP	Pre control	Post control	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4080310-VFD pump for chilled water (building loop & fluid chiller)	803100	4	20	Constant	VFD	103,168	85,890	83%
4080310-VFD pump for chilled water (building loop)		2	20	Constant	VFD	51,584	42,945	83%
4080310-VFD pump for chilled water (fluid chiller)		2	30	Constant	VFD	77,376	64,418	83%
Total						**232,128**	**193,253**	**83%**

A pump load-weather bin analysis was completed for each pump in the pre and post period. The pumps operate primarily in a lead/lag sequence, with one pump maintaining the temperature and pressure differential setpoint at a fixed speed, until 85F outside temperature, when the 2nd pump may be started. The project also added a non-incentivized plate and frame heat exchanger to separate the fluid chiller loop from the building loop. The relationship between water flow and motor power was modeled with Uniform Methods and Practice (UMP) algorithm below.

$$Flow_{\%} = a + b\ x\ Power_{\%} + c\ x\ Power_{\%}^2$$

The correlation coefficients for a throttle control pump and VFD pump are below:

Site 7129 Pump load and power coefficients

Coefficient	Throttle	VFD
a	0.55218	0.21976
b	0.6370	-0.87478

Coefficient	Throttle	VFD
c	-0.1900	1.65260

The ex ante End Use of Motors was confirmed, as the pumps operator for both heating, cooling and freeze protection of the fluid chiller. The model provided by the trade ally along with previously obtained chiller trend data for the chiller plant, confirmed the Cooling End Use.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The next table presents the energy savings achieved by the measure evaluated for this site along with the peak demand savings. The overall gross realization rate for the energy savings is 83%. The ex ante energy savings estimate was determined by the TRM deemed savings per controlled horsepower, which appears based on a single pump operating. The pumps operate primarily in a lead and lag rotation.

Site 7129 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Motors	232,128	193,253	83%	26.66
Total		**232,128**	**193,253**	**83%**	**26.66**

Site ID: 7140

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7140 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	12	12	72	10	5,744	1.15	4,425	-	4,914	111%
		107	107	53	10	730	1.06	3,552	-	3,560	100%
4060714-Fluorescent T8 replaced with LED Type B	800850	57	114	124	56	8,760	1.06	6,411	-	6,351	99%
		85	85	114	56	4,140	1.06	23,041	-	21,635	94%
		340	340	114	56	5,824	1.06	122,888	-	121,737	99%
		142	142	114	56	8,760	1.06	77,197	-	76,476	99%
		139	139	88	42	4,140	1.06	29,884	-	28,059	94%
		554	554	88	42	5,824	1.06	158,808	-	157,320	99%
		231	231	88	42	8,760	1.06	99,599	-	98,669	99%
		198	198	59	28	4,140	1.06	28,688	-	26,936	94%
		800	800	59	28	5,824	1.06	154,545	-	153,097	99%
		332	332	59	28	8,760	1.06	96,469	-	95,567	99%
		6	6	32	14	8,760	1.06	1,012	-	1,003	99%
4060912-Interior HID replaced with	800300	74	74	455	115	8,760	1.06	235,829	-	233,626	99%
		32	32	284	80	8,760	1.06	61,188	-	60,616	99%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
LED Lamp direct-wired		8	8	199	80	8,760	1.06	8,924	-	8,840	99%
		13	13	114	50	8,760	1.06	7,798	-	7,726	99%
Total								**1,120,258**	-	**1,106,132**	**99%**

The annual energy savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the energy savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the fourth, seventh, and tenth line items (4,140) are fewer than the annual hours of operation used to calculate ex ante savings (4,368). These were offices with a typical hours per week provided by the building tenant. The remaining measures had annual hours of operation (ranging from 730 – 8,760) corresponding with the ex ante hours, again provided by the tenant.

A heating and cooling interactive factor of 1.15, applicable to a freezer, was applied to the ex post lighting energy savings for the first line item in the above table and 1.06 for the remaining measures in a heated, air-conditioned large office facility. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the energy savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 99%.

Site 7140 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Standard	Lighting	1,120,258	1,106,132	99%	210.13
Total		**1,120,258**	**1,106,132**	**99%**	**210.13**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for omni directional lamps and their equivalent CFL wattage with the post midlife shift energy savings.

Site 7140 Measures with Midlife Savings

Program	End Use Category	Midlife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Standard	Lighting	2022	72	24.8	1,173
			53	18.9	737
Total					**1,910**

Appendix C. Desk Review and Onsite Reports: Custom Incentive Program

Site ID: 7000, 7001

Data Collection

The participant received Custom incentives for the same refrigeration measure implemented at two grocery store expansions. The projects installed efficient refrigerated cases and variable frequency drives on the condensing unit cooling fans.

Nameplate model information was collected for each case in the dairy, meat and produce sections. The model information was collected for the rooftop condensing unit. The construction manager provided access to the control system for verification of the modulating fan speeds.

Analysis Results

The savings for the evaluated measures from the Custom program is presented in the following table.

7000, 7001 Energy Savings by Measure

Measure Name	TRM	End Use	Program	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4100201-Refrigeration replacing no existing equipment (7000)	800850	Refrigeration	Custom	45,045	38,204	85%
4100601-Refrigeration head pressure control (7000)				7,290	10,455	143%
4100201-Refrigeration replacing no existing equipment (7001)				45,045	38,768	86%
4100601-Refrigeration head pressure control (7001)				7,293	10,455	143%
Total				**104,673**	**97,882**	**94%**

The baseline for the new refrigerated cases for the store expansion were subject to the DOE rule for minimum standards of refrigerated cases based on the temperature of the product stored, the source of refrigeration, and physical characteristics including the display area. The minimum kWh/day were determined, then extrapolated annually by the algorithm:

$$kWh = (0.64\ x\ Total\ Display\ Area + 4.07) x\ 365\ days/year$$

The realization rate for the first site was 85% with 38,204 kWh saving and 86% for the second site with 38,768 kWh savings. Although the methodology for savings was the same between the ex ante and ex post, the ex ante underestimated the LED lighting loads and fan loads on the case shelves and canopy. The ex post looked at two sources to verify the lighting loads. First, the model plates of all the cases were photographed during the site visit. Then the invoices which detailed the number of lamps for each type of case was totaled. The two ex post methods produced similar results. The ex ante also underestimated the fan watts, as the ex post used the model plate information.

The realization rate for the variable frequency drives on the condensing units were 143% for savings of 10,455 for each store. The ex post determined the kWh fan consumption per cooling MBH using a prototypical supermarket model with St Louis, MO weather data within the DOE-R computer software. The ex post also used the same refrigeration load and splitting of the high and low pressure sides as the ex ante. The ex ante approach applied a rule of thumb 15% savings factor to the fan power without VFDs.

The following table lists the energy savings achieved for the evaluated measures, along with the peak kW reduction.

Site 7000, 7001 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Refrigeration	52,335	48,659	99%	6.6
		52,338	49,223	92%	6.7
Total		**104,673**	**97,882**	**94%**	**13.3**

Site ID: 7003

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing the original building automatic control system with a new system and programmed energy saving measures.

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. Operating schedules, holiday schedules and temperature setpoints were noted. Trend data was obtained from the BMS system for points to demonstrate the occupied/unoccupied schedules, fan speed, discharge temperature resets.

Analysis Results

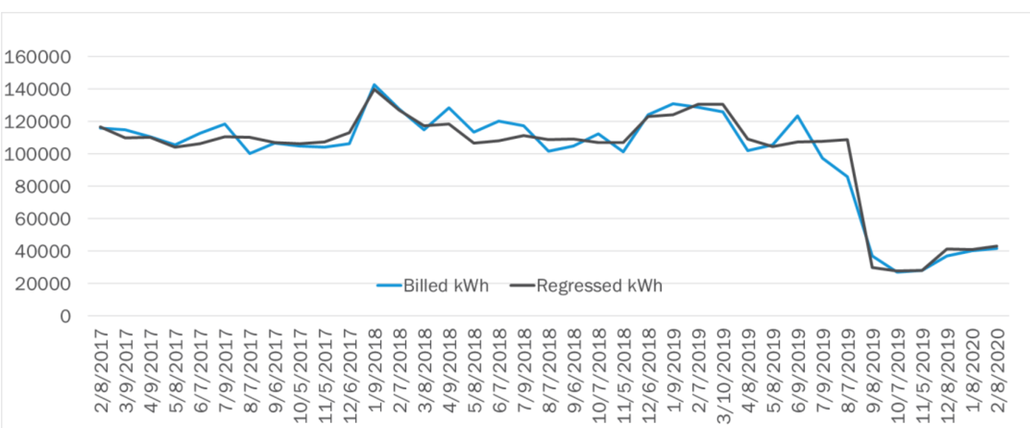
The savings for the evaluated measures to replace the building controls are presented in the following table.

Site 7003 Rooftop HVAC and Refrigeration savings and Algorithm Inputs

Measure Name	Regression coefficients – Degree Days to metered energy							Ex Ante (kWh)	Ex Post Gross (kWh)	RR
	CDD_{coef}		HDD_{coef}		$Post_{coef}$		R^2			
4051001-HVAC Controls	17		44		-79261		0.95	713,222	951,132	133%
	p_{value}	<0.05	p_{value}	<0.05	p_{value}	<0.05				
Total								**713,222**	**951,132**	**133%**

The ex post energy savings method applied the IPVMP Option C, Whole Facility Analysis. The regression model was based on two years prior to the project implementation and the months after completion with the metered billing data and weather data from the nearby NOAA weather station. The cooling and heating temperature balance points were set to optimize the regression statistics, for determining the heating degree days and cooling degree days. Factors that did not contribute to the regression model were not used. All the coefficients of the whole building model regression had significance with probability "p" value less than 0.05 and t-stat values over 2.0.

Site 7003 Metered billing data regression



The ex post energy savings had a realization rate of 133%. Although, the ex ante energy savings were estimated by a Trane Trace Building Model, the incentive offer appears to have been set to a value less than the Trane Model expected savings of over 1 MWH in annual savings. The conservative offer for the modeled savings is due to the very large percent reduction of annual electric usage, approximately 80%, which very few projects reach for building controls and equipment upgrades. Also, the interaction of new rooftop units was included in the ex post savings, as the measures for demand control ventilation could not have been implemented without the variable air flow.

Site 7003 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	HVAC	713,222	951,132	133%	422.29
Total		**713,222**	**951,132**	**133%**	**422.29**

Site ID: 7006

Data Collection

The participant received Custom incentives from Ameren Missouri for installing (12) variable frequency drives (VFD) and controls to regulate the supply fan speed of the rooftop units.

During the onsite verification visit, field staff verified the installation of VFDs and interviewed site personnel regarding equipment operation. Data was collected from the new BMS system which was installed with the VFDs. Also collected the mechanical schedules, model nameplates and the setback schedules from the single zone programmable thermostats before the installation.

Analysis Results

The savings for the evaluated measures to replace the building controls are presented in the following table.

Site 7006 Rooftop HVAC Variable Speed Supply Fans and Controls

Measure Name	Ex ante and Ex Post Inputs								Ex Ante (kWh)	Ex Post Gross (kWh)	RR
	Weather		Supply Fan		Schedules		Motors				
4052120-VFD for Fan	TMY3		horsepower		Occupied hrs		Efficiency		177,068	210,777	119%
	No	Yes	52	67	79	84	0.85	0.87			
Total									**177,068**	**210,777**	**119%**

The ex post energy savings method followed the IPMVP Option A, retrofit isolation, utilizing the same savings calculator as the ex ante savings. The calculator was first verified to previous work, then resolved any differences. First, the weather data did not align with TMY weather data and was updated with local NOAA weather data. The result of this run was a small increase in savings of less than 1%. Then the inputs for the occupied heating and cooling setpoints, unoccupied heating and cooling setpoints, were updated. The result of this run was a small decrease in savings of 3%. Next the total HVAC unit tonnage, motor HP and efficiency were updated based on the site visit model plate photographs. The result of this run was a 22% increase in ex post energy savings. Finally, the equipment schedules were updated to the values in the new BMS control system, which added hours on the weekday and shifted the weekend hours. The result of this run indicated annual savings of 210,777 kWh for an energy realization rate of 119%

Site 7006 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	HVAC	177,068	210,777	119%	93.50
Total		**177,068**	**210,777**	**119%**	**93.50**

Site ID: 7007

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing the existing HVAC system with three split DX units,

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. Operating schedules, holiday schedules and temperature setpoints were noted. Trend data was obtained from the BMS system for points to demonstrate the occupied/unoccupied schedules, fan speed, discharge temperature resets.

Analysis Results

The savings for the evaluated measures to replace the building controls are presented in the following table.

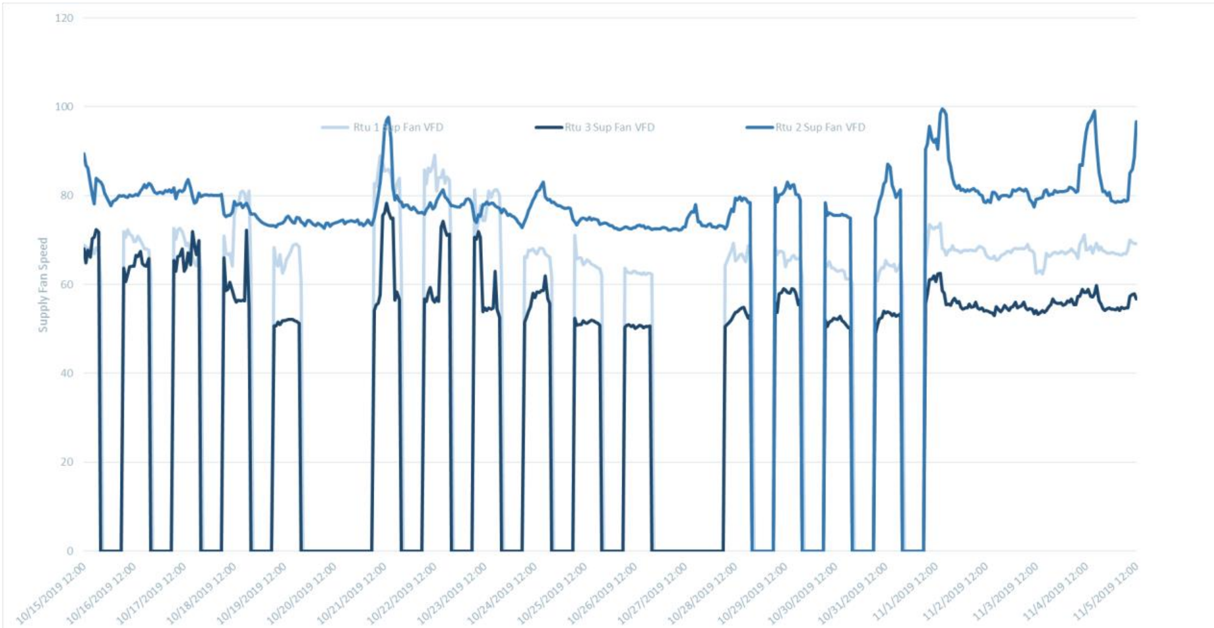
Site 7007 Split DX Air Conditioners and Algorithm Inputs

Measure Name	Ex ante and Ex Post Inputs									Ex Ante (kWh)	Ex Post Gross (kWh)	RR
	Efficiency		Baseline		Hours			Capacity				
4051801-HVAC-Rooftop Unit-Replacing No Existing	SEER		SEER		Occupied			Tons		11,652	9,890	85%
	16	16	10.8	13	60	85	140	14	14			
Total										**11,652**	**9,890**	**85%**

The ex post energy savings method followed the IPMVP Option A, retrofit isolation, utilizing the same savings calculator as the ex ante savings. The calculator was first verified to previous work, where the baseline was updated from the ex ante value of 10.8 to SEER 13.0. The ex ante aggregated the capacity of the three HVAC units together, which crossed the minimum efficient threshold bin of less than 65,000 BTU to the less minimum efficient bin of 135,000 to 240,000 BTU for an EER value of 10.8. Two of the installed units were 57,000 BTU, and the third had a capacity of 47,000 BTU. The minimum efficiency of 13 for the climate zone of the projects, has been in effect since the year 2006.

After setting the inputs to the appropriate baseline efficiencies in the calculator, the realized savings were reduced to 45%. The next calculator run utilized the trend data from the site visit to update the occupied schedule. Two units are scheduled for 14 hours per day, and the third unit conditions a work area for a night shift maintenance technician and operates 21 hours per day. The result of this run, increased the annual savings up to 9,890 kWh, for a realization rate of 85%.

Site 7007 Actual Hours of Use at Supply Fan



The ex post energy savings had a realization rate of 85%. The usage of the actual operating schedule and run hours increased the realized savings, but the update to the appropriate baseline of SEER 13 decreased the realized savings.

Site 7007 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Cooling	11,652	9,890	85%	9.01
Total		**11,652**	**9,890**	**85%**	**9.01**

Site ID: 7008

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7008 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061708- Non-Linear LED Fixture replacing Metal Halide		2	1	95	16	8,760	1.11	1,631	-	1,692	104%
Total								**1,631**	-	**1,692**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V sire visit (8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air-conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7008 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Lighting	1,631	1,692	104%	0.321
Total		**1,631**	**1,692**	**104%**	**0.321**

Site ID: 7010

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing the remaining portion of the Building Management Control System (BMS) with a new system.

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. Operating schedules, holiday schedules and temperature setpoints were noted. Trend data was obtained from the BMS system for points to demonstrate the occupied/unoccupied schedules, fan speed, and optimized morning start sequence.

Analysis Results

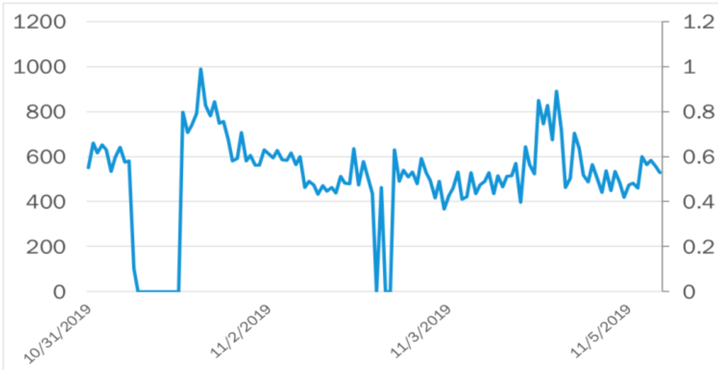
The savings for the evaluated measures to replace the building controls are presented in the following table.

Site 7010 BMS Controls Savings Algorithm Inputs

<table>
<tr><th rowspan="2">Measure Name</th><th colspan="9">Ex ante and Ex Post Inputs</th><th rowspan="2">Ex Ante (kWh)</th><th rowspan="2">Ex Post Gross (kWh)</th><th rowspan="2">RR</th></tr>
<tr><th colspan="2">Efficiency</th><th colspan="2"></th><th colspan="3">Hours</th><th colspan="2">Capacity</th></tr>
<tr><td rowspan="2">4051000-HVAC Controls EMS-Early Replacement</td><td colspan="2">EER</td><td colspan="2"></td><td colspan="3">Occupied</td><td colspan="2">MBTU</td><td rowspan="2">15,961</td><td rowspan="2">15,961</td><td rowspan="2">100%</td></tr>
<tr><td>9.7</td><td>9.7</td><td></td><td></td><td>60</td><td>85</td><td>140</td><td>756</td><td>756</td></tr>
<tr><td>Total</td><td colspan="9"></td><td>15,961</td><td>15,961</td><td>100%</td></tr>
</table>

The ex post energy savings method followed the IPMVP Option A, retrofit isolation, utilizing the same savings calculator as the ex ante savings. The calculator was first verified to previous work with no changes required. The inputs for capacity, efficiency and model nameplate data was verified to the onsite verification data. The controls drawings for the Sequence of Operations were verified to the programming in the control system for the VAV box interaction with the rooftop units. The rooms in the building are each scheduled and will call for cooling or heating to the rooftop HVAC unit when two or more do not have their setpoint temperature satisfied. The baseline system was pneumatic control, without the ability to schedule each room, as the occupants have different working patterns throughout the week. The following trend chart of data from the BMS validates the discharge boxes can run down to a minimum air flow during the occupied period as well as turning flow off completely when unoccupied.

Site 7010 VAV Airflow (cfm)



The ex post savings did not identify any updates needed for the savings calculator, and estimated the same savings of 15,961 kWh for a realization rate of 100%

Site 7010 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	HVAC	5,445	5,445	100%	2.42
	Cooling	10,516	10,516	100%	9.58
Total		**15,961**	**15,961**	**100%**	**11.99**

Site ID: 7015

Data Collection

The participant received Custom incentives from Ameren Missouri for recommissioning the existing Building Automation System (BAS) with savings from resets to air handler supply temperature setpoints, based on demand from the mixing boxes.

During the onsite verification visit, field staff verified the new control schedules in the BAS system, obtained photos of the chiller plant model plates, and air handler units.

Analysis Results

The savings for the evaluated measures to recommission the building automation system are in the following table.

Site 7015 Rooftop HVAC Variable Speed Supply Fans and Controls

<table>
<tr><th rowspan="2">Measure Name</th><th colspan="8">Ex ante and Ex Model Inputs</th><th rowspan="2">Ex Ante (kWh)</th><th rowspan="2">Ex Post Gross (kWh)</th><th rowspan="2">RR</th></tr>
<tr><th colspan="2">Pre Economizer</th><th colspan="2">Chiller Cap</th><th colspan="2">TMY Weather</th><th colspan="2">Post Economizer</th></tr>
<tr><td>4051000-HVAC Controls EMS-Early Replacement</td><td rowspan="2">Dry</td><td rowspan="2">Dry</td><td rowspan="2">355</td><td rowspan="2">355</td><td rowspan="2">Y</td><td rowspan="2">Y</td><td rowspan="2">Wet</td><td rowspan="2">Wet</td><td>78,075</td><td>78,075</td><td>100%</td></tr>
<tr><td>4051000-HVAC Controls EMS-Early Replacement</td><td>9,364</td><td>9,364</td><td>100%</td></tr>
<tr><td>Total</td><td colspan="8"></td><td>87,439</td><td>87,439</td><td>100%</td></tr>
</table>

The ex post energy savings method followed the IPMVP Option D, calibrated simulation, utilizing the original Trane Trace model built from the project design period, and updated with the as-built conditions. The trend data collected for supply air discharge temperature, duct static pressure and outdoor air damper for the economizer were similar to the model for the heating period. The small adjustments made in the ex post alternate run, produced some variation month to month, but the annual savings were nearly equal. As the ex ante model included both cooling and heating periods, the model reviewed in the heating season was determined accurate, and the ex post savings set equal to the ex ante savings, for a 100% realization rate.

The billing usage data was also collected and was set to complete a weather data and billing regression. The billing data indicated significant consumption for the heating period, due to the electric reheat boxes and perimeter heat in the building. The regression model had a low statistic for the R value and did not identify a significant coefficient to infer a weather to energy relationship to estimate the savings.

The energy and peak demand savings for this project are presented in the next table, aggregated by the Cooling and HVAC End Uses.

Site 7015 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Cooling	78,075	78,075	100%	71.10
	HVAC	9,364	9,364	100%	4.16

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Total		87,439	87,439	100%	75.26

Site ID: 7017

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7015 Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061713-LED Non-Linear LED Fixture Replacing CFL		172	172	54	12.4	8,760	1.14	67,067	-	70,931	106%
		68	68	31	18	8,760	1.14	8,286	-	8,828	107%
Total								**75,353**	-	**79,759**	**106%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage of the first line item in the table above (12.4W) is greater than the efficient wattage used to calculate ex ante savings (12W).

The annual lighting hours of operation verified during the M&V site visit (8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.14, applicable to a heated, air-conditioned apartment in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 106%.

Site 7015 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Lighting	75,353	79,759	106%	15.15
Total		**75,353**	**79,759**	**106%**	**15.15**

Site ID: 7018

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing two fixed speed air compressors with a single Variable Speed Drive air compressor and air receiver to tie two areas of the manufacturing facility together.

During the onsite verification visit of this project, the air compressor model nameplates were photographed, along with the baseline air compressor which was now the backup air compressor. The trade ally provided the air flow and power study that was completed before the project was started. The runtime hour meter of the backup compressors was also compared to a previous snapshot for verification that the single air compressor supports the plant air loads.

Analysis Results

The savings for the evaluated measures from the incentivized replacement air compressor is presented in the following table.

Site 7018 Air compressor savings and model inputs

Measure Name	Ex ante method	Ex post method	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4020600-Efficient Air Compressor	Pre data and bins	Pre data, hourly, weekends, weekdays	314,384	351,520	112%
Total			**314,384**	**351,520**	**112%**

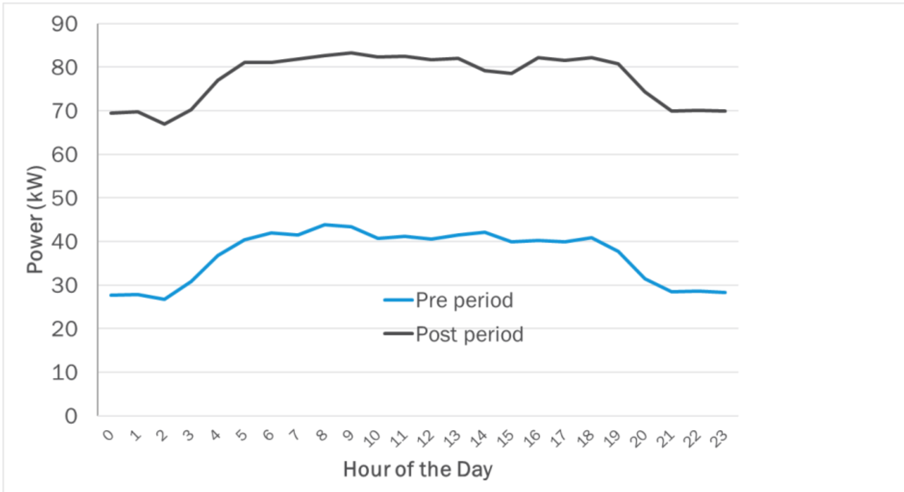
Energy savings for the air compressor measure was estimated using the International Performance Measurement and Verification Protocol Option A: Retrofit Isolation methodology. A model was created for the baseline period with the constant speed 60 hp and 75 hp compressors from the trade ally monitoring for the parameters of air flow, input power and output air pressure over 10 days.

