

BizSavers Program Evaluation Report

Volume II of II

March 2017 - February 2018

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Ameren Missouri

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Research Into Action

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1. Introduction

This report is divided into two volumes providing information on the impact, process, and cost effectiveness evaluation of the BizSavers portfolio of programs for the period March 2017 through February 2018. Volume II contains appendices presenting detailed information regarding evaluation methodologies, data collection instruments, and evaluation results. Volume II is organized as follows:

- Appendix 2 presents site-level gross impact evaluation reports for each site in which measurement and verification of energy savings was performed.
- Appendix 3 presents detailed information regarding the sampling plans that facilitated estimation of energy savings.
- Appendix 4 presents detailed information regarding the results of the gross impact evaluation, including a discussion of high impact measures (HIM).
- Appendix 5 contains the staff and implementer interview guide.
- Appendix 6 contains the online participant survey instrument.
- Appendix 7 presents the New Construction Program architect and designer interview guides.
- Appendix 8 presents the retro-commissioning interview guides.
- Appendix 9 presents the non-participant survey instrument.
- Appendix 10 presents the lighting trade ally interview guide.
- Appendix 11 presents non-participant spillover methodology.
- Appendix 12 presents the heating and cooling interaction factors used in assessment of ex post energy savings of lighting measures in conditioned spaces.
- Appendix 13 presents detailed information pertaining to the cost effectiveness evaluation.
- Appendix 14 contains a glossary of terms used in the evaluation report.

See report Volume I for narrative and summary information pertaining to the evaluation methods and results.

2. Site-Level Estimation of Ex Post Gross Savings

Site ID 5063

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/12/17 and 8/10/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
015801-100113-Lighting-Linear Tube LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	327	327	42	17	3,958	1.01	33,354	33,395	100%
				406	406	42	17	3,766	1.01	41,412	39,453	95%
				48	48	34	11	5,562	1.01	4,416	6,213	141%
				11	11	34	11	5,353	1.01	1,034	1,400	135%
				4	4	34	11	5,475	1.01	368	510	138%
				27	27	34	11	4,987	1.01	2,538	3,201	126%
015801-305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1		Standard	24	24	100	50	5,475	1.01	4,800	6,647	138%
Total										87,922	90,820	103%

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the above table (3,958 and 3,766, respectively) are fewer than the hours of operation used to calculate ex ante savings (4,000) while the remaining line items were greater (ranging from 4,987 – 5,562). The lighting measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.01, applicable to an electric heated, and air conditioned office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 103%. The ex ante energy savings estimate was premised on a set annual operating hour for all installations and an underestimated heating and cooling factor.

¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Incentive</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	83,122	84,172	101%	15.99
Standard		4,800	6,647	138%	1.26
Total		87,922	90,820	103%	17.25

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 6/09/17 and 7/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Realization Rate</i>
017074-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	14	14	455	164	1,801	0.98	7,627	7,207	94%
Total										7,627	7,207	94%

The annual lighting hours of operation verified during the M&V site visit (1,801) are similar to the annual hours of operation used to calculate ex ante savings (1,800).

A heating and cooling interactive factor of 0.98, applicable to an electric heated, air conditioned elementary 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²

A table showing the energy savings achieved by the measure evaluated for this site is shown below. The overall gross realization rate is 94%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	7,627	7,207	94%	1.37
Total		7,627	7,207	94%	1.37

² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/13/17 and 9/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017131-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	36	36	32	18	2,509	1.00	1,635	1,265	77%
				24	24	32	18	3,313	1.00	1,090	1,113	102%
				46	92	62	18	2,901	1.00	3,881	3,470	89%
				66	66	32	18	3,313	1.00	2,998	3,062	102%
017131-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	50	100	83	18	3,313	1.00	7,625	7,786	102%
017131-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			4	4	455	200	3,313	1.00	3,310	3,380	102%
Total										20,539	20,076	98%

The average annual lighting hours of operation for the first and third line items in the table above (2,509 and 2,901, respectively) are fewer than the hours of operation used to calculate ex ante savings (3,120), while the annual lighting hours for the remaining line items (3,313) are greater than the hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor was not applied to the ex post lighting energy savings since the facility was not electrically cooled. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 98%.

³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	20,539	20,076	98%	3.81
Total		20,539	20,076	98%	3.81

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/28/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate	
017231-100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169	Lighting	Custom	120	120	29	4	2,651	1.09	6,793	8,683	128%	
017231-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026		Standard		50	50	34	15	451	1.09	2,241	468	21%
017231-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025					50	50	32	14	451	1.09	2,123	450
Total										11,157	9,601	86%	

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (2,651) are greater than the annual hours of operation used to calculate ex ante savings (2,268), while the annual lighting hours of operation for the remaining line items are fewer (451).

The ex ante savings estimate used an LM adjusted base wattage of 28W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 29W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 40W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 86%. The ex ante energy savings estimate for the second and third measure was premised on overestimated annual hours of operation.

⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	6,793	8,683	128%	1.65
Standard		4,364	917	21%	0.17
Total		11,157	9,601	86%	1.82

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewed facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 6/12/17 and 9/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016648-100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	60	60	26	15	8,760	1.14	6,013	6,577	109%
				112	112	26	14	2,513	1.14	12,244	3,841	31%
				28	28	16	5	8,760	1.14	2,755	3,013	109%
016648-100216-Lighting-Non Linear LED Fixture Replacing Existing Inefficient Lighting Fixture					11	11	54	23	8,760	1.14	3,106	3,398
016648-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007		Standard	20	20	45	7	764	1.14	6,924	661	10%
Total										31,042	17,490	56%

The average annual lighting hours of operation for the second and fifth line item in the table above (2,513 and 764, respectively) are fewer than the hours of operation used to calculate ex ante savings (8,760), while the annual lighting hours for the remaining line items are equal to the hours of operation used to calculate ex ante savings. The measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned faith-based 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 56%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	24,118	16,829	70%	3.20
Standard		6,924	661	10%	0.13
Total		31,042	17,490	56%	3.32

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, interviewed facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/25/17 and 9/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017504-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	142	142	40	18	2,290	1.02	14,641	7,273	50%
				73	146	60	18	2,677	1.02	8,211	4,767	58%
017504-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			142	-	40	-	2,290	1.02	26,620	13,224	50%
				73	-	60	-	2,677	1.02	20,527	11,917	58%
Total										69,999	37,182	53%

The annual lighting hours of operation for all measures in the table above are fewer than the annual hours of operation used to calculate ex ante savings (4,380).

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large 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 total ex ante annual energy savings are 69,999 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 53%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	69,999	37,182	53%	7.06
Total		69,999	37,182	53%	7.06

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/28/17 and 8/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017396-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012	Lighting	Standard	5	5	50	7	3,446	1.03	690	764	111%
017396-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			36	36	65	10	1,446	1.03	6,414	2,979	46%
017396-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			110	110	90	15	1,550	1.03	26,483	13,181	50%
017396-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			4	4	43	10	1,427	1.03	417	197	47%
Total										34,004	17,121	50%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (3,446) are greater than the annual hours of operation used to calculate ex ante savings (3,000), while the annual lighting hours of operation for the remaining line items are fewer (ranging from 1,427 – 1,550).

The ex ante savings estimate used an LM adjusted base wattage of 42W for the fourth line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

A heating and cooling interactive factor of 1.03, applicable to an electrically heated, air conditioned assembly 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 measure name for the fourth line item in the table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 50%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	34,004	17,121	50%	3.25
Total		34,004	17,121	50%	3.25

⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017691-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	22	22	53	9	8,760	0.99	12,068	8,400	70%
017691-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			12	12	40	24	1,145	0.99	5,974	218	4%
017691-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			724	724	53	10	1,145	0.99	36,061	35,313	98%
Total										54,103	43,931	81%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (8,760) are greater than the annual hours of operation used to calculate ex ante savings (1,145). This measure was installed in the lobby with continuous usage. The second and third line items annual hours (1,145⁸) coincide with the ex ante hours of operation for guest room lighting.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first and third line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The quantity of the first line item in the first table above (22) verified during the M&V site visit is less than the ex ante savings quantity (248). The application states the measure was to be installed in guest rooms. These lamps were only installed in the lobby area.

The quantity of the second line item in the table above (12) verified during the M&V site visit is less than the ex ante savings quantity (212). During the original installation of this measure the lamps were blowing out the ballasts. The client had three different model lamps delivered with the same results. They are in the process of ordering ballasts and do not expect to have them until the middle of 2018.

⁸ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

A heating and cooling interactive factor of 0.99, applicable to an electric resistance heated, air conditioned lodging building in St. Louis, was applied to the ex post lighting energy savings. For the first and third line items in the table above, the ex ante savings estimate did not account for heating and cooling interactive factors. For the second line item, ex ante savings estimate accounted for a heating and cooling factor of 1.07. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the first and third line items. On the Microsoft Excel application form, the applicant cut and pasted the location name, and a technical error in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The measure name for the first and third line items in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 81%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	54,103	43,931	81%	8.35
Total		54,103	43,931	81%	8.35

⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/3/17 and 7/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate		
017654-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	11	11	40	18	4,489	1.11	945	1,201	127%		
017654-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			20	-	40	-	2,890	1.06	3,125	2,459	79%		
017654-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			29	29	40	18	2,405	1.11	2,492	1,697	68%		
				20	20	40	18	2,890	1.06	1,718	1,352	79%		
017654-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			11	-	40	-	4,489	1.11	1,719	2,184	127%		
				29	-	40	-	2,405	1.11	4,530	3,085	68%		
017654-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			6	6	40	18	1,532	1.11	516	224	43%		
				42	84	60	18	2,458	1.00	3,937	2,477	63%		
017654-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			6	-	40	-	1,532	1.11	937	407	43%		
				42	-	60	-	2,458	1.00	9,842	6,193	63%		
Total												29,761	21,279	72%

The annual lighting hours of operation verified during the M&V site visit for the first and fifth line items (4,489) are greater than the hours of operation applied to calculate ex ante savings (3,650), while the remaining line items have fewer annual lighting hours of operation (ranging from 1,532 – 2,890). The installation took place in multiple areas with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings for installations on the main floor. There was no electric cooling for the basement area installations which received a 1.00 heating and cooling interactive factor. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The total ex ante annual energy savings are 29,761 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but

did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 72%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	29,761	21,279	72%	4.04
Total		29,761	21,279	72%	4.04

¹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/18/17 and 9/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017398-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	2	2	40	18	360	1.11	206	18	9%
017398-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			84	-	40	-	3,850	1.11	15,747	14,327	91%
017398-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			84	84	40	18	3,850	1.11	8,661	7,880	91%
017398-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			2	-	40	-	360	1.11	375	32	9%
Total										24,989	22,257	89%

The annual lighting hours of operation for all measures in the above table are fewer than the annual hours of operation used to calculate ex ante savings (4,380). The measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings are 24,989 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹

¹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 89%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	24,989	22,257	89%	4.23
Total		24,989	22,257	89%	4.23

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, interviewed facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 08/01/17 and 10/10/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017215-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	12	12	60	13	1,998	1.11	1,484	1,261	85%
				24	24	60	6	458	1.11	3,374	657	19%
				12	12	60	6	458	1.11	1,687	329	19%
				12	12	60	6	402	1.11	1,687	288	17%
				24	24	60	6	449	1.11	3,374	644	19%
				36	36	60	6	402	1.11	5,060	865	17%
				36	36	60	13	2,679	1.11	4,451	5,073	114%
				24	24	60	13	2,394	1.11	2,968	3,022	102%
				18	18	60	13	2,846	1.11	2,226	2,695	121%
				12	12	60	6	458	1.11	1,687	329	19%
Total										27,998	15,163	54%

The annual hours of operation verified during the M&V site visit for the seventh and ninth line item in the table above (2,679 and 2,846, respectively) are greater than the annual hours of operation used to calculate ex ante savings (2,503), while the remaining line items have fewer annual lighting hours of operation. The measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 54%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

¹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	27,998	15,163	54%	2.88
Total		27,998	15,163	54%	2.88

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, interviewed facility personnel regarding lighting operating schedules, and installed nine photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/19/17 and 8/10/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016120-100204- Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	661	661	88	28	7,410	1.02	201,895	298,173	148%
				1	1	88	28	4,596	1.02	306	280	91%
				28	28	88	28	4,955	1.02	8,552	8,447	99%
				33	33	88	28	5,207	1.02	8,657	10,460	121%
				15	15	88	28	4,867	1.02	3,666	4,444	121%
016120-100504- Lighting-T8 28 Watt Fixture Replacing T8 Fixture				86	86	59	31	4,832	1.02	12,280	11,829	96%
				2	2	59	31	7,350	1.02	320	418	131%
				2	2	59	31	4,596	1.02	286	262	91%
				63	63	114	47	7,417	1.02	24,059	31,824	132%
				88	88	114	47	4,886	1.02	30,069	29,285	97%
				6	6	114	47	4,596	1.02	2,050	1,878	92%
				23	23	46	19	4,850	1.02	3,167	3,062	97%
				53	53	85	36	4,850	1.02	13,245	12,804	97%
016120-100604- Lighting-T8 25 Watt Fixture Replacing T8 Fixture				4	4	85	46	4,596	1.02	796	729	92%
Total										309,348	413,894	134%

The verified annual lighting hours of operation were different than those used to perform ex ante energy savings estimation:

- For the fifth line item in the table above, implemented in fitting rooms, verified annual operating hours (4,867) were greater than the estimated operating hours used to calculate ex ante savings (4,080).
- For the fourth line item in the table above, implemented in the stockroom and the sales floor, verified annual operating hours (5,207) were greater than the estimated operating hours used to calculate ex ante savings (4,380).
- For the seventh and ninth line items in the table above, verified annual operating hours (7,350 and 7,417, respectively) were greater than the estimated operating hours used to calculate ex ante savings (5,700).
- For the remaining line items, the ex ante savings estimated for the lighting equipment is based on an estimate of 5,100 annual lighting operating hours, and the ex post estimate of lighting

operating hours vary by line item, with some equipment having longer operating hours and some equipment having shorter operating hours.

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 134%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	309,348	413,894	134%	78.62
Total		309,348	413,894	134%	78.62

¹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewed facility personnel regarding lighting operating schedules, and installed nine photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/23/17 and 9/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
015567-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	4	4	32	15	3,461	1.02	546	239	44%
				42	42	32	15	6,544	1.02	5,733	4,749	83%
				12	12	32	15	6,818	1.02	1,639	1,414	86%
				26	26	32	15	4,789	1.02	3,549	2,152	61%
				288	288	32	15	6,427	1.02	39,314	31,987	81%
				16	16	32	15	6,818	1.02	2,184	1,885	86%
				528	528	32	15	4,560	1.02	72,077	41,608	58%
				1	1	32	15	3,461	1.02	137	60	44%
				1,932	1,932	32	15	4,369	1.02	263,738	145,861	55%
015567-100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	648	648	32	15	4,369	1.02	88,458	48,922	55%
				18	18	26	21	6,130	1.02	723	561	78%
Total										478,098	279,438	58%

The annual lighting hours of operation for all measures are fewer than the annual hours of operation used to calculate ex ante savings (8,030). The lighting was installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 58%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

¹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	477,376	278,877	58%	52.98
Custom		723	561	78%	0.11
Total		478,098	279,438	58%	53.08

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/25/17 and 8/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate	
017488-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	84	168	69	15	3,712	1.14	9,886	13,834	140%	
017488-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084		Standard		86	-	41	-	4,148	1.14	11,575	16,749	145%
017488-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026				2	2	41	16	3,712	1.14	165	211	128%
					60	120	69	15	3,712	1.14	7,061	9,882	140%
					2	2	41	15	4,148	1.14	157	174	111%
					86	86	41	16	4,148	1.14	7,058	10,213	145%
Total										35,902	51,063	142%	

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours (ranging from 3,712 – 4,148) exceeded those used to develop the ex ante energy savings estimates (ranging from 2,820 – 3,068).

The total ex ante annual energy savings for the second and sixth line items in the table above are 18,633 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

A heating and cooling interactive factors of 1.14, applicable to a gas heated, air conditioned recreation 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 kWh savings.¹⁵

¹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 142%. The ex ante energy savings estimate was premised on underestimated annual lighting hours of operation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	26,016	37,229	143%	7.07
SBDI		9,886	13,834	140%	2.63
Total		35,902	51,063	142%	9.71

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, interviewed facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/20/17 and 8/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016125-100204- Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	642	642	88	28	6,848	1.02	196,092	267,674	137%
				14	14	88	28	5,323	1.02	3,421	4,537	133%
				40	40	88	28	4,797	1.02	10,493	11,681	111%
				16	16	88	28	5,323	1.02	4,887	5,185	106%
				24	24	88	28	5,066	1.02	7,330	7,403	101%
5				5	88	28	6,036	1.02	1,527	1,837	120%	
016125-100504- Lighting-T8 28 Watt Fixture Replacing T8 Fixture				58	58	59	31	4,797	1.02	8,282	7,919	96%
				5	5	59	31	4,797	1.02	798	683	86%
				6	6	59	31	3,991	1.02	856	681	80%
				1	1	114	47	6,527	1.02	341	445	130%
				5	5	59	31	5,529	1.02	714	787	110%
				49	49	114	47	6,317	1.02	18,713	21,081	113%
				2	2	114	47	6,518	1.02	764	888	116%
				80	80	114	47	4,917	1.02	27,336	26,791	98%
				3	3	114	47	6,521	1.02	1,025	1,332	130%
	56	56	46	19	4,797	1.02	7,712	7,372	96%			
3	3	46	19	4,797	1.02	413	395	96%				
27	27	85	36	4,797	1.02	6,748	6,451	96%				
016125-100604- Lighting-T8 25 Watt Fixture Replacing T8 Fixture				1	1	85	46	4,797	1.02	199	190	96%
Total										297,651	373,330	125%

The verified annual lighting hours of operation were different than those used to perform ex ante energy savings estimation:

- For the second line item in the table above, implemented in fitting rooms, verified annual operating hours (5,323) were greater than the estimated operating hours used to calculate ex ante savings (4,080).
- For the fifth line item in the table above, implemented in the stockroom and the sales floor, verified annual operating hours (4,797) were greater than the estimated operating hours used to calculate ex ante savings (4,380).
- For the eighth line item in the table above, verified annual operating hours (4,797) were fewer than the estimated operating hours used to calculate ex ante savings (5,700).

- For the twelfth, and thirteenth line items in the table above, verified annual operating hours (6,317 and 6,518, respectively) were greater than the estimated operating hours used to calculate ex ante savings (5,700).
- For the remaining line items, the ex ante savings estimated for the lighting equipment is based on an estimate of 5,100 annual lighting operating hours, and the ex post estimate of lighting operating hours vary by line item, with some equipment having longer operating hours and some equipment having shorter operating hours.

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 125%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	297,651	373,330	125%	70.92
Total		297,651	373,330	125%	70.92

¹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017489-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Miscellaneous	Standard	232	232	53	10	2,721	1.00	21,788	27,462	126%
Total										21,788	27,462	126%

The annual lighting hours of operation verified during the M&V site visit (2,721) are greater than the annual hours of operation used to calculate ex ante savings (2,184). All measures installed within Common Area stairwells totaled 130 lamps with the remaining 102 lamps installed within individual residential apartments. Those lamps did not receive ex post hours of operation since each apartment has their own residential meter.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name in the table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷ The ex post savings analysis used the miscellaneous end use category since the measures were installed in exterior stairwells with non-daylight photo cells. Lighting was the end use category used in the ex ante savings estimate.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 126%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

¹⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Miscellaneous	21,788	27,462	126%	3.79
Total		21,788	27,462	126%	3.79

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, interviewed facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/04/2017 and 10/31/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
017028-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	152	152	37	18	3,593	1.00	6,538	10,269	157%
017028-305802-Lighting-Delamping Replacing T8 32 Watt	3084			76	-	37	-	3,593	1.00	6,399	10,050	157%
017028-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			12	12	30	17	2,300	1.00	343	345	101%
				22	22	28	18	2,686	1.00	503	591	117%
				24	24	28	18	2,691	1.00	549	646	118%
		36	36	30	18	3,593	1.00	947	1,488	157%		
Total										15,279	23,388	153%

During the M&V visit, the verified annual lighting hours of operations are greater than the annual light hours of operation applied to the ex ante savings (2,200).