The air flow load profile by day of the week and hour from the baseline period was an input for the performance curve of the new compressor using manufacturer specifications in the CAGI format, at various flow rates, and at the same output pressure.

Also, the efficient period flow-power demand model was compared to trend data displayed on the new variable speed air compressor for On Load Hours. The ex post model compares similar to the percentage of on-load time at 40 go 60% load and 60 to 100% load, with the difference being in the bin of under 40% load, which occurs during holidays and between the change of production shifts.

The realization rate for the measure is 112%. The ex post created an hourly bin by day, to determine the savings. The narrative from the ex ante estimation, appears to be a straight-line average for air flow (cfm) and input power (kW), which included monitoring over a holiday. The ex post removed the holiday data from the typical week model and considered the holiday schedule at the annual level.

7018 Pre and Post Air Compressor Power



The peak coincident kW savings were calculated using the algorithm below, with the air compressor Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The following table lists the ex post gross demand savings of 48.49 kW with the energy savings.

Site 7018 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Air Compressor	314,384	351,520	112%	48.49
Total		**314,384**	**351,520**	**112%**	**48.49**

Site ID: 7021

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7021 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061713-LED Non-Linear LED Fixture Replacing CFL		76	76	42	9.5	5,840	1.11	16,833	-	16,222	96%
Total								**16,833**	-	**16,222**	**96%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The baseline and efficient wattages (42W and 9.5W, respectively) are fewer than the wattages used in the ex ante estimate (46W and 11.5W, respectively).

The annual lighting hours of operation verified during the M&V site visit (5,840) are fewer than the annual hours of operation used to calculate ex ante savings (6,000).

A heating and cooling interactive factor of 1.11, applicable to a heated, air-conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 96%.

Site 7021 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Lighting	16,833	16,222	96%	3.08
Total		**16,833**	**16,222**	**96%**	**3.08**

Site ID: 7024

Data Collection

The participant received Custom incentives from Ameren Missouri for adding variable frequency drives (VFD) to their ground loop pumps and, also isolated their system, installing VFDs on their building loop water pumps used by the water source heat pumps. Also, control sequences were set up on the dedicated outdoor air supply unit (DOAS) to reduce the outdoor ventilation air during unoccupied periods.

During the first onsite verification visit, the equipment capacities, quantity and efficiencies were verified. Operating schedules, holiday schedules and temperature setpoints were noted. One-time power measurements were noted from the VFD display panels. The site was contacted again at the end of the year as a follow up to determine if their startup items had been resolved.

Analysis Results

The savings for the evaluated measures to add VFDs to the building loop and ground loop pumps are presented in the following table, along with the controls savings:

Site 7024 VFDs on pump motors and Algorithm Inputs

Measure Name	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051001-HVAC Controls No Existing Equipment	83,507	93,815	112%
4080800-VFD for Pump-Early Replacement	37,159	55,926	151%
4080800-VFD for Pump-Early Replacement	22,295	22,247	100%
Total	**142,961**	**171,989**	**120%**

During the onsite verification visit, the conditions observed for the operation of the VFDs on the pump motors are noted in the following table:

<table>
<tr><th></th><th colspan="2">Building Loop</th><th colspan="2">Ground Loop</th><th colspan="2">DOAS Rooftop Unit</th></tr>
<tr><td>Pump</td><td>Pump 1</td><td>Pump 2</td><td>Pump 3</td><td>Pump 4</td><td>BMS trend data</td><td rowspan="3">On 23.5 hours per day</td></tr>
<tr><td>HP</td><td>15</td><td>15</td><td>25</td><td>25</td><td rowspan="2">BMS schedule</td></tr>
<tr><td>Efficiency, motor</td><td>0.93</td><td>0.93</td><td>0.924</td><td>0.924</td></tr>
<tr><td>Speed, %</td><td>0</td><td>100</td><td>100</td><td>99</td><td></td><td></td></tr>
</table>

The above observations were shared with the site during the visit that energy savings would be low when the energy savings calculator is updated with the current operating conditions. Based on the site indicating that there were startup issues, and the building controls contractor was returning to troubleshoot and perform balancing on the water loops, it was agreed to contact the site again at the end of the year.

The site and their contractor provided updated screenshots of the building BMS computer system and trended data for each of the pump motors and the DOAS unit. The updates are in the following table:

<table>
<tr><th></th><th colspan="2">Building Loop</th><th colspan="2">Ground Loop</th><th colspan="2">DOAS Rooftop Unit</th></tr>
<tr><td>Pump</td><td>Pump 1</td><td>Pump 2</td><td>Pump 3</td><td>Pump 4</td><td>Weekday</td><td>On 6 AM, Off 4:30 PM</td></tr>
<tr><td>Cycling</td><td>Lead</td><td>Lag</td><td>Lead</td><td>Lag</td><td rowspan="2">Weekend</td><td rowspan="2">OFF</td></tr>
<tr><td>Speed, %</td><td>60</td><td>0</td><td>60</td><td>0</td></tr>
</table>

The ex post energy savings method applied the IPVMP Option A, Retrofit Isolation for the pump VFD motors and the engineering calculator workbook for the DOAS unit, which had determined the ex ante savings.

A pump load-weather bin analysis was completed for each pump in the pre and post period. The pumps now operate primarily in a lead/lag sequence, with one pump for each loop balanced to 60% of full speed. Although, not modulated the power is reduced from a throttled pump. The relationship between water flow and motor power was modeled with Uniform Methods and Practice (UMP) algorithm below.

$$Flow_{\%} = a + b\ x\ Power_{\%} + c\ x\ Power_{\%}^2$$

The correlation coefficients for a throttle control pump and VFD pump are below:

Site 7024 Pump load and power coefficients

Coefficient	Throttle	VFD
a	0.55218	0.21976
b	0.6370	-0.87478
c	-0.1900	1.65260

An hourly weather bin for pump flow, then calculated power where compared the pumps operating at the design baseline conditions for one pump operating as the lead pump at full flow. As the pump speed is constant, there was not a weather to load relationship, and the pumps transfer heat from the water source heat pumps for both heating and cooling.

The new inputs for RTU1, the dedicated outdoor air supply unit were running with the savings calculator for reducing the outdoor ventilation air, which was the same as the original design intent, less ½ hour.

The final results are the pumps have an energy savings of 78,174 kWh and the DOAS unit has energy savings of 83,507 kWh with realization rates of 151% and 112%, respectively.

Site 7024 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	HVAC	83,507	93,815	112%	41.65
	Motors	29,727	78,174	151%	7.71
Total		**142,961**	**171,989**	**120%**	**52.44**

Site ID: 7026

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7026 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061712-LED Non Linear LED Fixture Replacing HID		4	2	300	162	2,527	1.00	2,143	-	2,214	103%
Total								**2,143**	-	**2,214**	**103%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (2,527) are greater than the annual hours of operation used to calculate ex ante savings (2,286).

A heating and cooling interactive factor of 1.00, applicable to an unconditioned space in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 103%.

Site 7026 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Lighting	2,143	2,214	103%	0.42
Total		**2,143**	**2,214**	**103%**	**0.42**

Site ID: 7053

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing thirty-five rooftop HVAC units with higher efficiency units.

During the onsite verification visit, the equipment capacities, quantity and efficiencies were verified. Photographs of the 35 units were taken of their nameplates. Access to the BMS was limited without their maintenance technician, but the contact provided the operational schedules of the units, and the schedule for the Summer months, with reduced hours for maintenance work.

Analysis Results

The savings for the evaluated measures to replace all the rooftop units are presented in the following table.

Site 7053 Rooftop HVAC savings and Algorithm Inputs

<table>
<tr><th rowspan="2">Measure Name</th><th colspan="8">Ex ante and Ex Post Inputs</th><th rowspan="2">Ex Ante (kWh)</th><th rowspan="2">Ex Post Gross (kWh)</th><th rowspan="2">RR</th></tr>
<tr><th colspan="2">Efficiency</th><th colspan="2">Baseline</th><th colspan="2">Hours</th><th colspan="2">Capacity</th></tr>
<tr><td rowspan="3">4051800-HVAC-Packaged Rooftop Unit-Early Replacement(<65,000 BTU)</td><td colspan="2">SEER</td><td colspan="2">SEER</td><td colspan="2">Occupied</td><td colspan="2">Tons</td><td rowspan="3">80,160</td><td rowspan="3">80,160</td><td rowspan="3">100%</td></tr>
<tr><td>14</td><td>14</td><td rowspan="2">13</td><td rowspan="2">13</td><td rowspan="2">11</td><td rowspan="2">11</td><td rowspan="2">86</td><td rowspan="2">86</td></tr>
<tr><td>15.7</td><td>15.7</td></tr>
<tr><td rowspan="3">4051800-HVAC-Packaged Rooftop Unit-Early Replacement(>65,000 BTU)</td><td colspan="2">EER</td><td colspan="2">EER</td><td colspan="2">Occupied</td><td colspan="2">Tons</td><td rowspan="3">36,202</td><td rowspan="3">36,202</td><td rowspan="3">100%</td></tr>
<tr><td>10.7</td><td>10.7</td><td rowspan="2">9.9 to 11.2</td><td rowspan="2">9.9 to 11.2</td><td rowspan="2">11</td><td rowspan="2">11</td><td rowspan="2">271</td><td rowspan="2">271</td></tr>
<tr><td>14.3</td><td>14.3</td></tr>
<tr><td>Total</td><td colspan="8"></td><td>116,362</td><td>116,362</td><td>100%</td></tr>
</table>

The engineering savings calculator used for the ex ante savings estimate was updated with the current operating equipment and setpoints. The baseline was appropriate for the location. As there were not differences in the values inputted, the ex ante savings and ex post energy savings are equal at 116,362 kWh. The End Use factor for Cooling is appropriate, with 105 kW of realized demand savings.

Site 7053 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Cooling	116,362	116,362	100%	105.97
Total		**116,362**	**116,362**	**100%**	**105.97**

Site ID: 7055

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing rooftop HVAC equipment with efficient units.

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. Operating schedules, holiday schedules and temperature setpoints were noted. Trend data was obtained from the BMS system for points to determine the Summer break schedule occupancy.

Analysis Results

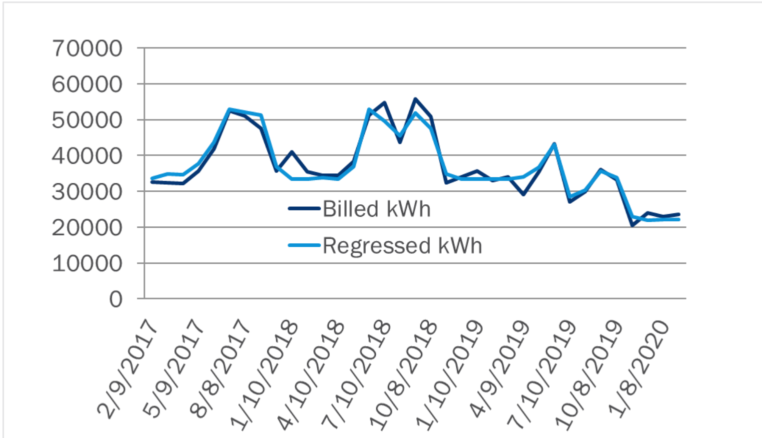
The savings for the evaluated measures to replace the rooftop units are presented in the following table.

Site 7055 Rooftop HVAC savings and Algorithm Inputs

Measure Name	Regression coefficients – Degree Days to metered energy									Ex Ante (kWh)	Ex Post Gross (kWh)	RR
	CDD_{coef}		HDD_{coef}		School		$Post_{coef}$		R^2			
Coefficient value	25		1		-9		-11422		0.93			
Statistic significance	p_{value}	<0.05	p_{value}	<0.05	p_{value}	<.05	p_{value}	<0.05				
4051801-HVAC-Rooftop Unit-Replacing No Existing										15,827	9,844	62%
4051801-HVAC-Rooftop Unit-Replacing No Existing										18,492	11,501	62%
Total										**34,319**	**21,345**	**62%**

The ex post energy savings method applied the IPVMP Option C, Whole Facility Analysis. The regression model was based on two years prior to the project implementation and the months after completion with the metered billing data and weather data from the nearby NOAA weather station. The cooling and heating temperature balance points were set to optimize the regression statistics, for determining the heating degree days and cooling degree days. Factors that did not contribute to the regression model were not used. All the coefficients of the whole building model regression had significance with probability "p" value less than 0.05 and t-stat values over 2.0. The regressed model and the billing metered data are presented in the following table.

Site 7055 Billing metered data and regression model



The ex post energy savings for all the measures implemented during the Summer break, including the new LED lighting, realized 140,000 kWh in savings. The realized savings were applied proportionately to both the lighting project and the HVAC project. The proportion of this project's savings results in 21,345 kWh of annual energy savings and 19.44 kW in demand savings. The ex ante calculator was not used for the basis of savings, as the calculator monthly profile did not consider the school Summer schedule. The school has a newer BMS system and schedules both within the system and through an external application for school staff to readily update based on their requirements to enter the school during the breaks.

Site 7055 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Cooling	34,319	21,345	124%	19.44
Total		**34,319**	**21,345**	**124%**	**19.44**

Site ID: 7059

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7059 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061713-LED Non-Linear LED Fixture Replacing CFL		92	92	58	12.4	6,856	1.14	39,322	-	32,787	83%
		24	24	32	14	7,848	1.14	4,049	-	3,865	95%
Total								**43,371**	-	**36,652**	**85%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit (6,856 and 7,848, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (8,760).

A heating and cooling interactive factor of 1.14, applicable to a heated, air-conditioned apartment in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 85%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7059 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Lighting	39,322	32,787	83%	6.23
		4,049	3,865	95%	0.73
Total		**43,371**	**36,652**	**85%**	**6.96**

Site ID: 7060

Data Collection

The participant received Custom incentives from Ameren Missouri for recommissioning their building with new building controls and programming for occupancy schedules, supply air reset based on VAV box demand, and optimized morning startup.

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. The site contact provided access to the BMS system to download historical trends since the project was completed, along with schedules and block programming for the reset routines.

Analysis Results

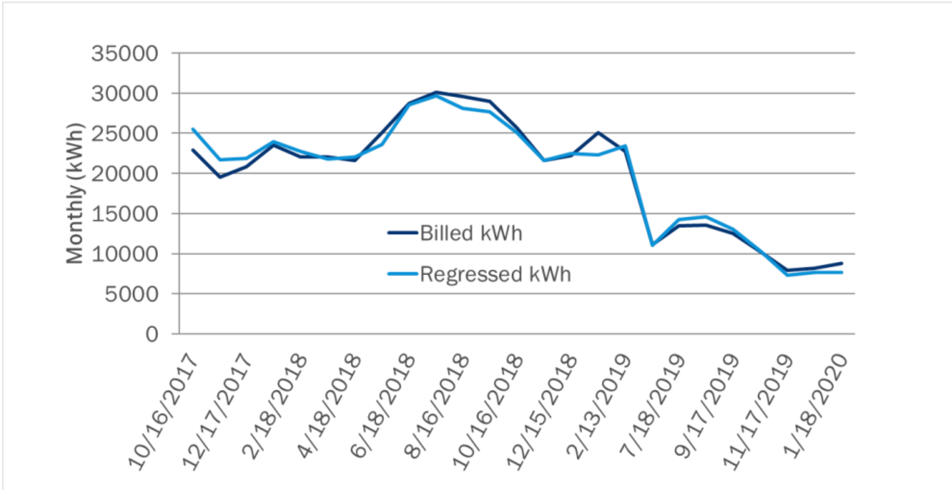
The savings for the evaluated measures to recommission the building are in the following table.

Site 7060 BMS controls savings and Algorithm Inputs

Measure Name			Regression coefficients – Degree Days to metered energy					Ex Ante (kWh)	Ex Post Gross (kWh)	RR
	CDD_{coef}		HDD_{coef}		$Post_{coef}$		R^2			
Coefficient value	20		4		-14435					
Statistic significance	p_{value}	<0.05	p_{value}	<0.05	p_{value}	<0.05	0.97			
4051000-HVAC Controls EMS-Early Replacement								80,119	121,041	151%
Total								**80,119**	**121,041**	**151%**

The ex post energy savings method applied the IPVMP Option C, Whole Facility Analysis. The regression model was based on two years prior to the project implementation and the months after completion with the metered billing data and weather data from the nearby NOAA weather station. The cooling and heating temperature balance points were set to optimize the regression statistics, for determining the heating degree days and cooling degree days. Factors that did not contribute to the regression model were not used. All the coefficients of the whole building model regression had significance with probability "p" value less than 0.05 and t-stat values over 2.0. The regressed model and the billing metered data are presented in the following table.

Site 7060 Billing metered data and regression model



The realized savings based on this reduced energy usage is 151% and has 60.97 kW savings in peak demand. The high realization rate is attributed to the site providing a conservative savings estimate, as the value was a large percentage of their annual consumption and also not taking the time to detail each of the energy savings measures in an engineering calculator tool.

Site 7060 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Cooling	69,871	105,559	151%	46.87
	HVAC	10,248	15,482	151%	14.10
Total		**80,119**	**121,041**	**151%**	**60.97**

Site ID: 7061

Data Collection

The participant received Custom incentives from Ameren Missouri for upgrading the building automation system (BAS) controls for an air handler and 57 VAV boxes. The savings are attributed to improving the VFD modulation, setting minimum air flows for the VAV boxes, and resetting the air duct static pressure.

During the onsite verification visit, field staff verified the location of the new controls in the building, obtain air handler model plate information, and downloaded trend data from the upgraded BAS system.

Analysis Results

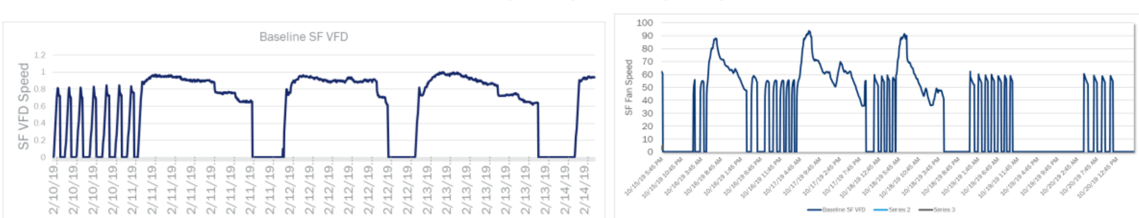
The savings for the evaluated measures to replace the building controls are presented in the following table.

Site 7061 HVAC Variable Speed Supply Fans and Controls

Measure Name	Ex Post Gross (kWh)	RR
4051000-HVAC Controls EMS-Early Replacement	78,589	102%
Total	**78,589**	**102%**

The ex post energy savings method followed the IPMVP Option A, retrofit isolation, utilizing the same engineering savings calculator as the ex ante savings. The calculator was first verified to previous work, then resolved any differences. The first energy saving measure reviewed was the EEM1 to achieve savings from modulating the air handler VFD. The baseline did not fully modulate, as there were 8 VAV boxes that required rebalancing for either too much or too little airflow. The cooling and heating setpoint inputs were set to those observed during the site visit, resulting in slightly less savings at 13,722 compared to the ex ante of 14,468. The most significant difference is for EEM2 and EEM 3 which achieve savings when the supply fan reduces speed and flow during Occupied periods, from both static pressure reduction and less cooling energy. The trend data downloaded from the BAS during the onsite visit, was compared to the baseline data that was also stored in the computer. In the following two figures, the pre and post air handler fan speed are presented. They both have the fan turning off during unoccupied periods, but the post period monitors the carbon dioxide levels and reduces the outdoor air along with the total fan air flow during the occupied period. The ex post savings determined the On fan time and Off fan time and applied the values to the engineering calculator inputs.

Site 7061 SF Speed pre and post period 1



The ex post savings from the three implemented measures total 78,589 kWh for a 102% realization rate.

Site 7061 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	HVAC	52,821	52,821	100%	23.45
	Cooling	24,440	25,768	105%	23.47
Total		**77,261**	**78,589**	**102%**	**46.92**

Site ID: 7062

Data Collection

The participant received Custom incentives and implemented a recommissioning measure from a study incentivized by Ameren Missouri.

The nameplates information for the air compressors in both areas along with the air dryers were collected. Site personnel provided manufacturing schedules and air compressor staging details. Data for the analysis was obtained from the monitoring performed by the trade ally for total air flow and power along with pressure on each compressor for 7 days. The absence of leaks was verified across various plant areas for the 39 leaks identified by ultrasound testing, for a reduction of 63 cfm.

Analysis Results

The savings for the evaluated measures from the incentivized replacement air compressor is presented in the following table.

Site 7062 Air compressor savings and model inputs

Measure Name	Ex ante method	Ex post method	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4020600-Efficient Air Compressor	Pre data and bins	Pre data, hourly, weekends,weekdays	144,415	133,008	92%
Total			**144,415**	**133,008**	**92%**

The project documentation was reviewed, and the Preliminary Air Study dataset from the trade ally, was used for the estimation of savings. The metered data for a one-week period, included amperage of each air compressor, and air pressure. There was a fixed speed base air compressor and a variable speed trim air compressor with an existing receiver tank.

Energy savings for the air compressor measure was estimated using the International Performance Measurement and Verification Protocol Option A: Retrofit Isolation methodology.

This air savings was estimated with the leak repair verification and using the facility's compressed air load profile, derived from baseline monitoring data. The air compressor logged current data was used to calculate power, using the following algorithm:

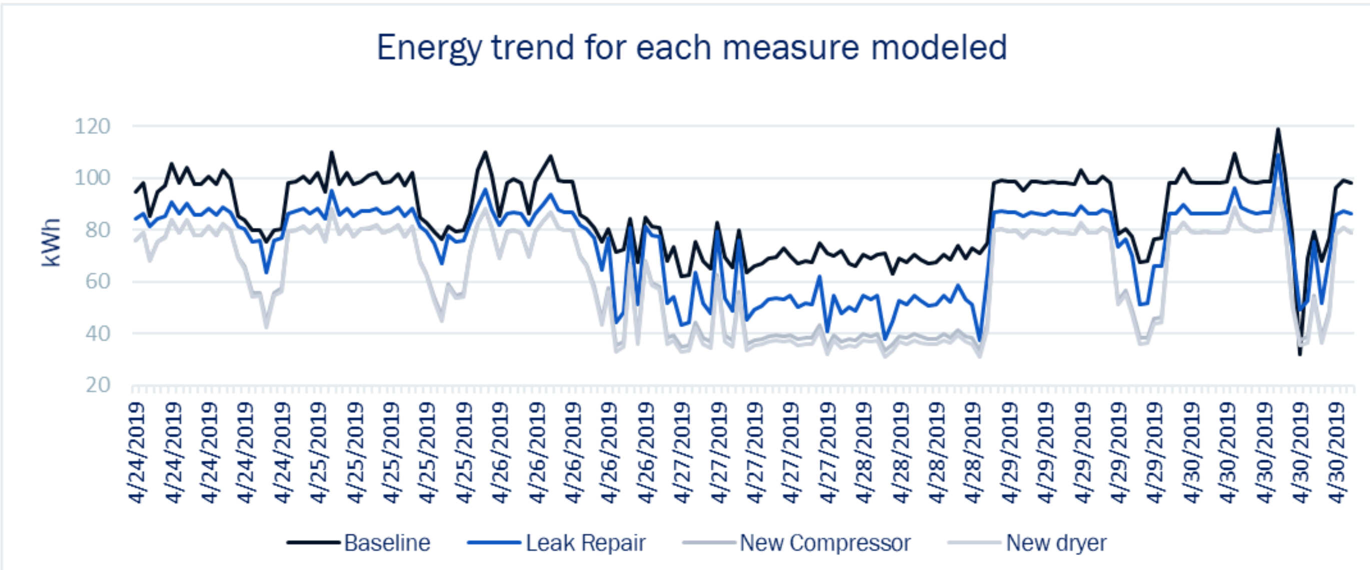
$$P = \frac{\sqrt{3} \times V \times A \times pf}{1{,}000}$$

Where:

P = *Power (kW)*
V = *Voltage (460)*
A = *Amperage*
pf = *Power factor (calculated using a power factor as a function of full-load amps curve)*

The load (cfm) at each monitoring point was determined using the calculated kW values and the CAGI datasheet for the air compressors. From the CAGI datasheet, the efficiency curve of kW vs cfm was built. The curve was used to determine the cfm at each data point. The cfm and kW values were summed for each air compressor to get total system kW and cfm. The system efficiency was determined with this dataset. The 37-cfm air reduction was applied to the ex post model to determine the typical week model savings. The estimated air leak reduction by the trade ally was used by both the ex ante and ex post which assigns a cfm value based on the sizing of “small, medium, large and extra-large”. This method is approved in the Chapter 22 of the Uniform Methods Projects for compressed air evaluation.

Site 7062 Energy trend for each measure model



The realization rate for the air leak repair was 99%, with 106,229 annual kWh saved. The ex ante and ex post models were similar, using the same CAGI air compressor data sheets and baseline trend data.

The Custom measure had two components, savings from the new air compressor and savings from a new air dryer. The new air compressor savings were similar from the ex ante to ex post, with the difference in that the ex post did not have bin ranges but determined the model savings from each data point.

The refrigerated air dryer ex post savings were 8,222 kWh compared to the ex ante savings of 16,875 kWh. The ex ante savings model set the full load dryer kW equal to the load for each data point, as indicated on their calculator for non-cycling refrigerated dryers. The ex post observed the manufacturer’s data sheet that indicated some reduction in power for less than full loads, varying from 4.32 kW to 3.13 kW. Both the ex ante and ex post model had the same values for the efficient dryer, which was a cycling type.

The peak coincident kW savings were calculated using the algorithm below, with the air compressor Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The following table lists the realized demand savings of 18.35 kW along with the energy savings for the Custom measure.

Site 7018 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Air Compressor	144,415	133,008	92%	18.35
Total		**144,415**	**133,008**	**92%**	**18.35**

Site ID: 7063

Data Collection

The participant received Custom incentives from Ameren Missouri to upgrade the building automation system (BAS) controls, mixing box controls and install new rooftop HVAC units.

During the site verification visit, the equipment capacities, quantity and efficiencies were verified. Operating schedules, holiday schedules and temperature setpoints were noted. Trend data was obtained from the BMS system for points to demonstrate the occupied/unoccupied schedules, fan speed, discharge temperature resets.

Analysis Results

The savings for the evaluated measures to replace the building controls are presented in the following table.

Site 7063 Rooftop HVAC with controls savings

Measure Name	Ex Ante (kWh)	Ex Post Gross(kWh)	RR
4051800-HVAC-Packaged / Rooftop Unit-Early Replacement	532,157	189,364	36%
4051801-HVAC-Rooftop Unit-Replacing No Existing	37,921	13,494	36%
Total	**570,078**	**189,364**	**36%**

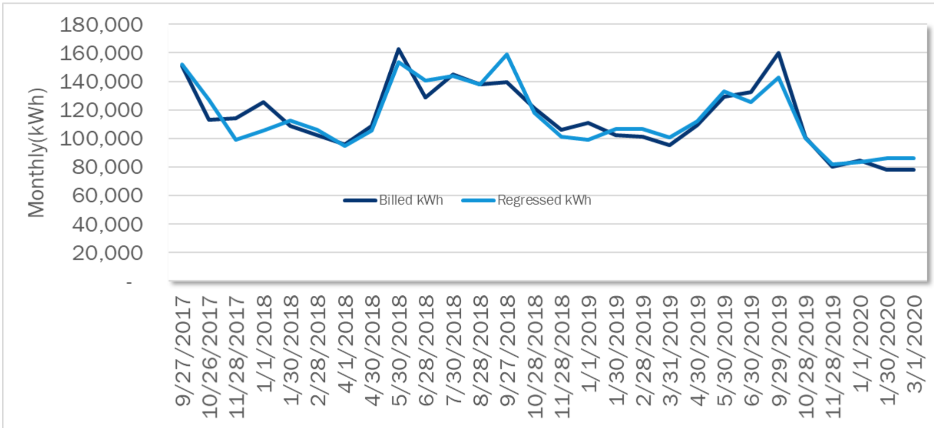
The ex post energy savings method applied the IPVMP Option C, Whole Facility Analysis. The regression model was based on two years prior to the project implementation and the months after completion with the metered billing data and weather data from the nearby NOAA weather station. The cooling and heating temperature balance points were set to optimize the regression statistics, for determining the heating degree days and cooling degree days. Factors that did not contribute to the regression model were not used. All the coefficients of the whole building model regression had significance with probability “p” value less than 0.05 and t-stat values over 2.0.

Site 7063 Rooftop HVAC and Algorithm Inputs

Regression coefficients – Degree Days to metered energy							
CDD_{coef}		HDD_{coef}		$Post_{coef}$		School	
92		40		-16904		-26684	
p_{value}	<0.05	p_{value}	<0.05	p_{value}	<0.05	p_{value}	<0.05

The regressed model to the billing data has an R square statistic of 0.93, a reasonable fit for a school with a schedule that varies.

Site 7063 Metered billing data regression



The model was the populated with TMY3 weather data to determine the annual energy savings of 189,364 kWh for a 36% realization rate.

The engineering calculator was then reviewed to determine the cause of the discrepant savings estimate.

Although a building code related baseline does not always reflect the baseline conditions for determining the actual energy savings, the baseline in the ex ante savings estimate for single packaged HVAC units from 135 MBTU to 240 MBTU was 10.0 EER. The ASHRAE 90.1 2007 indicates the minimum efficiency at 11.0 SEER.

Continuing to the Ventilation Savings worksheet, the expected savings of 374,070 based on reduced runtime on the rooftop units is difficult to achieve as the annual usage of the motors is nearly the same value. The ex ante had reset the cooling size value to better align with the billing data, but the ventilation savings effect was significantly overestimated by the change. The realization rate is 36% with 189,364 kWh in energy savings.

Site 7063 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Cooling	158,087	56,523	36%	51.23
	HVAC	411,991	146,604	36%	65.09
Total		**570,078**	**189,364**	**36%**	**116.32**

Site ID: 7064

Data Collection

The participant received Custom incentives to replace a baseload air compressor with a 500-horsepower air compressor.

The nameplate data for the air compressors and dryers were collected, along with the backup air compressors. Data was not trended in the SCADA system, but data was available from both the trade ally preinstall period and from a previous project evaluated for new trim air compressors.

Analysis Results

The savings for the evaluated measures from the incentivized replacement air compressor is presented in the following table.

Site 7064 Air compressor savings and model inputs

Measure Name	Ex ante method	Ex post method	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4020600-Efficient Air Compressor	Pre data and bins	Pre data, hourly, weekends,weekdays	338,005	331,882	98%
Total			**338,005**	**331,882**	**98%**

The project documentation was reviewed, and the Preliminary Air Study dataset from the trade ally, was used for the estimation of savings. The metered data for a one-week period, included amperage of each air compressor, and air pressure.

Energy savings for the air compressor measure was estimated using the International Performance Measurement and Verification Protocol Option A: Retrofit Isolation methodology. The air compressor logged current data was used to calculate power, using the following algorithm:

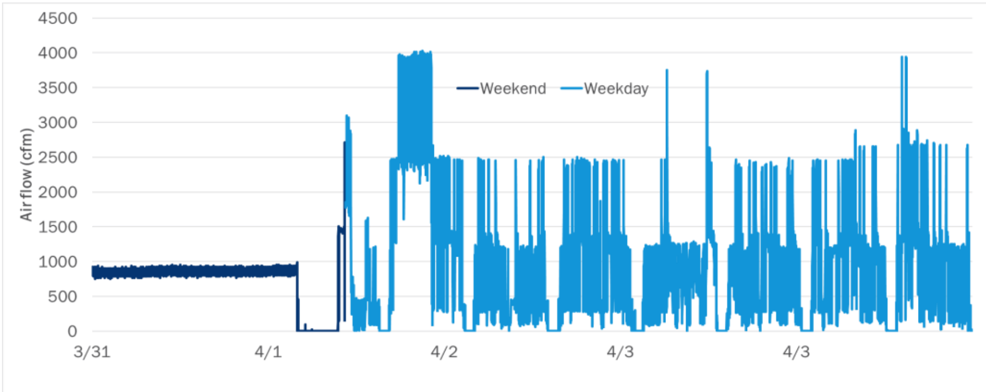
$$P = \frac{\sqrt{3} \times V \times A \times pf}{1{,}000}$$

Where:

P = *Power (kW)*
V = *Voltage (460)*
A = *Amperage*
pf = *Power factor (calculated using a power factor as a function of full-load amps curve)*

The load (cfm) at each monitoring point was determined using the calculated kW values and the CAGI datasheet for the air compressors. From the CAGI datasheet, the efficiency curve of kW vs cfm was built. The curve was used to determine the cfm at each data point. The cfm and kW values were summed for each air compressor to get total system kW and cfm. As the savings occurred due to the increased air supply on this air compressor, offsetting the run time on the less efficient compressor; the total air compressor plant supply was compared in the pre and post period. The system efficiency was determined with this dataset. Using the same trend data and CAGI resulted in similar savings, until the final step of extrapolating the savings from the trended period to an annual savings. The ex post observed the significant difference in the weekday and weekend air demand for this manufacturing facility. The ex ante applied the complete efficiency curve to the annual schedule.

Site 7064 Weekend and Weekday Trends for Air Flow (cfm)



The realized savings from this model is 331,882 kWh.

The peak coincident kW savings were calculated using the algorithm below, with the air compressor Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The following table lists the realized demand savings of 45.78kW along with the energy savings for the Custom measure.

Site 7064 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Air Compressor	338,005	331,882	98%	45.78
Total		**338,005**	**331,882**	**98%**	**45.78**

Site ID: 7066

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7066 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061713-LED Non-Linear LED Fixture Replacing CFL		291	291	84	35	8,760	1.14	133,652	(54,960)	87,436	65%
Total								**133,652**	**(54,960)**	**87,436**	**65%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air-conditioned apartment in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 65%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7066 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
SBDI	Lighting	133,652	87,436	65%	27.05
Total		**133,652**	**87,436**	**65%**	**27.05**

Site ID: 7067

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7067 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061713-LED Non-Linear LED Fixture Replacing CFL		3	3	64	27	2,921	1.14	330	-	370	112%
		5	5	192	54	2,921	1.14	2,050	-	2,298	112%
		28	28	36	9	2,921	1.14	2,246	-	2,518	112%
		8	8	36	27	3,230	1.14	214	-	265	124%
		2	2	72	27	3,230	1.14	267	-	331	124%
		25	25	80	40	2,921	1.14	2,971	-	3,330	112%
		14	14	80	18	3,230	1.14	2,579	-	3,196	124%
		1	1	120	60	3,230	1.14	178	-	221	124%
		106	106	42	9	2,921	1.14	10,394	-	11,649	112%
		8	8	42	27	1,152	1.14	357	-	158	44%
		21	21	84	18	1,152	1.14	4,118	-	1,819	44%
		13	13	84	27	1,152	1.14	2,202	-	973	44%
		14	14	26	8	3.230	1.14	749	-	928	124%
Total								**28,655**	-	**28,055**	**98%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit for the tenth through twelfth line item in the table above (1,152) are fewer than the annual hours of operation used to calculate ex ante savings (2,777). The remaining line items had hours (ranging from 2,921 – 3,230) which are greater than the ex ante savings estimate hours (2,777). The facility site contact provided weekly hours per area of use.

A heating and cooling interactive factor of 1.14, applicable to a heated, air-conditioned secondary educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 98%.

Site 7067 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Lighting	28,655	28,056	98%	5.33
Total		**28,655**	**28,056**	**98%**	**5.33**

Site ID: 7070

Data Collection

The participant received Custom miscellaneous lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, control method, and interviewed facility personnel regarding the building occupancy schedule and the lighting schedule for each usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7070 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4061604-LED Linear Tube LED Fixture Replacing T8 Fixture		456	456	59	28	8,760	1.00	123,831	-	123,831	100%
4061611-LED Linear Tube LED Fixture Replacing HID		47	47	66	31	8,760	1.00	14,410	-	14,410	100%
Total								**138,241**	-	**138,241**	**100%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation verified during the M&V site visit with the facility site contact (8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned space in St. Louis, was applied to the ex post lighting energy savings and corresponds with the ex ante savings estimate.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 100%.

Site 7070 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Miscellaneous	138,241	138,241	100%	19.07
Total		**138,241**	**138,241**	**100%**	**19.07**

Site ID: 7071

Data Collection

The participant received Custom incentives and implemented building shell measures to reduce the cooling the load.

The site had a detailed building assessment report completed on the building envelope to prioritize areas for reduction air infiltration and areas to increase the insulation. This report data was cross checked to the improvements that were verified as completed during a walk through with the project manager. Inputs to the savings algorithm, primarily sourced from the ASHRAE for "crack method calculations" to quantify air leakage were checked.

Analysis Results

The savings for the Custom evaluated measures are presented in the following table.

7071 Energy Savings by Measure

Measure Name	End Use	Program	Ex Ante kWh	Ex Post Gross kWh	Realization Rate
4010101-BuildingShell-Wall Insulation	Building Shell	Custom	79,989	79,989	100%
Total			**79,989**	**79,989**	**100%**

Areas were sampled from the completion report and verified as presented in the following table.

7071 Sampled measures for visual verification

Building	Measure	Expected quantity	Found quantity
Hall A	Door Sweeps	3	3
	Window sealing	990 LF	Checked 6 windows, all sealed
	Double door Sweep	88 LF	Identified all doors on perimeter completed,>88 LF
Hall B	Skylight ceiling	176 LF	Visible from ground level
Hall C	Mechanical openings	60	Verified six openings as sealed
Hall D	Door bottom sweeps	16	16

After the air leak CFM and insulation volume were verified, the inputs to the ASHRAE savings algorithm were reviewed. The heating degree days HDD, and cooling degree days CDD, were determined for TMY3 weather data at the nearby Lambert International Airport and determined to be correct. The setpoint for determining the HDD and CCD point for each hourly bin were not made available for the review but were stated to follow the ASHRAE degree day method.

The input for the cooling system efficiency appeared to be a default value but was within the range of the multiple mechanical systems across the seven buildings, which included an air cooled, self-contained DX units, and a couple split DX units for cooling.

The hours of operation appeared to be set at 24 hours per day, 7 days per week. This may overestimate the savings, but savings still existed during unoccupied hours as the setpoints increased from 73F to 80F for the space temperatures, even when the unit is enabled to run.

The savings for the building shell measures in the project are presented in the next table.

7071 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante kWh	Ex Post Gross kWh	Realization Rate	Ex Post Gross kW Reduction
Custom	Building Shell	79,989	79,989	100%	35.51
Total		**79,989**	**79,989**	**100%**	**35.51**

Site ID: 7073

Data Collection

The participant received Custom incentives to replace a fixed speed air compressor with a variable speed air compressor.

The nameplate data for the air compressors and dryers were collected, along with the backup air compressors. Trended data for the air study performed by the trade ally was used to determine the air flow profile.

Analysis Results

The savings for the evaluated measure to replace one air compressor is presented in the next table.

Site 7073 Air compressor savings and model inputs

Measure Name	Ex ante method	Ex post method	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4020800-VFD for Air Compressor	Pre data and bins	Pre data, hourly, weekends,weekdays	212,732	206,124	97%
Total			**212,732**	**206,124**	**97%**

The project documentation was reviewed, and the Preliminary Air Study dataset from the trade ally, was used for the estimation of savings. The metered data for a one week period, included amperage of each air compressor, and air pressure.

Energy savings for the air compressor measure was estimated using the International Performance Measurement and Verification Protocol Option A: Retrofit Isolation methodology. The air compressor logged current data was used to calculate power, using the following algorithm:

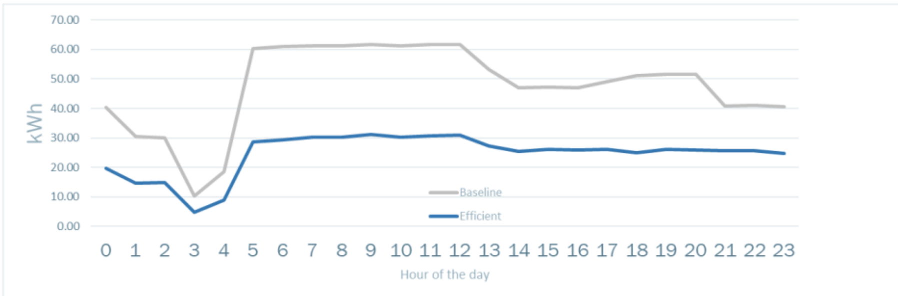
$$P = \frac{\sqrt{3} \times V \times A \times pf}{1{,}000}$$

Where:

P = *Power (kW)*
V = *Voltage (460)*
A = *Amperage*
pf = *Power factor (calculated using a power factor as a function of full-load amps curve)*

The load (cfm) at each monitoring point was determined using the calculated kW values and the CAGI datasheet for the air compressors. From the CAGI datasheet, the efficiency curve of kW vs cfm was built. The curve was used to determine the cfm at each data point. The only minor difference in the ex ante and ex post is the aggregating of weekend and weekday power to build the efficiency ratio, as the ex post considered the weekday and weekend separately, then extrapolated out to one year inclusive of the holiday schedule.

Site 7073 Weekday air compressor power, pre and post period



The peak coincident kW savings were calculated using the algorithm below, with the air compressor Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The air compressor replacement project realized 206,124 kWh in energy savings and 28.43 kW demand savings for realization rates of 97%.

Site 7073 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Air Compressor	212,732	206,124	97%	28.43
Total		**212,732**	**206,124**	**97%**	**28.43**

Site ID: 7077

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing the HVAC rooftop control system with a new networked control system.

During the onsite verification visit, field staff obtain pictures of all the rooftop units under control, walked through some of the tenant areas to collect data from some of the existing baseline thermostats, and establish the building occupancy schedule with multiple tenants.

Analysis Results

The savings for the evaluated measures to replace the building controls are presented in the following table.

Site 7077 HVAC controls savings

Measure Name	Ex ante method	Ex post method	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051000-HVAC Controls EMS-Early Replacement	Degree day-billing regression	Degree day-billing regression	37,984	20,314	54%
Total			**37,984**	**20,314**	**54%**

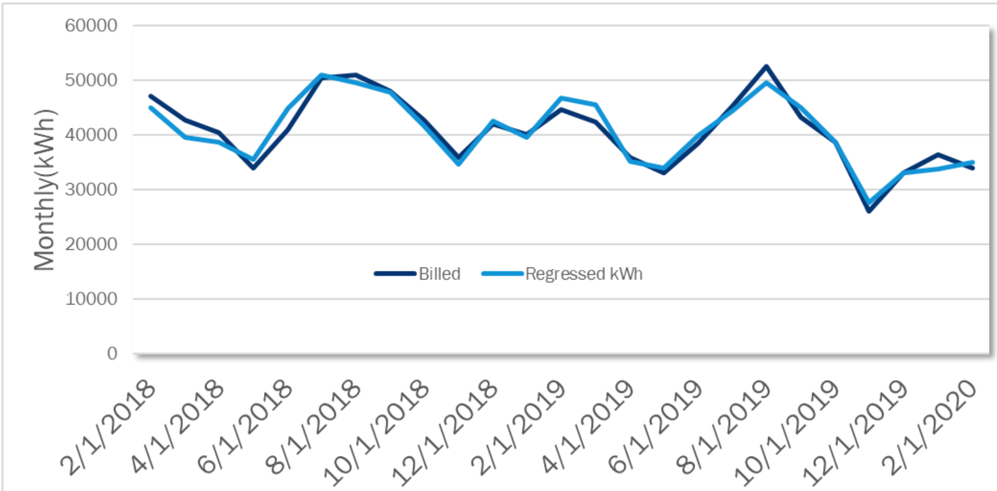
The ex post energy savings method applied the IPVMP Option C, Whole Facility Analysis. The regression model was based on two years prior to the project implementation and the months after completion with the metered billing data and weather data from the nearby NOAA weather station. The cooling and heating temperature balance points were set to optimize the regression statistics, for determining the heating degree days and cooling degree days. Factors that did not contribute to the regression model were not used. All the coefficients of the whole building model regression had significance with probability "p" value less than 0.05 and t-stat values over 2.0.

Site 7077 Regression Statistics

Regression coefficients – Degree Days to metered energy						
CDD_{coef}		HDD_{coef}		$Post_{coef}$		R^2
	58		23		-6505	
p_{value}	<0.05	p_{value}	<0.05	p_{value}	<0.05	0.92

The following figure presents the regressed model to the billed metered data spanning the pre and post periods. The Coefficient, Post, is set by a binary switch to only contribute to the regression during the period after the project installation. The R square fit was good with a value of 0.92 and all the coefficients were significant.

Site 7077 Billed metered data and regressed model



The regression model estimated an annual savings of 78,062 kWh. The expected savings from this project along with the expected savings from the lighting project also completed, were apportioned to the savings, resulting in 20,314 kWh energy savings for the HVAC controls project. During the site visit walkthrough, the old thermostats were still on site, which had been connected to a building control system. It was stated that the new networked system removes the tenant control, and schedules with setbacks are programmed at a master level, and exceptions programmed as needed. The ex ante savings was similarly based on a regression but presumed all the rooftop HVAC units ran 24/7. The new schedule for the HVAC units was 6 am to 6 pm Monday through Friday, which is better than the ex ante proposed schedule of 16 hours per day occupied.

The ex post energy savings had a realization rate of 54%. The usage of the actual operating schedule and run hours increased the realized savings, but the update to the appropriate baseline of SEER 13 decreased the realized savings.

Site 7077 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	HVAC	15,584	8,334	54%	3.70
	Cooling	22,400	11,979	54%	10.91
Total		**37,984**	**20,314**	**54%**	**14.61**

Site ID: 7081

Data Collection

The participant received Custom incentives from Ameren Missouri for replacing a 100 hp fixed speed air compressor with a 100 hp variable speed air compressor and relocated another as backup.

During the onsite verification visit of this project, the air compressor model nameplates were photographed, along with the baseline air compressor which was now the backup air compressor. The trade ally provided the air flow and power study that was completed before the project was started.

Analysis Results

The savings for the evaluated measures from the incentivized replacement air compressor is presented in the following table.

Site 7081 Air compressor savings and model inputs

Measure Name	Ex ante method	Ex post method	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4020600-Efficient Air Compressor	Pre data and bins	Pre data, hourly, weekends,weekdays	248,685	236,614	95%
Total			**248,685**	**236,614**	**95%**

Energy savings for the air compressor measure was estimated using the International Performance Measurement and Verification Protocol Option A: Retrofit Isolation methodology. The trend data from the air study which metered the baseline air compressor, was used to determine an air flow data series, which then determined the new compressor power from its specifications. After adding the site's holiday schedule to the hourly profile, the energy savings is 236,614 kWh for a 95% realization rate. As the same data source, same CAGI datasheets were used for the ex ante and ex post, the only value that differed was the number of holidays. The ex post was informed of 13 per year.

The peak coincident kW savings were calculated using the algorithm below, with the air compressor Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The following table lists the ex post gross demand savings of 32.64 along with the energy savings.

Site 7081 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
Custom	Air Compressor	248,685	236,614	95%	32.64
Total		**248,685**	**236,614**	**95%**	**32.64**

Site ID: 7142

Data Collection

The participant received Custom incentives for installing controls to optimize the three chillers in the chiller plant along with changes to the secondary chiller pumps, controlling outdoor air and economizers.

Nameplate model information was collected for chillers, chilled water pumps, condenser water pumps and the cooling tower. The BMS computer system was reviewed to identify the energy conservation measures.

Analysis Results

The savings for the evaluated measures from the Custom program is presented in the following table.

7142 Energy Savings by Measure

Measure Name	End Use	Program	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4050500-HVAC-Cooling Only Equipment	Cooling	Custom	585,532	594,992	102%
Total			**585,532**	**594,992**	**102%**

The ex post savings estimate updated the engineering calculator for each of the energy conservation measures (ECM). Baseline trend data had been provided by the trade ally, and additional post install trend data obtained during the onsite visit. For the largest ECM measure savings, days requiring mechanical cooling were limited, but the trend charts validated the only running chiller to turn off at 55F and the outdoor air dampers modulating for free cooling. The outdoor air dampers had been set at a minimum of 10% open and were modulated to 2% in the early evening hours. The ex post applied the Uniform Methods algorithm to the RTU pump measure as the ex ante completed the savings analysis with scaling a zero to ten distance, whereas the pump was not programmed to go less than 30% speed, and the BMS trend data of zero to ten represents the speeds from 30% to 100%, increasing the realized savings.

7142 Results of weather bin tool updates

Implemented ECMs					
Measures	**Baseline**	**Change to inputs**	**Efficient**	**Group**	**Ex post (kWh)**
Econo single zone	39,538	No change	37,162		
Econo AHU7	55,373	No change	49,693		
Econo VAV	1,371,039	No change	1,187,740		
	1,465,949	No change	1,274,595	191,354	191,354
Chiller Off at 55F	85,977	More off time than ex ante, but not enough cooling days for certainty	-	85,977	85,977
RTU1,2,3, VFD	44,091	Pump speed adjusted	12,458	31,633	31,633
VAV OA damper	282,373	No change	274,378	7,995	
VAV OA damper	218,057	No change	207,088	10,969	
	500,430		481,466	18,964	18,964
Chiller optimizer	1,250,855	No change	1,181,269	69,586	69,586

Implemented ECMs					
Chiller pumps	237,840	No change	40,362	197,478	197,478
Total					**594,992**

The results of updating the nine measures with the as-built conditions, and TMY3 weather data, increased the savings to 594,992 kWh for a 102% realization rate.

7142 Energy and Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Custom	Cooling	585,532	594,992	102%	541.85
Total		**585,532**	**594,992**	**102%**	**541.85**

Appendix D. Desk Review Reports: SBDI Program

Site ID: 7200

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7200 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	8	8	221	87	2,080	0.78	2,385	(580)	1,739	73%
		14	14	114	58	2,080	0.85	1,745	(391)	1,386	79%
		1	1	59	29	2,080	0.78	67	(16)	49	73%
Total								**4,197**	**(987)**	**3,174**	**76%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,080) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 76%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7200 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	4,197	3,174	76%	0.79
Total		**4,197**	**3,174**	**76%**	**0.79**

Site ID: 7201

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7201 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	10	10	75	10	1,624	1.11	739	-	766	104%
4060814-Fluorescent T12 replaced with LED Type B	800900	8	8	227	86	1,624	1.11	1,960	-	2,033	104%
		6	6	138	86	1,624	1.11	542	-	562	104%
Total								**3,241**	-	**3,361**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (1,624) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 107%.