A heating and cooling interactive factor was not applied to the ex post lighting energy savings since there was no electric cooling in the facility. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The total ex ante annual energy savings for the first and second line items in the table above are 12,937 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸

¹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 153%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	15,279	23,388	153%	4.44
Total		15,279	23,388	153%	4.44

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed nine photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/4/17 and 9/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016137-100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	75	75	164	59	1,484	1.14	15,332	13,297	87%
Total										15,332	13,297	87%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates (1,872).

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 87%. The ex ante energy savings estimate was premised on overestimated annual lighting hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Ex Post Gross kW Reduction
		Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate	
Custom	Lighting	15,332	13,297	87%	2.53
Total		15,332	13,297	87%	2.53

¹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/13/17 and 10/10/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016510-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	6	6	72	15	978	1.00	1,143	337	30%
016510-201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			6	6	40	3	8,760	1.00	2,023	1,945	96%
016510-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			12	12	40	13	6,052	1.11	1,112	2,169	195%
				42	42	40	18	2,110	1.09	3,171	2,116	67%
				6	6	40	18	3,473	1.11	453	507	112%
016510-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			20	20	400	200	2,896	1.00	13,728	11,582	84%
016510-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			46	46	32	18	3,508	1.11	2,210	2,498	113%
016510-305802-Lighting-Delamping Replacing T8 32 Watt	3084			46	-	32	-	3,508	1.11	5,052	5,711	113%
Total										28,892	26,866	93%

The annual lighting hours of operation verified during the M&V site visit regarding the second line item in the table above (8,760) are equal than the annual hours of operation used to calculate ex ante savings (8,760). The annual lighting hours of operation regarding the first and fourth line item (978 and 2,110, respectively) are fewer than the annual lighting hours of operation used to calculate ex ante savings (3,300), while the remaining line items have greater annual hours of operation used to calculate ex ante savings). Measures were installed in multiple locations with varying usage.

The ex ante savings estimate was premised on an adjusted base wattage of 70W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was applied in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office building in St. Louis, was applied to the ex post lighting energy savings. No heating and cooling

interactive effects were considered for lighting installed in warehouse locations due to no electrical space conditioning. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The total ex ante annual energy savings for the seventh and eighth line items in the above table are 7,262 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The measure names of the first line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 93%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	28,892	26,866	93%	5.10
Total		28,892	26,866	93%	5.10

²⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed eleven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/21/17 and 8/17/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016236-100204- Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	595	595	88	28	6,810	1.02	181,736	246,680	136%
				4	4	88	28	2,143	1.02	1,222	522	43%
				38	38	88	28	4,095	1.02	9,968	9,472	95%
				14	14	88	28	3,855	1.02	4,276	3,286	77%
				45	45	88	28	4,968	1.02	10,996	13,610	124%
				19	19	88	28	5,611	1.02	5,803	6,490	112%
016236-100504- Lighting-T8 28 Watt Fixture Replacing T8 Fixture				3	3	59	31	5,486	1.02	429	468	109%
				6	6	59	31	7,009	1.02	958	1,197	125%
				1	1	59	31	5,486	1.02	143	156	109%
				93	93	114	47	4,739	1.02	31,778	30,018	94%
				2	2	59	31	2,813	1.02	286	160	56%
				2	2	114	47	5,486	1.02	684	747	109%
				61	61	114	47	7,194	1.02	23,296	29,886	128%
				10	10	46	19	4,914	1.02	1,377	1,349	98%
				98	98	59	31	4,850	1.02	13,994	13,529	97%
				1	1	46	19	5,486	1.02	138	151	109%
				2	2	46	19	5,486	1.02	275	301	110%
				31	31	85	36	4,850	1.02	7,747	7,489	97%
016236-100604- Lighting-T8 25 Watt Fixture Replacing T8 Fixture				4	4	85	46	4,850	1.02	796	769	97%
Total										295,902	366,281	124%

The verified annual lighting hours of operation were different than those used to perform ex ante energy savings estimation:

- For the third line item in the table above, implemented in fitting rooms, verified annual operating hours (4,095) were fewer than the estimated operating hours used to calculate ex ante savings (4,380).
- For the fifth line item in the table above, implemented in the stockroom and the sales floor, verified annual operating hours (4,968) were greater than the estimated operating hours used to calculate ex ante savings (4,080).

- For the eighth and thirteenth line items in the table above, verified annual operating hours (7,009 and 7,194) were greater than the estimated operating hours used to calculate ex ante savings (5,700).
- For the remaining line items, the ex ante savings estimated for the lighting equipment is based on an estimate of 5,100 annual lighting operating hours, and the ex post estimate of lighting operating hours vary by line item, with some equipment having longer operating hours and some equipment having shorter operating hours.

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 124%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	295,902	366,281	124%	69.58
Total		295,902	366,281	124%	69.58

²¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed eleven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/18/17 and 10/17/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016210-100204- Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	731	731	88	28	6,673	1.10	223,276	322,399	144%
				11	11	88	28	6,809	1.10	3,360	4,951	147%
				64	64	88	28	6,552	1.10	16,788	27,715	165%
				8	8	88	28	2,175	1.10	1,954	1,150	59%
				19	19	88	28	4,466	1.10	5,803	5,609	97%
				3	3	88	28	1,397	1.10	916	277	30%
016210-100504- Lighting-T8 28 Watt Fixture Replacing T8 Fixture				16	16	88	28	6,326	1.10	3,910	6,690	171%
				43	43	59	31	5,008	1.10	6,863	6,655	97%
				6	6	59	31	6,805	1.10	856	1,262	147%
				12	12	59	31	5,272	1.10	1,714	1,955	114%
				1	1	59	31	5,008	1.10	143	155	108%
				105	105	114	47	5,008	1.10	35,878	38,882	108%
				67	67	114	47	6,806	1.10	25,588	33,717	132%
20	20	46	19	5,008	1.10	2,754	2,985	108%				
6	6	46	19	5,272	1.10	827	943	114%				
28	28	85	36	5,008	1.10	6,997	7,583	108%				
Total										337,627	462,926	137%

The verified annual lighting hours of operation were different than those used to perform ex ante energy savings estimation:

- For the fourth line item in the table above, implemented in stock room and break room, verified annual operating hours (2,175) were fewer than the estimated operating hours used to calculate ex ante savings (4,080), while the seventh line item has greater annual hours of operation (6,326).
- For the third line item in the table above, implemented in the fitting rooms, verified annual operating hours (6,552) were greater than the estimated operating hours used to calculate ex ante savings (4,380).
- For the eighth line item in the table above, verified annual operating hours (5,008) were fewer than the estimated operating hours used to calculate ex ante savings (5,700), while the thirteenth line item has greater annual hours of operation (6,806).
- For the remaining line items, the ex ante savings estimated for the lighting equipment is based on an estimate of 5,100 annual lighting operating hours, and the ex post estimate of lighting

operating hours vary by line item, with some equipment having longer operating hours and some equipment having shorter operating hours.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 137%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	337,627	462,926	137%	87.94
Total		337,627	462,926	137%	87.94

²² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/28/17 and 9/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
014906-100107- Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture	1169	Lighting	Custom	76	76	468	96	5,503	1.00	72,291	155,593	215%
				29	29	360	72	2,436	1.00	21,356	20,345	95%
				105	105	240	46	2,436	1.00	52,086	49,619	95%
014906-100104- Lighting-Linear Tube LED Fixture Replacing T8 Fixture				130	130	59	26	3,817	1.11	10,969	18,110	165%
Total										156,702	243,667	155%

The average annual lighting hours of operation for the first and fourth line items in the table above (5,503 and 3,817, respectively) are greater than the hours of operation used to calculate ex ante savings (2,557), while the annual lighting hours for the remaining line items (2,436) are fewer than the hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings for the fourth line item in the table above. The measures for the first three line items were installed in areas with not cooling. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 155%. The ex post energy savings estimate for the first and fourth line items underestimated the annual hours of operation.

²³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Ex Post Gross kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	156,702	243,667	155%	46.29
Total		156,702	243,667	155%	46.29

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Ex Post Gross kWh Savings	Gross kWh Realization Rate
016546-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	74	74	400	230	4,129	1.00	50,320	51,943	103%
				28	28	400	164	4,080	1.00	26,432	26,963	102%
Total										76,752	78,907	103%

The verified annual lighting hours of operation for all the measures in the table above are greater than the annual hours of operation used to calculate ex ante savings (4,000).

The ex post savings and ex ante savings estimate did not account for heating and cooling interactive factors. The measures were installed in areas without electric cooling.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 103%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	76,752	78,907	103%	14.99
Total		76,752	78,907	103%	14.99

²⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/07/17 and 10/03/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017760-305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	8	8	175	15	8,760	1.14	4,547	12,755	281%
017760-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			93	93	43	9	3,815	1.14	10,902	13,722	126%
017038-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			24	24	34	9	2,717	1.14	2,072	1,854	90%
				664	664	40	15	2,012	1.14	57,316	37,983	66%
				28	28	21	9	2,976	1.14	1,194	1,137	95%
				500	500	34	15	3,337	1.14	33,748	36,065	107%
				24	24	34	9	3,417	1.14	2,131	2,332	109%
				664	664	40	15	1,771	1.14	58,970	33,435	57%
				22	22	34	9	3,045	1.14	1,899	1,905	100%
300	300	40	15	4,095	1.14	25,896	34,937	135%				
Total									198,675	176,125	89%	

The verified annual lighting hours of operation for the third, fourth, fifth, eighth, and ninth line items in the table above (ranging from 1,771 - 3,045) are fewer than the annual hours of operation used to calculate ex ante savings (3,320), while the remaining line items have greater annual hours of operation (ranging from 3,337 – 8,760).

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned faith-based building in St. Louis, was applied to the ex post lighting energy savings. For the third, fourth, ninth, and tenth line item in the table above, the ex ante savings estimate accounted for a heating and cooling factor of 1.04, while the remaining line items ex ante savings estimate accounted for a heating and cooling factor of 1.07. The difference is due to the application versions submitted for the multiple projects.

The ex ante savings estimate was premised on an adjusted base wattage of 42W for the second line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W

was applied in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The measure names of the first line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 89%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	198,675	176,125	89%	33.46
Total		198,675	176,125	89%	33.46

²⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewed facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/06/17 and 9/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017722-100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	158	158	26	9	8,760	1.09	25,176	25,762	102%
018302-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard	60	60	32	10	4,294	1.09	7,062	6,206	88%
017722-305013-Lighting-<=80 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 100-175 Watt Lamp or Fixture	3006-1	Miscellaneous	Standard	32	32	100	15	8,760	1.00	23,827	23,827	100%
				22	22	100	30	8,760	1.00	13,490	13,490	100%
017722-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting		350	350	32	15	5,879	1.07	19,100	37,524	196%
Total										88,656	106,809	120%

The verified annual lighting hours of operation of the second line item (4,294) are fewer than the estimated lighting hours of operation used to calculate ex ante savings (5,000). The verified annual lighting hours of operation for the fifth line item in the table above (5,879) are greater than the hours of operation used to calculate ex ante savings (3,000). The remaining line items are equal to the hours of operation used to calculate ex ante savings (8760).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned large office building in St. Louis, was applied to the ex post lighting energy savings for the interior installations. For the third and fourth line items in the table above, the ex ante savings estimate did not account for heating and cooling interactive factors. For all measures installed within the garage location a heating and cooling factor of 1.00 was used which matched the ex ante savings estimate for the third and fourth line items in the table above. For the remaining line items, the ex ante estimate used a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 120%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Miscellaneous	37,318	37,318	100%	5.15
	Lighting	26,162	43,729	167%	8.31
Custom		25,176	25,762	102%	4.89
Total		88,656	106,809	120%	18.35

²⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/10/17 and 9/07/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017757-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,389	1,389	28	15	5,819	1.02	125,896	106,812	85%
Total										125,896	106,812	85%

The annual lighting hours of operation verified during the M&V site visit (5,819) are fewer than the annual hours of operation used to calculate ex ante savings (6,516). The ex ante estimate was based on average annual hours of operation for all stores across the country.

A heating and cooling interactive factor of 1.02, applicable to a gas heated, air conditioned large single-story retail 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 kWh savings.²⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 85%. The ex ante energy savings estimate was premised on overestimated annual hours of operation and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	125,896	106,812	85%	20.29
Total		125,896	106,812	85%	20.29

²⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/16/17 and 9/12/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/ Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
014561-100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Miscellaneous	Custom	228	45	82	216	2,427	1.00	78,630	21,789	28%
				17	5	138	216	2,781	1.00	11,090	3,521	32%
014561-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				645	603	455	216	4,328	1.00	1,429,869	706,417	49%
Total										1,519,589	731,727	48%

The annual lighting hours of operation verified during the M&V site visit for the line items in the above table are fewer than the hours of operation used to calculate ex ante savings (8,760). The site does not operate continuously as the ex ante presumed.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 48%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

²⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Miscellaneous	1,519,589	731,727	48%	100.94
Total		1,519,589	731,727	48%	100.94

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, interviewed facility personnel regarding lighting operating schedules, and installed eleven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/28/17 and 9/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
014622-100101- Lighting-Linear Tube LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	26	26	82	32	5,698	1.11	7,800	8,192	105%
				24	24	164	36	5,718	1.11	18,432	19,429	105%
014622-100104- Lighting-Linear Tube LED Fixture Replacing T8 Fixture				113	113	110	32	3,508	1.11	52,884	34,194	65%
				14	14	64	32	2,516	1.11	2,688	1,247	46%
				34	34	64	22	4,353	1.11	8,568	6,875	80%
				178	178	145	36	4,725	1.11	116,412	101,400	87%
				134	134	110	26	3,186	1.11	67,536	39,668	59%
014622-100107- Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture				30	30	360	144	5,612	1.11	38,880	40,223	103%
				27	27	360	144	5,612	1.11	34,992	36,200	103%
014622-100104- Lighting-Linear Tube LED Fixture Replacing T8 Fixture				265	265	145	44	5,612	1.00	160,590	150,213	94%
				118	118	145	36	5,612	1.00	77,172	72,186	94%
014622-100107- Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture				6	6	360	144	3,582	1.00	7,776	4,643	60%
				22	22	145	26	5,612	1.11	15,708	16,250	103%
014622-100104- Lighting-Linear Tube LED Fixture Replacing T8 Fixture	211	211	220	108	5,612	1.00	141,792	132,630	94%			
	6	6	74	22	5,612	1.00	1,872	1,751	94%			
	1	1	110	26	5,329	1.11	504	495	98%			
	12	12	145	36	5,329	1.11	7,848	7,709	98%			
Total										761,454	673,304	88%

The annual lighting hours of operation for all measures in the above table are fewer than the annual hours of operation used to calculate ex ante savings (6,000). The measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings. The measures installed in the unconditioned

warehouse had a factor of 1.00 applied. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 88%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	761,454	673,304	88%	127.90
Total		761,454	673,304	88%	127.90

²⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/15/17 and 9/12/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017778-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	482	482	32	14	2,617	1.09	47,958	24,840	52%
				70	70	32	14	2,473	1.09	6,965	3,409	49%
Total										54,923	28,249	51%

The verified annual lighting hours of operation for all measures are fewer than the annual hours of operation used to calculate ex ante savings (5,166).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned manufacturing 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.³⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 51%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	54,923	28,249	51%	5.37
Total		54,923	28,249	51%	5.37

³⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewed facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/10/17 and 9/7/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017971-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,156	1,156	32	16	6,269	1.02	83,121	117,864	142%
				54	54	32	16	4,148	1.02	3,882	3,643	94%
				60	60	32	16	4,982	1.02	4,314	4,862	113%
017971-305802-Lighting-Delamping Replacing T8 32 Watt	3084					54	-	32	-	4,148	1.02	7,766
Total										99,083	133,654	135%

The annual hours of operation verified during the M&V site visit for the first and third line items in the table above (6,269 and 4,982, respectively) are greater than the hours of operation used to calculate ex ante savings (4,200), while the second and third lines above had fewer hours of operation (4,148). For the first measure the ex ante hours did not consider after hours restocking of the sales floor areas.

The total ex ante annual energy savings for the second and fourth line items above table are 11,648 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large 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.³¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 135%.

³¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	99,083	133,654	135%	25.39
Total		99,083	133,654	135%	25.39

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, interviewed facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/30/17 and 9/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017983-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	262	262	34	18	6,973	1.02	15,699	29,714	189%
017983-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			17	-	60	-	4,263	1.02	3,820	4,420	116%
017983-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			17	34	60	18	4,263	1.02	1,528	1,768	116%
017983-305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			262	-	34	-	6,973	1.02	33,360	63,143	189%
Total										54,408	99,046	182%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,500).

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large 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 total ex ante annual energy savings are 54,408 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²

³² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 182%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	54,408	99,046	182%	18.82
Total		54,408	99,046	182%	18.82

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, interviewed facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/17/17 and 9/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
018014-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	12	12	75	10	2,657	1.04	7,311	2,160	38%
				5	5	75	10	4,308	1.00	3,046	1,400	
				1	1	75	10	8,760	1.00	609	569	
018014-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			58	116	61	18	8,760	1.04	13,591	13,239	97%
018014-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			22	22	26	18	8,760	1.04	1,547	1,507	97%
018014-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			10	10	36	18	2,273	1.04	1,687	427	25%
018014-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	168	168	72	14	6,690	1.04	88,183	67,948	77%		
Total										115,975	87,250	75%

The annual lighting hours of operation for the second and third measure in the table above are equal to the annual hours of operation used to calculate ex ante savings (8,760), while the remaining line items are fewer than the annual lighting hours of operation used to calculate the ex ante savings.

The ex ante savings estimate was premised on an adjusted base wattage of 70W for the fifth line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was applied in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp.

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

The measure names of the first line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³³

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

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	115,975	87,250	75%	16.57
Total		115,975	87,250	75%	16.57

³³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/8/17 and 9/7/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
018078-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	20	20	32	18	5,756	1.02	1,527	1,638	107%
018078-305802-Lighting-Delamping Replacing T8 32 Watt	3084			20	-	32	-	5,576	1.02	3,490	3,745	107%
018078-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			223	223	32	18	7,090	1.02	28,245	22,500	80%
018078-305802-Lighting-Delamping Replacing T8 32 Watt	3084			223	-	32	-	7,090	1.02	64,560	51,343	80%
Total										97,822	79,226	81%

The annual lighting hours of operation for all measures in the table above are greater than the annual hours of operation used to calculate ex ante savings (5096).

The total ex ante annual energy savings are 97,822 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The quantity of the third and fourth line items in the table above (223) verified during the M&V site visit is less than the ex ante savings quantity (370). The remaining lamps were found in storage. An additional ADM site visit occurred with the same quantities installed and located in storage.

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large 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.³⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 81%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	97,822	79,226	81%	15.05
Total		97,822	79,226	81%	15.05

³⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/2/17 and 5/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016748-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	83	83	65	8	2,006	1.12	6,150	10,612	173%
016748-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			-	-	72	9	-	-	362	-	-
Total										6,512	10,612	163%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

The ex ante savings estimate used an adjusted base wattage of 45.5W for the first line item in the above table by multiplying the provided wattage by 70%. The base lamps for these measures (65W BR reflector) are exempt from an adjusted wattage calculation.