Site 7201 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	3,241	3,361	104%	0.64
Total		**3,241**	**3,361**	**104%**	**0.64**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7201 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	75	18.9	160
		2025	227	128	606
			138	128	454
Total					**1,220**

Site ID: 7202

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7202 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	55	55	60	9	1,200	1.09	2,330	-	2,374	102%
4060310-Halogen BR/R 45W replaced with LED 13W	800150	14	14	60	9	1,200	1.09	917	-	934	102%
4060814-Fluorescent T12 replaced with LED Type B	800900	54	54	164	48	600	1.09	4,022	-	4,097	102%
		19	19	72	30	1,200	1.09	1,025	-	1,044	102%
		97	97	82	24	600	1.09	3,611	-	3,679	102%
		1	1	56	18	1,200	1.09	48	-	50	104%
		32	32	48	17	300	1.09	319	-	324	102%
		39	35	48	12	600	1.09	932	-	950	102%
		10	10	28	9	600	1.09	122	-	124	102%
4060330-Halogen PAR	800250	9	9	75	15	300	1.09	173	-	177	102%
		8	8	50	7	1,200	1.09	442	-	450	102%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
48W replaced with LED 2W											
Total								13,941	-	14,203	102%

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings annual hours of operation (ranging from 300 – 1,200).

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7202 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	13,941	14,203	102%	2.70
Total		**13,941**	**14,203**	**102%**	**2.70**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7202 Measures with Midlife Savings

<table>
<tr><th>Program</th><th>End Use Category</th><th>MidLife Baseline Shift Year</th><th>Baseline Watts Pre Shift</th><th>Baseline Watts Post Shift</th><th>Ex Post Gross (kWh)</th></tr>
<tr><td rowspan="8">SBDI</td><td rowspan="8">Lighting</td><td>2022</td><td>60</td><td>13.4</td><td>317</td></tr>
<tr><td rowspan="7">2025</td><td>164</td><td>128</td><td>2,825</td></tr>
<tr><td>72</td><td>64</td><td>845</td></tr>
<tr><td>82</td><td>64</td><td>2,538</td></tr>
<tr><td>56</td><td>32</td><td>18</td></tr>
<tr><td>48</td><td>32</td><td>157</td></tr>
<tr><td>48</td><td>32</td><td>542</td></tr>
<tr><td>28</td><td>16</td><td>46</td></tr>
<tr><td>Total</td><td colspan="4"></td><td>7,288</td></tr>
</table>

Site ID: 7203

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7203 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	17	17	164	58	250	1.11	482	-	500	104%
4060813-Fluorescent T12 replaced with LED Type A/B		1	1	72	32	250	1.11	11	-	11	100%
Total								**493**	-	**511**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (250).

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7203 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	493	511	104%	0.10
Total		**493**	**511**	**104%**	**0.10**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7203 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	330
			72	64	9
Total					**339**

Site ID: 7204

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7204 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	66	66	138	86	1,500	1.04	5,508	-	5,354	97%
Total								**5,508**	-	**5,354**	**97%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (1,500).

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7204 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	5,508	5,354	97%	1.02
Total		**5,508**	**5,354**	**97%**	**1.02**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7204 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	138	128	4,324
Total					**4,324**

Site ID: 7205

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7205 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	2	2	60	9	1,825	1.11	129	-	134	104%
		1	1	60	9	1,825	1.11	65	-	67	103%
		1	1	60	9	1,825	1.11	65	-	67	103%
4060814-Fluorescent T12 replaced with LED Type B	800900	3	3	138	86	1,825	1.11	305	-	316	104%
		1	1	138	86	1,825	1.11	102	-	105	103%
		8	8	138	86	1,825	1.11	812	-	843	104%
		3	3	138	86	1,825	1.11	305	-	316	104%
		1	1	138	86	1,825	1.11	102	-	105	103%
		5	5	164	74	1,825	1.11	880	-	912	104%
		4	4	164	74	1,825	1.11	703	-	729	104%
		2	2	82	37	1,825	1.11	175	-	182	104%
4060810-Fluorescent T12 replaced with LED fixture		1	1	164	40	1,825	1.11	242	-	251	104%
		2	2	164	40	1,825	1.11	485	-	502	104%
		2	2	164	40	1,825	1.11	485	-	502	104%
Total								**4,855**	-	**5,031**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = \ kWh_{savings(Whf)} - \ kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (1,825) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7205 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	4,855	5,031	104%	0.96
Total		**4,855**	**5,031**	**104%**	**0.95**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7205 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	18
			60	13.4	9
			60	13.4	9
		2025	138	128	255
			138	128	85
			138	128	681
			138	128	255
			138	128	85
			164	128	547
			164	128	438
			82	64	109
			164	128	178
			164	128	357
			164	128	357
Total					**3,383**

Site ID: 7206

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7206 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	28	28	60	9.5	250	0.9	247	(48)	205	83%
4060310-Halogen BR/R 45W replaced with LED 13W	800150	10	10	65	9.5	250	0.9	149	(29)	125	84%
4060814-Fluorescent T12 replaced with LED Type B	800900	9	9	138	86	500	0.9	250	(49)	211	84%
		55	55	82	29	500	0.9	1,559	(306)	1,312	84%
Total								**2,205**	**(432)**	**1,853**	**84%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)}=\left(Qty_{pre}x\ Watts_{pre}-Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident}=kWh_{savings(Whf)}x\ \ CF$$

The efficient wattage for the first- and second-line items in the table above (9.5W) is greater than the wattage used to calculate ex ante savings (9W). The invoice specifies 9.5W in the description.

The annual lighting hours of operation referenced the ex ante savings hours (250).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 84%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive factors.

Site 7206 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	2,205	1,853	84%	0.43
Total		**2,205**	**1,853**	**84%**	**0.43**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7206 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	30
		2025	138	128	210
			82	64	1,068
Total					**1,308**

Site ID: 7207

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7207 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	51	51	75	9	1,000	1.09	2,374	-	2,418	102%
		9	9	40	5	2,000	1.09	443	-	451	102%
4060310-Halogen BR/R 45W replaced with LED 13W	800150	32	32	65	8	2,000	1.09	3,903	-	3,976	102%
4060814-Fluorescent T12 replaced with LED Type B	800900	10	10	138	43	2,500	1.09	2,541	-	2,589	102%
		50	50	164	35	2,500	1.09	17,254	-	17,576	102%
		1	1	48	12	2,500	1.09	96	-	98	102%
4060330-Halogen PAR 48W replaced with LED 2W	800250	29	29	75	7	2,000	1.09	4,220	-	4,299	102%
Total								**30,831**	-	**31,407**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the

waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the annual hours of operation used to calculate ex ante savings (2,388).

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7207 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	30,831	31,407	102%	5.97
Total		**30,831**	**31,407**	**102%**	**5.97**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. .Also included are the omni directional lamps and their equivalent CFL wattages.

Site 7207 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	75	18.9	550
			40	9.4	86

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
			138	128	2,316
		2025	164	128	12,671
			48	32	55
Total					**15,678**

Site ID: 7208

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7208 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	18	18	114	48	2,000	1.11	2,542	-	2,637	104%
Total								**2,542**	-	**2,637**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,000) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7208 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	2,542	2,637	104%	0.50
Total		**2,542**	**2,637**	**104%**	**0.50**

Site ID: 7209

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7209 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814- Fluorescent T12 replaced with LED Type B	800900	5	5	164	58	2,080	0.78	1,180	(287)	860	73%
		33	33	82	29	2,080	0.90	3,892	(764)	3,274	84%
Total								**5,072**	**(1,051)**	**4,134**	**82%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,080) and correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than one, applicable to a heated, air conditioned warehouse and small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 82%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7209 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	5,072	4,134	82%	0.99
Total		**5,072**	**4,134**	**82%**	**0.99**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7209 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	757
			82	64	2,667
Total					**3,424**

Site ID: 7210

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7210 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	45	45	164	60	2,973	1.08	14,888	-	15,027	101%
		3	3	72	36	2,973	1.08	343	-	347	101%
Total								**15,231**	-	**15,374**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,973) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7210 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	15,231	15,374	101%	2.92
Total		**15,231**	**15,374**	**101%**	**2.92**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7210 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	9,825
			72	64	270
Total					**10,095**

Site ID: 7211

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7211 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	4	4	60	9	3,300	1.09	466	-	475	102%
		1	1	60	9	3,300	1.09	116	-	119	103%
		1	1	60	9	3,300	1.09	116	-	119	103%
		5	5	60	9	3,300	1.09	582	-	594	102%
		1	1	60	9	3,300	1.09	116	-	119	103%
4060310-Halogen BR/R 45W replaced with LED 13W	800150	1	1	65	8	3,300	1.09	202	-	205	101%
		6	6	65	8	3,300	1.09	1,208	-	1,230	102%
		10	10	65	8	3,300	1.09	2,013	-	2,050	102%
		9	9	65	8	3,300	1.09	1,811	-	1,845	102%
4060814-Fluorescent T12 replaced with LED Type B	800900	1	1	138	86	3,300	1.09	183	-	187	102%
		3	3	82	24	2,000	1.09	372	-	379	102%
		4	4	82	24	2,000	1.09	496	-	506	102%
		6	6	122	24	3,300	1.09	2,077	-	2,115	102%
		3	3	48	12	3,300	1.09	381	-	388	102%
		13	13	82	12	3,300	1.09	3,213	-	3,273	102%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		1	1	82	12	3,300	1.09	247	-	252	102%
4060320-Halogen MR-16 35W replaced with LED 20W	800200	3	3	50	7	3,300	1.09	456	-	464	102%
4060911-Interior HID replaced with LED fixture	800300	8	8	1080	300	3,300	1.09	22,033	-	22,445	102%
Total								**36,088**	**-**	**36,765**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 2,000 – 3,300) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7211 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	36,088	36,765	102%	6.98
Total		**36,088**	**36,765**	**102%**	**6.98**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7211 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	63
			60	13.4	16
			60	13.4	16
			60	13.4	79
			60	13.4	16
		2025	138	128	151
			82	64	262
			82	64	349
			122	96	1,554
			48	32	216
			82	64	2,432
			82	64	187
Total					**5,341**

Site ID: 7212

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7212 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	5	5	60	9.8	4,380	0.85	750	(190)	599	80%
4060310-Halogen BR/R 45W replaced with LED 13W	800150	6	6	65	9.5	4,380	0.85	1,546	(394)	1,240	80%
4060714-Fluorescent T8 replaced with LED Type B	800850	6	6	114	30	4,380	0.85	2,363	(596)	1,876	79%
Total								**4,659**	**(1,180)**	**3,715**	**80%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post})xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The efficient wattages for the first and second line items in the table above (9.8W and 9.5W, respectively) are greater than the wattages used to calculate ex ante savings (10W).

The annual lighting hours of operation using secondary sources (4,380) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 80%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7212 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	4,659	3,715	80%	0.93
Total		**4,659**	**3,715**	**80%**	**0.93**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for omni directional lamps and their equivalent CFL wattage with the post midlife shift kWh savings.

Site 7212 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	88
Total					**88**

Site ID: 7213

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7213 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	3	3	72	30	2,060	1.11	278	-	288	104%
		53	53	164	24	2,060	1.11	16,356	-	16,967	104%
Total								**16,634**	-	**17,255**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,060) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7213 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	16,634	17,255	104%	3.28
Total		**16,634**	**17,255**	**104%**	**3.28**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7213 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	72	64	233
			164	128	12,604
Total					**12,83**

Site ID: 7214

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7214 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060810-Fluorescent T12 replaced with LED fixture	800900	20	15	164	40	2,060	1.11	5,907	-	6,128	104%
Total								**5,907**	-	**6,128**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,060) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7214 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	5,907	6,128	104%	1.16
Total		**5,907**	**6,128**	**104%**	**1.16**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7214 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	4,482
Total					**4,482**

Site ID: 7215

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7215 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	6	6	114	48	2,000	1.11	847	-	879	104%
		6	6	59	24	2,500	1.04	562	-	546	97%
		59	59	114	24	2,000	1.11	11,363	-	11,788	104%
		322	322	59	12	2,500	1.04	40,483	-	39,348	97%
Total								**53,255**	-	**52,561**	**99%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 2,000 – 2,500) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings and 1.04 for the the warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 99%.

Site 7215 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	53,255	52,561	99%	9.99
Total		**53,255**	**52,561**	**99%**	**9.99**

Site ID: 7216

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7216 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	4	4	60	8.5	520	1.08	75	-	75	100%
4060814-Fluorescent T12 replaced with LED Type B	800900	32	32	138	43	520	1.08	1,691	-	1,707	101%
		5	5	164	37	520	1.08	353	-	357	101%
		4	4	82	37	520	1.08	101	-	101	100%
Total								**2,220**	-	**2,240**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage for the first line item in the table above (8.5W) is greater than the wattage used to calculate ex ante savings (8W).

The annual lighting hours of operation using secondary sources (520) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7216 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	2,220	2,240	101%	0.43
Total		**2,220**	**2,240**	**101%**	**0.43**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7216 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	11
		2025	138	128	1,528
			164	128	256
			82	64	61
Total					**1,856**

Site ID: 7217

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7217 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	25	25	164	30	520	1.11	1,864	-	1,934	104%
		1	1	72	15	520	1.11	31	-	33	106%
Total								**1,895**	-	**1,967**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (520) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7217 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	1,895	1,967	104%	0.37
Total		**1,895**	**1,967**	**104%**	**0.37**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7217 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	1,414
			72	64	28
Total					**1,442**

Site ID: 7218

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7218 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	6	6	72	30	2,860	0.87	771	(151)	627	81%
4060320-Halogen MR-16 35W replaced with LED 20W	800200	24	24	50	7	2,860	0.87	3,159	(620)	2,568	81%
Total								**3,930**	**(771)**	**3,195**	**81%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,860) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 81%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7218 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	3,930	3,195	81%	0.75
Total		**3,930**	**3,195**	**81%**	**0.75**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7218 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	72	64	630
Total					**630**

Site ID: 7219

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7219 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	2	2	227	86	1,500	0.85	453	(102)	360	79%
		2	2	164	58	1,500	0.85	340	(76)	270	79%
		16	16	82	29	1,500	0.85	1,361	(305)	1,081	79%
Total								**2,154**	**(483)**	**1,711**	**79%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (1,500) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 79%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7219 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	2,154	1,711	79%	0.42
Total		**2,154**	**1,711**	**79%**	**0.42**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7219 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	227	196	360
			164	128	229
			82	64	916
Total					**1,505**

Site ID: 7220

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7220 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	12	12	164	27	3,666	1.08	6,449	-	6,509	101%
		1	1	164	24	3,666	1.08	549	-	554	101%
Total								**6,998**	-	**7,063**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,666) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7220 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	6,998	7,063	101%	1.34
Total		**6,998**	**7,063**	**101%**	**1.34**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7220 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	4,799
			164	128	412
Total					**5,211**

Site ID: 7221

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7221 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	26	26	227	36	2,340	1.00	12,434	-	11,620	93%
		8	8	164	24	2,340	1.00	2,804	-	2,621	93%
		1	1	227	18	2,340	1.00	523	-	489	93%
		2	2	125	18	2,340	1.00	536	-	501	93%
		1	1	138	18	2,340	1.00	301	-	281	93%
		1	1	164	18	2,340	1.00	366	-	342	93%
		4	4	125	9	2,340	1.00	1,162	-	1,086	93%
		2	2	82	9	2,340	1.00	366	-	342	93%
Total								**18,492**	-	**17,282**	**93%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,340) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 93%.

Site 7221 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	18,492	17,282	93%	3.28
Total		**18,492**	**17,282**	**93%**	**3.28**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7221 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	227	196	9,734
			164	128	1,947
			227	196	417
			125	98	374
			138	128	257
			164	128	257

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
			125	98	833
			82	64	257
Total					**14,076**

Site ID: 7222

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7222 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	3	3	138	86	2,990	1.04	731	-	485	66%
		1	1	138	86	2,990	1.04	243	-	162	67%
		10	10	138	86	2,990	1.04	2,436	-	1,617	66%
		8	8	138	86	2,990	1.04	1,951	-	1,294	66%
		7	7	164	56	2,990	1.04	3,543	-	2,351	66%
		2	2	164	56	2,990	1.04	1,012	-	672	66%
		50	50	164	56	2,990	1.04	25,308	-	16,792	66%
		8	8	83	43	2,990	1.04	1,499	-	995	66%
		8	8	83	43	2,990	1.04	1,499	-	995	66%
4060714-Fluorescent T8 replaced with LED Type B	800850	2	2	56	30	2,990	1.04	244	-	162	66%
		2	2	59	28	2,990	1.04	291	-	193	66%
4060814-Fluorescent T12 replaced with LED Type B	800900	2	2	164	28	2,990	1.04	1,275	-	846	66%
		6	6	48	14	2,990	1.04	956	-	634	66%
Total								**40,988**	-	**27,198**	**66%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The annual lighting hours of operation using secondary sources (2,990) are fewer than the annual hours of operation used to calculate ex ante savings (4,380).

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 66%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive factors.

Site 7222 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	40,988	27,198	66%	5.17
Total		**40,988**	**27,198**	**66%**	**5.17**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7222 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	138	128	392
			138	128	131
			138	128	1,306
			138	128	1,045
			164	128	1,567
			164	128	448
			164	128	11,195
			83	64	522
			83	64	522
			164	128	622
			48	32	336
Total					**18,086**

Site ID: 7223

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7223 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	4	4	60	9	150	0.9	22	(4)	18	82%
4060814-Fluorescent T12 replaced with LED Type B	800900	21	21	164	58	200	0.9	476	(93)	401	84%
4060310-Halogen BR/R 45W replaced with LED 13W	800150	2	2	70	13	200	0.9	25	(5)	21	84%
4060713-Fluorescent T8 replaced with LED Type A/B	800850	6	6	69	29	8,760	0.9	2,250	(442)	1,892	84%
Total								**2,773**	**(544)**	**2,332**	**84%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante annual hours of use (ranging from 150 – 8760).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 84%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7223 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	2,773	2,332	84%	0.55
Total		**2,773**	**2,332**	**84%**	**0.55**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattages.

Site 7223 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	3
		2025	164	128	326
Total					**329**

Site ID: 7224

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7224 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	79	79	164	48	2,060	1.11	20,198	-	20,954	104%
		63	63	164	48	2,060	1.11	16,109	-	16,710	104%
		5	5	82	24	2,060	1.11	640	-	663	104%
Total								**36,947**	-	**38,327**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the first line item (2,060) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7224 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	36,947	38,327	104%	7.28
Total		**36,947**	**38,327**	**104%**	**7.28**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7224 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	14,451
			164	128	11,524
			82	64	457
Total					**26,432**

Site ID: 7225

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7225 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	24	24	138	86	2,990	1.04	4,861	-	3,881	80%
		88	88	164	48	2,990	1.04	39,758	-	31,743	80%
		3	3	82	24	2,990	1.04	677	-	541	80%
Total								**45,296**	-	**36,165**	**80%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,990) are fewer than the annual hours of operation used to calculate ex ante savings (3,640).

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 80%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive effects.

Site 7225 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	45,296	36,165	80%	6.87
Total		**45,296**	**36,165**	**80%**	**6.87**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7225 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	138	128	3,134
			164	128	21,892
			82	64	373
Total					**25,399**

Site ID: 7226

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7226 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	35	35	100	11	1,326	1.09	5,612	-	2,985	53%
		11	11	75	11	1,326	1.09	1,241	-	660	53%
		32	32	60	9	1,326	1.09	2,869	-	1,526	53%
4060814-Fluorescent T12 replaced with LED Type B	800900	44	44	164	30	1,326	1.09	16,024	-	8,522	53%
4060714-Fluorescent T8 replaced with LED Type B	800850	53	53	114	30	1,326	1.09	12,100	-	6,435	53%
		1	1	248	30	1,326	1.09	593	-	315	53%
4060814-Fluorescent T12 replaced with LED Type B	800900	1	1	48	15	1,326	1.09	90	-	48	53%
4060912-Interior HID replaced with LED Lamp direct-wired	800300	10	10	456	115	1,326	1.09	9,267	-	4,929	53%
	800750	6	6	40	4	8,760	1.09	2,025	-	2,062	102%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060410-Incand Exit Sign replaced with LED 5W		2	2	40	4	8,760	1.09	675	-	687	102%
Total								**50,496**	-	**28,169**	**56%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the last two-line items in the table above (8,760) correspond with the annual hours of operation used to calculate ex ante savings. These are continuous usage exit signage. The remaining measures have annual lighting hours (1,326) which are fewer than the ex ante hours (2,540). The facility is a religious site.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 56%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7226 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	50,498	28,169	56%	5.35
Total		**50,498**	**28,169**	**56%**	**5.35**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7226 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	100	24.8	698
			75	18.9	126
			60	13.4	204
		2025	164	128	6,232
			48	32	25
Total					**7,285**

Site ID: 7227

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7227 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	116	116	164	36	2,200	1.09	34,953	-	35,606	102%
4060711-Fluorescent T8 replaced with LED retrofit kit	800850	62	62	59	18	2,200	1.09	5,985	-	6,096	102%
Total								**40,938**	-	**41,702**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,200) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7227 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	40,938	41,702	102%	7.92
Total		**40,938**	**41,702**	**102%**	**7.92**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7227 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	25,591
Total					**25,591**

Site ID: 7228

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7228 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	37	37	114	48	3,224	1.08	11,392	-	8,503	75%
		22	22	88	36	3,224	1.08	5,337	-	3,983	75%
		10	10	59	24	3,224	1.08	1,633	-	1,219	75%
4060814-Fluorescent T12 replaced with LED Type B	800900	9	9	82	24	3,224	1.08	2,435	-	1,818	75%
Total								**20,797**	-	**15,523**	**75%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,224) are fewer than the annual hours of operation used to calculate ex ante savings (4,360).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 75%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7228 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	20,797	15,523	75%	2.95
Total		**20,797**	**15,523**	**75%**	**2.95**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7228 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	82	64	1,253
Total					**1,253**

Site ID: 7229

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7229 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060340-Halogen A-Lamp > 28 W replaced with LED Lamp	800050	7	7	60	9	2,652	1.08	864	-	1,023	118%
4060814-Fluorescent T12 replaced with LED Type B	800900	70	70	164	30	2,652	1.08	22,683	-	26,866	118%
4060811-Fluorescent T12 replaced with LED retrofit Kit		8	8	138	30	2,652	1.04	2,090	-	2,383	114%
Total								**25,637**	-	**30,272**	**118%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)}=\left(Qty_{pre}x\ Watts_{pre}-Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident}=kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,652) are greater than the annual hours of operation used to calculate ex ante savings (2,260).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 118%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site 7229 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	25,637	30,272	118%	5.75
Total		**25,637**	**30,272**	**118%**	**5.75**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7229 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	19,648
			138	128	2,162
Total					**21,810**

Site ID: 7230

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7230 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	2	2	56	30	2,808	0.78	186	(38)	114	61%
		12	12	114	24	2,808	0.78	3,861	(788)	2,365	61%
		11	11	114	24	2,808	0.78	3,540	(723)	2,168	61%
		8	8	114	24	2,808	0.78	2,574	(526)	1,577	61%
		6	6	114	24	2,808	0.78	1,930	(394)	1,183	61%
4060911-Interior HID replaced with LED fixture	800300	26	26	455	150	2,808	0.78	28,349	(5,790)	17,369	61%
Total								**40,440**	**(8,259)**	**24,776**	**61%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,808) are fewer than the annual hours of operation used to calculate ex ante savings (3,341).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 61%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and overestimated heating and cooling interactive effects.

Site 7230 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	40,440	24,776	61%	6.28
Total		**40,440**	**24,776**	**61%**	**6.28**

Site ID: 7231

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7231 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060714-Fluorescent T8 replaced with LED Type B	800850	11	11	59	24	2,600	1.08	1,401	-	1,081	77%
4060814-Fluorescent T12 replaced with LED Type B	800900	5	5	82	24	2,600	1.08	1,055	-	814	77%
		2	2	82	24	2,600	1.08	423	-	326	77%
4060714-Fluorescent T8 replaced with LED Type B	800850	5	5	59	24	2,600	1.08	637	-	491	77%
4060714-Fluorescent T8 replaced with LED Type B	800850	7	7	59	24	2,600	1.08	734	-	688	94%
Total								**4,250**	**-**	**3,400**	**80%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,600) are fewer than the annual hours of operation used to calculate ex ante savings (ranging from 2,800 – 3,400).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 80%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7231 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	4,250	3,400	80%	0.65
Total		**4,250**	**3,400**	**80%**	**0.65**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7231 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	82	64	562
			82	64	225
Total					**787**

Site ID: 7232

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7232 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	145	145	138	36	3,484	1.08	37,031	-	55,651	150%
		8	8	164	36	3,484	1.08	2,564	-	3,853	150%
		5	5	82	18	3,484	1.08	800	-	1,204	151%
Total								**40,395**	-	**60,708**	**150%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,484) are greater than the annual hours of operation used to calculate ex ante savings (2,340). The ex ante hours do not represent the posted hours.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 150%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site 7232 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	40,395	60,708	150%	11.53
Total		**40,395**	**60,708**	**150%**	**11.53**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7232 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	138	128	50,195
			164	128	2,769
			82	64	865
Total					**53,829**

Site ID: 7233

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7233 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	60	60	227	24	3,040	1.08	39,619	-	39,989	101%
		1	1	164	24	3,040	1.08	456	-	460	101%
		4	4	82	12	3,040	1.08	911	-	919	101%
Total								**40,986**	-	**41,368**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the first line item (3,040) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7233 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	40,986	41,368	101%	7.86
Total		**40,986**	**41,368**	**101%**	**7.86**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7233 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	227	196	33,883
			164	128	341
			82	64	683
Total					**34,907**

Site ID: 7234

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7234 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060611-Fluorescent T5 replaced with LED retrofit Kit	800800	42	42	360	72	6,500	1.00	84,128	-	78,624	93%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	12	12	164	36	6,500	1.00	10,683	-	9,984	93%
		10	10	234	36	6,500	1.00	13,771	-	12,870	93%
		12	12	227	24	6,500	1.00	16,942	-	15,834	93%
		66	66	82	12	6,500	1.00	32,132	-	30,030	93%
Total								**157,656**	**-**	**147,342**	**93%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the first line item (6,500) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned site in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 93%.

Site 7234 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	157,656	147,342	93%	27.99
Total		**157,656**	**147,342**	**93%**	**27.99**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7234 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	7,176
			227	196	13,416
			82	64	22,308
Total					**42,900**

Site ID: 7235

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7235 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060810-Fluorescent T12 replaced with LED fixture	800900	21	10	227	80	4,260	1.04	18,082	-	17,575	97%
		2	2	133	40	8,760	1.04	1,743	-	1,695	97%
Total								**19,825**	-	**19,270**	**97%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 4,260 – 8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7235 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	19,825	19,270	97%	3.66
Total		**19,825**	**19,270**	**97%**	**3.66**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7235 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	227	196	14,691
			133	98	1,057
Total					**15,748**

Site ID: 7236

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7236 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	85	85	164	29	3,000	1.09	36,835	-	37,523	102%
4060410-Incand Exit Sign replaced with LED 5W	800750	15	15	25	1	8,760	1.09	3,375	-	3,437	102%
Total								**40,210**	-	**40,960**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 3,000 – 8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7236 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	40,210	40,960	102%	7.78
Total		**40,210**	**40,960**	**102%**	**7.78**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7236 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	27,517
Total					**27,517**

Site ID: 7237

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7237 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	7	7	60	8.8	2,300	1.08	568	-	577	102%
4060814-Fluorescent T12 replaced with LED Type B	800900	25	25	164	28	2,300	1.08	8,367	-	8,446	101%
4060714-Fluorescent T8 replaced with LED Type B	800850	7	7	59	28	2,300	1.08	534	-	539	101%
Total								**9,469**	-	**9,562**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post})xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The efficient wattage of the first line item in the table above (8.8W) is fewer than the wattage used to calculate ex ante savings (9W).

The annual lighting hours of operation using secondary sources for the first line item (2,300) correspond with the annual hours of operation used to calculate ex ante savings (2,388).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7237 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	9,469	9,562	101%	1.82
Total		**9,469**	**9,562**	**101%**	**1.82**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7237 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	80
		2025	164	128	6,210
Total					**6,290**

Site ID: 7238

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7238 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	64	64	65	9	2,000	1.08	4,999	-	5,046	101%
4060814-Fluorescent T12 replaced with LED Type B	800900	1	1	138	86	2,184	1.08	167	-	123	74%
		9	9	164	58	2,184	1.08	3,062	-	2,250	73%
4060714-Fluorescent T8 replaced with LED Type B	800850	7	7	114	58	2,184	1.08	1,258	-	925	74%
4060814-Fluorescent T12 replaced with LED Type B	800900	1	1	82	29	2,184	1.08	170	-	125	74%
Total								**9,656**	-	**8,469**	**88%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the first line item above (2,000) correspond with the annual hours of operation used to calculate ex ante savings. The remaining measures have annual hours (2,184) which are fewer than those used in the ex ante calculation (3,000).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 88%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for four of the measures.

Site 7238 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	9,656	8,469	88%	1.61
Total		**9,656**	**8,469**	**88%**	**1.61**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7238 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	65	13.4	608
		2025	138	128	99

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
			164	128	1,486
			82	64	83
Total					**2,276**

Site ID: 7239

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7239 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060911-Interior HID replaced with LED fixture	800300	2	2	455	88	4,680	1.00	3,435	-	3,435	100%
4060611-Fluorescent T5 replaced with LED retrofit Kit	800800	9	9	468	72	4,680	1.00	16,679	-	16,680	100%
		1	1	360	72	4,680	1.00	1,348	-	1,348	100%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	4	4	227	36	4,680	1.00	3,575	-	3,576	100%
		5	5	164	24	4,680	1.00	3,276	-	3,276	100%
		5	5	82	12	4,680	1.00	1,638	-	1,638	100%
Total								**29,951**	-	**29,953**	**100%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the first line item (4,680) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned facility in St. Louis, was applied to the ex post lighting energy savings and corresponded with the ex ante savings estimate.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 100%.

Site 7239 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	29,951	29,953	100%	5.69
Total		**29,951**	**29,953**	**100%**	**5.69**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7239 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	227	196	2,995
			164	128	2,434
			82	64	1,217
Total					**6,646**

Site ID: 7240

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7240 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	67	67	227	36	2,910	1.08	39,846	-	40,218	101%
		5	5	164	24	2,910	1.08	2,180	-	2,200	101%
		5	5	82	12	2,910	1.08	1,089	-	1,100	101%
Total								**43,115**	-	**43,518**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ CF$$

The annual lighting hours of operation using secondary sources for the first line item (2,910) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7240 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	43,115	43,518	101%	8.27
Total		**43,115**	**43,518**	**101%**	**8.27**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7240 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	227	196	33,691
			164	128	1,634
			82	64	817
Total					**36,142**

Site ID: 7241

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7241 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	15	15	227	36	2,610	1.04	8,001	-	7,777	97%
		13	13	227	36	2,610	1.04	6,935	-	6,740	97%
Total								**14,936**	-	**14,517**	**97%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the first line item (2,910) corresponds with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7241 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	14,936	14,517	97%	2.76
Total		**14,936**	**14,517**	**97%**	**2.76**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7241 Measures with Midlife Savings

<table>
<tr><th>Program</th><th>End Use Category</th><th>MidLife Baseline Shift Year</th><th>Baseline Watts Pre Shift</th><th>Baseline Watts Post Shift</th><th>Ex Post Gross (kWh)</th></tr>
<tr><td rowspan="2">SBDI</td><td rowspan="2">Lighting</td><td rowspan="2">2025</td><td>227</td><td>196</td><td>6,515</td></tr>
<tr><td>227</td><td>196</td><td>5,646</td></tr>
<tr><td>Total</td><td colspan="4"></td><td>12,161</td></tr>
</table>

Site ID: 7242

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7242 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060330-Halogen PAR 48W replaced with LED 2W	800250	6	6	60	8	1,200	1.08	400	-	404	101%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	126	126	164	30	2,600	1.08	46,971	-	47,410	101%
Total								**47,371**	-	**47,814**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 1,200 – 2,600) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7242 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	47,371	47,814	101%	9.08
Total		**47,371**	**47,814**	**101%**	**9.08**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7242 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	34,673
Total					**34,673**

Site ID: 7243

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7243 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060912-Interior HID replaced with LED Lamp direct-wired	800300	4	4	284	36	3,200	0.78	3,396	(825)	2,476	73%
		6	6	95	15	3,800	0.78	1,952	(474)	1,423	73%
4060611-Fluorescent T5 replaced with LED retrofit Kit	800800	30	30	360	96	3,800	0.78	32,203	(7,825)	23,475	73%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	45	45	164	36	3,800	0.78	23,420	(5,691)	17,073	73%
		4	4	227	36	3,800	0.78	3,106	(755)	2,264	73%
		10	10	82	24	3,800	0.78	2,358	(573)	1,719	73%
		9	9	72	18	3,800	0.78	1,975	(480)	1,441	73%
		6	6	82	18	3,800	0.78	1,562	(379)	1,138	73%
		16	16	82	12	2,600	0.78	3,116	(757)	2,271	73%
Total								**73,088**	**(17,760)**	**53,280**	**73%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the

waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 2,600 – 3,800) corresponds with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 73%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7243 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	73,088	53,280	73%	13.50
Total		**73,088**	**53,280**	**73%**	**13.50**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7243 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	16,361
			227	196	2,529

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
			82	64	1,581
			72	64	1,636
			82	64	1,091
			82	64	2,250
Total					**25,448**

Site ID: 7244

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7244 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	28	28	60	9	1,200	1.11	1,187	-	1,231	104%
4060814-Fluorescent T12 replaced with LED Type B	800900	2	2	164	68	1,700	1.11	350	-	362	103%
		13	13	111	51	2,200	1.11	1,836	-	1,905	104%
		21	21	122	36	2,200	1.11	4,251	-	4,410	104%
	800300	36	36	455	100	1,700	1.11	23,247	-	24,116	104%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060912-Interior HID replaced with LED Lamp direct-wired		10	10	1080	100	2,200	1.11	23,069	-	23,932	104%
4060410-Incand Exit Sign replaced with LED 5W	800750	14	14	60	3	8,760	1.11	7,480	-	7,759	104%
4060310-Halogen BR/R 45W replaced with LED 13W	800150	23	23	60	8	1,200	1.11	1,535	-	1,593	104%
Total								**62,955**	-	**65,308**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 1,200 – 8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7244 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	62,955	65,308	104%	12.41
Total		**62,955**	**65,308**	**104%**	**12.41**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7244 Measures with Midlife Savings

<table>
<tr><th>Program</th><th>End Use Category</th><th>MidLife Baseline Shift Year</th><th>Baseline Watts Pre Shift</th><th>Baseline Watts Post Shift</th><th>Ex Post Gross (kWh)</th></tr>
<tr><td rowspan="4">SBDI</td><td rowspan="4">Lighting</td><td>2022</td><td>60</td><td>13.4</td><td>164</td></tr>
<tr><td rowspan="3">2025</td><td>164</td><td>128</td><td>226</td></tr>
<tr><td>111</td><td>96</td><td>1,429</td></tr>
<tr><td>122</td><td>96</td><td>3,077</td></tr>
<tr><td>Total</td><td colspan="4"></td><td>4,896</td></tr>
</table>

Site ID: 7245

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7245 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	52	52	82	12	2,600	1.08	10,126	-	10,221	101%
4060330-Halogen PAR 48W replaced with LED 2W	800250	6	6	60	11	1,200	1.08	378	-	381	101%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	56	56	122	30	2,600	1.08	14,333	-	14,467	101%
Total								**24,837**	-	**25,069**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 1,200 – 2,600) corresponds with the annual hours of operation used to calculate ex ante savings (2,388).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7245 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	24,837	25,069	101%	4.76
Total		**24,837**	**25,069**	**101%**	**4.76**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7245 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	82	64	7,593
			122	96	10,378
Total					**17,971**

Site ID: 7246

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7246 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	21	21	164	58	2,080	0.9	4,955	(972)	4,167	84%
		6	6	138	50	500	0.78	282	(69)	206	73%
		4	4	72	32	2,080	0.9	356	(70)	300	84%
4060330-Halogen PAR 48W replaced with LED 2W	800250	24	24	65	14	2,080	0.9	2,724	(535)	2,291	84%
Total								**8,317**	**(1,645)**	**6,964**	**84%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 500 – 2,080) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 84%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7246 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	8,317	6,964	84%	1.64
Total		**8,317**	**6,964**	**84%**	**1.64**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7246 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	3,394
			138	128	243
			72	64	296
Total					**3,933**

Site ID: 7247

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7247 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060614-Fluorescent T5 replaced with LED Type B	800800	18	18	360	150	2,496	0.78	10,095	(2,453)	7,359	73%
4060714-Fluorescent T8 replaced with LED Type B	800850	50	50	221	87	2,496	0.78	17,894	(4,348)	13,044	73%
		13	13	114	58	2,496	0.78	1,944	(472)	1,417	73%
4060814-Fluorescent T12 replaced with LED Type B	800900	5	5	138	50	2,496	0.78	1,175	(286)	857	73%
4060714-Fluorescent T8 replaced with LED Type B	800850	33	33	59	29	2,496	0.78	2,644	(642)	1,927	73%
4060911-Interior HID replaced with LED fixture	800300	1	1	455	105	2,496	0.78	935	(227)	681	73%
Total								**34,687**	**(8,429)**	**25,285**	**73%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,496) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 73%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site 7247 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	34,687	25,285	73%	6.41
Total		**34,687**	**25,285**	**73%**	**6.41**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7247 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	138	128	1,012

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Total					1,012

Site ID: 7248

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7248 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060614-Fluorescent T5 replaced with LED Type B	800800	42	42	234	100	3,626	1.08	19,029	-	22,040	116%
4060714-Fluorescent T8 replaced with LED Type B	800850	84	84	59	24	3,626	1.08	9,940	-	11,513	116%
4060911-Interior HID replaced with LED fixture	800300	26	26	455	100	3,626	1.08	31,209	-	36,145	116%
4060330-Halogen PAR 48W replaced with LED 2W	800250	54	54	75	15	3,626	1.08	10,955	-	12,688	116%
		17	17	75	11	3,626	1.08	17,373	-	4,261	25%
Total								**88,506**	-	**86,647**	**98%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The base quantity of the last item in the table above (17) is fewer than the quantity used to calculate ex ante savings (71). The invoice confirms 17 lamps. An error in the application input is thought to have occurred.

The annual lighting hours of operation using secondary sources (3,626) are greater than the annual hours of operation used to calculate ex ante savings (3,160).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 98%.

Site 7248 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	88,506	86,647	98%	16.46
Total		**88,506**	**86,647**	**98%**	**16.46**

Site ID: 7249

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7249 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060310-Halogen BR/R 45W replaced with LED 13W	800150	6	6	60	12	1,800	1.08	554	-	560	101%
4060810-Fluorescent T12 replaced with LED fixture	800900	4	4	164	46	800	1.08	404	-	408	101%
		1	1	164	40	1,800	1.08	239	-	241	101%
4060710-Fluorescent T8 replaced with LED fixture	800850	12	13	88	37.2	1,800	1.08	1,107	-	1,113	101%
Total								**2,304**	-	**2,322**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 800 to 1,800) correspond with the annual hours of operation used to calculate ex ante savings (2,388).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned primary school in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7249 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	2,304	2,322	101%	0.44
Total		**2,304**	**2,322**	**101%**	**0.44**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7249 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	283
			164	128	171
Total					**454**

Site ID: 7250

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7250 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060614-Fluorescent T5 replaced with LED Type B	800800	70	70	360	150	3,500	1.09	55,052	-	56,081	102%
4060714-Fluorescent T8 replaced with LED Type B	800850	13	13	88	36	2,600	1.09	1,880	-	1,916	102%
		16	16	56	30	2,600	1.09	1,158	-	1,179	102%
		22	22	59	24	2,600	1.09	2,142	-	2,182	102%
Total								**60,232**	-	**61,358**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 2,600 – 3,500) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7250 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	60,232	61,358	102%	11.66
Total		**60,232**	**61,358**	**102%**	**11.66**

Site ID: 7251

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7251 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	9	9	125	36	6,370	1.08	7,286	-	5,511	76%
Total								**7,286**	-	**5,511**	**76%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (6,370) are fewer than the annual hours of operation used to calculate ex ante savings (8,500).

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 76%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7251 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	7,286	5,511	76%	1.05
Total		**7,286**	**5,511**	**76%**	**1.05**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7251 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	125	98	3,839
Total					**3,839**

Site ID: 7252

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7252 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060810-Fluorescent T12 replaced with LED fixture	800900	41	41	164	40	2,860	1.09	15,559	-	15,849	102%
		3	3	72	30	2,860	1.09	386	-	393	102%
4060911-Interior HID replaced with LED fixture	800300	13	13	455	100	2,860	1.09	14,123	-	14,387	102%
		1	1	455	18	2,860	1.09	1,338	-	1,362	102%
4060330-Halogen PAR 48W replaced with LED 2W	800250	6	6	75	11	2,860	1.09	1,175	-	1,197	102%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	17	17	227	36	2,860	1.09	9,937	-	10,122	102%
		4	4	164	24	2,860	1.09	1,713	-	1,746	102%
Total								**44,231**	-	**45,056**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,860) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7252 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	44,231	45,056	102%	8.56
Total		**44,231**	**45,056**	**102%**	**8.56**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7252 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	11,248
			72	64	318
			227	196	8,479
			164	128	1,297

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
Total					21,342

Site ID: 7253

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7253 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	23	23	138	36	1,300	1.09	3,264	-	3,324	102%
		1	1	164	36	2,080	1.09	285	-	290	102%
		22	22	82	18	1,300	1.09	1,958	-	1,995	102%
Total								**5,507**	-	**5,609**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 1,300 – 2,080) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7253 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	5,507	5,609	102%	1.07
Total		**5,507**	**5,609**	**102%**	**1.07**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7253 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	138	128	2,998
			164	128	209
			82	64	1,434
Total					**4,641**

Site ID: 7254

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7254 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060814-Fluorescent T12 replaced with LED Type B	800900	3	3	82	24	1,560	1.09	291	-	296	102%
		1	1	164	24	1,560	1.09	234	-	238	102%
4060610-Fluorescent T5 replaced with LED Fixture	800800	1	1	360	72	1,560	1.09	482	-	490	102%
4060911-Interior HID replaced with LED fixture	800300	14	14	455	100	1,560	1.09	8,296	-	8,451	102%
		7	21	455	24	1,560	1.09	4,476	-	4,559	102%
		1	5	455	24	1,560	1.09	560	-	570	102%
4060611-Fluorescent T5 replaced with LED retrofit Kit	800800	7	7	360	72	1,560	1.09	3,365	-	3,428	102%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	29	29	164	36	1,560	1.09	6,195	-	6,312	102%
		1	1	227	36	1,560	1.09	319	-	325	102%
		11	11	82	18	1,560	1.09	1,175	-	1,197	102%
		4	4	72	12	1,560	1.09	400	-	408	102%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
Total								**25,793**	**-**	**26,274**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (1,560) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7254 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	25,793	26,274	102%	4.99
Total		**25,793**	**26,274**	**102%**	**4.99**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7254 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	82	64	204
			164	128	177
			164	128	4,537
			227	196	272
			82	64	860
			72	64	354
Total					**6,404**

Site ID: 7255

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7255 Lighting Retrofit Savings and Algorithm Inputs

<table>
<tr><th>Measure Name</th><th>TRM</th><th>Pre Qty</th><th>Post Qty</th><th>Pre Watts</th><th>Post Watts</th><th>Annual HOU</th><th>Whf</th><th>Ex Ante (kWh)</th><th>Electric Heat (kWh)</th><th>Ex Post Gross (kWh)</th><th>Realization Rate</th></tr>
<tr><td>4060714-Fluorescent T8 replaced with LED Type B</td><td>800850</td><td>32</td><td>32</td><td>59</td><td>24</td><td>4,020</td><td>0.86</td><td>2,756</td><td>(991)</td><td>3,872</td><td>140%</td></tr>
<tr><td>4060814-Fluorescent T12 replaced with LED Type B</td><td rowspan="4">800900</td><td>206</td><td>206</td><td>48</td><td>12</td><td>4,020</td><td>0.86</td><td>18,250</td><td>(6,559)</td><td>25,639</td><td>140%</td></tr>
<tr><td rowspan="3">4060811-Fluorescent T12 replaced with LED retrofit Kit</td><td>6</td><td>6</td><td>164</td><td>24</td><td>4,020</td><td>0.86</td><td>2,067</td><td>(743)</td><td>2,904</td><td>140%</td></tr>
<tr><td>1</td><td>1</td><td>138</td><td>24</td><td>4,020</td><td>0.86</td><td>280</td><td>(101)</td><td>394</td><td>141%</td></tr>
<tr><td>2</td><td>2</td><td>82</td><td>12</td><td>4,020</td><td>0.86</td><td>345</td><td>(124)</td><td>484</td><td>140%</td></tr>
<tr><td>Total</td><td colspan="7"></td><td>23,698</td><td>(8,517)</td><td>33,293</td><td>140%</td></tr>
</table>

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)}=\left(Qty_{pre}x\ Watts_{pre}-Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident}=kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation using secondary sources (4,020) are greater than the annual hours of operation used to calculate ex ante savings (2,300).

A heating and cooling interactive factor less than 1.00 applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 140%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site 7255 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	23,698	33,293	140%	7.94
Total		**23,698**	**33,293**	**140%**	**7.94**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7255 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	48	32	17,887
			164	128	2,709
			138	128	452
			82	64	452
Total					**21,500**

Site ID: 7256

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7256 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	43	43	164	36	2,340	1.09	13,782	-	14,039	102%
		20	20	138	36	2,340	1.09	5,107	-	5,203	102%
		15	15	82	18	2,340	1.09	2,403	-	2,449	102%
Total								**21,292**	-	**21,691**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,340) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7256 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	21,292	21,691	102%	4.12
Total		**21,292**	**21,691**	**102%**	**4.12**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7256 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2025	164	128	10,090
			138	128	4,693
			82	64	1,760
Total					**16,543**

Site ID: 7257

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7257 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060912-Interior HID replaced with LED Lamp direct-wired	800300	11	11	455	60	2,000	1.04	9,298	-	9,038	97%
		76	76	284	60	2,000	1.04	36,431	-	35,410	97%
Total								**22,865**	-	**22,224**	**97%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,000) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.04, applicable to a heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 97%.

Site 7257 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	22,865	22,224	97%	8.44
Total		**22,865**	**22,224**	**97%**	**8.44**

Site ID: 7258

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7258 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	12	12	60	9	3,120	1.09	1,322	-	1,347	102%
4060810-Fluorescent T12 replaced with LED fixture	800900	12	12	227	24	3,120	1.09	8,132	-	8,284	102%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	3	3	100	17	3,120	1.09	531	-	541	102%
4060711-Fluorescent T8 replaced with LED retrofit kit	800850	1	1	292	48	3,120	1.09	814	-	830	102%
		32	32	114	36	3,120	1.09	8,333	-	8,488	102%
		18	18	114	36	3,120	1.09	4,687	-	4,775	102%
		82	82	124	36	3,120	1.09	24,090	-	24,540	102%
		10	10	59	18	3,120	1.09	1,369	-	1,394	102%
		12	12	59	18	3,120	1.09	1,642	-	1,673	102%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
		2	2	59	18	3,120	1.09	274	-	279	102%
4060811-Fluorescent T12 replaced with LED retrofit Kit	800900	2	2	72	12	3,120	1.09	400	-	408	102%
Total								**51,594**	-	**52,559**	**102%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,120) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated, air conditioned facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7258 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	51,594	52,559	102%	9.98
Total		**51,594**	**52,559**	**102%**	**9.98**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7258 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
SBDI	Lighting	2022	60	13.4	180
		2025	227	196	7,019
		2022	100	28	112
		2025	72	64	354
Total					**7,665**

Site ID: 7259

Data Collection

The participant received Small Business Direct Install lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7259 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat (kWh)	Ex Post Gross (kWh)	Realization Rate
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	8	8	60	9	1,000	1.08	282	-	285	101%
4060814-Fluorescent T12 replaced with LED Type B	800900	18	18	164	23	5,000	1.08	13,578	-	13,705	101%
		4	4	82	12	5,000	1.08	1,498	-	1,512	101%
Total								**15,358**	-	**15,502**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 1,000 – 5,000) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7259 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	Realization Rate	Ex Post Gross kW Reduction
SBDI	Lighting	15,358	15,502	101%	2.95
Total		**15,358**	**15,502**	**101%**	**2.95**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7259 Measures with Midlife Savings

<table>
<tr><th>Program</th><th>End Use Category</th><th>MidLife Baseline Shift Year</th><th>Baseline Watts Pre Shift</th><th>Baseline Watts Post Shift</th><th>Ex Post Gross (kWh)</th></tr>
<tr><td rowspan="3">SBDI</td><td rowspan="3">Lighting</td><td>2022</td><td>60</td><td>13.4</td><td>38</td></tr>
<tr><td rowspan="2">2025</td><td>164</td><td>128</td><td>10,206</td></tr>
<tr><td>82</td><td>64</td><td>1,123</td></tr>
<tr><td>Total</td><td colspan="4"></td><td>11,367</td></tr>
</table>

Appendix E. Desk Review Reports: New Construction Program

Site ID: 7116

Data Collection

The participant received New Construction incentives from Ameren Missouri for installing optimized building controls in the renovation of an existing building. The energy saving features included, VAV cooling system with mini-split singles zones, enthalpy air economizer, demand control ventilation.

For the Engineering Desk Review, the building simulation model in Trane Trace was updated with available as-built construction documents.

Analysis Results

The savings for the evaluated measures from the incentivized Cooling and HVAC is presented in the following table.

Site 7116 HVAC and Cooling Savings

Measure Name	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051001-HVAC-HVAC Controls / EMS-Replacing No Existing Equipment or Replacing Failed Equipment	35.743	16,195	45%
	5.074	2,013	40%
Total	**40,817**	**18,208**	**45%**

The ex post evaluated this project with IPMVP Option D, whole building simulation, by reviewing and updating the Trane Trace model from the project applicant. The verification of the model was limited without visual verification data collected from the site. Also, there were adjustments in the software model that did not match the .pdf format outputs in the project documents. The model could not be calibrated to weather data, neither year 2019 or TMY data, as the months of September and October had the highest energy usage, which did not fit local weather patterns.

The alternative 1 model (efficient) had a different lighting power density (LPD) than the alternative 2 (baseline model). The decrease in the lighting also produces a decrease in the interactive effects, as there is less cooling required to remove the waste heat from inefficient lamps or more lamps per square foot. Normally, the LPD is set constant in each model run, to only quantify the effects of the incentivized equipment. The LPD was incentivized in an associated project, in a different program year.

The ex ante alternative 2 (baseline) listed no economizer. The ex post considered that the economizer is required by the observed building code. The alternative 1 model has an enthalpy economizer for both the ex ante and ex post run, but the ex post model had a dry bulb economizer as required, for less economizer savings.