The quantity of the second line item in the above table (0) verified during the M&V site visit is fewer than the ex ante savings quantity (3). ADM staff verified that only linear lighting was present in locations in which LED A-line lamps were applied to be installed.

The measure name for the second line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 163%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	6,512	10,612	163%	2.02
Total		6,512	10,612	163%	2.02

³⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/12/17 and 6/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016768-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	804	804	53	9	1,754	1.09	41,647	67,909	163%
Total										41,647	67,909	163%

The annual lighting hours of operation verified during the M&V site visit (1,754) are greater than the annual hours of operation used to calculate ex ante savings (1,145³⁶). The annual hours of operation used to calculate ex ante savings did not account for lighting installed in areas with 24/7 operation, such as the main lobby and hallways.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned assisted living facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate references a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 163%.

³⁶ The ex ante and ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

³⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	41,647	67,909	163%	12.90
Total		41,647	67,909	163%	12.90

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/11/17 and 5/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016754-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	SBDI	2	2	53	11	-	1.01	102	-	0%
				38	38	72	15	1,749	1.01	2,558	3,811	149%
016754-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			5	5	72	9	571	1.01	373	181	48%
Total										3,033	3,992	132%

The annual lighting hours of operation verified during the M&V site visit for the second line item in the table above (1,749) are greater than the annual hours of operation used to calculate ex ante savings (1,224) while the hours for the third line are less (571). The ex ante hours were based on the posted hours where the gallery is open to the public and not the hours the employees work in the space. The third line item was installed in restrooms where the lighting is used when occupied.

The client stated that the first line item had originally been installed but that they had removed the fixture during a renovation. The fixture was not reinstalled during the subsequent visit.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first line item in the above table and 70W for the second and third line items by multiplying the provided wattage by 70%. An adjusted base wattage of 53W and 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W and 100W incandescent lamp.

The measure name for the third line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 132%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	3,033	3,992	132%	0.76
Total		3,033	3,992	132%	0.76

³⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/26/17 and 6/9/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016616-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	3	3	65	8	1,680	1.11	53	318	605%
016616-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			54	54	53	11	1,568	1.11	1,049	3,938	376%
016616-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			2	2	72	9	1,680	1.11	57	235	411%
Total										1,159	4,491	388%

The annual lighting hours of operation verified during the M&V site visit (ranging from 1,568 – 1,680) are greater than the annual hours of operation used to calculate ex ante savings (468). The ex ante hours are slightly fewer than the posted public hours of the facility (476). In addition to the posted hours the gallery is also a working artist studio and hosts many gallery showings monthly.

The ex ante savings estimate used an adjusted base wattage of 45.5W, 52.5W, and 70W for the line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W and 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W and 100W incandescent lamp for the second and third line items. The base lamps for the first measure (BR reflector) are exempt from an adjusted wattage calculation.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The measure name for the third line item in the table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 388%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	1,159	4,491	388%	0.85
Total		1,159	4,491	388%	0.85

³⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
015635-100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	10	10	34	15	8,760	1.09	2,497	1,821	73%
				31	31	35	14	8,760	1.09	6,623	6,241	94%
Total										9,120	8,062	88%

The annual lighting hours of operation verified during the M&V site visit are equal to the annual hours of operation used to calculate ex ante savings (8,760).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The total quantity of lamps in the table above (41) verified during the M&V site visit is less than the ex ante savings quantity (51). LED lamps are to be installed as current lighting reaches end of useful life.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 88%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	9,120	8,062	88%	1.53
Total		9,120	8,062	88%	1.53

⁴⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016553-100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	500	500	26	15	1,145	1.00	9,418	7,704	82%
Total										9,418	7,704	82%

The annual lighting hours of operation verified during the M&V site visit for the measure in the table above (1,145⁴¹) are fewer than the annual hours of operation used to calculate ex ante savings (1,638). These lamps were installed in guest rooms.

A heating and cooling interactive factor of 1.17, applicable to a gas heated, air conditioned hotel in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 82%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	9,418	7,704	82%	1.46
Total		9,418	7,704	82%	1.46

⁴¹ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

⁴² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/21/17 and 6/3/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016504-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	10	10	43	10	532	1.09	1,096	173	16%
016504-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			1,181	1,181	32	15	2,630	1.09	68,759	57,821	84%
016504-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft				2	2	30	11	8,760	1.09	131	364	278%
016504-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft				48	48	17	9	2,883	1.09	1,315	1,212	92%
Total										71,301	59,570	84%

The annual lighting hours of operation verified first, second, and fourth line item during the M&V site visit (532, 2,630, and 2,883, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,293), while the third line item (8,760) are greater. There were multiple areas of installation with varying usage.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned large office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did account for heating and cooling interactive effects with a factor of 1.04.

An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp. The ex ante base wattage of 42W was computed within the application by factoring 70% of a 60W incandescent lamp.

The measure name for the first line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 84%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom/Standard	Lighting	71,301	59,570	84%	11.32
Total		71,301	59,570	84%	11.32

⁴³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016228-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	4	8	1,080	240	8,592	1.01	21,024	20,752	99%
Total										21,024	20,752	99%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours are fewer than those used to develop the ex ante energy savings estimates due to holiday closures.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned manufacturing facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 99%. The ex ante energy savings estimate did not account for facility holidays or heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	21,024	20,752	99%	3.94
Total		21,024	20,752	99%	3.94

⁴⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/27/17 and 5/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016413-100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169	Lighting	Custom	6	6	175	17	577	1.14	937	609	66%
016413-100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169	Lighting	Custom	9	9	140	18	571	1.14	1,085	713	66%
Total										2,022	1,322	66%

The annual lighting hours of operation verified during the M&V site visit (Between 571 and 577) are fewer than the annual hours of operation used to calculate ex ante savings (950).

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned faith-based building in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did account for heating and cooling interactive effects with a factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 66%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	2,022	1,322	66%	0.25
Total		2,022	1,322	66%	0.25

⁴⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/23/17 and 6/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016426-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	7	7	53	14	2,622	1.09	631	783	124%
016426-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			36	36	40	19	1,537	1.09	1,966	1,271	65%
016426-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			11	11	43	7	813	1.09	901	352	39%
016426-100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169		Custom	35	35	164	40	1,543	1.09	10,181	7,343	72%
				3	3	82	17	1,556	1.09	457	332	73%
016426-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1		Standard	12	12	455	142	2,372	1.09	8,789	9,744	111%
Total										22,925	19,825	86%

The annual lighting hours of operation verified during the M&V site visit range between 813 and 2,622. The annual lighting hours of operation for the first and sixth line items in the table above (2,622 and 2,372, respectively) are greater than the hours of operation used to calculate ex ante savings (2,340), while the hours of operation for the other line items are fewer. A portion of the lighting retrofit occurred in lower-usage areas such as bathrooms, storage areas, and the gym.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the first line item in the table above and 42W for the third line item by multiplying the provided wattage by 70%. An adjusted base wattage of 53W and 43W for the first and third line items, respectively, were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W and 60W incandescent lamp.

The quantity of the second line item in the above table (36) verified during the M&V site visit is fewer than the ex ante savings quantity (40).

The measure name for the third line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 86%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	12,287	12,150	99%	2.31
Custom		10,638	7,675	72%	1.46
Total		22,925	19,825	86%	3.77

⁴⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/22/17 and 6/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016087-100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169	Lighting	Custom	229	229	40	4	1,975	1.14	11,990	18,779	157%
Total										11,990	18,779	157%

The annual lighting hours of operation verified during the M&V site visit (1,975) are greater than the annual hours of operation used to calculate ex ante savings (1,875). The lamps were installed in multiple ballroom locations as well as the grill and entry of the facility.

The ex ante savings estimate used an LM adjusted base wattage of 28W in the above table by multiplying the provided wattage by 70%. The base lamps for this measure (Candelabra B10) are exempt from an adjusted wattage calculation.

The quantity for the measure in the above table (229) verified during the M&V site visit are fewer than the ex ante savings quantity (261). The remaining lamps were found to be in storage during the M&V visit.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 157%.

⁴⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	11,990	18,779	157%	3.57
Total		11,990	18,779	157%	3.57

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/4/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016440-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	24	24	65	14	2,249	1.01	2,814	2,785	99%
016440-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			24	24	43	10	1,375	1.01	1,765	1,102	62%
016440-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			112	112	32	17	1,392	1.01	3,861	2,367	61%
016440-100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169		Custom	42	34	164	30	2,119	1.01	13,487	12,581	93%
				63	42	164	40	2,481	1.01	19,886	21,721	109%
Total										41,813	40,555	97%

The annual lighting hours of operation verified during the M&V site visit for the first and fifth line items in the above table (2,250 and 2,525, respectively) are greater than the annual hours of operation used to calculate ex ante savings (2,210), while the annual hours of operation for the second, third, and fourth line items (1,386, 1,403, and 2,159, respectively) are fewer.

The ex ante savings estimate used an adjusted base wattage of 42W for the second line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The measure name for the second line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 97%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	8,440	6,253	74%	1.19
Custom		33,373	34,302	103%	6.52
Total		41,813	40,555	97%	7.70

⁴⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/24/17 and 6/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016685-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	138	138	49	12	3,112	1.10	19,168	17,535	91%
				90	90	53	12	5,124	1.10	17,484	20,867	119%
Total										36,652	38,401	105%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the above table (3,112) is fewer than the annual hours of operation used to calculate ex ante savings (3,754), while the annual hours for the second line item (5,124) are greater. Thirty-six percent of the lamps for the second measure are operating 24/7.

The quantity for the second line item in the above table (90) is fewer than the ex ante savings quantity (115). The remaining lamps were located in storage and intended as replacements.

The ex ante savings estimate used an LM adjusted base wattage of 49W and 52.5W for the first and second line items in the table above by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used for the second measure in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 105%.

⁴⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	36,652	38,401	105%	7.29
Total		36,652	38,401	105%	7.29

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours cite guest room operation.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016799-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	40	40	53	10	1,145	1.17	2,048	2,331	114%
Total										2,048	2,331	114%

The annual lighting hours of operation verified during the M&V site visit (1,145⁵⁰) match the ex ante savings. These lamps were installed in guest rooms.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.17, applicable to a gas heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for heating and cooling interactive effects with a factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 114%.

⁵⁰ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

⁵¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	2,048	2,331	114%	0.44
Total		2,048	2,331	114%	0.44

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/12/17 and 6/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016791-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	272	272	28	12	4,444	1.10	17,200	21,346	124%
Total										17,200	21,346	124%

The annual lighting hours of operation verified during the M&V site visit (4,444) are greater than the annual hours of operation used to calculate ex ante savings (3,800). The ex ante estimate did not account for opening and closing store activities in addition to the store’s posted hours. Safety lighting that is operational 24/7 was also not accounted for in the ex ante estimate.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 a cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 124%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	17,200	21,346	124%	4.05
Total		17,200	21,346	124%	4.05

⁵² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours cite guest room operation.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016488-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	948	948	72	18	1,145	0.99	58,702	58,066	99%
Total										58,702	58,066	99%

The annual lighting hours of operation verified during the M&V site visit (1,145⁵³) match the ex ante savings. The lamps were installed in guest rooms.

The ex ante savings estimate used an adjusted base wattage of 70W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of .99, applicable to an electric heated, air conditioned hotel in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did account for heating and cooling interactive effects with a factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 99%.

⁵³ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

⁵⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	58,702	58,066	99%	11.03
Total		58,702	58,066	99%	11.03

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/10/17 and 6/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016801-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	750	750	32	14	2,886	1.09	49,140	41,128	84%
				24	24	32	12	3,931	1.09	1,747	2,066	118%
				8	8	32	12	421	1.09	582	74	13%
Total										51,469	43,267	84%

The annual lighting hours of operation verified during the M&V site visit ranges between 421 and 3,931. The annual lighting hours of operation regarding the first and third line items in the table above (2,886 and 421, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,500), while the second line item (3,931) is greater. The facility had multiple areas of use with varying hours.

The quantity for the first line item in the above table (723) is fewer than the ex ante savings quantity (750). The remaining lamps were found in storage and are to be used as replacements.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 84%.

⁵⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	51,469	43,267	84%	8.22
Total		51,469	43,267	84%	8.22

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/28/17 and 8/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016624-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	10	10	65	8	4,626	1.12	3,841	2,948	77%
016624-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			7	7	75	10	2,817	1.12	3,066	1,433	47%
Total										6,908	4,381	63%

The annual lighting hours of operation verified during the M&V site visit (ranging from 2,817 – 4,626) are fewer than the annual hours of operation used to calculate ex ante savings (6,480). Besides a stairwell installation the majority of the two measures above were located in a less frequently used dining room.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned small 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 63%. The ex ante savings was premised on overestimating annual lighting hours of operation.

⁵⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	6,908	4,381	63%	0.83
Total		6,908	4,381	63%	0.83

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/15/17 and 6/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016530-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,436	1,436	32	17	1,723	1.09	43,235	40,483	94%
Total										43,235	40,483	94%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours are less than those used to develop the ex ante energy savings estimates (1,930). Installation of measures took place in multiple areas with varying usage.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned elementary school 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 94%. The ex ante energy savings estimate was premised on overestimate annual lighting operating hours and an underestimated heating and cooling factor.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	43,235	40,483	94%	7.69
Total		43,235	40,483	94%	7.69

⁵⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/15/17 and 6/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016534-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	182	182	32	17	2,229	1.09	5,480	6,639	121%
Total										5,480	6,639	121%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (1,930).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned high school 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵⁸

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

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	5,480	6,639	121%	1.26
Total		5,480	6,639	121%	1.26

⁵⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/23/17 and 6/14/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016738-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	14	14	48	15	2,706	1.01	1,094	1,242	114%
Total										1,094	1,242	114%

The annual lighting hours of operation verified during the M&V site visit (2,706) are greater than the annual hours of operation used to calculate ex ante savings (2,398).

The ex ante savings estimate used an LM adjusted base wattage of 47.6W by multiplying the provided wattage by 70%. No wattage adjustment was made for ex post savings due to installed lamps not qualifying for an EISA 2007 adjustment.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned small retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁵⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 114%. The higher hours of use and addition to a heating and cooling factor resulted in a higher realization.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	1,094	1,242	114%	0.24
Total		1,094	1,242	114%	0.24

⁵⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/8/17 and 6/6/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016574-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	98	98	60	11	4,524	1.14	34,954	24,711	71%
016574-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			5	5	35	8	4,524	1.14	655	695	106%
016574-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			23	23	29	4	4,524	1.14	2,679	2,959	110%
016574-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			19	19	35	6	4,524	1.14	2,674	2,835	106%
Total										40,962	31,200	76%

The annual lighting hours of operation verified during the M&V site visit (4,524) are fewer than the annual hours of operation used to calculate ex ante savings (4,666).

The ex ante savings estimate used an LM adjusted base wattage of 28W for the third line item in the table above by multiplying the provided wattage by 70%. An adjusted base wattage of 29W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 40W incandescent lamp.

The quantity of the first line item in the above table (98) verified during the M&V site visit is fewer than the ex ante savings quantity (147).

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 76%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	40,962	31,200	76%	5.93
Total		40,962	31,200	76%	5.93

⁶⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/5/17 and 7/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016581-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	8	8	53	12	947	1.14	885	353	40%
016581-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			3	3	75	12	947	1.14	459	204	44%
016581-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			24	24	53	9	947	1.14	1,900	1,137	60%
Total										3,244	1,694	52%

The annual lighting hours of operation verified during the M&V site visit (947) are fewer than the annual hours of operation used to calculate ex ante savings (1,820).

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the first and third line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The quantities of the first and second line items in the above table (8 and 3, respectively) verified during the M&V site visit are fewer than the ex ante savings quantities (12 and 4, respectively). The remaining lamps were located in storage and purchased as replacements.

The measure name for the third line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 52%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	3,244	1,694	52%	0.32
Total		3,244	1,694	52%	0.32

⁶¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/22/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
015968-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	50	50	40	15	8,596	1.09	10,950	11,760	107%
015968-100207-Lighting-Non Linear LED Fixture Replacing T5 HO Fixture	1169		Custom	48	48	62	28	6,962	1.09	14,297	12,428	87%
Total										25,247	24,188	96%

The annual lighting hours of operation verified during the M&V site visit, ranging between 6,962 and 8,596, are fewer than the annual hours of operation used to calculate ex ante savings (8,760). The ex ante estimate did not consider lighting that is not operational 24/7.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned industrial facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 96%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	10,950	11,760	107%	2.23
Custom		14,297	12,428	87%	2.36
Total		25,247	24,188	96%	4.59

⁶² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 5/26/17 and 7/6/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016557-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	110	220	75	15	1,501	1.10	12,630	8,324	66%
Total										12,630	8,324	66%

The annual lighting hours of operation verified during the M&V site visit (1,501) are fewer than the annual hours of operation used to calculate ex ante savings (2,400) due to lighting being installed in a storage warehouse with limited use.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned storage facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 66%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	12,630	8,324	66%	1.58
Total		12,630	8,324	66%	1.58

⁶³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/22/17 and 6/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
015912-100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	76	65	164	40	1,816	1.11	25,646	19,811	77%
Total										25,646	19,811	77%

The annual lighting hours of operation verified during the M&V site visit (1,816) are fewer than the annual hours of operation used to calculate ex ante savings (2,600). The ex ante savings estimate referred to a set facility schedule, however there were several areas of use with different operating hours within the facility.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 77%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	25,646	19,811	77%	3.76
Total		25,646	19,811	77%	3.76

⁶⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/18/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016431-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	108	108	32	18	1,729	1.01	4,536	2,645	58%
Total										4,536	2,645	58%

The annual lighting hours of operation verified during the M&V site visit (1,729) are fewer than the annual hours of operation used to calculate ex ante savings (3,000). The ex ante assumed more than 9 ½ hours per day, 6 days each week while the facility is open approximately 3 ½ days a week.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 58%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	4,536	2,645	58%	0.50
Total		4,536	2,645	58%	0.50

⁶⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/19/17 and 6/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016327-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	14	14	65	8	1,421	1.11	1,813	1,255	69%
016327-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			60	60	32	15	1,250	1.11	2,317	1,410	61%
Total										4,129	2,664	65%

The annual lighting hours of operation verified during the M&V site visit, ranging between 1,250 and 1,421, are fewer than the annual hours of operation used to calculate ex ante savings (2,184). There is only one employee at this facility, thus lighting is turned off when he is not present instead of following a strict schedule.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 65%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	4,129	2,664	65%	0.51
Total		4,129	2,664	65%	0.51

⁶⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/2/17 and 5/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016756-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	19	19	53	9	4,934	1.13	2,771	4,652	168%
016756-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			47	47	65	8	4,261	1.12	8,983	12,761	142%
Total										11,754	17,413	148%

The annual lighting hours of operation verified during the M&V site visit, ranging between 4,312 and 4,995, are greater than the annual hours of operation used to calculate ex ante savings (3,224). The ex ante hours of operation are the posted restaurant hours which do not include the opening and closing activities of the site.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the first line item in the table above by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings for lighting installed in non-refrigerated spaces. Heating and cooling interactive factors of 1.15 and 1.18 were referenced for lighting installed in freezer and walk-in refrigerator spaces (4 and 2 A-line lamps, respectively). The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 148%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	11,754	17,413	148%	3.31
Total		11,754	17,413	148%	3.31

⁶⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/9/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
015196-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,040	1,030	32	15	6,458	1.02	130,159	117,057	90%
				2,436	2,436	32	15	7,227	1.02	302,307	304,233	101%
				50	50	32	15	5,553	1.17	6,205	5,521	89%
				784	784	32	15	7,185	1.02	97,294	97,344	100%
				39	39	32	15	6,570	1.02	4,840	4,428	91%
				48	48	32	15	8,760	1.02	5,957	7,266	122%
				12	10	32	16	1,166	1.15	1,635	300	18%
Total										548,397	536,150	98%

The annual lighting hours of operation verified during the M&V site visit for the sixth line item above (8,760) are greater than the annual hours of operation used to calculate ex ante savings (7,300), while the remaining line items are less (ranging from 1,166 – 7,227). The measures were installed in multiple areas with varying usage.