The ex ante alternative 1 (efficient) model listed demand control ventilation, but not in the baseline model. ASHRAE 90.1 2013 baseline requires DCV for the office's spaces and classrooms. Also, the area covered by the ex ante model for DCV covers the full building, corridors and kitchens, which could be present, but is not typical.

Site 7116 Ex post energy model pre and post, lighting constant

	Cooling Energy (kWh)	
	Baseline	As Built
RTU	153,364	137,972
Condenser	9,721	9,173
Control panel	241	230
Dx Mini Split	4,759	4,518
Condenser	382	378
Control panel	438	438
Total	**168,903**	**152,708**
	Heating Fan Energy (kWh)	
VAV Fans	45,688	43,687
Dx Mini Splits	637	625
Ex Post Savings (kWh)	16,195	2,013
Ex Ante Savings (kWh)	35,743	5,074

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 45%. The ex ante energy savings estimate was premised with building code required features and lighting interactive effects.

Site 7116 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
New Construction	Cooling	35,743	16,743	45%	14.75
	HVAC	5,074	2,013	40%	0.89
Total		**40,817**	**18,208**	**45%**	**15.64**

Site ID: 7117

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7117 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting System to Efficient Lighting System Lighting Power Density (LPD)		18	18	48	18	6,399	1.12	3,535		3,867	109%
		3	3	29	11	6,399	1.12	360		394	109%
		12	12	8	3	6,399	1.12	393		430	109%
		48	48	27	10	6,399	1.12	5,238		5,729	109%
		8	8	27	10	6,399	1.12	873		955	109%
		17	17	107	40	6,399	1.12	7,420		8,117	109%
Total								**17,819**	-	**19,492**	**109%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (6,399) are fewer than the annual hours of operation used to calculate ex ante savings (6,552).

A heating and cooling interactive factor of 1.12, applicable to a quick service restaurant in St. Louis, was applied to the ex post lighting energy saving awhile the ex ante savings estimate used a factor of 1.00.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 109%.

Site 7117 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	17,819	19,492	109%	3.73
Total		**17,819**	**19,492**	**109%**	**3.73**

Site ID: 7119

Data Collection

The participant received Custom Program incentives from Ameren Missouri for installing several energy conservation measures (ECMs) at their new construction ice rink facility. The following measures were installed:

- High efficiency ammonia chiller system
- Three open drive compressors
- Variable compressor flow rate
- Floating head pressure with large condenser and ammonia refrigerant
- Flooded evaporator
- Variable speed fan on condenser
- Better than market standard rink floor insulation
- Better than code roof and wall insulation
- Heat reclamation for snow melting and sub-soil heating system

The as-built system is a primary/secondary fluid cooling system. The primary refrigerant is ammonia which operates in the refrigeration cycle. Heat is pulled from glycol, the secondary fluid, in a plate and frame evaporator by the ammonia. The glycol is then pumped underneath the rink to cool the ice.

A desk review included the collection of ex-ante calculations, savings narrative, invoices, spec sheets, implementor's post install visit photographs and building drawings. Also, standards were sourced from Chapter 44 "Ice Rinks" of the 2010 ASHRAE Handbook: Refrigeration, I-P (ASHRAE 2010) to verify some of the values in the calculations.

Analysis Results

The savings for the evaluated measures from the incentivized measures is presented in the following table.

Site 7119 Building and Shell and Refrigeration Retrofit Savings and Algorithm Inputs

Measure Name	TRM	End Use	P	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4010101-BuildingShell-Wall Insulation	2.10.2			38,193	24,339	64%
4100201-Commercial Freezer- No Existing	-	Refrigeration	New Cons	743,056	607,265	82%
4100511-Freezer-No Existing Equip	2.10.2			571,934	83,812	15%
4010101-BuildingShell-Wall Insulation	2.10.2	Building Shell		55,202	31,517	57%
Total				**1,408,385**	**746,933**	**53%**

Refrigeration

Energy savings for the refrigeration system were determined by comparing the high efficiency ammonia refrigeration system with a standard refrigeration system. The baseline system is assumed to have three semi-hermetic non-variable flow reciprocating compressors, R507 refrigerant without floating head pressure, a DX chiller, and constant speed condenser fans.

Performance specifications for either the baseline or as-built refrigeration systems were not available, so estimated capacities at varying condensing temperatures were sourced from the ex-ante calculations. Capacities for both the baseline and as-built systems were estimated in the ex-ante while operating one, two or three compressors. The baseline system listed capacities at 80, 85, 90, and 95°F condensing temperatures, while the as-built system listed capacities at 70, 75, 80, 85, 90, and 95°F condensing temperatures. Net capacity of cooling was determined by the difference of heat gain from the pumps in the secondary fluid from the estimated refrigeration system capacity. Compressor power consumption was estimated at each condensing temperature while the secondary fluid pumps, condensing fan, condensing pump were assumed to operate at constant power under all conditions. In the post inspection photos, it appeared that the submitted compressors had a design change for an *Emerson Vilter* model for which no spec sheet could be located. Likewise, the post inspection photos provided the only system diagram in the project docs. Due the amount of uncertainty about the baseline and as-built refrigeration systems, the estimated net capacities and power consumption provided in the ex-ante calculations were used to determine the kW/Ton of cooling at each condensing temperature and number of operating compressors.

To determine the condensing temperatures of the system, the TMY3 weather data for Spirit of St Louis Airport informed the average wet-bulb temperature for each month of a typical year. Assuming a 16°F approach temperature (as was used in the ex-ante calculations), the average condensing temperature of each month was determined. The typical average dry-bulb (DB), wet-bulb (WB), and condensing temperature (CT) for each month are presented in the table.

Site 7119 Average Monthly Wet-Bulb, Dry-Bulb, and Condensing Temperatures

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average DB °F	29.7	35.6	47.0	60.3	66.9	73.2	78.2	76.6	66.9	56.8	50.4	39.3
Average WB °F	27.6	30.4	40.1	53.1	59.4	66.4	69.4	70.5	58.0	51.6	45.6	36.1
Average CT °F	43.6	46.4	56.1	69.1	75.4	82.4	85.4	86.5	74.0	67.6	61.6	52.1

The operating conditions of baseline and as-built refrigeration systems were only provided at minimum condensing temperatures of 80°F and 70°F respectively in the ex-ante calculations, a polynomial curve estimated the kW/ton at each average condensing temperature. The ex-ante calculations and savings narrative assume that the ice rink will demand one compressor providing 40 tons of cooling for 8 hours per day, two compressors providing 80 tons of cooling for 8 hours per day, and three compressors providing 120 tons of cooling for 8 hours per day. Monthly kWh consumption for the baseline and as-built systems were calculated using the following equation:

$$kWh_{month} = Days_{month} \times 8 \times (kW/Ton_1 \times 40 + kW/Ton_2 \times 80 + kW/Ton_3 \times 120)$$

Where:

kWh_{month} = Monthly kWh Consumption
$Days_{month}$ = Number of Days per month

8 = Number of hours per day that 1, 2, or 3 compressors are operating
kW/Ton_1 = Consumption per ton of cooling with one compressor running
kW/Ton_2 = Consumption per ton of cooling with two compressors running
kW/Ton_3 = Consumption per ton of cooling with three compressors running
40 = Cooling ton demand with one compressor running
80 = Cooling ton demand with two compressors running
120 = Cooling ton demand with three compressors running

The monthly baseline and as-built refrigeration consumption as well as monthly and annual savings are listed in the table.

Site 7119 Monthly Baseline and As-Built kWh and Baseline Consumption and Savings

Month	Days	CT °F	As-Built, kW/ton			Baseline, kW/ton			As-Built kWh	Baseline kWh	kWh Savings
			1 Comp	2 Comp	3 Comp	1 Comp	2 Comp	3 Comp			
Jan	31	43.6	0.83	0.72	0.67	2.51	1.49	1.19	42,617	89,909	47,292
Feb	28	46.4	0.85	0.74	0.69	2.53	1.51	1.21	39,493	82,391	42,898
Mar	31	56.1	0.94	0.83	0.78	2.64	1.62	1.32	48,838	97,496	48,658
Apr	30	69.1	1.12	0.99	0.94	2.92	1.83	1.51	56,958	106,675	49,718
May	31	75.4	1.23	1.10	1.04	3.11	1.96	1.62	64,960	118,113	53,153
Jun	30	82.4	1.38	1.23	1.17	3.37	2.13	1.77	70,437	124,155	53,718
Jul	31	85.4	1.44	1.29	1.22	3.48	2.21	1.83	76,351	132,954	56,602
Aug	31	86.5	1.47	1.31	1.25	3.53	2.24	1.86	77,757	134,794	57,037
Sep	30	74.0	1.21	1.07	1.02	3.07	1.94	1.60	61,521	112,563	51,042
Oct	31	67.6	1.10	0.97	0.92	2.88	1.81	1.48	57,550	108,553	51,003
Nov	30	61.6	1.01	0.89	0.84	2.74	1.70	1.39	50,957	99,006	48,049
Dec	31	52.1	0.90	0.79	0.74	2.58	1.57	1.27	46,508	94,603	48,095
Total									**693,947**	**1,301,212**	**607,264**

Rink Floor Insulation

Energy savings for the above market condition ice rink floor insulation were calculated by determining the difference in heat load between the ice and the heated sub-soil for the market condition insulation and the as-built insulation. Savings are a product of the reduced cooling load on the refrigeration system. According the ASHRAE 2010, the ice temperature for a rink used for hockey should be maintained between 20 and 22°F while sub-soil should be maintained between 40 and 42°F. Therefore, an ice temperature of 21°F and a subsoil temperature of 41°F was assumed. Additionally, ASHRAE 2010 claims that a standard North American hockey rink has a surface area of 16,327 ft2. This facility has two ice rinks, resulting in a total ice rink surface area of 32,654 ft2.

The ex-ante estimated stated the market condition rink floor insulation is R-10 insulation. This value could not be sourced, so R-10 insulation was assumed to be the baseline. Additionally, the ex-ante calculation listed the as-built insulation to be R-20 which could not be sourced, therefore R-20 insulation was assumed for the as-built condition.

Baseline and as-built heat load from the sub-soil heating system on the refrigeration system were determined using the following equation:

$$BTU_{floor} = \frac{(T_{SS} - T_{ice}) \times A_{rink}}{R}$$

Where:

BTU_{floor} = Heat load on the refrigeration system from the subsoil heating system
T_{SS} = Temperature of the sub-soil, 41°F
T_{ice} = Temperature of the ice, 21°F
A_{rink} = Combined surface areas of the two ice rinks, 32,654 ft^2
R = Thermal resistance (R-Value) of the insulation, R-10 and R-20 (ft^2·°F·hr/BTU)
This results in a baseline heat load of 65,308 BTU, an as-built heat load of 32,654 BTU, and a difference in heat load of 32,654 BTU. This converts to a difference in heat load of 2.72 tons of cooling which is assumed to be a reduction in load on the as-built refrigeration system. Savings for above market condition rink floor insulation assume the same operating conditions and equation used to determine savings for the refrigeration system but with an assumed load of 2.72 tons for all numbers of operating compressors. Monthly and annual savings for above market rink floor insulation are listed in the next table.

Site 7119 Monthly and Annual Rink Floor Insulation Savings

Month	Days	CT °F	Tons	As-Built, kW/ton			kWh Savings
				1 Comp	2 Comp	3 Comp	
Jan	31	43.6	2.72	0.83	0.72	0.67	1,503
Feb	28	46.4	2.72	0.85	0.74	0.69	1,392
Mar	31	56.1	2.72	0.94	0.83	0.78	1,717
Apr	30	69.1	2.72	1.12	0.99	0.94	1,997
May	31	75.4	2.72	1.23	1.10	1.04	2,275
Jun	30	82.4	2.72	1.38	1.23	1.17	2,465
Jul	31	85.4	2.72	1.44	1.29	1.22	2,670
Aug	31	86.5	2.72	1.47	1.31	1.25	2,719
Sep	30	74.0	2.72	1.21	1.07	1.02	2,155
Oct	31	67.6	2.72	1.10	0.97	0.92	2,019
Nov	30	61.6	2.72	1.01	0.89	0.84	1,790
Dec	31	52.1	2.72	0.90	0.79	0.74	1,637
Total							**24,339**

Wall and Ceiling Insulation

Energy savings for installing better than code wall and ceiling insulation were calculated by determining the difference in heat load between the indoor and outdoor air temperatures for the code standard insulation and the as-built insulation. Savings are a product of the reduced cooling load on the refrigeration system. According to ASHRAE 2010, room temperature of an ice rink should be maintained at 45°F. It is assumed the operating conditions used in the refrigeration savings calculations will maintain this air temperature. The ice rink facility's website claims that it is an 84,000 ft2 building, therefore the ceiling surface area is assumed to be 84,000 ft2. Total wall area was determined by assuming a square building construction resulting in four 290 ft walls. Using the assumed wall height of 20 ft used in the ex-ante equation, this results in a total wall surface area of 23,186 ft2.

IECC 2009 states that commercial buildings in Climate Zone 4 must have a minimum of R-9.5 wall insulation and R-20 ceiling insulation. The ex-ante calculation stated the as-built wall and ceiling insulation to be R-23 and R-30, respectfully, which could not be verified, therefore R-23 and R-30 insulation was assumed for the walls and ceiling in the as-built condition, respectively.

Baseline and as-built heat loads from the exterior air temperature on the refrigeration system were determined using the following equation:

$$BTU_{air} = \frac{(T_{OA} - T_{IA}) \times A}{R}$$

Where:

BTU_{air} = Heat load on the refrigeration system from outside air temperature
T_{OA} = Average monthly dry-bulb air temperature, °F
T_{IA} = Average indoor dry-bulb air temperature, 45°F
A = Wall or ceiling surface area, 84,00 ft^2 ceiling and 23,186 ft^2 walls
R = Thermal resistance (R-Value) of the insulation, R-19/R-30 ceiling and R-9.5/R-20 walls(ft^2·°F·hr/BTU)
As the average outdoor air temperature varies by month, the difference in heat load between the baseline and as-built insulation varies by month. The average monthly difference in heat load between the baseline and as-built condition is listed in the table below:

Site 7119 Heat Load with Better than Code Insulation

Month	Days	Avg DB, °F	Inside Air Temp, °F	Baseline Heat Load, BTU		As-Built Heat Load, BTU		Heat Load Difference, BTU	Heat Load Difference, Tons
				R-20 Ceiling	R-9.5 Walls	R-30 Ceiling	R-23 Walls		
Jan	31	29.7	45	(64,113)	(37,257)	(42,742)	(15,389)	(43,239)	(3.60)
Feb	28	35.6	45	(39,581)	(23,001)	(26,388)	(9,500)	(26,694)	(2.22)
Mar	31	47.0	45	8,323	4,836	5,549	1,998	5,613	0.47
Apr	30	60.3	45	64,324	37,379	42,883	15,439	43,381	3.62
May	31	66.9	45	91,987	53,454	61,325	22,079	62,038	5.17
Jun	30	73.2	45	118,640	68,942	79,093	28,476	80,013	6.67
Jul	31	78.2	45	139,275	80,934	92,850	33,429	93,930	7.83
Aug	31	76.6	45	132,765	77,151	88,510	31,867	89,539	7.46
Sep	30	66.9	45	91,883	53,394	61,256	22,054	61,968	5.16
Oct	31	56.8	45	49,760	28,916	33,173	11,943	33,559	2.80
Nov	30	50.4	45	22,629	13,150	15,086	5,431	15,261	1.27
Dec	31	39.3	45	(23,802)	(13,832)	(15,868)	(5,713)	(16,053)	(1.34)

Savings for better than code ceiling and wall insulation assume the same operating conditions and equation used to determine savings for the refrigeration system but with a varying load based on outside air temperature for all numbers of operating compressors. Monthly and annual savings for better than code ceiling and wall insulation is below:

Site 7119 Monthly Annual Wall and Ceiling Insulation Savings

Month	Days	CT, °F	Heat Load Difference, Tons	As-Built, kW/ton			Tons
				1 Comp	2 Comp	3 Comp	kWh Savings
Jan	31	43.6	(3.60)	0.83	0.72	0.67	(1,990)
Feb	28	46.4	(2.22)	0.85	0.74	0.69	(1,138)
Mar	31	56.1	0.47	0.94	0.83	0.78	295
Apr	30	69.1	3.62	1.12	0.99	0.94	2,653
May	31	75.4	5.17	1.23	1.10	1.04	4,323
Jun	30	82.4	6.67	1.38	1.23	1.17	6,039
Jul	31	85.4	7.83	1.44	1.29	1.22	7,681
Aug	31	86.5	7.46	1.47	1.31	1.25	7,456
Sep	30	74.0	5.16	1.21	1.07	1.02	4,090
Oct	31	67.6	2.80	1.10	0.97	0.92	2,075
Nov	30	61.6	1.27	1.01	0.89	0.84	836
Dec	31	52.1	(1.34)	0.90	0.79	0.74	(805)
Total							31,517

Heat Reclamation

Energy savings for the heat recovery used to melt the snow were determined by calculating the energy needed to melt the snow generated when resurfacing the ice. The ex-ante calculations and savings narrative claimed that there are 16 total resurfacings per day. According to ASHRAE 2010, one resurfacing will generate between 1000 and 1600 lbs. of snow. Assuming an average snow generation of 1300 lbs. per resurfacing, energy savings were calculated using the following equation:

$$kWh_{annual} = lbs_{resurfacing} \times \left(\frac{1\ gram}{453.6\ lbs}\right) \times Enthalpy\ of\ Fusion_{water} \times N_{resurfacing} \times Days_{year} \left(\frac{1\ kWh}{3{,}600{,}000\ J}\right)$$

Where:

kWh_{annual} = Annual kWh savings
$lbs_{resurfacing}$ = Pounds of snow generated per resurfacing. 1,300 lbs
Enthalpy of $Fusion_{water}$ = The energy needed to convert one gram of ice into water, 333.54 J/g
$N_{resurfacing}$ = Number of ice resurfacings per day, 16 hours
$Days_{year}$ = Number of days the ice rink operates per year, 365 days

Energy savings for the heat recovery used to heat the sub-soil of the ice rink was determined using the heat load between the ice rink and the sub-soil. This was determined when calculating the energy savings from the ice rink floor insulation to be 32,654 BTU. The sub-soil heat recovery savings were calculated using the following equation:

$$kWh_{annual} = Heat\ Load_{sub-soil} \times Hours_{day} \times Days_{year} \left(\frac{1\ kWh}{2412.14\ BTU}\right)$$

Where:

kWh_{annual} = Annual kWh savings
$Heat\ Load_{sub\text{-}soil}$ = The heat load between the ice rink and the sub-soil, 32,654 BTU
$Hours_{day}$ = Hours per day the refrigeration system runs, 24 hours
$Days_{year}$ = Number of days per year the refrigeration system runs, 365 days
Annual kWh savings for using the waste heat from the refrigeration system melt resurfacing snow and to heat the sub-soil of the ice rink:

Site 7119 Annual Heat Reclamation Savings

Heat Reclamation Use	kWh Savings
Snow Melting Pit	319,066
Sub-Soil Heating	83,812
Total	**402,879**

Though the methodologies used to calculate savings each of the installed energy conservation measure were similar between the ex-ante and ex-post, different input values and methodologies results in an overall project realization rate of 76%.

For the refrigeration system, the ex-ante calculation did not use TMY3 weather data to determine average monthly condensing temperatures. Both the ex-ante and ex-post calculations assume a 16°F above wet-bulb condensing temperature, but the weather used in the ex-ante calculations showed higher average monthly wet-bulb temperatures resulting in high condensing temperatures. This made a significant impact during the winter months where TMY3 data showed an average wet-bulb temperature of 31.4°F in December, January, and February, while the ex-ante weather had an average wet-bulb temperature over these three months of 56.0°F. Because both the baseline and efficient refrigeration systems operate more efficiently at lower condensing temperatures, this results in a reduction in savings. Ex post model extrapolated the kW/Ton used in the ex-ante at varying compressor and condensing temperatures to estimate performance at these lower condensing temperatures using a polynomial trend line. While the ex-ante calculation used the nearest listed condensing temperature to determine the baseline and as-built consumption, the ex-post calculation used the polynomial trendlines to estimate monthly consumption, resulting in more precise savings estimates.

For the rink floor insulation, the ex-ante assumed an ice temperature of 15°F and a sub-soil temperature of 45°F. The ex post saving sourced average values outlined in ASHRAE 2010 of 21°F ice temperature and 41°F sub-soil temperature when determining the heat load from the sub-soil heating system on the refrigeration system. Additionally, the ex-ante calculation assumed a total rink surface area of 37,700 ft^2. Drawings were not provided, so the ex post sourced the American hockey rink surface area stated in ASHRAE 2010 of 16,327 ft^2, resulting in a total surface area for both rinks of 32,654 ft^2. The reduction in ΔT across the ice and sub-soil as well as the reduction in total rink surface results in a lower the overall heat load of the refrigeration system, reducing savings. Finally, the ex-ante assumed a constant kW/ton capacity of the refrigeration system when calculating savings, while the ex-post calculation assumed the same operation as was claimed when determining refrigeration system savings, resulting in more precise savings estimates.

For the wall and ceiling insulation, the ex-ante assumed an average outdoor air temperature of 70°F year-round, while the ex-post calculation used the average monthly dry-bulb temperature from TMY3 weather data to determine the average monthly difference in heat load. Because TMY3 weather data showed an average dry-bulb temperature of 56°F, the assumed overall heat load is less, reducing savings. Additionally, because the dry-bulb temperature is lower than the indoor temperature for the months of January, February, November and December, the increased R-value insulation results in negative savings for these months. This was not accounted for in the ex-ante calculation. Additionally, the ex-ante calculation claimed that the baseline ceiling and wall insulation were R-19 and R-10, respectfully. According to IECC 2009, baseline ceiling wall and ceiling insulation are R-20 and R9.5 respectfully. The IECC 2009 values were used in the ex-post calculations. Finally, the ex-ante assumed a constant kW/ton capacity of the refrigeration system when calculating savings, while the ex-post calculation assumed the same operation as was claimed when determining refrigeration system savings, resulting in more precise savings estimates.

For heat reclamation used for melting resurfacing snow, the ex-ante calculation assumed that 220,848 BTU was required to melt each load of snow. Using the average lbs. of snow per resurfacing from ASHRAE 2010 along with the enthalpy of fusion of water to determine the energy needed to melt the snow results in lower heat load required to melt the snow than claimed. Additionally, once the ex-ante calculation converted the BTU's necessary to melt the snow into kWh, their value was divided by a value of 0.93 to determine savings. This value is not explained in the ex-ante calculation or the savings narrative therefore it was not used in the ex-ante calculation. The project narrative suggested that the alternative for snow melt reclamation is "an electric hot water tank, or gas fired boiler". Due to the uncertainty that the project would have used electric resistance heat for snow melting, the baseline was set to the same process as the as installed, resulting in zero kWh savings.

For heat reclamation used for the sub-soil heating system, the ex-ante calculation assumed a 60,000 BTU heat load necessary to heat the subsoil. The ex-post used the heat load determined when calculating ice rink insulation savings of 32,654 BTU to determine savings. The lower heat load required results in reduced savings. Additionally, once the ex-ante calculation converted the BTU's necessary to heat the sub-soil into kWh, this value was divided by a value of 0.93 to determine savings. This value is not explained in the ex-ante calculation or the savings narrative therefore it was not used in the ex-ante calculation.

The verified annual site-level energy savings are 746,933 kWh, resulting in a 53% realization rate.

The energy and peak demand savings for this new construction project are listed below:

Site 7119 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	ExPost (kW)
New Construction	Building Shell	55,202	31,517	57%	13.99
	Refrigeration	743,056	607,265	82%	82.43
	Refrigeration	571,934	83,812	15%	11.38
	Building Shell	38,193	24,339	64%	3.03
Total		**1,408,385**	**746,933**	**53%**	**111.11**

Site ID: 7120

Data Collection

The participant received New Construction lighting HVAC incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code and installing HVAC equipment more efficient than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area. The thirteen new rooftops units had the baseline verified to St Louis County Building Code efficiency requirements and obtained the inputs for the heating/cooling savings calculator.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7120 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting System to Efficient Lighting System Lighting Power Density (LPD)		60	60	229.1	113.8	8,760	1.09	60,475		66,033	109%
		69	69	64.3	32	8,760	1.09	19,528		21,285	109%
		82	82	70.3	35	8,760	1.09	25,379		27,663	109%
		20	20	25.1	12.5	8,760	1.09	2,211		2,410	109%
		60	60	42.2	21	8,760	1.09	11,142		12,145	109%
		10	10	56.3	28	8,760	1.09	2,476		2,699	109%
		10	10	48.2	24	8,760	1.09	2,122		2,313	109%
		14	14	113.2	56.3	8,760	1.09	6,972		7,600	109%
		26	26	21.1	12	8,760	1.09	2,414		2,259	94%
Total								**132,719**	-	**144,407**	**109%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post})xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The efficient wattage for the first- and ninth-line items in the table above (113.8W and 12W, respectively) differ from the efficient wattage used in the ex ante savings calculation (114W and 10.5W, respectively).

The annual lighting hours of operation using secondary sources (8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a heated and air-conditioned facility in St. Louis, was applied to the ex post lighting energy saving. The ex post savings calculation used a factor of 1.00.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The energy savings for the new rooftop units were determined with the ex ante calculator after verifying the output. First the weather data was updated to TMY3 weather data, then checked to prior work. The baseline IEER efficiencies, and installed efficiencies were the same for the ex ante and ex post. The realized savings was 199,838 kWh, with the 101% realization rate due to the ex post TMY3 weather data usage.

Site 7120 Cooling and HVAC Retrofit Savings

Measure Name	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051801-HVAC-Packaged / Rooftop Unit-Replacing No Existing Equipment or Replacing Failed Equip	118,962	119,838	101%
Total	**118,962**	**119,838**	**101%**

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 105%.