A heating and cooling interactive factor of 1.02, applicable to an electrically heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings for interior installations. In addition, a factor for freezers and coolers (1.15 and 1.29, respectively) was applied. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%.

⁶⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	548,397	536,150	98%	101.85
Total		548,397	536,150	98%	101.85

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/19/17 and 6/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016539-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	51	51	65	8	5,951	1.12	18,438	19,338	105%
016539-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			78	78	32	14	6,645	1.11	8,411	10,665	127%
016539-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			22	22	29	8	6,433	1.12	6,877	3,402	45%
016539-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			4	4	75	11	5,315	1.12	3,834	1,521	40%
016539-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			8	8	40	5	6,433	1.12	3,355	2,014	60%
016539-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			8	8	53	13	5,315	1.12	1,917	1,925	100%
Total										42,831	38,864	91%

The annual lighting hours of operation verified during the M&V site visit ranges between 5,315 and 6,645. The annual lighting hours of operation for the first, second, third and fifth line items in the table above are greater than the annual hours of operation used to calculate ex ante savings (5,760), while the fourth and sixth line items are fewer. The site had multiple areas of use with varying hours.

The ex ante savings estimate used an LM adjusted base wattage of 28W and 52.5W for the third and sixth line items in the above table by multiplying the provided wattage by 70%. Adjusted base wattages of 29W and 53W were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 40W and 75W incandescent lamp, respectively.

The quantities of the first, third, fourth, and fifth line item in the above table (51, 22, 4, and 8, respectively) verified during the M&V site visit are fewer than the ex ante savings quantity (54, 56, 10, and 16, respectively). For the third line item the facility personnel did not like the color that the LED A-

line lamps showed through the fixture, so they replaced the LED lamps with the old incandescent lamps. The manager was not able to locate the remaining uninstalled lamps during the site visit.

The measure names for the third and sixth line items in the above table are not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. In addition, an interactive factor of 1.18 was used for lamps installed in the walk in cooler (6 T8s) and 1.00 was used for the lamps installed in an outdoor shed with no heating/cooling (9 T8s). The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁶⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 91%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	42,831	38,664	91%	7.38
Total		42,831	38,664	91%	7.38

⁶⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/09/17 and 6/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016837-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	265	265	40	15	2,482	1.14	17,190	18,701	109%
Total										17,190	18,701	109%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual hours closely reflect those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned faith-based 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 109%. The ex ante energy savings estimate was premised on a lower heating and cooling interactive factor.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	17,190	18,701	109%	3.55
Total		17,190	18,701	109%	3.55

⁷⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/8/17 and 6/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016846-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	SBDI	66	66	53	15	1,834	1.01	5,500	4,626	84%
016846-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			1	1	72	9	1,834	1.01	113	116	103%
016846-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			47	47	65	7	97	1.01	3,359	2,735	81%
Total										8,972	7,478	83%

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the table above are greater than the annual hours of operation used to calculate ex ante savings (1,785), while the hours of operation for the third line item is fewer. A portion of the lighting referred to in the third line item (36) is used as shelf lighting, which is only illuminated when customers are present.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W, 70W, and 45.5W for the first, second and third line items in the above table, respectively, by multiplying the provided wattage by 70%. Adjusted base wattages of 53W and 72W were used in the ex post savings analysis for the first and second line items, respectively, to meet the EISA 2007 standard lumen equivalent for a 75W and 100W incandescent lamp. The base lamps for the third line item (MR16) are exempt from an adjusted wattage calculation.

The quantity of the first line item in the above table (66) verified during the M&V site visit is fewer than the ex ante savings quantity (79). The remaining lamps were found in storage during the time of the site visit.

The measure name for the second line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did account for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 83%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	8,972	7,478	83%	1.42
Total		8,972	7,478	83%	1.42

⁷¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/30/17 and 7/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016849-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	12	12	53	11	4,598	1.12	2,505	2,590	103%
016849-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			14	14	53	8	4,598	1.12	3,133	3,238	103%
016849-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			48	48	65	8	4,308	1.12	13,761	13,176	96%
016849-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			2	2	50	7	3,968	1.12	282	381	135%
				14	14	53	9	4,553	1.12	3,063	3,135	102%
016849-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			19	19	43	6	4,598	1.12	3,440	3,613	105%
Total										26,184	26,134	100%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimate.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned food & beverage service facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did account for heating and cooling interactive effects with a factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 100%. The ex ante energy savings estimate was premised on

⁷² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

overestimate annual lighting operating hours and accounted for a lower heating and cooling interactive effects causing an increase in the savings.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	26,184	26,134	100%	4.96
Total		26,184	26,134	100%	4.96

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/5/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016888-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	148	148	40	17	8,760	1.12	6,443	33,335	517%
Total										6,443	33,335	517%

The annual lighting hours of operation verified during the M&V site visit (8,760) are much greater than the annual hours of operation used to calculate ex ante savings (1,820). The ex ante savings estimate did not account for lighting being operational 24/7.

A heating and cooling interactive factor of 1.12, applicable to a non-heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 517%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	6,443	33,335	517%	6.33
Total		6,443	33,335	517%	6.33

⁷³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016890-305013-Lighting-<=80 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	20	20	175	31	4,310	1.00	11,520	12,412	108%
Total										11,520	12,412	108%

The annual lighting hours of operation (4,310⁷⁴) are greater than the hours of operation used to calculate ex ante savings (4,000). Lighting is controlled with photo cells, limiting operation to non-daylight hours.

No heating and cooling interactive factor was referenced due to lighting only being installed in exterior locations.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 108%. The additional hours produced a higher realization rate.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	11,520	12,412	108%	2.36
Total		11,520	12,412	108%	2.36

⁷⁴ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

⁷⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/12/17 and 6/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016907-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,300	1,300	32	15	8,760	1.09	201,340	211,965	105%
				311	311	32	17	6,116	1.09	42,500	31,238	74%
Total										243,840	243,203	100%

The hours of operation verified during the M&V site visit for the first line item are equal to the annual hours of operation used to calculate ex ante savings (8,760), while the hours of operation for the second line item (6,116) are fewer. The ex ante estimate did not consider lighting that was not operational 24/7.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	243,840	243,203	100%	46.20
Total		243,840	243,203	100%	46.20

⁷⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016911-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	120	120	40	15	2,422	1.09	8,112	7,927	98%
Total										8,112	7,927	98%

The annual lighting hours of operation verified during the M&V site visit in the table above (2,422⁷⁷) are less than the annual hours of operation used to calculate ex ante savings (2,600).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned elementary school 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁷⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	8,112	7,927	98%	1.51
Total		8,112	7,927	98%	1.51

⁷⁷ The ex post savings analysis cites the Ameren MO 2017 iTRL elementary school annual lighting operation estimate of 2,422 hours.

⁷⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016914-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	900	900	53	10	1,145	1.13	44,312	50,710	114%
Total										44,312	50,710	114%

The annual lighting hours of operation verified during the M&V site visit (1,145⁷⁹) are equal to the annual hours of operation used to calculate ex ante savings. These lamps were installed in resident bedrooms.

The ex ante savings estimate used an adjusted base wattage of 52.5W by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.13, applicable to an electrically heated, air conditioned assisted living facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 114%.

⁷⁹ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

⁸⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	44,312	50,710	114%	9.63
Total		44,312	50,710	114%	9.63

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 05/17/17 and 06/08/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016917-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,000	1,000	32	12	3,461	1.15	114,400	79,467	69%
Total										114,400	79,467	69%

The annual lighting hours of operation verified during the M&V site visit (2,777) are fewer than the annual hours of operation used to calculate ex ante savings (5,500). The majority of the installation took place in areas with infrequent usage.

A heating and cooling interactive factor of 1.15, applicable to a gas heated, air conditioned small 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 56%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	114,400	63,748	56%	12.11
Total		114,400	63,748	56%	12.11

⁸¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 5/30/17 and 6/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016526-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	90	90	53	10	8,224	1.09	33,507	34,830	104%
Total										33,507	34,830	104%

The annual lighting hours of operation verified during the M&V site visit (8,224) are fewer than the annual hours of operation used to calculate ex ante savings (8,760). A portion of the lamps were installed in meeting and dining areas that do not operate continuously.

An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp. The ex ante base wattage of 52W was computed within the application by factoring 70% of a 75W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned retirement facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The measure name for the first line item in the table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 104%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

⁸² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	33,507	34,830	104%	6.62
Total		33,507	34,830	104%	6.62

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/1/17 and 7/6/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016717-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	3	6	295	50	5,766	1.11	3,416	3,736	109%
Total										3,416	3,736	109%

The annual lighting hours of operation verified during the M&V site visit (5,766) are fewer than the annual hours of operation used to calculate ex ante savings (5,840).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 109%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	3,416	3,736	109%	0.71
Total		3,416	3,736	109%	0.71

⁸³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed a photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 4/28/17 and 6/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016870-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture_201743-9120_5-305233	3005-1	Lighting	SBDI	8	8	400	200	1,762	1.10	2,560	3,111	122%
				6	6	400	200	2,703	1.10	2,400	3,579	149%
			Standard	4	4	400	200	2,703	1.10	1,600	2,386	149%
				2	2	400	200	8,760	1.10	3,504	3,867	110%
Total										10,064	12,943	129%

Primary data were used to develop estimates of annual lighting operating hours. The first three facility hours in the table above, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 129%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	10,064	12,943	129%	2.46
Total		10,064	12,943	129%	2.46

⁸⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/26/17 and 6/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016957-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft_2	3026	Lighting	Standard	120	120	40	20	1,881	1.11	6,165	4,993	81%
016957-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft_2				8	8	40	17	2,255	1.11	473	459	97%
Total										6,638	5,452	82%

The annual lighting hours of operation verified during the M&V site visit (ranging from 1,881 to 2,255) are fewer than the hours of operation used to calculate ex ante savings (2,470 and 2,470). Lamp installations were in multiple locations with varying usage.

A heating and cooling interactive factor of 1.07, applicable to a gas 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 82%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	6,638	5,452	82%	1.04
Total		6,638	5,452	82%	1.04

⁸⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/15/17 and 6/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016961-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,588	1,588	32	17	1,461	1.09	47,812	37,968	79%
Total										47,812	37,968	79%

The annual lighting hours of operation verified during the M&V site visit (1,461) are fewer than the annual hours of operation used to calculate ex ante savings (1,930). Installation took place in multiple areas with varying usage.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned elementary school facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 79%. The ex ante energy savings estimate was premised on overestimated annual operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	47,812	37,968	79%	7.21
Total		47,812	37,968	79%	7.21

⁸⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 5/3/17 and 6/12/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017001-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	13	13	455	125	3,844	1.09	15,928	18,038	113%
Total										15,928	18,038	113%

Primary data were used to develop estimates of annual lighting operating hours. For the facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 113%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and accounted for a lower heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	15,928	18,038	113%	3.43
Total		15,928	18,038	113%	3.43

⁸⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 5/4/17 and 6/8/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017009-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	180	180	40	15	1,643	1.09	8,986	8,068	90%
Total										8,986	8,068	90%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours are fewer than those used to develop the ex ante energy savings estimates (1,920).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned high school 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 90%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	8,986	8,068	90%	1.53
Total		8,986	8,068	90%	1.53

⁸⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 5/9/17 and 6/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	46	46	32	18	5,922	1.10	3,394	4,209	124%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			46	46	32	-	5,922	1.10	7,758	9,621	124%
Total										11,153	13,830	124%

The annual lighting hours of operation verified during the M&V site visit (5,922) are greater than the annual hours of operation used to calculate ex ante savings (5,068).

There was an error made in the process of converting a single measure in the application to two measures in the database. The database refers to ex ante savings of 3,693 and 7,460 kWh for line items one and two, respectively, while values should be 3,394 and 7,758 kWh.

A heating and cooling interactive factor of 1.10, applicable to a gas 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 interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁸⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 124%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	11,153	13,830	124%	2.63
Total		11,153	13,830	124%	2.63

⁸⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/26/2017 and 6/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	150	150	40	14	1,877	1.03	11,794	7,546	64%
Total										11,794	7,546	64%

The annual lighting hours of operation verified during the M&V site visit (1,877) are fewer than the annual hours of operation used to calculate ex ante savings (3,024). The majority of the installation took place in areas with infrequent usage.

A heating and cooling interactive factor of 1.03, applicable to an electric heated, air conditioned assembly building in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 64%. The ex ante energy savings estimate was premised on overestimated annual operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	11,794	7,546	64%	1.43
Total		11,794	7,546	64%	1.43

⁹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/26/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	6	6	53	11	2,921	1.01	600	746	124%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			4	4	50	7	2,921	1.01	270	509	189%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			31	31	65	11	2,039	1.01	4,032	3,462	86%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			34	34	32	14	1,569	1.01	1,474	974	66%
Total										6,376	5,692	89%

The hours of operation for the first and second line items (2,921) are greater than the annual hours of operation used to calculate ex ante savings (2,316), while the third and fourth line items (2,039 and 1,569, respectively) are fewer. The facility has five rooms where contracted hair stylists cut hair, three of which were unoccupied during both site visits. Facility personnel was unsure of when/if a new employee would occupy those rooms. The lamps installed in these rooms are operated minimally for cleaning, which was estimated at approximately 15 minutes per week.

The ex ante savings estimate used LM adjusted base wattages of 52.5W and 35W for the first and second line items in the above table, respectively, by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis for the first line item to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The base lamps for the second line item (MR16) are exempt from an adjusted wattage calculation.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned retail facility in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 89%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	6,376	5,692	89%	1.08
Total		6,376	5,692	89%	1.08

⁹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/26/17 and 7/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	30	30	72	9	220	1.14	2,220	474	21%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			-	-	90	15	-	-	936	-	-
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			21	21	65	8	704	1.14	2,490	959	39%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			43	43	75	11	839	1.14	5,724	2,625	46%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			5	5	43	9	925	1.14	385	179	46%
Total										11,755	4,237	36%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates.

The measure name for the first and fifth line item in the table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps.

During the M&V site visit the first line item in the table above had a quantity (30) fewer than the ex ante savings estimate quantity (35).

The second line item in the table above had not received an LED upgrade due to no compatible lamp for the existing fixture. The ex ante savings estimate stated a quantity of 6.

For the fifth line item in the table above, the ex ante savings estimate states LED A15 (5W) lamps, but the M&V site visit confirmed LED A19 (9W) lamps were installed.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned small retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did account for heating and cooling interactive effects with a factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 36%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and measures with a lesser installed quantity than stated.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	11,755	4,237	36%	0.80
Total		11,755	4,237	36%	0.80

⁹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/19/17 and 7/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	2	2	43	10	2,414	1.09	1,109	177	16%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			35	35	40	15	2,643	1.09	2,987	2,529	85%
Total										4,096	2,706	66%

The annual lighting hours of operation verified during the M&V site visit (ranging between 2,414 and 2,643) are fewer than the annual hours of operation used to calculate ex ante savings (3,190).

The ex ante savings estimate used an LM adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The quantity of the first line item in the above table (2) verified during the M&V site visit is fewer than the ex ante savings quantity (10).

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

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

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹³

⁹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 66%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	4,096	2,706	66%	0.51
Total		4,096	2,706	66%	0.51

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 6/28/2017 and 7/26/2017.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	36	36	40	17	577	1.15	404	550	136%
Total										404	550	136%

Primary data were used to develop estimates of annual lighting operating hours. For the monitored facility, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.15, applicable to a gas heated, air conditioned assembly in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 136%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and an underestimated the heating and cooling factor.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	404	550	136%	0.10
Total		404	550	136%	0.10

⁹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/6/17 and 7/6/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012	Lighting	Standard	34	34	50	5	3,562	1.01	5,795	5,483	95%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			2	2	43	10	2,963	1.01	267	200	75%
				8	8	29	6	3,562	1.01	740	674	91%
Total										6,802	6,357	93%

The annual lighting hours of operation verified during the M&V site visit (ranging between 2,963 and 3,562) are fewer than the annual hours of operation used to calculate ex ante savings (3,952).

The ex ante savings estimate used LM adjusted base wattages of 35W, 42W, and 28W for the first, second, and third line items in the table above, respectively, by multiplying the provided wattage by 70%. Adjusted base wattages of 43W, and 29W were used in the ex post savings analysis for the second and third line items to meet the EISA 2007 standard lumen equivalent for a 60W and 40W incandescent lamp. The base lamps for the first line item (MR16) are exempt from an adjusted wattage calculation.

The quantity of the first line item in the above table (34) verified during the M&V site visit is fewer than the ex ante savings quantity (47). The remaining lamps (13) were removed due to the lumen level being too high.

The measure name for the second and third line items in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned small 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 interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 93%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	6,802	6,357	95%	1.21
Total		6,802	6,357	95%	1.21

⁹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/28/17 and 7/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	83	39	138	114	3,240	1.00	23,323	22,709	97%
100210-Lighting-Non Linear LED Fixture Replacing Mercury Vapor Fixture				1	1	455	114	3,240	1.00	1,135	1,105	97%
Total										24,458	23,814	97%

The annual lighting hours of operation verified during the M&V site visit (3,240) are greater than the annual hours of operation used to calculate ex ante savings (3,200).

No heating and cooling interactive factor was applied to the ex post lighting energy savings due to lighting only being installed in an unconditioned space. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 97%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	24,458	23,814	97%	4.52
Total		24,458	23,814	97%	4.52

⁹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/20/17 and 7/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	244	244	40	15	1,999	1.09	13,707	13,314	97%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			20	20	40	18	2,324	1.09	989	1,117	113%
Total										14,696	14,430	98%

The hours of operation for the first line item in the table above (1,999) are fewer than the annual hours of operation used to calculate ex ante savings (2,100), while the second line item (2,324) is greater. The lamps were installed in various areas with differing hours of use.

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

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	14,696	14,430	98%	2.74
Total		14,696	14,430	98%	2.74

⁹⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewed facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	176	176	25	12	8,760	1.18	3,569	23,724	665%
Total										3,569	23,724	665%

The annual lighting hours of operation verified during the M&V site visit (8,760) are greater to the annual hours of operation used to calculate ex ante savings (1,500). The ex ante presumed the measures were to be installed within guest rooms and not in public areas with continuous usage.

A heating and cooling interactive factor of 1.18, applicable to a gas heated, air conditioned hotel 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹⁸

A table showing the energy savings achieved by the measure evaluated for this site is shown below. The overall realization rate is 665%. The ex ante energy savings estimate was premised on underestimated annual hours of operation and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	3,569	23,724	665%	4.51
Total		3,569	23,724	665%	4.51

⁹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	107	107	43	9	8,760	1.04	36,077	33,104	92%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture				81	81	65	10	8,760	1.04	51,109	40,677	80%
Total										87,187	73,781	85%

The annual lighting hours of operation verified during the M&V site visit (8,760) are the same as the annual hours of operation used to calculate ex ante savings (8,760).

The quantities in the above table (107 and 81, respectively) are fewer than the ex ante savings estimate quantities (120 and 102, respectively). The remaining lamps were in storage and intended for replacements.

The first line item in the table above had a number of lamps (9) installed on the outside of the building. The measure should have been divided into two as to represent the two end use installations (lighting and exterior).