Site 7120 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	132.719	144,407	109%	27.43
	Cooling	118,962	119,838	101%	109.13
Total		**251,681**	**264,245**	**105%**	**136.56**

Site ID: 7131

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7131 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting System to Efficient Lighting System Lighting Power Density (LPD)		9	9	459	142	2,679	1.00	8,838		7,892	89%
Total								**8,838**	-	**7,891**	**89%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources and the stated hours on the operating hours calculator tab from the application (2,693) are fewer than the annual hours of operation used to calculate ex ante savings (3,000).

A heating and cooling interactive factor of 1.00, applicable to an unconditioned garage in St. Louis, was applied to the ex post lighting energy saving and corresponds with the ex ante savings estimate. The application states electric heat only which would reduce the kWh ex post savings.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 89%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site 7131 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	8,838	7,892	89%	1.50
Total		**8,838**	**7,892**	**89%**	**1.50**

Site ID: 7132

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7132 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
New Construction to-Lighting-New Construction Lighting Power Density (LPD)		216	216	757	186	3,056	1.00	376,854		376,854	100%
Total								**376,854**	-	**376,854**	**100%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,056) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned space in St. Louis, was applied to the ex post lighting energy savings and corresponds with the ex ante savings estimate.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 100%.

Site 7132 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	376,854	376,854	100%	71.59
Total		**376,854**	**376,854**	**100%**	**71.59**

Site ID: 7133

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7133 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting - Baseline Lighting System to Efficient Lighting System - New Construction Lighting Power Density (LPD)		20	20	275	105	2.034	1.08	6,797		7,465	110%
		74	74	24	12	2,139	1.08	1,853		2,000	108%
		12	12	71	36	2,139	1.08	902		974	108%
		36	36	41	21	2,139	1.08	1,578		1,704	108%
Total								**11,130**	-	**12,142**	**109%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources for the first line item in the table above (2,034) are greater than the annual hours of operation used to calculate ex ante savings (2,000). The hours for the remaining line items above (2,139) are fewer than the ex ante hours (2,140).

A heating and cooling interactive factor of 1.08, applicable to a heated, air-conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 109%.

Site 7133 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	11,130	12,142	109%	2.31
Total		**11,130**	**12,142**	**109%**	**2.31**

Site ID: 7134

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7134 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting System to Efficient Lighting System - New Construction Lighting Power Density (LPD)		68	68	403	249	7,043	1.00	74,103		74,103	100%
		54	54	292	180	7,043	1.00	42,588		42,588	100%
Total								**116,691**	-	**116,691**	**100%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (7,043) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.04, applicable to an unconditioned space in St. Louis, was applied to the ex post lighting energy savings and correspond with the ex ante savings estimate.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 100%.

Site 7134 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	116,691	116,691	100%	22.17
Total		**116,691**	**116,691**	**100%**	**22.17**

Site ID: 7135

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7135 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting System to Efficient Lighting System - New Construction Lighting Power Density (LPD)		13	13	20	13	6,137	1.12	529		591	112%
		8	8	17	11	6,137	1.12	275		308	112%
		2	2	46	30	6,137	1.12	189		212	112%
		34	34	16	11	6,137	1.12	1,160		1,296	112%
		8	8	23	15	6,137	1.12	376		420	112%
		16	16	70	46	6,137	1.12	2,328		2,602	112%
		12	12	9	6	6,137	1.12	225		252	112%
Total								**5,082**	-	**5,681**	**112%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (6,137) are less than the annual hours of operation used to calculate ex ante savings (6,150).

A heating and cooling interactive factor of 1.12, applicable to a heated, air-conditioned quick service restaurant in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.00.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 112%.

Site 7135 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	5,082	5,681	112%	1.08
Total		**5,082**	**5,681**	**112%**	**1.08**

Site ID: 7136

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7136 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting System to Efficient Lighting System - New Construction Lighting Power Density (LPD)		43	43	568	178	2,000	1.00	33,532		33,535	100%
Total								**33,532**	-	**33,535**	**100%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,000) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.00, applicable to an unconditioned space in St. Louis, was applied to the ex post lighting energy savings and corresponds with the ex ante savings estimate.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 100%.

Site 7136 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	33,532	33,535	100%	6.37
Total		**33,532**	**33,535**	**100%**	**6.37**

Site ID: 7137

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri for installing efficient lighting with a lighting power density less than the building code.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7137 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Baseline Lighting System to Efficient Lighting System - New Construction Lighting Power Density (LPD)		36	36	707	134	3,120	1.04	64,396		66,975	104%
		3	3	512	97	3,120	1.04	3,885		4,040	104%
Total								**68,281**	-	**71,015**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,120) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.04, applicable to a heated, air-conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.00.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7137 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	Lighting	68,281	71,015	104%	13.49
Total		**68,281**	**71,015**	**104%**	**13.49**

Site ID: 7138

Data Collection

The participant received incentives from Ameren Missouri for building a new construction facility that is more energy efficient that than IECC 2015.

Ex-ante savings were estimated using an eQuest full building energy simulation model, which was not available. The documents reviewed included site photos, mechanical submittals, and the "Facility Energy Savings Analysis" to determine the proper baseline conditions as prescribed in IECC 2015 were used.

Analysis Results

The savings for the evaluated measures from the incentivized HVAC is presented in the following table.

Site 7138 HVAC Retrofit Savings and Algorithm Inputs

Measure Name	End Use	Program	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051801- Rooftop Unit-Replacing No Existing Equipment	HVAC	New Construction	96,148	96,148	100%
4051001-HVAC Controls/EMS- Replac No Existing Equip			136,040	136,040	100%
4050701-HVAC-Demand Control Ventilation-Replac No Existing Equip			54,460	54,460	100%
Total			**286,648**	**286,648**	**100%**

All the equipment, HVAC control sequences for demand control ventilation, and HVAC capacity for the building exceeded the building code requirements.

Without the native energy model of the building project to perform ex post runs, calibrated with current billing energy usage, instead a billing energy to weather regression was attempted to verify the as-built annual energy consumption met the energy model forecast.

Monthly billing meter data was used to perform a regression analysis with the months from July 2019 through January of 2020, with July and August dropped as the building was not fully occupied.

The regression was performed using cooling degree days (CDD) and heating degree days (HDD) as the variables. Total monthly CDD and HDD from actual weather over the billing period from St. Louis' Lambert International Airport was used in the regression. It was determined that a CDD base temp of 70°F and an HDD base temp of 65°F provided the regression with the most accurate results. The regression equation is next.

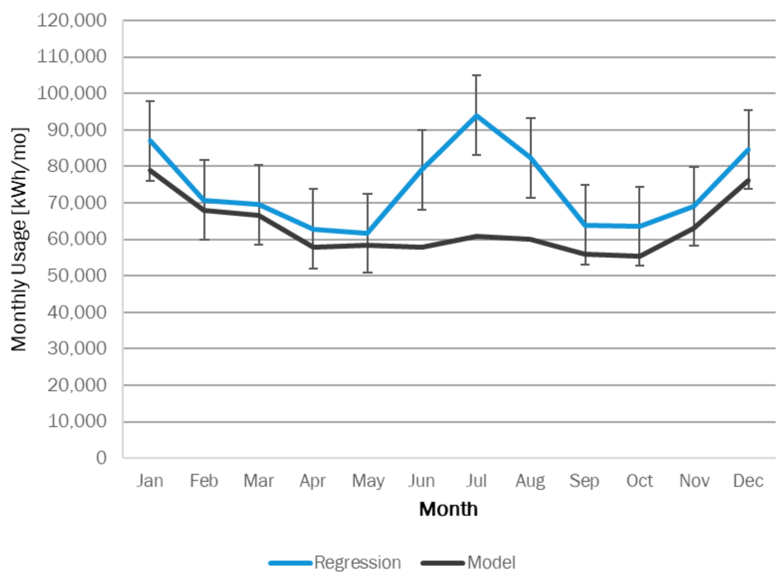
$$kWh_{day} = C_{base} + a_1 CDD + a_2 HDD$$

Where:

kWh day = kWh consumption per day in respective month
C base = Base daily kWh consumption
a1 = Cooling coefficient

a2 = Heating coefficient
CDD = Total monthly CDD in respective month
HDD = Total monthly HDD in respective month

Site 7139 Monthly Billed Metered Data and Regression Model



The regression equation statistic for the fit of the model had an R square value of 0.36, which is too low to provide a quantitative analysis of savings with reasonable certainty. The months of June, July and August are outside of the error bands of the model. Without the operational conditions from this period, such as building commissioning, or cooling by ventilation air, the ex post analysis does not provide a quantitative estimate of the energy savings. The measures evaluated under this project are better than code for HVAC efficiency, HVAC controls, and HVAC demand control ventilation. The ex post savings were set equal to the ex ante energy and demand savings based on the availability of documents and data.

Site 7138 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
New Construction	HVAC	286,648	286,648	100%	127.27
Total		**286,648**	**286,648**	**100%**	**127.27**

Appendix F. Desk Review and Onsite Reports: Retro-Commissioning Program

Site ID: 7062

Data Collection

The participant received Custom incentives towards a new air compressor and Retro commissioning measure incentives from Ameren Missouri for identifying and repairing air leaks in their manufacturing plant.

During the onsite verification visit, the nameplate information for the air compressors in both areas along with the air dryers were collected. Site personnel provided manufacturing schedules and air compressor staging details. Data for the analysis was obtained from the monitoring performed by the trade ally for total air flow and power along with pressure on each compressor for 7 days. The absence of leaks was verified across various plant areas for the 39 leaks identified by ultrasound testing, for a reduction of 63 cfm.

Analysis Results

The savings for the evaluated measures from the incentivized replacement air compressor is presented in the following table.

Site 7062 Air compressor savings and model inputs

Measure Name	Ex ante method	Ex post method	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4020600-Efficient Air Compressor	Pre data and bins	Pre data, hourly, weekends,weekdays	107,346	105,011	98%
Total			**107,346**	**105,011**	**98%**

The project documentation was reviewed, and the Preliminary Air Study dataset from the trade ally, was used for the estimation of savings. The metered data for a one-week period, included amperage of each air compressor, and air pressure. There was a fixed speed base air compressor and a variable speed trim air compressor with an existing receiver tank.

Energy savings for the air compressor measure was estimated using the International Performance Measurement and Verification Protocol Option A: Retrofit Isolation methodology.

This air savings was estimated with the leak repair verification and using the facility’s compressed air load profile, derived from baseline monitoring data. The air compressor logged current data was used to calculate power, using the following algorithm:

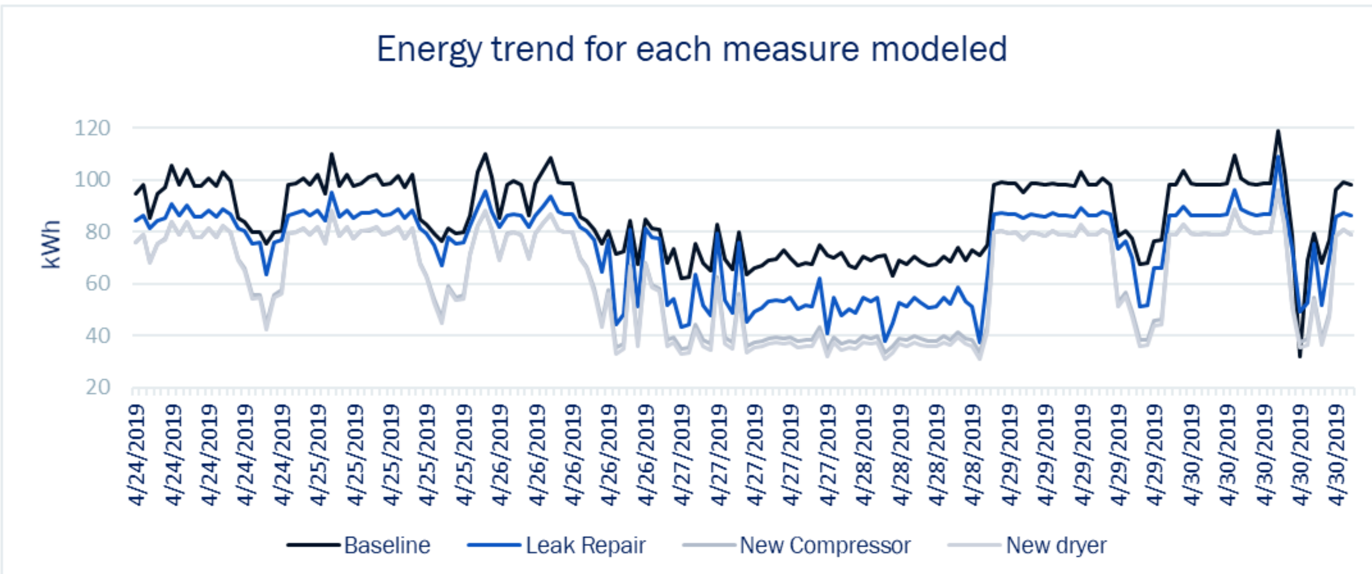
$$P = \frac{\sqrt{3} \times V \times A \times pf}{1{,}000}$$

Where:

P = *Power (kW)*
V = *Voltage (460)*
A = *Amperage*

pf = *Power factor (calculated using a power factor as a function of full-load amps curve)*
The load (cfm) at each monitoring point was determined using the calculated kW values and the CAGI datasheet for the air compressors. From the CAGI datasheet, the efficiency curve of kW vs cfm was built. The curve was used to determine the cfm at each data point. The cfm and kW values were summed for each air compressor to get total system kW and cfm. The system efficiency was determined with this dataset. The 37-cfm air reduction was applied to the ex post model to determine the typical week model savings. The estimated air leak reduction by the trade ally was used by both the ex ante and ex post which assigns a cfm value based on the sizing of “small, medium, large and extra-large”. This method is approved in the Chapter 22 of the Uniform Methods Projects for compressed air evaluation.

Site 7062 Energy trend for each measure model



The realization rate for the air leak repair was 99%, with 106,229 annual kWh saved. The ex ante and ex post models were similar, using the same CAGI air compressor data sheets and baseline trend data.

The Custom measure had two components, savings from the new air compressor and savings from a new air dryer. The new air compressor savings were similar from the ex ante to ex post, with the difference in that the ex post did not have bin ranges but determined the model savings from each data point.

The refrigerated air dryer ex post savings were 8,222 kWh compared to the ex ante savings of 16,875 kWh. The ex ante savings model set the full load dryer kW equal to the load for each data point, as indicated on their calculator for non-cycling refrigerated dryers. The ex post observed the manufacturer’s data sheet that indicated some reduction in power for less than full loads, varying from 4.32 kW to 3.13 kW. Both the ex ante and ex post model had the same values for the efficient dryer, which was a cycling type.

The peak coincident kW savings were calculated using the algorithm below, with the air compressor Coincident Factor applied to the energy savings.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The following table lists the realized demand savings of 14.70 kW along with the energy savings for the RCx measure.

Site 7062 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
RCx	Air Compressor	107,346	105,011	98%	14.70
Total		107,346	105,011	**98%**	**14.70**

Site ID: 7114

Data Collection

The participant received Retro commissioning measure incentives from Ameren Missouri for identifying and repairing air leaks in their manufacturing plant.

During the onsite verification visit, the nameplate information for the air compressors in both areas along with the air dryers were collected. Site personnel provided manufacturing schedules and air compressor staging details. Data for the analysis was obtained from the monitoring performed by the trade ally for total air flow and power along with pressure on each compressor for 7 days. The absence of leaks was verified across various plant areas for the 39 leaks identified by ultrasound testing, for a reduction of 63 cfm.

Analysis Results

The savings for the evaluated measure from the RCx program is presented in the following table.

Site 7114 Retro Commissioning Savings and Inputs

Measure Name	End Use	Air Leak Pre	Air Leak Post	CFM reduced	Annual HOU	Pressure (psi)	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4020500- Compressed Air System Leak Repair	Air Compressor	36	36	37	8,760	96	67,171	69,419	103%
Total							67,171	69,419	103%

The project documentation was reviewed, and the Preliminary Air Study dataset from the trade ally, was used for the estimation of savings. The metered data for a one-week period, included amperage of each air compressor, and air pressure. There was a fixed speed base air compressor and a variable speed trim air compressor with an existing receiver tank.

Energy savings for the air compressor measure was estimated using the International Performance Measurement and Verification Protocol Option A: Retrofit Isolation methodology.

This air savings was estimated with the leak repair verification and using the facility's compressed air load profile, derived from baseline monitoring data. The air compressor logged current data was used to calculate power, using the following algorithm:

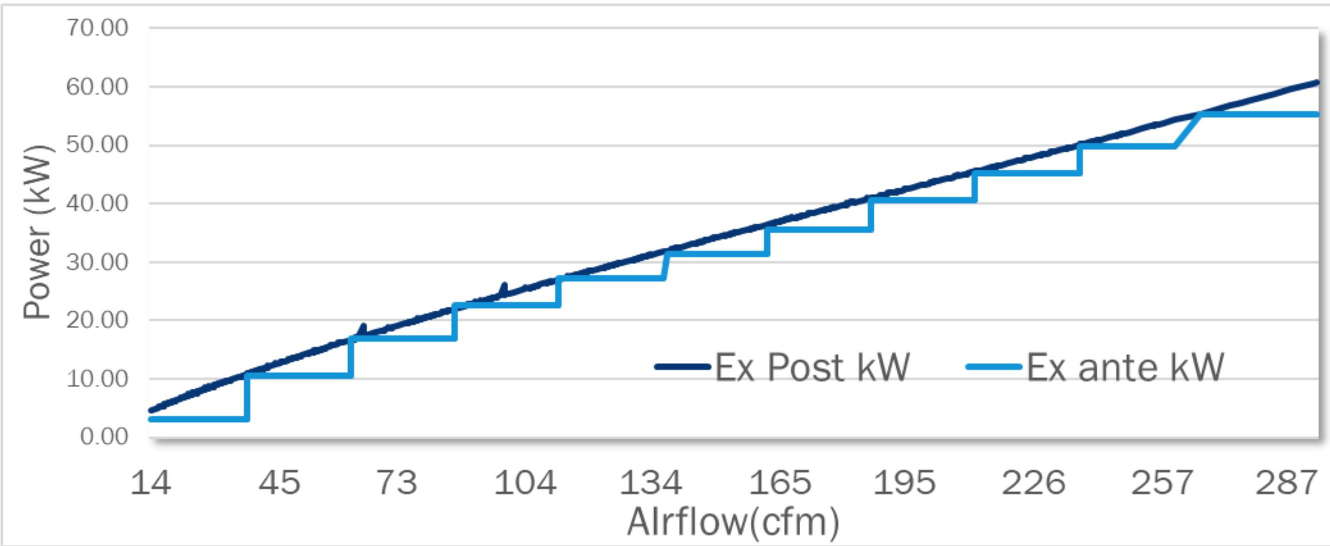
$$P = \frac{\sqrt{3} \times V \times A \times pf}{1{,}000}$$

Where:

P = *Power (kW)*
V = *Voltage (460)*
A = *Amperage*
pf = *Power factor (calculated using a power factor as a function of full-load amps curve)*

The load (cfm) at each monitoring point was determined using the calculated kW values and the CAGI datasheet for the air compressors. From the CAGI datasheet, the efficiency curve of kW vs cfm was built. The curve was used to determine the cfm at each data point. The cfm and kW values were summed for each air compressor to get total system kW and cfm. The system efficiency was determined with this dataset. The 37-cfm air reduction was applied to the ex post model to determine the typical week model savings. The estimated air leak reduction by the trade ally was used by both the ex ante and ex post which assigns a cfm value based on the sizing of “small, medium, large and extra-large”. This method is approved in the Chapter 22 of the Uniform Methods Project for compressed air evaluation. The comparison of the two models is in the next figure.

Site 7114 Ex ante and Ex post cfm to kW model



The ex ante and ex post models have a similar trend, with the ex ante model stair stepping with the larger size “bins” for aggregating the data.

The 37-cfm air reduction was applied to the ex post model to determine the typical week model savings. The estimated air leak reduction by the trade ally was used by both the ex ante and ex post which assigns a cfm value based on the sizing of “small, medium, large and extra large”.

The realization rate is 103%, with 69,410 annual kWh saved. The ex post considered weekday and weekend days separately, whereas the ex ante model considered all days weighted equally.

Also, the ex post evaluation compared the list of repair items in each piece of equipment to the list from another evaluated air leak project at the site from the year 2017. Although, there can be many causes of air leaks on a piece of equipment, three of the 36 repairs were like those repaired previously. The three items were identified by the equipment name and the description of the repair. The description for a similar pair included “repaired Ross valve” and “water filter inside panel” along with photographs taken during the site visit. The EUL for this measure is 10 years, which was not achieved by 3 of the 36 repairs.

The following table lists the energy savings achieved for the evaluated measure, along with the peak kW reduction after factoring the “Air Compressor” CF value by the energy savings.

Site 7114 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
RCx	Air Compressor	67,171	69,419	103%	51.25
Total		**67,171**	**69,419**	**103%**	**51.25**

Site ID: 7112

Data Collection

The participant received Retro commissioning program and Custom program incentives from Ameren Missouri for improving the operation of the rooftop HVAC units by implementing scheduling, better supply fan modulation and static pressure reduce in the air ducts.

The sampled project had completed measures from both programs with interactive effects. The savings for the RCx portion of this project will be presented, with the project savings realization rate.

Analysis Results

The savings for the evaluated RCx energy conservation measures are listed below.

Site 7112 RCx savings

Measure Name	Evaluation Boundary	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051000-HVAC Controls	RTU1,2,3,4 and RTU5	89,041	88,599	125%
Total		**94,423**	**118,029**	**125%**

IPMVP Option A, retrofit isolation was followed to estimate savings. First the ex ante savings calculator was verified to prior work. Then the inputs to the calculator were validated. The following table presents those inputs that differed from the ex ante inputs, and the impact on the energy savings.

Site 7112 RCx Calculator Inputs

Input	Ex Ante Value	Ex Post Value	Savings change (kWh)	Ex post Source
RTU 1-4 Efficiency	0.55 kW/ton	1.03 kW/ton	28%	RTU Submittals
RTU 1-4 UnOcc Cooling Setpoint	85 °F	79 °F	-1%	RCx Study
RTU 5 Efficiency	0.65 kW/ton	1.03 kW/ton	5%	RTU Submittals
RTU 5 UnOcc Cooling Setpoint	85 °F	79 °F	-3%	RCx Study

The ex ante analysis used a different RTU efficiency and UnOcc cooling setpoint. The ex post value was sourced from the RTU submittals and then confirmed in RCx study report. The value selected in the calculator would be appropriate for a chiller plant and building with air handling units. The 1.03 kW/ton is closer to system efficiency of buildings with rooftop HVAC units.

The realized savings for the RCx measures in the project are listed in the next table.

Site 7112 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
RCx	Air Compressor	94,423	118,029	125%	51.25
Total		**94,423**	**118,029**	**125%**	**51.25**

Site ID: 7115

Data Collection

The participant received Retro commissioning program incentives Ameren Missouri for improving the HVAC equipment and controls in a 135,00 square feet office building.

During the onsite verification visit, current operating data was collected from their Building Automation System (BAS) computer, equipment model nameplate data collected, along with discussion of the baseline operating method.

Analysis Results

The savings for the evaluated RCx energy conservation measures are listed next.

Site 7115 RCx savings

Measure Name	Energy Conservation Measure	Ex Ante (kWh)	Ex Post Gross (kWh)	RR
4051000-HVAC Controls-Cooling 4051000 HVAC Controls	Schedule RTU1,2,3 and exhaust	526,836 290,211	665,436 355,560	126%
	Reset static pressure RTU,1,2,3,4,5,6,7			
	Reset economizer SP from 55 to 65F			
	Replace inlet guide vanes RTU3,4,5			
Total		**817,047**	**1,031,996**	**126%**

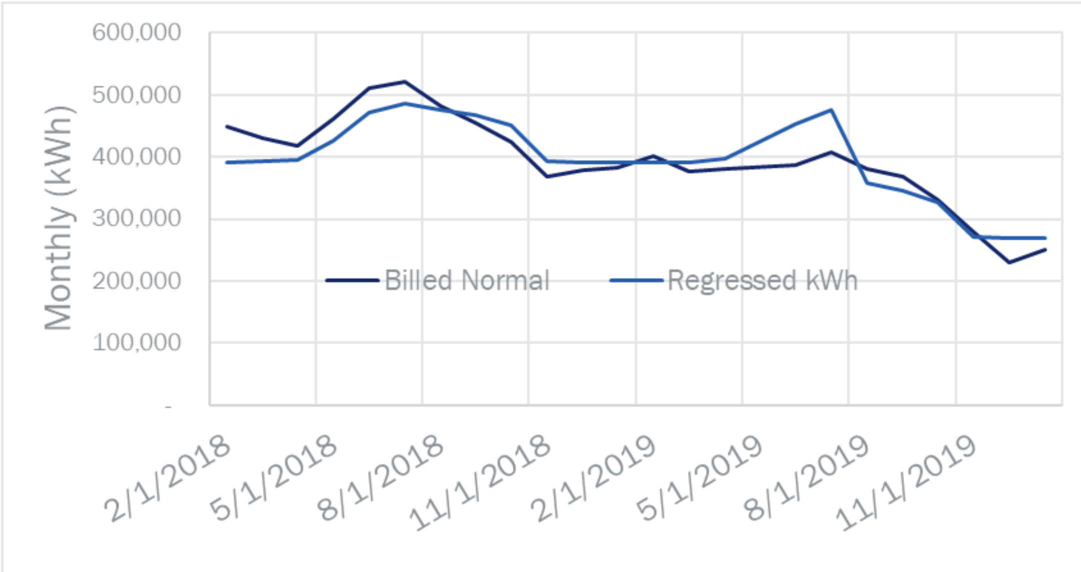
During the onsite visit, trend data collected from the BAS system verified the scheduling of units RTU1,2 and 3. The start and stop of the units was observed at 4AM to 11PM for one unit, and 5AM-4Am for the other two. Also, the site contacted supplied access to the areas with the new building controls and rework of the air handlers to handle the increase outside air for the economizer, along with repairing broken actuators.

The new wall thermostats are no longer adjustable by occupant but set by the system to control both airflow and temperature, seeking the minimum airflow to reach the temperature setpoint. Input from all the VAV boxes now informs the rooftop unit to adjust both airflow and the discharge air temperature.

RTU3 was sampled from the three AHUs where VFDs had been installed to replace the inlet guide vanes.

To determine the savings from these measures and their interactive effects, IPMVP Option C, whole building, was selected for the ex post savings estimate. There are other buildings in the campus, all on the same Ameren utility meter, but from previous projects evaluated at this site, it was known that all other buildings are sub metered. The difference in the billing meter usage and the sum of the submeter usage, nets the usage for this building. The regression of the billed/submeter data with weather data is next.

Site 7115 Billed meter data and regressed model



The regressed model had coefficient factors for cooling degree days (CDD), heating degree days(HDD) and a flag for the post period, which all have significance with their probability values all under 0.05. The model was then ran with TMY3 weather data, to estimate the annual savings 1,031,996 kWh and a demand savings of 769 kW. The realized savings is 126%. The project included a continuous retro commissioning feature attached to their BAS system, which is monitored remotely and the setpoints are adjusted to refine the energy savings and to meet the space temperature requirements of the building occupants.

Site 7115 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross (kW)
RCx	Cooling	526,836	665,436	126%	606
	HVAC	290,211	355,560		163
Total		**817,046**	**1,031,996**	**126%**	**769**

Appendix G. Desk Review Reports: BSS Program

Site ID: 7260

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7260 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060814- Fluorescent T12 replaced with LED Type B	800900	28	28	164	48	3,060	1.08	10,635	-	10,734	101%
		2	2	82	24	3,060	1.08	380	-	383	101%
		2	2	72	28	3,060	1.08	289		291	101%
4060714- Fluorescent T8 replaced with LED Type B	800850	43	43	88	36	3,060	1.08	7,321		7,390	101%
		19	19	56	30	3,060	1.08	1,742		1,633	94%
		1	1	59	24	3,060	1.08	116		116	100%
4060912- HID Replaced with LED Lamp direct-wired	800300	4	4	284	30	3,060	1.08	3,012		3,358	111%
4060410- Incand Exit Sign Replaced with LED 5 W	800750	11	11	30	2	8,760	1.08	2,784		2,893	104%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	3	3	43	9	3,060	1.08	324		327	101%
		8	8	45.5	11	3,060	1.08	904		912	101%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Total								27,507	-	28,036	102%

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage of the fifth line item in the table above (30W) is greater than the wattage used to calculate the ex ante savings (28W). The efficient wattages of the seventh and eighth measures (30W and 2W, respectively) is less than the ex ante wattages (54W and 3W, respectively).

The annual lighting hours of operation using secondary sources (3,060) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 102%.

Site 7260 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	27,507	28,036	102%	5.33

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
Total		**27,507**	**28,036**	**102%**	**5.33**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7260 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2026	164	128	7,403
			82	64	262
			72	64	238
		2022	43	13.4	44
Total					**7,949**

Site ID: 7261

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7261 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	7	7	43	9	1,000	1.08	247	-	249	101%
4060714-Fluorescent T8 replaced with LED Type B	800850	5	5	114	48	3,120	1.08	1,101		1,112	101%
		6	6	56	30	3,120	1.08	520		526	101%
		2	2	59	24	3,120	1.08	233		236	101%
4060310- Halogen BR/R 45 W Replaced w LED ? 13 W	800150	38	38	65	11	3,120	1.08	6.851		6,914	101%
4060612-Fluorescent T5 Replaced with LED Type A	800800	8	8	234	100	3,120	1.08	3,579		3,614	101%
		4	4	120	50	3,120	1.08	935		943	101%
		4	4	59	25	3,120	1.08	454		458	101%
Total								**13,920**	-	**14,051**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=} (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,120) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7261 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	13,920	14,051	101%	2.67
Total		**13,920**	**14,051**	**101%**	**2.67**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for omni directional lamps and their equivalent CFL wattage with the post midlife shift kWh savings.

Site 7261 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	43	13.4	33
Total					**33**

Site ID: 7262

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7262 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	23	15	43	9	1,000	1.08	889		897	101%
4060814-Fluorescent T12 replaced with LED Type B	800900	48	48	164	48	3,120	1.08	18,589	-	18,762	101%
		36	36	164	48	3,120	1.08	13,941		14,071	101%
		17	17	164	48	3,120	1.08	6,584		6,645	101%
		4	4	72	30	3,120	1.08	562		566	101%
		26	26	82	24	3,120	1.08	5,034		5,081	101%
		5	5	82	24	3,120	1.08	968	-	977	101%
		3	3	82	24	3,120	1.08	581		586	101%
4060714-Fluorescent T8 replaced with LED Type B	800850	10	10	59	24	3,120	1.08	375		378	101%
4060814-Fluorescent T12 replaced with LED Type B	800900	2	2	56	18	3,120	1.08	254		256	101%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	6	6	45	11	3,120	1.08	691		698	101%
Total								**48,468**	-	**48,918**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,120) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7262 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	48,468	48,918	101%	9.29
Total		**48,468**	**48,918**	**101%**	**9.29**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7262 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	43	13.4	187
		2026	164	128	12,939
			164	128	9,704
			164	128	4,583
			72	64	458
			82	64	3,504
			82	64	674
			82	64	404
			56	32	94
Total					**32,549**

Site ID: 7263

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7263 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060410-Incandescent Exit Sign Replaced with LED 5 W	800750	24	24	40	3	8,760	1.11	8,323		8,635	104%
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	15	15	43	10	3,060	1.11	1,572		1,630	104%
4060714-Fluorescent T8 replaced with LED Type B	800850	322	332	88	46	3,060	1.11	42,774		44,373	104%
		25	25	56	26	3,060	1.11	2,456		2,547	104%
		24	24	59	23	3,060	1.11	2,034		2,110	104%
4060810-Fluorescent T12 Replaced with LED Fixture	800900	15	15	48	23	3,060	1.11	1,227		1,274	104%
		3	3	82	23	3,060	1.11	284		295	104%
Total								**58,670**	-	**60,864**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,060) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7263 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	58,670	60,864	104%	11.56
Total		**58,670**	**60,864**	**104%**	**11.56**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7263 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	43	13.4	173
		2026	48	32	459
			82	64	205
Total					**837**

Site ID: 7264

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7264 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714-Fluorescent T8 replaced with LED Type B	800850	34	34	114	48	2,200	1.21	5,283		5,974	113%
		40	40	88	36	2,200	1.21	4,896		5,537	113%
		14	14	59	24	2,200	1.21	1,153		1,304	113%
Total								**11,332**	-	**12,815**	**113%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,200) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.21, applicable to a heated, air conditioned outpatient healthcare facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 113%. The ex ante was premised on underestimated heating and cooling interactive effects.

Site 7264 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	11,332	12,815	113%	2.43
Total		**11,332**	**12,815**	**113%**	**2.43**

Site ID: 7265

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7265 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714- Fluorescent T8 replaced with LED Type B	800850	1	1	56	26	1,400	1.02	45	(4)	43	95%
4060410- Incand Exit Sign Replaced with LED 5 W	800750	25	25	40	3	8,760	1.02	8,670	(729)	8,265	95%
4060714- Fluorescent T8 replaced with LED Type B	800850	300	300	88	30	2,500	1.02	46,545	(3,915)	44,370	95%
		18	18	32	23	2,500	1.02	433	(36)	413	95%
		1	1	59	23	8,760	1.02	388	(28)	322	95%
4060814- Fluorescent T12 replaced with LED Type B	800900	1	1	48	23	1,000	1.02	27	(2)	26	96%
Total								**56,058**	**(4,714)**	**53,438**	**95%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante calculations (ranging from 1,000 – 8,760).

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 95%.

Site 7265 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	56,058	53,438	95%	11.05
Total		**56,058**	**53,438**	**95%**	**11.05**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7265 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2026	48	32	9.99
Total					**9.99**

Site ID: 7266

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7266 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	31	31	72	13	2,040	1.08	3,857		3,893	101%
		7	7	72	11	2,040	1.08	902		910	101%
		256	256	43	9	2,040	1.08	18,440		18,613	101%
		69	69	43	9	2,040	1.08	4,970		5,017	101%
		35	35	43	9	2,040	1.08	2,521		2,545	101%
		11	11	29	9	2,040	1.08	456		460	101%
4060814-Fluorescent T12 replaced with LED Type B	800900	2	2	227	86	2,040	1.08	615	-	621	101%
		1	1	227	86	2,040	1.08	308	-	311	101%
		76	76	164	48	2,040	1.08	19,244		19.423	101%
		11	11	164	48	2,040	1.08	2,785		2,811	101%
		9	9	72	30	2,040	1.08	825		833	101%
		100	100	82	24	2,040	1.08	12,660		12,779	101%
		30	30	82	24	2,040	1.08	3,797		3,834	101%
	800750	15	15	30	2	8,760	1.08	3,515		3,945	112%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060410- Incand Exit Sign Replaced with LED 5 W		7	7	30	2	8,760	1.08	1,771		1,841	104%
4060330-Lighting-Halogen PAR 48 W Replaced with LED 20 W	800250	29	29	100	11	2,040	1.08	5,634		5,686	101%
		21	21	65	11	2,040	1.08	2,476		2,498	101%
Total								**84,776**	-	**86,020**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage of the fourteenth and fifteenth line items in the table above (2W) are less than the wattage used to calculate the ex ante savings (5W and 3W, respectively).

The annual lighting hours of operation using secondary sources (2,040 and 8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7266 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	84,776	86,020	101%	16.34
Total		**84,776**	**86,020**	**101%**	**16.34**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7266 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	72	24.8	806
			72	24.8	213
			43	13.4	2,482
			43	13.4	669
			43	13.4	339
			29	9.4	10
		2026	227	196	485
			227	196	242
			164	128	13,395
			164	128	1,939
			72	64	674
			82	64	8,813
			82	64	2,644
Total					**32,710**

Site ID: 7267

Data Collection

The participant received BSS Program lighting and thermostat incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7267 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	24	24	43	9	2,294	1.08	1,943		1,962	101%
4060814-Fluorescent T12 replaced with LED Type B	800900	14	4	164	48	2,294	1.08	3,986		4,023	101%
4060714-Fluorescent T8 replaced with LED Type B	800850	4	4	114	48	2,294	1.08	648		654	101%
4060814-Fluorescent T12 replaced with LED Type B	800900	20	20	48	12	2,294	1.08	1,767		1,784	101%
4060410- Incand Exit Sign Replaced with LED 5 W	800750	7	7	30	2	8,760	1.08	1,771		1,841	104%
4060310-LightingHalogen BR/R45W Repl. w LED 13 W	800150	115	115	65	11	2,294	1.08	15,243		15,243	101%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
Total								25,358	-	25,650	101%

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage of the fifth line item in the table above (2W) is less than the wattage used to calculate the ex ante savings (3W).

The annual lighting hours of operation using secondary sources (2,294 and 8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The savings for the Learning Thermostat was determined with the TRM algorithm and the known inputs.

$$kWh_{savings\ per\ ton} = \frac{1}{Efficiency}\ x\ EFLH\ x\ Capacity * SF/1000$$

Where:

EFLH = 1053
SF, savings factor = 0.1625
The ex post savings determined the HVAC units were installed after 2006, so their minimum efficiency is SEER 13. The realization rate was 90% since the efficiency value is closer to the actual installed unit

compared to the ex ante deemed savings which uses the kWh per ton value, based on an SEER 10 HVAC unit.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 100%.

Site 7267 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	25,358	25,650	101%	4.87
	Thermostat	2,464	2,211	90%	2.01
Total		**27,822**	**27,861**	**100%**	**6.89**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7267 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	43	13.4	26
		2026	164	128	2,775
			48	32	991
Total					**4,027**

Site ID: 7268

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7268 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714-Fluorescent T8 replaced with LED Type B	800850	56	56	114	48	3,120	1.08	12,338		12,454	101%
		12	12	88	36	3,120	1.08	2,083		2,103	101%
		15	15	59	24	3,120	1.08	1,753		1,769	101%
4060712-Fluorescent T8 replaced with LED Type A		15	15	114	64	3,120	1.08	2,504		2,527	101%
Total								**18,678**	-	**18,853**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,120) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7268 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	18,678	18,853	101%	3.58
Total		**18,678**	**18,853**	**101%**	**3.58**

Site ID: 7269

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7269 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714-Fluorescent T8 replaced with LED Type B	800850	63	63	88	36	2,080	1.11	7,292		7,564	104%
		36	36	48	27	2,080	1.11	1,682		1,745	104%
		2	2	59	24	2,080	1.11	155		162	104%
Total								**9,129**	-	**9,471**	**104%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings calculation (2,080).

A heating and cooling interactive factor of 1.11, applicable to a heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 104%.

Site 7269 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	9,129	9,471	104%	1.80
Total		**9,129**	**9,471**	**104%**	**1.80**

Site ID: 7270

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7270 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714-Fluorescent T8 replaced with LED Type B	800850	14	14	59	24	2,500	0.93	1,311	(135)	1,139	87%
4060610-Fluorescent T5 Replaced with LED Fixture	800800	51	51	360	213	1,250	0.93	10,027	(1,031)	8,715	87%
Total								**11,338**	**-**	**9,855**	**87%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)}{=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,500 and 1,250) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned warehouse in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 87%. The ex ante savings was premised on overestimated heating and cooling interactive effects.

Site 7270 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	11,338	9,855	87%	2.09
Total		**11,338**	**9,855**	**87%**	**2.09**

Site ID: 7271

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7271 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411- Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	10	10	43	9	1,000	1.08	353		356	101%
4060714- Fluorescent T8 replaced with LED Type B	800850	37	37	114	48	3,500	1.08	9,145		9,231	101%
		28	28	59	24	3,500	1.08	3,670		3,704	101%
4060912- HID Replaced with LED Lamp direct-wired	800300	4	4	95	15	3,500	1.08	822	-	829	101%
4060710- Fluorescent T8 replaced with LED Fixture	800850	28	28	221	213	3,500	1.08	839		847	101%
		154	154	114	40	3,500	1.08	42,678		43,077	101%
		25	251	114	40	3,500	1.08	6,928		6,993	101%
		11	11	56	30	3,500	1.08	1,071		1,081	101%
4060912- HID Replaced with	800300	28	28	455	213	3,500	1.08	25,376		25,613	101%
		21	21	455	200	2,000	1.08	11,460		11,567	101%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
LED Lamp direct-wired		1	1	95	20	3,500	1.08	281		284	101%
4060310-Halogen BR/R 45 W Replaced with LED 13 W	800150	15	15	95	12	1,000	1.08	1,332		1,345	101%
		55	55	65	11	1,000	1.08	3,178		3,208	101%
Total								**107,133**	**-**	**108,134**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (ranging from 1,000 – 3,500) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7271 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	107,133	108,134	101%	20.54
Total		**107,133**	**108,134**	**101%**	**20.54**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7271 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	43	13.4	48
Total					**48**

Site ID: 7272

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7272 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060814-Fluorescent T12 replaced with LED Type B	800900	74	74	164	48	3,900	1.21	35,820	-	40,508	113%
		417	417	122	36	3,900	1.21	149,652	-	169,233	113%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714-Fluorescent T8 replaced with LED Type B	800850	33	33	88	36	3,900	1.21	7,162		8,098	113%
4060814-Fluorescent T12 replaced with LED Type B	800900	38	38	82	24	3,900	1.21	9,197		10,401	113%
Total								**201,831**	-	**228,239**	**113%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (3,900) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.21, applicable to a heated, air conditioned outpatient healthcare facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 113%. The ex ante savings was premised on underestimated heating and cooling interactive effects.

Site 7272 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	201,831	228,239	113%	43.36
Total		**201,831**	**228,239**	**113%**	**43.36**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings

Site 7272 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2026	164	128	27,936
			122	96	118,069
			82	64	7,173
Total					**153,179**

Site ID: 7273

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7273 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060814-Fluorescent T12 replaced with LED Type B	800900	89	89	164	48	2,860	1.21	31,594	-	35,727	113%
		1	1	138	48	2,860	1.21	276	-	311	113%
		16	16	122	36	2,860	1.21	4,212		4,762	113%
		26	26	72	34	2,860	1.21	3,024		3,419	113%
Total								**39,106**	-	**44,220**	**113%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,860) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.21, applicable to a heated, air conditioned outpatient healthcare facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 113%. The ex ante savings was premised on underestimated heating and cooling interactive effects.

Site 7273 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	39,106	44,220	113%	8.40
Total		**39,106**	**44,220**	**113%**	**8.40**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings.

Site 7273 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2026	164	128	24,639
			138	128	277
			122	96	3,322
			71	64	2,699
Total					**30,938**

Site ID: 7274

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7274 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	1	1	53	11	500	1.14	22		24	108%
		5	5	43	9	2,800	1.14	494		527	107%
4060614-Fluorescent T5 Replaced with LED Type B	800800	26	26	234	100	2,800	1.14	10,438		11,121	107%
4060814-Fluorescent T12 replaced with LED Type B	800900	18	18	258	72	2,800	1.14	10,030	-	10.687	107%
		66	66	164	48	2,800	1.14	22,938	-	24,438	107%
		67	67	82	24	2,800	1.14	11,643		12,404	107%
4060714-Fluorescent T8 replaced with LED Type B	800850	6	6	59	24	2,800	1.14	629		670	107%
4060814-Fluorescent T12 replaced with LED Type B	800900	33	33	48	12	2,800	1.14	3,559		3,792	107%

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060410- Incand Exit Sign Replaced with LED 5 W	800750	11	11	30	2.2	8,760	1.14	2,784		3,054	110%
4060320-Halogen MR-16 35 W Replaced with LED 20 W	800200	6	6	35	12	2,800	1.14	413		440	107%
4060614- Fluorescent T5 Replaced with LED Type B	800800	4	4	54	23	2,800	1.14	371		396	107%
4060810- Fluorescent T12 replaced with LED fixture	800900	3	3	56	16	2,800	1.14	360		383	106%
		8	8	48	12	2,800	1.14	862		919	107%
4060330-Halogen PAR 48 W Replaced with LED 20 W	800250	15	15	65	11	2,800	1.14	2,427		2,585	107%
Total								**66,970**	**-**	**71,441**	**107%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The efficient wattage of the ninth line item in the table above (2.2W) is greater than the wattage used to calculate the ex ante savings (3W).

The annual lighting hours of operation using secondary sources (ranging from 500 – 8,760) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.14, applicable to a heated, air conditioned medium office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 107%.

Site 7274 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	66,970	71,441	107%	13.57
Total		**66,970**	**71,441**	**107%**	**13.57**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7274 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	53	18.9	5
			43	13.4	70
		2026	258	192	6,895
			164	128	16,854
			82	64	8,555
			48	32	2,107
			56	32	153
			48	32	511
Total					**35,148**

Site ID: 7275

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7275 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714- Fluorescent T8 replaced with LED Type B	800850	63	63	114	48	2,340	1.21	10,411		11,773	113%
		23	23	88	36	2,340	1.21	2,994		3,386	113%
		2	2	59	24	2,340	1.21	175		198	113%
Total								**13,500**	-	**15,358**	**113%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,340) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.21, applicable to a heated, air conditioned outpatient healthcare facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 113%.

Site 7275 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	13,580	15,358	113%	2.92
Total		**13,580**	**15,358**	**113%**	**2.92**

Site ID: 7276

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7276 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060714- Fluorescent T8 replaced with LED Type B	800850	73	73	114	48	2,340	1.08	12,063		12,176	101%
		35	35	59	24	2,340	1.08	3,067		3,096	101%
4060912- HID Replaced w LED Lamp fixture	800300	24	24	455	150	2,340	1.08	18,328		18,499	101%
Total								**33,458**	-	**33,771**	**101%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,340) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.08, applicable to a heated, air conditioned educational facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 101%.

Site 7276 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	33,458	33,771	101%	6.42
Total		**33,458**	**33,771**	**101%**	**6.42**

Site ID: 7277

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7277 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	13	13	43	9	2,200	0.90	1,010	(198)	849	84%
		10	10	29	9	2,200	0.90	447	(88)	376	84%
4060814-Fluorescent T12 replaced with LED Type B	800900	90	90	164	46	2,200	0.90	24,999	(4,906)	21,028	84%
		24	24	122	46	2,200	0.90	4,294	(843)	3,612	84%
		10	10	72	26	2,200	0.90	1,083	(213)	911	84%
4060310-Halogen BR/R 45 W Replaced with LED 13 W	800150	16	16	60	8	2,200	0.90	1,958	(384)	1,647	84%
Total								**33,791**	**(6,632)**	**28,423**	**84%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}\left(Qty_{pre}x\ Watts_{pre} - Qty_{post}xWatts_{post}\right)xHOU_{annual}x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)}x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,200) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 84%. The ex ante was premised on overestimated heating and cooling interactive effects.

Site 7277 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	33,791	28,423	84%	6.66
Total		**33,791**	**28,423**	**84%**	**6.66**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7277 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	43	13.4	140
			29	9.4	10
		2026	164	128	18,022
			122	96	2,930
			72	64	928
Total					**22,030**

Site ID: 7278

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7278 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060411-Incand A-series Lamp 40W replaced with LED Lamp 20W	800100	6	6	43	9	2,200	0.90	466	(91)	392	84%
4060810-Fluorescent T12 replaced with LED fixture	800900	13	13	164	46	2,200	0.90	3,610	(709)	3,037	84%
Total								**4,076**	**(800)**	**3,429**	**84%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = (Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)=}(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF

components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation referenced the ex ante savings hours (2,200).

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 84%. The ex ante savings estimate was based on overestimated heating and cooling interactive effects.

Site 7278 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	4,076	3,429	84%	0.80
Total		**4,076**	**3,429**	**84%**	**0.80**

The following table presents those measures subject to the Ameren Missouri TRM baseline adjustment for T12 lamps, and their equivalent T8 wattage with the post midlife shift kWh savings. Also included are the omni directional lamps and their equivalent CFL wattage.

Site 7278 Measures with Midlife Savings

Program	End Use Category	MidLife Baseline Shift Year	Baseline Watts Pre Shift	Baseline Watts Post Shift	Ex Post Gross (kWh)
BSS	Lighting	2022	43	13.4	64
		2026	164	128	2,603
Total					**2,668**

Site ID: 7279

Data Collection

The participant received BSS Program lighting incentives from Ameren Missouri.

For the Engineering Desk Review, the quantity of each lighting product from submitted invoices were matched to the application, along with the lighting specification sheet wattages. The building type was verified from either the participant's website or online mapping applications, from which a TRM compliant waste heat factor and interactive factor were obtained. The annual hours of use were compared to the operating hours and holiday calendar, for each measure and usage area.

Analysis Results

The savings for the evaluated measures from the incentivized lighting is presented in the following table.

Site 7279 Lighting Retrofit Savings and Algorithm Inputs

Measure Name	TRM	Pre Qty	Post Qty	Pre Watts	Post Watts	Annual HOU	Whf	Ex Ante (kWh)	Electric Heat kWh	Ex Post Gross (kWh)	RR
4060310-LHalogen BR/R 45 W Replaced with LED 13 W	800150	4	4	64	10	2,500	0.90	589	(116)	495	84%
Total								**589**	**(116)**	**495**	**84%**

The annual kWh savings were calculated using the algorithm below for each combination of Measure - Installed Area-End Use. The savings shown in the table have been aggregated to each Measure - End Use with their respective algorithm inputs. The Annual Hours of Use and HCIF for the installed areas have been aggregated and weighted in the table above. The heating cooling interactive factor (HCIF) includes both the waste heat factor (Whf) from the TRM to include HVAC cooling savings, along with the interactive factor (IF) to for the increase in energy usage for electric heat buildings.

$$kWh_{Ex\ Post\ Gross} = kWh_{savings(Whf)} - kWh_{electric\ heat\ penalty(IF)}$$

$$kWh_{savings(Whf)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ W_{hf}\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

$$kWh_{electric\ heat\ penalty(IF)} = \left(Qty_{pre} x\ Watts_{pre} - Qty_{post} x Watts_{post}\right) x HOU_{annual} x\ \ IF\ x\ \frac{1\ kWh}{1{,}000\ Wh}$$

The peak coincident kW savings were calculated using the algorithm below, with the Coincident Factor applied to the kWh savings from each Measure ID-End Use. When the usage area has electric heat, the HCIF components of Waste Heat Factor and Interactive Factor are used, to consider the peak period occurring in the Summer.

$$kW_{peak\ coincident} = kWh_{savings(Whf)} x\ \ CF$$

The annual lighting hours of operation using secondary sources (2,500) correspond with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor less than 1.00, applicable to an electric heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.

The next table presents the energy savings achieved by the measures evaluated for this site. The overall gross realization rate is 84%. The ex ante savings estimate was based on overestimated heating and cooling interactive effects.

Site 7279 Energy and Peak Demand Savings

Program	End Use Category	Ex Ante (kWh)	Ex Post Gross (kWh)	RR	Ex Post Gross kW Reduction
BSS	Lighting	589	495	84%	0.11
Total		**589**	**495**	**84%**	**0.11**

Appendix H. Data Collection Instruments

Data collection instruments are provided under separate cover.

For more information, please contact:

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