The ex ante savings estimate used an adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

A heating and cooling interactive factor of 1.04, applicable to a gas heated, air conditioned multi-family residential facility in St. Louis, was applied to the ex post lighting energy savings for the interior installations. The ex ante heating and cooling factor was the same.

The measure name for the first line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 85%. The ex ante energy savings estimate was premised on an overestimated installed quantity.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	87,187	73,781	85%	14.02
Total		87,187	73,781	85%	14.02

⁹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/14/17 and 7/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017324-305502-Lighting-Linear ft T8 25 Watt (<=7 Watts/ft) Replacing T8 32 Watt Linear ft	3022	Lighting	Standard	80	80	32	25	8,000	1.01	2,577	4,509	175%
017324-305502-Lighting-Linear ft T8 25 Watt (<=7 Watts/ft) Replacing T8 32 Watt Linear ft				180	180	32	25	3,939	1.01	5,797	4,994	86%
Total										8,374	9,503	113%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the above table (8,000) is greater than the annual hours of operation used to calculate ex ante savings (4,300), while the second line item is fewer (3,939). The lighting installation took place in multiple locations with varying usage.

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned industrial 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 kWh savings.¹⁰⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 113%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for the first measure and overestimation of the heating and cooling interactive factor.

¹⁰⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	8,374	9,503	113%	1.81
Total		8,374	9,503	113%	1.81

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/27/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	2	2	65	10	3,326	1.11	289	405	140%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			4	4	20	2	8,760	1.11	189	698	368%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			3	3	20	1	8,760	1.11	148	544	368%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			300	300	40	18	1,315	1.11	17,366	9,598	55%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			18	18	32	17	941	1.11	710	281	40%
Total										18,702	11,525	62%

The ex ante savings estimate for all lighting measures was premised upon 2,530 annual operating hours. For the first three line items in the above table the annual lighting hours verified during the M&V site visit were greater (3,326 – 8,760) than the ex ante hours. The first measure was installed in the entrance and the second and third measure were exit signs with continuous use. For the fourth and fifth line items the hours (1,315 and 941) were fewer than the ex ante hours due to multiple installation locations with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰¹

¹⁰¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 62%. The fourth and fifth line items account for the majority of savings, and reference fewer annual lighting hours than the ex ante savings estimate, resulting in a low realization rate.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	18,703	11,525	62%	2.19
Total		18,703	11,525	62%	2.19

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/26/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	34	34	140	40	2,511	0.98	9,579	8,392	88%
Total										9,579	8,392	88%

The annual lighting hours of operation verified during the M&V site visit (2,511) are fewer than the annual hours of operation used to calculate ex ante savings (2,709).

A heating and cooling interactive factor of 0.98, applicable to an electrically heated, air conditioned education facility in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 88%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	9,579	8,392	88%	1.59
Total		9,579	8,392	88%	1.59

¹⁰² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/30/17 and 6/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	2	2	400	165	2,784	1.10	1,477	1,444	98%
Total										1,477	1,444	98%

The annual lighting hours of operation verified during the M&V site visit (2,784) are fewer than the annual hours of operation used to calculate ex ante savings (3,021).

A heating and cooling interactive factor of 1.10, applicable to a gas 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 interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	1,477	1,444	98%	0.27
Total		1,477	1,444	98%	0.27

¹⁰³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/15/17 and 7/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	12	12	53	10	2,162	1.11	2,236	1,248	50%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft)	3026			82	82	40	20	2,658	1.11	4,435	4,821	109%
Replacing T12 <=40 Watt Linear ft				66	66	40	15	2,923	1.06	4,462	5,101	114%
Total										11,133	11,171	100%

The verified annual lighting hours of operation for the first line item in the table above (2,162) are fewer than the annual hours of operation used to calculate ex ante savings (2,600), while the second and third line items (2,658 and 2,923, respectively) are greater.

The quantity of the first line item in the table above (12) verified during the M&V site visit is fewer than the ex ante energy savings estimate (20). The remaining lamps were in storage for replacements.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings for installations made in office locations. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04 regarding the second and third line items in the table above, but did not account for heating and cooling interactive effects regarding the first line item.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	11,133	11,171	100%	2.12
Total		11,133	11,171	100%	2.12

¹⁰⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/27/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	272	272	32	14	1,831	1.16	10,183	10,375	102%
Total										10,183	10,375	102%

The annual lighting hours of operation verified during the M&V site visit (1,831) are fewer than the annual hours of operation used to calculate ex ante savings (2,080).

A heating and cooling interactive factor of 1.16, applicable to an electrically heated, air conditioned office facility in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 102%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	10,183	10,375	102%	1.98
Total		10,183	10,375	102%	1.98

¹⁰⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/8/17 and 7/6/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012	Lighting	SBDI	5	5	50	7	6,372	1.02	803	1,401	175%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			92	92	32	18	6,572	1.02	7,383	8,655	117%
Total										8,186	10,056	123%

The annual lighting hours of operation verified during the M&V site visit, ranging between 6,372 and 6,572, are greater than the annual hours of operation used to calculate ex ante savings (5,512). The ex ante hours are fewer than the posted store hours and also do not include employee prep and cleanup.

The ex ante savings estimate used an LM adjusted base wattage of 35W for the first line item in the above table by multiplying the provided wattage by 70%. The base lamps for these measures (MR16) are exempt from an adjusted wattage calculation.

A heating and cooling interactive factor of 1.02, applicable to an electrically heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for heating and cooling interactive effects of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 123%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

¹⁰⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	8,186	10,056	123%	1.91
Total		8,186	10,056	123%	1.91

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/6/17 and 7/7/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	18	18	138	38	8,155	1.10	8,236	16,199	197%
				2	2	138	38	8,760	1.10	915	1,934	211%
100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture				5	5	59	36	8,655	1.10	526	1,098	209%
				23	23	59	36	8,155	1.15	2,421	4,961	205%
				12	12	59	36	8,155	1.10	1,263	2,484	197%
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture				2	2	138	76	8,155	1.10	567	1,116	197%
				86	86	59	18	5,037	1.10	16,135	19,602	121%
100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture				11	11	114	36	8,155	1.10	3,926	7,722	197%
				4	4	59	18	8,155	1.10	751	1,476	197%
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture							113	113	138	38	8,169	1.10
				113	113	138	38	8,760	1.10	98,988	109,244	110%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	2	2	75	38	8,760	1.10	338	715	212%
	4			4	85	18	3,382	1.10	1,227	1,000	82%	
	4			4	75	38	3,382	1.10	677	552	82%	
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			10	10	40	25	8,155	1.18	686	1,443	210%
				9	9	32	18	8,655	1.10	577	1,203	209%
				104	104	32	18	8,155	1.10	6,663	13,103	197%
				81	81	40	25	8,155	1.15	5,560	11,394	205%
Total												201,166

The annual lighting hours of operation verified during the M&V site visit for the thirteenth and fourteenth line items in the table above (3,382) were fewer than the annual hours of operation used to calculate ex ante savings (4,576). These measures were found in one stockroom and the manager’s office. The eleventh line item matched the ex ante hours (8,760). The remaining lines in the table had hours (ranging from 5,037 – 8,760) and were greater than the ex ante savings estimate hours (4,576). The majority of the store is operational beyond regular hours for restocking and cleaning with annual hours ranging from 8,155 – 8,760.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large retail facility in St. Louis, was applied to the ex post lighting energy savings. A heating and cooling interactive factor of 1.15, applicable to a freezer space in St. Louis, was applied to the ex post lighting energy savings. A heating and cooling interactive factor of 1.18, applicable to a medium temperature refrigerator space in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 148%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	185,438	267,715	144%	50.86
Standard		15,728	29,412	187%	5.59
Total		201,166	297,127	148%	56.44

¹⁰⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/22/17 and 7/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	95	95	400	200	2,463	1.00	61,651	46,803	76%
Total										61,651	46,803	76%

The annual lighting hours of operation verified during the M&V site visit (2,463) are fewer than the annual hours of operation used to calculate ex ante savings (3,120). Installation took place in four different locations with varying hours.

No heating and cooling interactive effects were considered due to lamps being installed in an unconditioned space.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 76%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	61,651	46,803	76%	8.89
Total		61,651	46,803	76%	8.89

¹⁰⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/14/17 and 7/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	14	14	32	15	8,736	1.02	1,737	2,114	122%
				628	628	32	15	5,504	1.07	77,935	62,604	80%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	34	15	8,736	1.02	555	675	122%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			18	18	32	17	5,802	1.08	2,037	1,740	85%
				84	84	32	15	5,745	1.11	10,424	9,104	87%
				101	46	32	15	6,552	1.02	18,557	16,931	91%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			22	44	75	15	8,736	1.02	7,227	8,792	122%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			20	20	32	15	6,552	1.02	2,482	2,265	91%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			42	42	32	15	5,802	1.08	5,212	4,454	85%
				6	12	54	15	8,736	1.02	1,051	1,279	122%
			1,920	1,874	32	15	5,745	1.11	243,309	212,494	87%	
			156	156	28	15	5,802	1.08	14,804	12,650	85%	
			100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Custom	7	7	26	11	6,552	1.02	767
1	1		15	11		6,552	1.02	29	30	102%		
11	11	30	21	6,552		1.02	644	659	102%			
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Standard	3	3	29	11	6,552	1.02	383	370	96%	
Total										387,153	336,858	87%

The annual lighting hours of operation verified during the M&V site visit for the first, third, seventh, and tenth line items in the table above (8,736) are greater than the annual hours of operation used to calculate ex ante savings (7,300). The annual lighting hours of operations for the fourteenth and fifteenth line items (6,552) are roughly equal to the annual hours of operation used to calculate ex ante savings (6,500). The annual lighting hours of operation for the remaining line items, ranging between 5,504 and 6,552, are fewer than the annual hours of operation used to calculate ex ante savings (7,300).

The ex ante savings estimate used an LM adjusted base wattage of 28W for the sixteenth line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 29W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 40W incandescent lamp.

A heating and cooling interactive factor of 1.02, applicable to an electrically heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings regarding lamps installed in non-refrigerated spaces. Heating and cooling interactive factors of 1.15 and 1.12 were referenced for lighting installed in freezer and refrigerated spaces, respectively. The ex ante savings estimate did not account for heating and cooling interactive factors.

The measure name for the sixteenth line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁰⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 87%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	385,714	335,469	87%	63.73
Custom		1,439	1,389	96%	0.26
Total		387,153	336,858	87%	63.99

¹⁰⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor logger collected data between 6/12/17 and 7/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	2	2	175	60	426	1.03	124	101	81%
				2	2	175	60	426	1.03	124	101	81%
305106-Lighting-62-130 Watt Lamp or Fixture Replacing Interior HID 176-300 Watt Lamp or Fixture	3004-1			4	4	295	95	426	1.03	433	352	81%
Total										681	554	81%

The annual lighting hours of operation verified during the M&V site visit (426) are fewer than the annual hours of operation used to calculate ex ante savings (520).

A heating and cooling interactive factor of 1.03, applicable to an electrically heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 81%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	681	554	81%	0.11
Total		681	554	81%	0.11

¹¹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/21/17 and 7/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	146	146	40	15	3,797	1.11	9,734	15,326	157%
Total										9,734	15,326	157%

The annual lighting hours of operation verified during the M&V site visit (3,797) are greater than the annual hours of operation used to calculate ex ante savings (2,340). The measure was installed in multiple locations with varying usage with 34% running 24/7.

The quantity in the table above (146) verified during the M&V site visit is less than the ex ante savings quantity (160). The remaining lamps were found to be in storage to be used as replacements.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 157%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects. Lighting that is operational 24/7 was likely not accounted for in the ex ante energy savings estimate.

¹¹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	9,734	15,326	157%	2.91
Total		9,734	15,326	157%	2.91

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed ten photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/7/17 and 7/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	Standard	1	1	30	4	8,760	1.09	230	252	110%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			53	53	400	200	6,130	1.00	66,144	64,977	98%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			299	299	40	15	2,678	1.09	23,322	21,917	94%
				50	50	40	18	3,118	1.09	3,432	3,755	109%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			1	1	30	2	8,760	1.09	245	269	109%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			60	60	40	15	5,870	1.00	9,360	8,805	94%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			12	12	72	12	100	1.09	2,172	79	4%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			8	8	75	22	3,569	1.00	2,646	1,513	57%
				10	20	96	15	5,870	1.00	4,118	3,874	94%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			16	16	32	15	5,870	1.00	1,697	1,597	94%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			16	16	40	15	5,870	1.00	2,496	2,348	94%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			140	140	32	22	6,706	1.00	8,736	9,388	107%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			44	44	40	15	5,870	1.00	6,864	6,457	94%
				24	24	40	15	5,870	1.00	3,744	3,522	94%
		8	8	40	15	5,870	1.00	1,248	1,174	94%		
		152	152	40	15	5,870	1.00	23,712	22,305	94%		

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
				14	14	40	15	5,870	1.00	2,184	2,054	94%
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169		Custom	17	10	210	200	6,130	1.00	9,797	9,624	98%
100202-Lighting-Non Linear LED Fixture Replacing T12 HO Fixture				36	10	227	200	6,130	1.00	38,513	37,834	98%
Total										210,660	201,743	96%

The annual lighting hours of operation verified during the M&V site visit for the twelfth line item in the table above (6,706) is greater than the annual hours of operation used to calculate ex ante savings (6,240). The first and fifth line items have hours equal to the ex ante savings estimate hours (8,760). The annual lighting hours of operation for the remaining line items, ranging between 100 and 6,130, are fewer than the annual hours of operation used to calculate ex ante savings (ranging between 3,120 and 6,240).

The ex ante savings estimate used an LM adjusted base wattage of 70W for the seventh line item in the above table and 210W for the eighteenth line item by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis for the seventh line item to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp. The base lamps for the eighteenth line item are exempt from an adjusted wattage calculation due to an unknown incandescent type.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings for lighting installed in office locations. No heating and cooling interactive factor was applied to lighting installed in the production area since the space is unconditioned. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 96%.

¹¹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	162,350	154,285	96%	29.31
Custom		48,310	47,458	98%	9.02
Total		210,660	201,743	96%	38.32

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	40	40	53	10	3,810	1.09	3,094	7,172	232%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			-	-	40	15	-	-	2,366	-	-
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			300	300	53	10	1,145	1.09	23,478	16,351	70%
Total										28,938	23,523	81%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (3,810) are greater than the annual hours of operation used to calculate ex ante savings (3,120), while the hours of operation for the third line item (1,145¹¹³) are fewer. Approximately one third of the quantity of the first line item was installed in areas with continuous use while the remaining lamps were in in resident rooms.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first and third line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The quantity of the second line item in the above table (0) verified during the M&V site visit is fewer than the ex ante savings quantity (50). During the M&V visit, these lamps were found to be in storage.

The measure names for the first and third line items in the above table are not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

¹¹³ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned assisted living facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04 for linear lamps, but did not account for heating and cooling interactive effects for incandescent lighting.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 81%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	28,938	23,523	81%	4.47
Total		28,938	23,523	81%	4.47

¹¹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/22/17 and 7/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	60	60	53	10	6,529	1.09	11,720	18,648	159%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			168	168	32	17	3,807	1.09	11,448	10,499	92%
Total										23,168	29,147	126%

The hours of operation for the first line item in the table above (6,529) are greater than the annual hours of operation used to calculate ex ante savings (4,368), while the hours of operation for the second line item (3,807) are fewer.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned assisted living facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 126%.

¹¹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	23,168	29,147	126%	5.54
Total		23,168	29,147	126%	5.54

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/9/17 and 7/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	20	20	65	8	4,984	1.12	6,089	6,352	104%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			35	35	72	9	4,227	1.12	11,404	10,434	91%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			8	8	50	7	5,062	1.12	1,837	1,947	106%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			1	1	50	7	5,062	1.12	150	243	163%
Total										19,480	18,975	97%

The annual lighting hours of operation verified during the M&V site visit for line items three and four in the table above (5,062) are greater than the annual hours of operation used to calculate ex ante savings (4,992), while the first and second line items (4,984 and 4,227, respectively) are fewer.

The ex ante savings estimate used LM adjusted base wattages of 70W and 35W for the second and fourth line items, respectively, in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis for the second line item to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp. The base lamps for the fourth line item (MR16) are exempt from an adjusted wattage calculation.

The measure name for the second line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings for lighting installed in the restaurant interior. A heating and cooling interactive factor of 1.18 was used for lighting installed in the walk in cooler. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 97%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for a portion of the installation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	19,480	18,975	97%	3.60
Total		19,480	18,975	97%	3.60

¹¹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/19/17 and 7/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	31	31	32	17	4,181	1.03	1,765	2,009	114%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			68	68	50	12	3,527	1.03	9,809	9,419	96%
Total										11,574	11,429	99%

Primary data were used to develop estimates of annual lighting operating hours for all facility areas monitored, the estimated annual hours were comparable with those used to develop the ex ante energy savings estimate.

A heating and cooling interactive factor of 1.03, applicable to an electrically heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 99%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	11,574	11,429	99%	2.17
Total		11,574	11,429	99%	2.17

¹¹⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/27/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	344	344	32	15	2,243	1.11	12,650	14,585	115%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			4	-	32	-	2,243	1.11	277	319	115%
Total										12,927	14,884	115%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

The total ex ante annual energy savings are 12,927 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 115%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	kWh Savings
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¹¹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

	<i>End Use Category</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	<i>Gross Ex Post kW Reduction</i>
Standard	Lighting	12,927	14,884	115%	2.83
Total		12,927	14,884	115%	2.83

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor loggers collected data between 6/28/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	50	50	40	15	2,131	1.01	3,900	2,701	69%
Total										3,900	2,701	69%

The annual lighting hours of operation verified during the M&V site visit (2,131) are fewer than the annual hours of operation used to calculate ex ante savings (3,000).

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned retail facility in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹¹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 69%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	3,900	2,701	69%	0.51
Total		3,900	2,701	69%	0.51

¹¹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, interviewed facility personnel regarding equipment operation, and took photos of equipment associated with the incentive, including nameplates, statuses, and pressure gauges. ADM also deployed motor on/off loggers on the two new blowers, and left the monitoring equipment in place for approximately 46 days. All project documentation was also reviewed.

ADM obtained billing data for the electric utility meter serving the facility, which was used in the billing regression discussed in the “Analysis Results” section below. ADM also attempted to obtain production data from the customer to use in the regression and to corroborate information, but the data was not available.

Analysis Results

ADM estimated energy savings using an IPMVP¹²⁰ Option C: Whole Facility analysis methodology. The monthly pre/post billing data regression compares weather data from the St. Louis Lambert International Airport NOAA weather station and a pre/post-implementation binary flag, against monthly billing data to determine how energy consumption of the facility varied with changes in weather and the implemented measures. Heating Degree Days (HDD) were the sole weather variable accounted for in the regression, since the meter served a small office, which was assumed to contribute to/explain the upward swings in electric consumption (i.e. heating) observed during the winter months. Additional regression runs were made to verify the measure not being impacted by outside air dry bulb temperature.

HDD were calculated for each billing period and used with other variables in an electric usage regression resulting in a R² of 0.991 and adjusted R² of 0.923. From the regression, the following equation was derived and used to calculate monthly energy consumption for the pre and post configurations:

$$kWh_{monthly} = 37.24 \times HDD + 3,908.84 \times \#Days - 3,247.54 \times PP$$

Where:

- kWh_{monthly}* = Monthly kWh consumption
- HDD* = Heating Degree Days for the month
- PP* = Pre/Post-implementation binary flag
- #Days* = Number of days for the month

¹²⁰ International Performance, Measurement, and Verification Protocol. “Concepts and Options for Determining Energy and Water Savings”, Volume 1. January 2012.

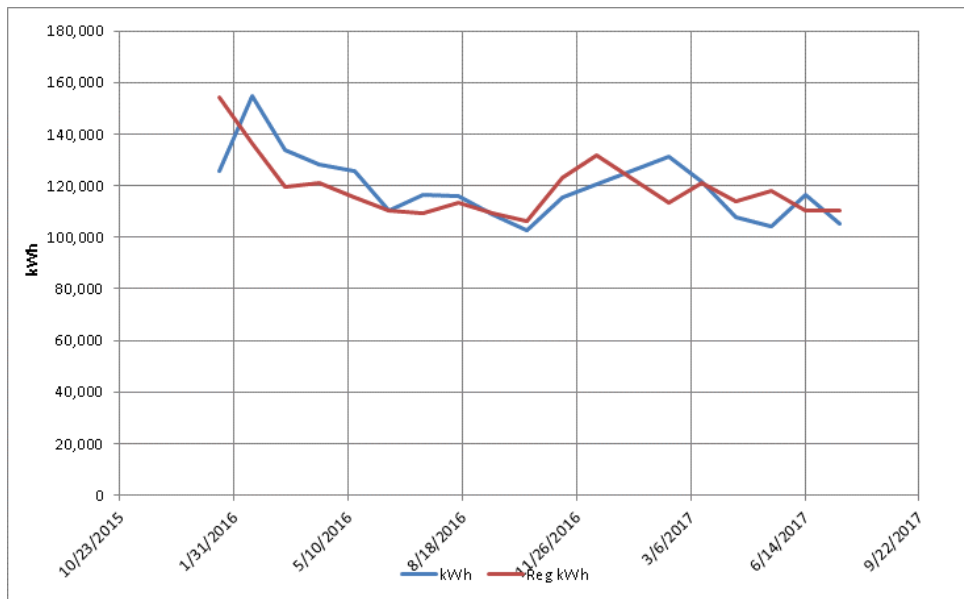
The following table presents the T-Stats for the regression variables:

Significance of kWh Regression Variables

Variable	T-Stat
HDD	3.4
#Days	24.1
PP	-0.5

Electric energy usage values were calculated using the derived regression equation and summed on a monthly basis. The following graph compares the monthly billed kWh to the calculated kWh:

Billed Vs. Regressed Monthly kWh



Annual kWh savings for the installed measures were determined by using the derived equation to calculate monthly pre/post energy consumption of the facility for Typical Meteorological Year 3 (TMY3) weather. Annual kWh savings are the difference between baseline and as-built energy consumption for the facility, and can be seen in the following table:

Monthly kWh Savings

Month	HDD	#Days	kWh		
			Baseline	As-Built	Savings
1	1,022	31	159,224	155,977	3,247
2	761	28	137,805	134,557	3,248
3	434	31	137,343	134,095	3,248
4	227	30	125,726	122,478	3,248
5	92	31	124,591	121,344	3,247
6	6	30	117,489	114,241	3,248
7	0	31	121,176	117,928	3,248
8	1	31	121,207	117,959	3,248
9	24	30	118,176	114,929	3,247
10	263	31	130,969	127,722	3,247
11	536	30	137,219	133,971	3,248
12	948	31	156,485	153,237	3,248
Total			1,587,410	1,548,438	38,972

All savings were assumed to be associated with the new Vortron low-pressure blower and the custom low-pressure air horns it serves. The new Gardner Denver IQ blower package installed for tank aeration did not come on during ADM’s monitoring period (appx. 46 days), and the electrician mentioned the pressure not being high enough. This piece of information was not altogether surprising, as the spec sheet for the new Gardner Denver blower package indicates a discharge pressure of just 5 psig, while the existing Quincy QSF100 compressor was on and outputting appx. 108 psig during ADM’s field visit. The fact that the existing compressor was on during the field visit, did not bolster confidence that it had been replaced by the two new blowers.

The factors for the low site-level realization rate of 8% cannot be fully explained, since ex ante savings calculations were not provided with the project documentation. However, the ex ante analysis did not have the hindsight of an Option C approach, as the projects had not yet been implemented. They also would have no way of knowing, in advance, about issues with equipment design and application (e.g. pressure problems for a given application), and the associated impact on energy consumption. The site was contacted again twice at the end of the program year, to provide an update regarding the tank aeration blower installation issues. The program implementor also contacted the trade ally to determine if the system was working as designed. All of these queries resulted without a positive response for the operation of the system.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Tank Aeration Blower	Compressed Air	345,665	0	0%	0
Barge Cleaning Blower		122,403	38,972	32%	4.45
Total		468,068	38,972	8%	4.45

Data Collection

The participant received Custom incentives from Ameren Missouri.

During the M&V visit, ADM staff verified measured implementation, interviewed facility personnel regarding equipment operation, and took photos of equipment associated with the incentive, including chiller trend information, as well as building mechanical plans. All project documentation was also reviewed.

ADM obtained billing data for the electric utility meter serving the facility, which was used in the billing regression discussed in the “Analysis Results” section below.

Analysis Results

ADM estimated energy savings using an IPMVP¹²¹ Option C: Whole Facility analysis methodology. The monthly pre/post billing data regression compares weather data from the St. Louis Lambert International Airport NOAA weather station and a pre/post-implementation binary flag, against monthly billing data to determine how energy consumption of the facility varied with changes in weather and the implemented measures.

Cooling Degree Days (CDD) and Heating Degree Days (HDD) were calculated for each billing period and used with other variables in an electric usage regression resulting in a R² of 0.998 and adjusted R² of 0.926. From the regression, the following equation was derived and used to calculate monthly energy consumption for the pre and post configurations:

$$kWh_{monthly} = 300.16 \times CDD - 76.30 \times CDD \times PP + 230.19 \times HDD + 5,525.64 \times \#Days$$

Where:

- $kWh_{monthly}$ = Monthly kWh consumption
- CDD = Cooling Degree Days for the month
- PP = Pre/Post-implementation binary flag
- HDD = Heating Degree Days for the month
- $\#Days$ = Number of days for the month

The following table presents the T-Stats for the regression variables:

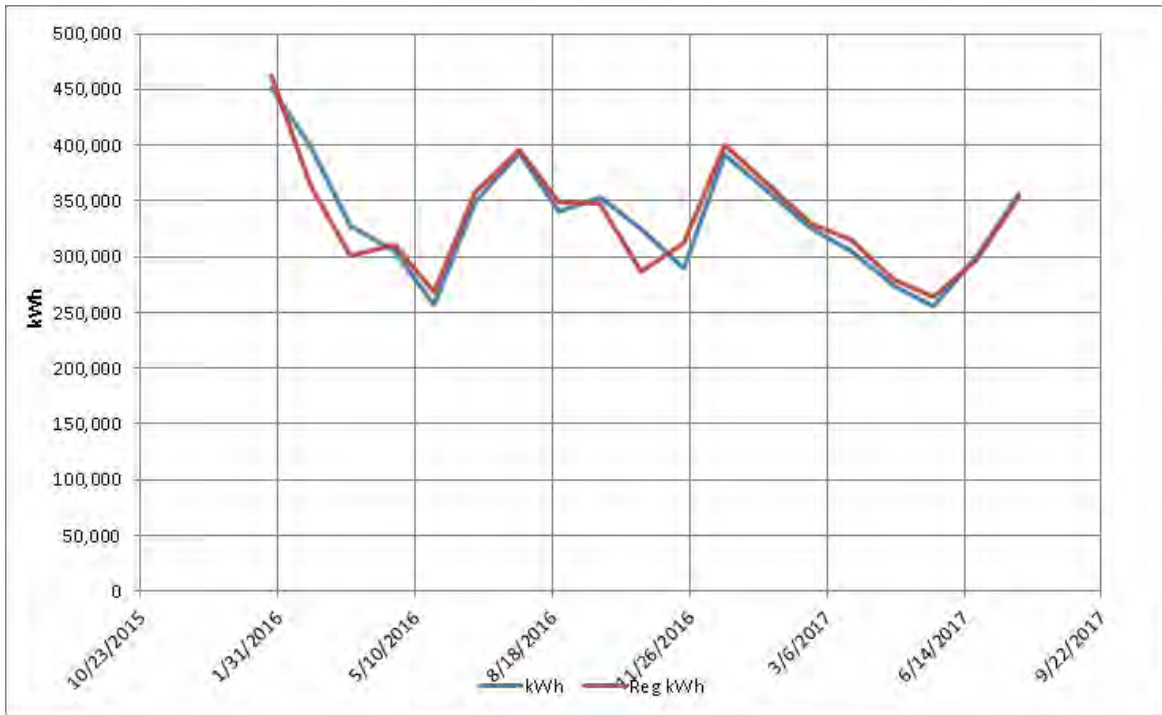
Significance of kWh Regression Variables

¹²¹ International Performance, Measurement, and Verification Protocol. “Concepts and Options for Determining Energy and Water Savings”, Volume 1. January 2012.

Variable	T-Stat
CDD	8.8
CDDxPP	-3.4
HDD	9.4
#Days	8.3

Electric energy usage values were calculated using the derived regression equation and summed on a monthly basis. The following graph compares the monthly billed kWh to the calculated kWh:

Billed Vs. Regressed Monthly kWh



Annual kWh savings for the installed measures were determined by using the derived equation to calculate monthly pre/post energy consumption of the facility for Typical Meteorological Year 3 (TMY3) weather. Annual kWh savings are the difference between baseline and as-built energy consumption for the facility, and can be seen in the following table:

Monthly kWh Savings

Month	CDD	HDD	#Days	kWh		
				Baseline	As-Built	Savings
1	3	1,269	31	464,343	464,105	238
2	9	982	28	383,564	382,875	689
3	82	646	31	344,472	338,241	6,231
4	147	406	30	303,200	292,022	11,178

Month	CDD	HDD	#Days	kWh		
				Baseline	As-Built	Savings
5	246	229	31	297,796	279,021	18,775
6	566	37	30	344,141	300,944	43,197
7	709	7	31	385,736	331,645	54,091
8	607	15	31	356,866	310,556	46,310
9	374	103	30	301,590	273,071	28,519
10	94	468	31	307,282	300,094	7,188
11	31	762	30	350,500	348,153	2,347
12	1	1,196	31	446,938	446,833	105
Total				4,286,428	4,067,560	218,868

The site-level realization rate is 93%. The ex ante analysis involved using a manufacturer's calculator (YorkCalc Program), which involved an outdoor air temperature bin analysis, and equipment data specific to the site. Fortunately, the realization rate was positive, which indicates the software used, and associated algorithms, provides an accurate estimate of energy savings. The ex post analysis used an Option C approach, based on the facility's utility meter data, which supported claimed savings.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Chiller Optimization	HVAC	235,951	218,868	93%	199.32
Total		235,951	218,868	93%	199.32

Data Collection

The participant received Custom incentives from Ameren Missouri.

During the M&V visit, ADM staff verified measured implementation, interviewed facility personnel regarding equipment operation, took photos of equipment associated with the incentive and refrigeration schedules, and obtained trend information for pertinent equipment. All project documentation was also reviewed.

ADM obtained billing data for the electric utility meter serving the facility, which was used in the billing regression discussed in the “Analysis Results” section below.

Analysis Results

ADM estimated energy savings using an IPMVP¹²² Option C: Whole Facility analysis methodology. The monthly pre/post billing data regression compares weather data from the St. Louis Lambert International Airport NOAA weather station and a pre/post-implementation binary flag, against monthly billing data to determine how energy consumption of the facility varied with changes in weather and the implemented measures.

Cooling Degree Days (CDD) were calculated for each billing period and used with other variables in an electric usage regression resulting in a R² of 0.997 and adjusted R² of 0.913. From the regression, the following equation was derived and used to calculate monthly energy consumption for the pre and post configurations:

$$kWh_{monthly} = 416.60 \times CDD - 360.97 \times CDD \times PP - 198,203.13 \times PP + 38,373.46 \times \#Days$$

Where:

- kWh_{monthly}* = Monthly kWh consumption
- CDD* = Cooling Degree Days for the month
- PP* = Pre/Post-implementation binary flag
- #Days* = Number of days for the month

The following table presents the T-Stats for the regression variables:

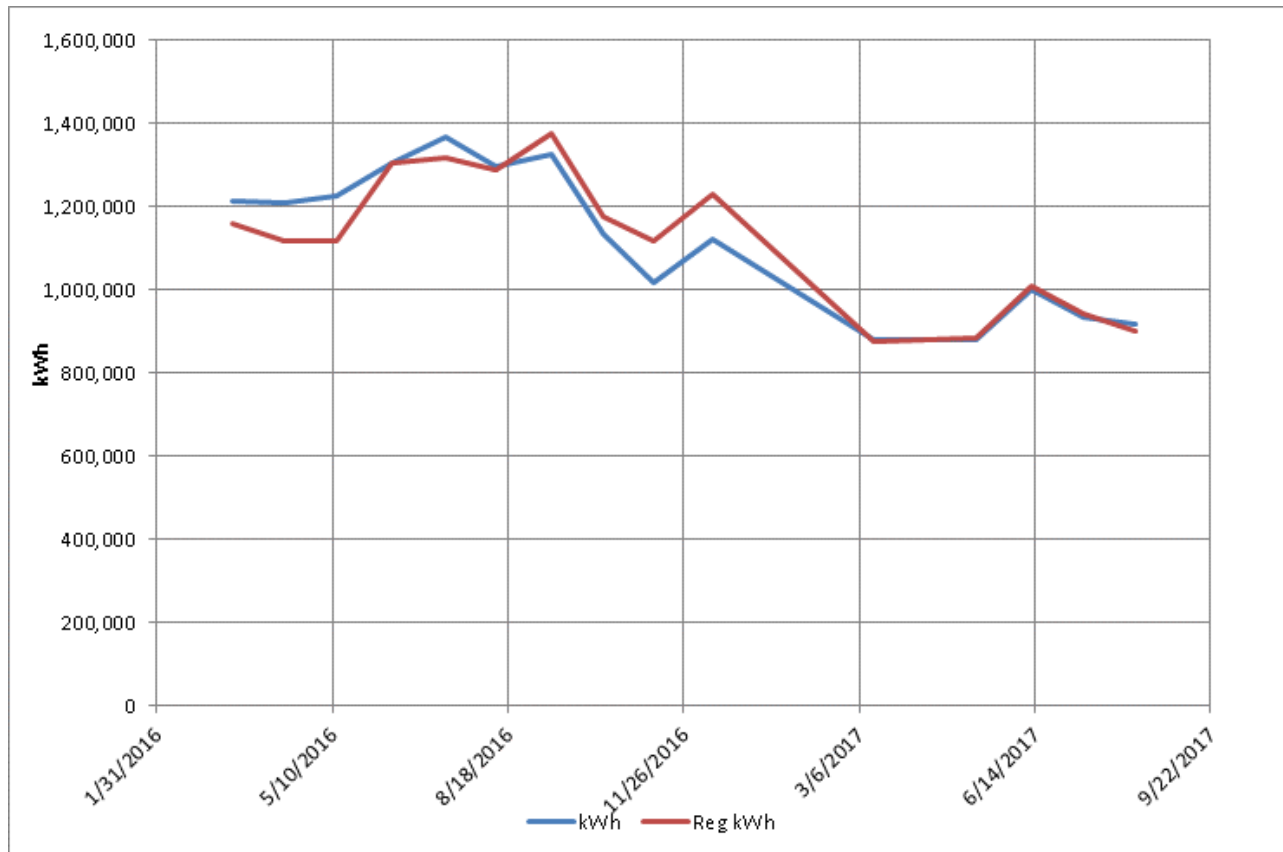
¹²² International Performance, Measurement, and Verification Protocol. “Concepts and Options for Determining Energy and Water Savings”, Volume 1. January 2012.

Significance of kWh Regression Variables

Variable	T-Stat
CDD	3.8
CDDxPP	-2.0
PP	-3.7
#Days	35

Electric energy usage values were calculated using the derived regression equation and summed on a monthly basis. The following graph compares the monthly billed kWh to the calculated kWh:

Billed Vs. Regressed Monthly kWh



Annual kWh savings for the installed measures were determined by using the derived equation to calculate monthly pre/post energy consumption of the facility for Typical Meteorological Year 3 (TMY3) weather. Annual kWh savings are the difference between baseline and as-built energy consumption for the facility, and can be seen in the following table:

Monthly kWh Savings

Month	CDD	#Days	kWh		
			Baseline	As-Built	Savings
1	0	31	1,189,612	991,379	198,233
2	1	28	1,074,769	876,296	198,473
3	33	31	1,203,516	993,236	210,280
4	69	30	1,179,758	956,814	222,944
5	108	31	1,234,518	997,375	237,143
6	369	30	1,304,963	973,533	331,430
7	493	31	1,394,995	1,018,805	376,190
8	393	31	1,353,300	1,013,237	340,063
9	200	30	1,234,402	964,111	270,291
10	35	31	1,203,950	993,293	210,657
11	7	30	1,154,276	953,411	200,865
12	0	31	1,189,577	991,374	198,203
Total			14,717,636	11,722,864	2,994,772

The savings tabled above included savings associated with the Phase I (ID# 14531) and Phase II (ID# 14689) LED lighting retrofit projects implemented in 2016. These savings were evaluated as part of ADM’s Program Year 7 evaluation, and found to total 221,458 kWh. In addition, the regression did not account for the two week plant shutdown in December. That being said, savings for this incentive were determined by applying a 96% multiplier to account for the two week plant shutdown, and then subtracting the lighting project’s impact, with resulting savings being 2,773,314 kWh (i.e. 2,994,772 kWh x 96%, minus 221,458 kWh).

Savings estimated by ADM’s regression model were significantly higher than those claimed. This positive realization rate was consistent with the customer stating that savings are exceeding expectations. The ex ante analysis involved using engineering equations in a bin analysis, informed by site-specific trending information and equipment specifications. The ex post analysis used an Option C approach, based on the facility’s utility meter data. Evidently, some of the assumptions made in the ex ante model were not accurate, and/or not normalizing for changes in production in the ex post regression, had a substantial impact on energy savings. ADM attempted to obtain production data during the sit visit, for use as an additional variable in the regression, but it was not available. For these reasons, ADM decided to average ex ante and Option C savings, in order to obtain final savings tabled below.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Refrigeration Controls and Condenser VFDs	Refrigeration	1,425,449	2,041,790	143%	277.15
Total		1,425,449	2,041,790	143%	277.15

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 07/01/17 and 07/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169	Lighting	Custom	272	272	50	10	8,440	.94	95,309	86,463	91%
Total										95,309	86,463	91%

The annual lighting hours of operation verified during the M&V site visit (8,440) are fewer than the annual hours of operation used to calculate ex ante savings (8,760). During the M&V visit, ADM staff verified that a portion of the installed lighting was in event rooms, the ex ante savings estimate only refers to 24/7 lighting installed in hallways.

A heating and cooling interactive factor of 0.94, applicable to an electrically heated, air conditioned multi-family facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹²³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 91%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	95,309	86,463	91%	16.42
Total		95,309	86,463	91%	16.42

¹²³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/30/17 and 7/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	548	548	40	17	6,561	1.12	44,181	92,440	209%
Total										44,181	92,440	209%

The annual lighting hours of operation verified during the M&V site visit (6,561) are greater than the annual hours of operation used to calculate ex ante savings (3,276). Multiple facility areas operate greater than 12 hours per day.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned full service restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did account for heating and cooling interactive effects with a factor of 1.07.

The application building type stated office. The accurate building type is food and beverage.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹²⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 209%. The ex ante savings was premised on underestimated annual lighting hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	44,181	92,440	209%	17.56
Total		44,181	92,440	209%	17.56

¹²⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	190	190	40	20	8,760	1.11	35,618	36,826	103%
Total										35,618	36,826	103%

The annual lighting hours of operation verified during the M&V site visit equal the annual hours of operation used to calculate ex ante savings (8,760).

A heating and cooling interactive factor of 1.11, applicable to an electric heated, air conditioned hotel 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.¹²⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 103%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	35,618	36,826	103%	7.00
Total		35,618	36,826	103%	7.00

¹²⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed thirteen photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/21/17 and 7/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	3	3	53	10	610	1.14	446	90	20%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			98	98	40	13	1,837	1.14	9,040	5,528	61%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			1	1	43	10	610	1.14	112	23	21%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	30	10	141	1.14	274	13	5%
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169		Custom	2	2	84	18	2,238	1.14	451	336	75%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				21	21	82	20	2,233	1.14	4,448	3,307	74%
				71	71	164	24	1,375	1.14	33,959	15,545	46%
				67	67	122	24	1,375	1.14	22,432	10,268	46%
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture				4	4	43	8	4,308	1.00	465	603	130%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1		Standard	24	24	455	110	1,063	1.14	28,288	10,015	35%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	4		4	40	18	141	1.14	301	14	5%	
Total										100,216	45,966	46%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, except for line item eight in the table above (4,308¹²⁶), the estimated annual operating hours

¹²⁶ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

are fewer than those used to develop the ex ante energy savings estimates (3,285). The lamps referred to in the eighth line item are controlled by photocells, thus operating from dusk to dawn.

The ex ante savings estimate used an adjusted base wattage of 42W for the third and ninth line items in the above table and 84W (two 42W lamps) for the fifth line item by multiplying the provided wattages by 70%. An adjusted base wattage of 43W for the third and ninth line items and 86W (two 43W lamps) were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings for all interior installations. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The measure name for the third line item in the table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹²⁷

The correct end use for the ninth line item in the table above is exterior. The ex ante energy savings estimate end use stated lighting. The measure was installed outside.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 46%. The ex ante energy savings estimate was premised on annual lighting operating hours of nine hours workdays, 365 days per year, and a heating and cooling interactive factor of 1.04.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	38,460	15,896	41%	3.02
Custom		61,756	30,069	49%	5.60
Total		100,216	45,966	46%	8.62

¹²⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/10/17 and 8/8/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	104	104	40	18	4,896	1.11	10,723	12,408	116%
				3	3	40	18	4,216	1.11	309	308	100%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			104	104	40	-	4,896	1.11	19,496	22,559	116%
				3	3	40	-	4,216	1.11	562	560	100%
Total										31,091	35,835	115%

Primary data were used to develop estimates of annual lighting operating hours. The estimated annual operating hours for the first and third line items in the table above exceeded those used to develop the ex ante energy savings estimates (4,380), while the estimated annual operating hours for the remaining line items were fewer.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 total ex ante annual energy savings are 31,091 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹²⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 115%.

¹²⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	31,091	35,835	115%	6.81
Total		31,091	35,835	115%	6.81

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, interviewing facility personnel regarding lighting operating schedules, and installed eleven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/23/17 and 7/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	56	56	40	15	2,200	1.09	4,296	3,360	78%
				246	246	40	15	2,200	1.09	18,873	14,759	78%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			9	9	72	12	2,364	1.09	1,602	1,395	87%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			20	20	40	15	1,870	1.09	1,534	1,020	66%
				8	8	40	15	2,200	1.09	614	480	78%
Total										26,919	21,015	78%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours are fewer than those used to develop the ex ante energy savings estimates (2,868). The annual lighting hours of operation used to develop the ex ante savings estimate refers to operating hours of 7:30 am to 6:00 pm, five days per week, 52 weeks per year. The ex post savings estimate accounts for lighting that does not follow typical facility operating hours.

The ex ante savings estimate used an adjusted base wattage of 70W for the third line item in the above table by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas 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 measure name for the second line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹²⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 78%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	26,919	21,015	78%	3.99
Total		26,919	21,015	78%	3.99

¹²⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/6/17 and 8/3/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	25	25	59	24	2,668	1.01	2,972	2,362	79%
				2	2	114	48	2,657	1.01	448	355	79%
				3	6	59	13	2,332	1.01	336	234	69%
100107-Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture				9	9	234	72	2,668	1.01	4,952	3,936	79%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	126	126	32	22	2,216	1.01	4,280	2,825	66%
				32	32	32	18	556	1.01	1,522	252	17%
305802-Lighting-Delamping Replacing T8 32 Watt	3084	Lighting	Standard	126	126	32	-	2,216	1.01	13,695	9,040	66%
				32	32	32	-	556	1.01	3,478	576	17%
Total										31,683	19,580	62%

The annual lighting hours of operation verified during the M&V site visit (ranging between 556 and 2,668) are fewer than the hours of operation used to calculate ex ante savings (3,266). The installation took place in multiple locations with varying usage.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned 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 1.04.

The total ex ante annual energy savings for the fifth through eight line items in the above table are 31,683 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³⁰

¹³⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 62%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	8,709	6,887	79%	1.31
Standard		22,975	12,693	55%	2.41
Total		31,683	19,580	62%	3.72

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/28/17 and 8/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	384	384	34	18	2,105	1.06	24,613	13,711	56%
Total										24,613	13,711	56%

The annual lighting hours of operation verified during the M&V site visit (2,105) are fewer than the annual hours of operation used to calculate ex ante savings (3,744). The measure was installed in multiple areas within the facility with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings. No heating and cooling interactive factor was applied to measures installed in the warehouse areas. 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.¹³¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 56%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	24,613	13,711	56%	5.21
Total		24,613	13,711	56%	5.21

¹³¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/4/17 and 7/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	72	72	34	18	4,353	1.11	4,499	5,554	123%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft				9	18	60	18	3,875	1.11	844	927	110%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3026			72	-	34	-	4,353	1.11	9,561	11,802	123%
305801-Lighting-Delamping Replacing T12 <=40 Watt				9	-	60	-	3,875	1.11	2,109	2,317	110%
Total										17,013	20,600	121%

The annual lighting hours of operation for the first and third line item above (4,353) are greater than the hours of operation used to calculate ex ante savings (3,650). The annual lighting hours of operation for the second and fourth line item above (3,875) are greater than the hours of operation used to calculate ex ante savings (3,650).

The total ex ante annual energy savings are 17,031 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate used a heating and cooling interactive factor of 1.07.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³²

¹³² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 123%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	17,013	20,600	121%	3.91
Total		17,013	20,600	121%	3.91

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/14/17 and 8/8/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	49	49	164	50	2,425	1.01	21,767	13,703	63%
				13	13	82	36	3,252	1.01	2,928	1,967	67%
Total										24,695	15,671	63%

The annual lighting hours of operation verified during the M&V site visit regarding the first line item in the table above are fewer than the annual hours of operation used to calculate ex ante savings (3,060), while the annual lighting hours of operation for the second line item are greater. The measures were installed in various locations with varying usage.

The quantities in the table above (49 and 13, respectively) verified during the M&V site visit are less than the ex ante savings quantity (60 and 20, respectively). The remaining lamps were found to be in storage during the M&V visit, and are to be used as replacement lamps.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned office 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 63%. The ex ante energy savings estimate was premised on an overestimated lamp count, annual hours of operation not dependent on area, and a higher heating and cooling factor.

¹³³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	24,695	15,671	63%	2.98
Total		24,695	15,671	63%	2.98

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/4/17 and 7/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	28	28	32	18	3,986	1.11	1,531	1,731	113%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3084			256	256	32	18	4,537	1.11	13,997	18,008	129%
305802-Lighting-Delamping Replacing T8 32 Watt	3025			28	-	32	-	3,986	1.11	3,499	3,956	113%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			256	-	32	-	4,537	1.11	31,994	41,161	129%
Total										51,021	64,855	127%

The annual lighting hours of operation verified during the M&V site visit (3,986 and 4,537) are greater than the hours of operation used to calculate ex ante savings (3,650).

The final application associated with this project contained two line items which, in the table above, are further disaggregated into four line items. The total ex ante annual energy savings are 51,021 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly distributed across measures. The ex ante energy savings of the first two line items in the above table (1,531 kWh and 13,997 kWh, respectively) are fewer than the values that should have been calculated, based on the assumptions underlying the ex ante savings analysis (1,760 kWh and 16,090 kWh, respectively). On the other hand, the ex ante energy savings of the last two line items in the above table (3,499 and 31,994, respectively) are greater than the values that should have been calculated, based on the assumptions underlying the ex ante savings analysis (3,270 and 29,901, respectively). ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate used a heating and cooling interactive factor of 1.07.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 127%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and a lower heating and cooling interactive factor.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	51,021	64,855	127%	12.32
Total		51,021	64,855	127%	12.32

¹³⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/7/17 and 8/3/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	18	18	65	11	1,873	1.11	3,245	2,013	62%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			286	286	32	14	2,701	1.11	17,186	15,377	89%
Total										20,431	17,390	85%

The annual lighting hours of operation verified during the M&V site visit, ranging between 1,879 and 2,709, are fewer than the annual hours of operation used to calculate ex ante savings (3,120). A portion of the lighting was installed in locations (such as storage and conference rooms) that receive less usage than typical office hours.

The application indicated that the incandescent BR/R lamps were replaced with LED BR/R lamps, but LED PAR lamps were actually installed.

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

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 85%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and an underestimated heating and cooling factor.

¹³⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	20,431	17,390	85%	3.30
Total		20,431	17,390	85%	3.30

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed twelve photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/28/17 and 8/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID	3005-1	Lighting	Standard	2	2	445	95	1,128	1.09	2,462	865	35%
301-500 Watt Lamp or Fixture				2	2	445	150	5,100	1.09	2,074	3,294	159%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			8	8	53	13	6,186	1.09	1,100	2,146	195%
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169		Custom	69	69	114	40	2,524	1.09	18,671	14,109	76%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009		Standard	6	6	53	13	1,611	1.09	825	419	51%
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169		Custom	22	22	114	40	2,538	1.09	5,953	4,523	76%
		8		8	114	40	1,128	1.09	2,165	731	34%	
		13		13	114	30	1,128	1.09	3,993	1,349	34%	
Total										37,243	27,436	74%

The average annual lighting hours of operation for the second and third line items in the table above (5,100 and 6,186, respectively) are greater than the hours of operation used to calculate ex ante savings (3,516), while the annual lighting hours for the remaining line items are fewer. The measures were installed in multiple locations with varying usage.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the third and fifth line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04 for line items four, six, seven and eight in the table above, and did not account for heating and cooling interactive effects for the remaining line items. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the first three line items. On the Microsoft Excel application form, the

applicant cut and pasted the location name, and a technical error in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The measure name for the third and fifth line items in the first table above are not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 74%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours by not accounting for lighting installed in areas which do not follow the typical office operating schedule, such as storage rooms. The ex ante savings estimate also did not account for heating and cooling interactive effects for all installed lighting.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	6,461	6,724	104%	1.28
Custom		30,782	20,712	67%	3.93
Total		37,243	27,436	74%	5.21

¹³⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/31/17 and 8/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture	3005-1	Lighting	Standard	4	4	400	220	2,477	1.10	1,572	1,955	124%
Replacing Interior HID 301-500 Watt Lamp or Fixture				63	63	400	160	2,477	1.10	33,004	41,051	124%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft)	3026			24	24	34	15	8,760	1.10	995	4,378	440%
Total										35,571	47,384	133%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (2,040). In addition, the lighting referred to in the third line item in the table above operates 24/7.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned warehouse 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.¹³⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 133%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and did not account for lighting that is operational 24/7.

¹³⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	35,571	47,384	133%	9.00
Total		35,571	47,384	133%	9.00

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/17/17 and 8/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	497	497	40	14	2,572	1.05	32,549	35,004	108%
				4	4	40	15	2,801	1.00	1,377	280	20%
Total										33,926	35,284	104%

The annual lighting hours of operation verified during the M&V site visit (ranging between 2,572 and 2,801) are greater than the annual hours of operation used to calculate ex ante savings (2,340).

The quantities in the above table (497 and 4, respectively) verified during the M&V site visit are fewer than the ex ante savings quantity (500 and 22, respectively). The remaining lamps were found to be in storage during the M&V visit. Facility personnel expressed that the remaining 40W lamps will be installed in a new building when construction is completed.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings regarding lamps installed in office locations. No heating and cooling interactive factor was referenced regarding lamps installed in shop locations since these spaces have no air conditioning and gas heating. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 104%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hour and heating and cooling interactive effects.

¹³⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	33,926	35,284	104%	6.70
Total		33,926	35,284	104%	6.70

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/11/17 and 8/1/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	286	286	40	15	2,820	1.09	43,160	22,048	51%
Total										43,160	22,048	51%

The annual lighting hours of operation verified during the M&V site visit (2,820) are fewer than the annual hours of operation used to calculate ex ante savings (5,000). The ex ante savings estimate did not account for lighting installed in locations that do not follow typical office hours.

The quantity (286) verified during the M&V site visit is fewer than the ex ante savings quantity (332). The remaining lamps were found to be in storage during the M&V visit and are planned to be installed at a later date.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹³⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 51%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours, a greater quantity than installed, and underestimated heating and cooling interactive effects.

¹³⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	43,160	22,048	51%	4.19
Total		43,160	22,048	51%	4.19

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/7/17 and 8/3/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate			
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	3	3	43	10	782	1.15	362	90	25%			
100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture	1169		Custom		2	2	59	24	2,290	1.00	260	160	62%		
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture							6	12	164	22	2,732	1.15	2,680	2,258	84%
							10	20	123	24	2,290	1.00	2,792	1,717	61%
							1	1	82	24	2,290	1.00	216	133	61%
							1	1	82	22	2,732	1.15	223	188	84%
							29	58	164	22	2,890	1.15	12,956	11,544	89%
						11	11	82	24	3,005	1.00	2,375	1,917	81%	
100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture							1	2	114	24	3,005	1.00	245	198	81%
							3	3	59	24	3,005	1.00	391	315	81%
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture							5	10	164	24	3,005	1.00	2,159	1,743	81%
							7	14	164	22	163	1.15	3,127	158	5%
							2	4	164	24	2,941	1.00	864	682	79%
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture							5	5	16	9	782	1.15	130	31	24%
100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture				2	4	114	24	2,941	1.00	491	388	79%			
Total										29,273	21,524	74%			

The annual lighting hours of operation verified during the M&V site visit, ranging between 163 and 3,005, are fewer than the annual hours of operation used to calculate ex ante savings (3,723). Multiple installation locations with varying hours.

The ex ante savings estimate used an LM adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.15, applicable to an electrically heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings for lighting installed in office locations. No heating and cooling interactive factor was applied to lighting installed in warehouse locations since the space is unconditioned. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 74%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	362	90	25%	0.02
Custom		28,911	21,433	74%	4.07
Total		29,273	21,524	74%	4.09

¹⁴⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/13/17 and 8/10/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	1	1	43	9	1,019	1.01	76	35	46%
				5	5	29	9	3,549	1.01	217	359	165%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	455	120	1,902	1.00	3,066	2,549	83%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			136	136	28	18	4,054	1.01	3,112	5,578	179%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			16	16	30	18	1,902	1.00	421	350	83%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			136	-	28	-	4,054	1.01	8,712	15,619	179%
Total											15,602	24,491

The annual lighting hours of operation verified during the M&V site visit for the second, fourth, and sixth line items in the above table (3,549, 4,054, and 4,054, respectively) are greater than the hours of operation used to calculate ex ante savings (2,200) while the remaining line items were fewer (1,019 – 1,902).

The total ex ante annual energy savings for the fourth and sixth line items in the above table are 15,602 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The ex ante savings estimate referenced an adjusted base wattage of 42W for the first line item in the above table and 28W for the second line item by multiplying the provided wattage by 70%. An adjusted base wattage of 43W and 28W was applied in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W and 40W incandescent lamp.

The measure name for the first two line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.01, applicable to a gas heated, air conditioned office 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 157%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	15,604	24,491	157%	4.65
Total		15,604	24,491	157%	4.65

¹⁴¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/17/17 and 8/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	126	126	34	18	3,118	1.01	7,291	6,324	87%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			126	-	34	-	3,118	1.01	15,494	13,438	87%
Total										22,785	19,762	87%

The annual lighting hours of operation verified during the M&V site visit (3,117) are fewer than the annual hours of operation used to calculate ex ante savings (3,380). The measures were installed/removed from multiple areas within the facility with varying usage.

The total ex ante annual energy savings are 22,785 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

A heating and cooling interactive factor of 1.01, applicable to electric heated, air conditioned small 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.¹⁴²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 87%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

¹⁴² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	22,785	19,762	87%	3.75
Total		22,785	19,762	87%	3.75

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/3/17 and 7/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	108	108	56	40	3,397	1.09	15,013	6,427	43%
72				72	82	50	3,397	1.09	20,017	8,569	43%	
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				589	589	164	50	3,733	1.09	294,099	273,476	93%
Total										329,129	288,472	88%

The annual lighting hours of operation verified during the M&V site visit, ranging between 3,397 and 3,733, are fewer than the annual hours of operation used to calculate ex ante savings (ranging between 4,380 and 8,688). The multiple installation areas have usage that varies.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings regarding lighting installed in office locations. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 88%. The ex ante energy savings estimate was premised on overestimated annual operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	329,129	288,472	88%	54.80
Total		329,129	288,472	88%	54.80

¹⁴³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/10/17 and 8/8/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	2	1	82	45	4,663	1.11	619	614	99%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				29	16	455	165	3,933	1.00	54,886	41,508	76%
				30	14	455	165	3,933	1.00	58,968	44,595	76%
				24	6	82	95	3,915	1.00	7,270	5,472	75%
				3	1	82	95	4,653	1.11	786	777	99%
				12	4	82	95	4,578	1.00	3,141	2,765	88%
				1	1	138	45	4,587	1.00	484	427	88%
				2	1	82	45	4,653	1.11	619	614	99%
				31	31	164	36	1,916	1.11	20,634	8,409	41%
Total												

The annual lighting hours of operation verified during the M&V site visit, ranging between 1,916 and 4,653, are fewer than the annual hours of operation used to calculate ex ante savings (5,000). The installations took place in multiple locations with varying usage.

A heating and cooling interactive factor of 1.11 applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings for lighting installed in office locations. No heating and cooling interactive factor was applied to lighting installed in warehouse locations since the space is unconditioned. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 71%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and a lower heating and cooling interactive factor for the office areas.

¹⁴⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	147,406	105,178	71%	19.98
Total		147,406	105,178	71%	19.98

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/13/17 and 8/3/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	119	119	164	56	3,419	1.09	67,249	47,931	71%
				29	29	164	35	3,577	1.09	19,633	14,639	75%
Total										86,882	62,571	72%

The annual lighting hours of operation verified during the M&V site visit, ranging between 3,419 and 3,577, are fewer than the annual hours of operation used to calculate ex ante savings (5,252).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 72%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	86,882	62,571	72%	11.89
Total		86,882	62,571	72%	11.89

¹⁴⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/27/17 and 8/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	680	680	53	10	1,145	1.11	33,091	37,038	112%
				36	36	53	10	1,145	1.11	1,752	1,961	112%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			19	19	53	14	8,760	1.11	6,390	7,181	112%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			56	56	40	15	4,465	1.11	13,087	6,915	53%
Total										54,320	53,096	98%

The annual lighting hours of operation verified during the M&V site visit for the first and second line item in the table above (1,145¹⁴⁶), equals the annual lighting hours of operation applied to ex ante savings. The third line item in the table above has hours of operation (8,760) greater than the ex ante energy savings estimate (8,746), while the fourth line item is lower (4,465). The fourth measure was installed in multiple locations with varying usage.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first three line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was applied in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W.

A heating and cooling interactive factor of 1.11, applicable to an electric heated, air conditioned lodging building in St. Louis, was applied to the ex post lighting energy savings. For the first three line items in the table above, the ex ante savings estimate did not account for heating and cooling interactive factors. For the last line item, ex ante savings estimate accounted for a heating and cooling factor of 1.07. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the first three line items. On the Microsoft Excel application form, the

¹⁴⁶ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

applicant cut and pasted the location name, and a technical error in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The measure name for the first line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	54,320	53,096	98%	10.09
Total		54,320	53,096	98%	10.09

¹⁴⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor logger collected data between 7/17/17 and 8/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	49	49	400	200	2,299	1.00	25,480	22,530	88%
Total										25,480	22,530	88%

The annual lighting hours of operation verified during the M&V site visit (2,299) are fewer than the annual hours of operation used to calculate ex ante savings (2,500).

A heating and cooling interactive factor was not applied for gas heated, no electric cooling industrial building in St. Louis. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 88%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	25,480	22,530	88%	4.28
Total		25,480	22,530	88%	4.28

¹⁴⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/27/2017 and 8/22/2017.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	24	24	32	15	4,269	1.10	2,027	1,922	95%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			28	28	75	43	4,782	1.10	4,450	4,729	106%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			6	6	40	15	8,760	1.10	745	1,450	195%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			300	300	59	43	4,937	1.10	23,842	26,155	110%
Total										31,064	34,257	110%

The annual hours of operation verified during the M&V site visit for the first line item in the table above (4,269) are fewer than the annual hours of operation used to calculate ex ante savings (4,776), while the remaining line items are greater (4,782, 8,760, and 4,937, respectively). The measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁴⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 110%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	

¹⁴⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Standard	Lighting	31,064	34,257	110%	6.51
Total		31,064	34,257	110%	6.51

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, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/17/17 and 8/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	64	64	65	12	1,590	1.09	15,282	5,903	39%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			230	230	40	12	2,730	1.09	32,704	19,252	59%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			4	4	17	9	2,995	1.09	163	105	65%
				54	54	31	13	1,849	1.09	4,936	1,967	40%
				361	361	32	14	3,163	1.09	32,999	22,502	68%
Total									86,084	49,730	58%	

The ex ante savings estimate was premised upon 4,332 annual lighting hours of operation for the first line item in the table above, and 4,883 annual lighting hours of operation for the remaining line items. The annual lighting hours of operation verified during the M&V visit are lower for all line items.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁵⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 58%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours by not accounting for lighting installed in locations which do not follow the typical office hours, such as storage and conference rooms.

¹⁵⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	86,084	49,730	58%	9.45
Total		86,084	49,730	58%	9.45

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	64	64	75	12	1,145	1.17	35,320	5,402	15%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			260	260	43	9	3,078	1.17	9,824	31,840	324%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			28	28	53	10	1,145	1.17	1,363	1,613	118%
Total										46,507	38,855	84%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (1,145¹⁵¹) are fewer than the annual hours of operation used to calculate ex ante savings (8,760), while the annual lighting hours of operation for the second line item (3,078) are greater than the annual hours of operation used to calculate ex ante savings (1,145). The annual lighting hours of operation for the third line item are accurate.

The ex ante savings estimate used an LM adjusted base wattage of 42W and 52.5W for the second and third line item in the table above, respectively, by multiplying the provided wattage by 70%. Adjusted base wattages of 43W and 53W were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W and 75W incandescent lamp.

A heating and cooling interactive factor of 1.17, applicable to an electrically heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

¹⁵¹ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

The measure names for the second and third line items in the first table above are not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁵²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 84%. The ex ante savings estimate mistakenly accounted for the LED BR30 lamps to be installed in 24/7 locations. During the M&V site visit, ADM staff verified that LED A-lines were installed in the lobby (24/7 operation), while LED BR30 lamps were installed in guest room restrooms.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	46,507	38,855	84%	7.38
Total		46,507	38,855	84%	7.38

¹⁵² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/3/17 and 9/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	136	136	40	18	4,407	1.11	14,022	14,605	104%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			136	136	40	-	4,407	1.11	25,495	26,555	104%
Total										39,517	41,161	104%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (4,380).

A heating and cooling interactive factor of 1.11, applicable to a gas 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 total ex ante annual energy savings are 41,161 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁵³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 104%.

¹⁵³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	39,517	41,161	104%	7.82
Total		39,517	41,161	104%	7.82

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	25	25	175	80	8,760	1.00	22,261	20,805	93%
Total										22,261	20,805	93%

The annual lighting hours of operation verified during the M&V site visit are equal to the annual hours of operation used to calculate ex ante savings.

The ex post savings analysis did not apply a heating and cooling interactive factor due to the site not being electrically heated or cooled. 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.¹⁵⁴

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

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	22,261	20,805	93%	3.95
Total		22,261	20,805	93%	3.95

¹⁵⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/3/17 and 9/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012	Lighting	Standard	12	12	50	7	3,676	1.01	1,115	1,908	171%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			17	17	90	18	3,987	1.01	4,060	4,909	121%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			88	88	40	18	3,937	1.01	11,186	7,667	69%
				2	2	40	18	4,524	1.01	254	200	79%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			88	88	40	-	3,937	1.01	20,339	13,940	69%
Total										36,954	28,626	77%

The annual lighting hours of operation verified during the M&V site visit regarding the first two line items in the table above (3,676 and 3,987, respectively) are greater than the annual hours of operation used to calculate ex ante savings (3,100), while the annual lighting hours of operation for the remaining line items (3,937 and 4,524) are fewer than the annual hours of operation used to calculate ex ante savings (5,400). Measures were installed in multiple locations with varying usage.

The ex ante savings estimate used an LM adjusted base wattage of 35W for the first line item in the above table by multiplying the provided wattage by 70%. The base lamps for these measures (MR16) are exempt from an adjusted wattage calculation.

A heating and cooling interactive factor of 1.01, applicable to an electrically 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 total ex ante annual energy savings for the third and fifth line items in the above table are 31,525 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁵⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 77%. The ex ante energy savings estimate was premised on overestimated annual operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	36,954	28,626	77%	5.44
Total		36,954	28,626	77%	5.44

¹⁵⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours cite guest room operation.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	400	400	40	20	1,145	0.99	41,129	9,074	22%
Total										41,129	9,074	22%

The annual lighting hours of operation verified during the M&V site visit (1,145¹⁵⁶) are less than the annual hours of operation used to calculate ex ante savings (4,368). These lamps were installed in guest rooms.

A heating and cooling interactive factor of .99, applicable to a gas heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for heating and cooling interactive factor of 1.07.

The quantity (400) verified during the M&V site visit is less than the ex ante savings quantity (440). The remaining lamps were found in storage and intended to be used as replacements.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁵⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 22%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

¹⁵⁶ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

¹⁵⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	41,129	9,074	22%	1.72
Total		41,129	9,074	22%	1.72

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 7/25/17 and 8/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	10	10	465	150	3,075	1.00	10,169	9,687	95%
				15	15	465	150	3,075	1.00	16,270	14,531	89%
Total										26,439	24,218	92%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,017).

The quantity of the second line item in the table above (15) verified during the M&V site visit is less than the ex ante savings quantity (16). One lamp was removed due to excessive lumen levels and stored as a replacement lamp.

No heating and cooling interactive effects were considered due to no electrical space conditioning. 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.¹⁵⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 92%. The ex ante energy savings estimate was premised on an overestimated heating and cooling interactive factor.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	26,439	24,218	92%	4.60
Total		26,439	24,218	92%	4.60

¹⁵⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/4/17 and 9/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305106-Lighting-62-130 Watt Lamp or Fixture Replacing Interior HID 176-300 Watt Lamp or Fixture	3004-1	Lighting	Standard	13	13	295	80	4,231	1.01	9,842	11,897	121%
				6	6	295	80	3,894	1.01	5,300	5,053	95%
Total										15,142	16,951	112%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,386).

The quantity of the second line item in the table above (6) verified during the M&V site visit is less than the ex ante savings quantity (7). The extra lamp was in storage.

A heating and cooling interactive factor of 1.01, applicable to an electrically 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁵⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 112%. The ex ante energy savings estimate was premised on underestimated annual operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	15,142	16,951	112%	3.22
Total		15,142	16,951	112%	3.22

¹⁵⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/4/17 and 9/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	30	30	75	7	4,616	1.12	7,833	10,528	134%
				19	19	90	8	4,424	1.12	5,982	7,705	129%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			14	14	84	11	4,494	1.12	3,924	5,146	131%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			25	25	53	9	4,616	1.12	4,176	5,677	136%
Total										21,915	29,055	133%

The annual lighting hours of operation verified during the M&V site visit (ranging between 4,424 and 4,616) are greater than the hours of operation used to calculate ex ante savings (3,692).

The ex ante savings estimate used an LM adjusted base wattage of 84W for the third line item in the above table and 52.5W for the fourth line item by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis for the fourth line item to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant 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 1.04.

The measure name for the fourth line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶⁰

¹⁶⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 133%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	21,915	29,055	133%	5.52
Total		21,915	29,055	133%	5.52

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 8/4/17 and 9/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016777-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,020	1,020	32	15	5,153	1.11	89,086	98,956	111%
Total										89,086	98,956	111%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (4,940).

A heating and cooling interactive factor of 1.11, applicable to a gas 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 111%. The ex ante energy savings estimate was premised on underestimated annual operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	89,086	98,956	111%	18.80
Total		89,086	98,956	111%	18.80

¹⁶¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/26/17 and 8/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016711-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	420	420	40	18	6,685	1.09	84,180	67,598	80%
016711-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft				54	54	30	12	6,674	1.09	8,856	7,098	80%
Total										93,036	74,696	80%

The ex ante savings estimated for the lighting equipment is based on an estimate of 8,760 annual lighting operating hours. As shown in the table above, the ex post estimate of lighting operating hours varied by line item, and were fewer than the operating hours applied to the ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 80%. The ex ante energy savings estimate was premised on overestimated annual operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	93,036	74,696	80%	14.19
Total		93,036	74,696	80%	14.19

¹⁶² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed thirteen photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/25/17 and 8/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017734-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	14	14	32	18	3,963	1.07	546	834	153%
017734-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			156	156	40	18	3,442	1.10	11,553	13,036	113%
				284	284	40	18	5,175	1.10	36,602	35,685	97%
				32	32	40	18	3,553	1.00	1,507	2,501	166%
				92	92	40	18	4,801	1.10	6,757	10,723	159%
				112	112	40	18	4,801	1.10	9,117	13,055	143%
				28	28	40	18	3,192	1.10	1,714	2,170	127%
				56	56	40	18	4,492	1.10	3,427	6,107	178%
				48	48	40	18	4,435	1.10	6,186	5,169	84%
				84	84	40	18	2,752	1.10	5,932	5,613	95%
				16	16	40	18	5,179	1.10	2,062	2,012	98%
28	28			40	18	5,359	1.10	3,609	3,643	101%		
017734-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			4	4	72	15	1,436	1.10	430	361	84%
				4	4	72	15	4,801	1.10	430	1,208	281%
				10	10	72	15	409	1.00	1,074	233	22%
017734-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			5	5	43	7	4,801	1.10	1,025	954	93%
				11	11	43	11	5,179	1.10	2,030	2,043	101%
				7	7	43	11	4,801	1.10	816	1,205	148%
		15	15	43	11	2,752	1.10	1,517	1,481	98%		
5	5	43	11	4,422	1.10	923	793	86%				
Total										97,256	108,828	112%

The ex ante savings estimate was premised upon annual lighting operating hours ranging between 1,825 and 5,475. The annual lighting hours of operation used to calculate the ex post savings estimate are greater for line items one, two, four through eight, fourteen, and eighteen in the table above, while the annual operating hours for the remaining line items are fewer.

The ex ante savings estimate used an LM adjusted base wattage of 70W for the thirteenth through fifteenth line items in the above table and 42W for the sixteenth through twentieth line items by multiplying the provided wattage by 70%. Adjusted base wattages of 72W and 43W were used in the

ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W and 60W incandescent lamp.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. No heating and cooling interactive effects were considered for lighting installed in warehouse locations due to no electrical space conditioning. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The measure names for the thirteenth through twentieth line items in the table above are not accurate. The baseline lamps were Incandescent and were replaced with LED lamps. During the M&V visit, ADM staff verified that the installed lighting referred to in line items thirteen, fifteen, and seventeen through twenty are LED BR30 lamps instead of LED A-line lamps.

The final application listed the building type as lodging. The ex post savings analysis used retail to accurately represent the building type.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 112%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	97,256	108,828	112%	20.67
Total		97,256	108,828	112%	20.67

¹⁶³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 8/9/17 and 9/7/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016669-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	192	192	53	13	1,700	1.17	9,031	15,280	169%
				90	90	53	13	8,760	1.17	32,387	36,902	114%
016669-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			460	460	43	10	1,145	1.17	17,802	20,647	116%
016828-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			323	323	53	13	8,760	1.17	111,458	132,438	119%
017061-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			275	275	53	13	7,938	1.17	98,962	102,180	103%
Total										269,640	307,447	114%

The annual lighting hours of operation verified during the M&V site visit for the first and fourth line items in the table above (1,700 and 8,760, respectively) are greater than the annual hours of operation used to calculate ex ante savings (1,145 and 8,736, respectively), while the annual lighting hours of operation for the last line item (7,938) are fewer than the annual hours used to calculate ex ante savings (8,760). The remaining line items have accurate annual lighting hours of operation estimates (1145¹⁶⁴ and 8,760).

The ex ante savings estimate used an LM adjusted base wattage of 42W for the third line item in the above table and 52.5W for the remaining line items by multiplying the provided wattage by 70%. Adjusted base wattages of 43W and 53W were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W and 75W incandescent lamp.

A heating and cooling interactive factor of 1.17, applicable to an electrically heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings

¹⁶⁴ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

estimate did not account for heating and cooling interactive effects regarding the fourth line item in the table above, while the remaining line items accounted for a heating and cooling factor of 1.04.

The measure name for the third line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 114%. The ex ante energy savings estimate was premised on underestimated annual operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	269,640	307,447	114%	58.40
Total		269,640	307,447	114%	58.40

¹⁶⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
014627-200102-Lighting-Linear LED Lamp <=22 Watt Lamp Replacing T8 32 Watt Lamp	3025	Lighting	Standard	738	738	32	18	8,760	1.00	90,508	90,508	100%
				110	110	32	18	8,760	1.00	13,490	13,490	100%
014627-100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture		Miscellaneous	Custom	176	176	32	18	7,647	1.00	21,585	18,842	87%
014627-200102-Lighting-Linear LED Lamp <=22 Watt Lamp Replacing T8 32 Watt Lamp	1169	Lighting	Standard	28	28	126	40	8,760	1.00	21,094	21,094	100%
014627-100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture		Miscellaneous	Custom	17	17	126	40	8,416	1.00	6,404	12,305	192%
014627-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				9	9	86	39	8,760	1.00	3,705	3,705	100%
014627-100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture				9	9	215	62	4,308	1.00	6,031	5,932	98%
014627-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				1	1	295	45	8,760	1.00	2,190	2,190	100%
014627-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				1	1	215	62	8,760	1.00	1,340	1,340	100%
Total												

The annual lighting hours of operation verified during the M&V site visit for the third and seventh line items above (7,647 and 4,308¹⁶⁶, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (8,760 and 4380, respectively). For the fifth line item the annual lighting hours of operation (8,416) are greater than the hours of operation used to calculate ex ante savings (4,380), the majority of these lamps have continuous usage.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 102%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	125,583	122,841	98%	23.76
Custom	Miscellaneous	40,764	46,566	114%	6.11
Total		166,348	169,407	102%	29.88

¹⁶⁶ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

¹⁶⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
014620-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	321	321	215	84	8,760	1.00	368,366	368,366	100%
014620-100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture				49	49	114	47	8,760	1.00	28,673	28,673	100%
014620-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				5	5	455	84	8,760	1.00	16,263	16,263	100%
Total										413,302	413,302	100%

The annual lighting hours of operation verified during the M&V site visit (8,760) are equal to the annual hours of operation used to calculate ex ante savings (8,760).

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	413,302	413,302	100%	78.51
Total		413,302	413,302	100%	78.51

¹⁶⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
014560-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Misc.	Custom	465	465	455	216	8,760	1.00	973,543	973,543	100%
Total										973,543	973,543	100%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas, the estimated annual operating hours equaled those used to develop the ex ante energy savings estimate.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁶⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Miscellaneous	973,543	973,543	100%	134.29
Total		973,543	973,543	100%	134.29

¹⁶⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016916-100213- Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	56	56	56	21	8,760	1.09	17,969	18,907	105%
				168	168	56	18	8,760	1.09	58,926	62,003	105%
				10	10	56	13	8,760	1.09	3,881	4,084	105%
016916-200909- Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007		Standard	20	20	65	12	8,760	1.09	9,730	10,238	105%
Total										90,506	95,232	105%

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated that the four line items above are on 24/7/365 which correspond with the ex ante energy savings estimate.

A heating and cooling interactive factor of 1.09 applicable to a gas heated, air conditioned nursing home 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 105%. The ex ante energy savings estimate was premised on underestimated heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	80,776	84,994	105%	16.15
Standard		9,730	10,238	105%	1.94
Total		90,506	95,232	105%	18.09

¹⁷⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewed facility personnel regarding lighting operating schedules, and installed fourteen photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/7/2017 and 9/7/2017.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
018096-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	140	140	43	5	3,884	1.09	15,750	22,908	145%
018096-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			789	789	32	14	5,414	1.09	72,911	84,138	115%
018096-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			152	152	40	13	5,095	1.09	19,181	22,881	119%
Total										107,842	129,927	120%

The annual lighting hours of operation (ranging from 3,884 – 5,414)) verified during the M&V site visit are greater than the operating hours applied to ex ante savings (ranging from 3,000 – 4,368).

The ex ante savings estimate used an adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was applied in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The quantity of the second line item in the first table above (789) verified during the M&V site visit is less than the ex ante savings quantity (1040). ADM staff verified that 251 lamps were still in storage.

The efficient wattage (14) for the second line item is fewer than the intended efficient wattage (17) listed on the application. The lower wattage lamps were delivered and accepted by the client.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home 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 for the second and third line items in the above table and 1.00 for the first line item. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the first three line items. On the Microsoft Excel application form, the applicant cut and pasted the location name, and a technical error

in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The measure name for the first line item in the first table above is not accurate. The baseline lamps were Incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 120%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	107,842	129,927	120%	24.68
Total		107,842	129,927	120%	24.68

¹⁷¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, and verified annual lighting operating hours by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016761-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	59	59	45	8	5,730	1.12	9,710	13,909	143%
016761-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			14	14	29	9	5,730	1.12	1,190	1,794	151%
Total										10,900	15,702	144%

The annual lighting hours of operation verified during the M&V site visit (5,730) are greater than the annual hours of operation used to calculate ex ante savings (4,472). The client confirmed that all lighting is turned on throughout the facility 4 hours prior to opening and remains on after the stated restaurant hours for cleaning.

The ex ante savings estimate used LM adjusted base wattages of 44.8W and 28W for the first and second line items in the above table respectively by multiplying the provided wattage by 70%. The ex post savings estimate used an adjusted base wattage of 29W for the second line item to meet EISA 2007 requirements for a 40W incandescent lamp.

The measure names in the table above are not accurate. The baseline lamps were incandescent BR/R and A-line and were replaced with LED BR/R and A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The verified peak coincident kW reduction was determined by applying the corresponding end use kW factor to the verified kWh savings.¹⁷²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 144%.

¹⁷² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	10,900	15,702	144%	2.98
Total		10,900	15,702	144%	2.98

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/24/17 and 5/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016645-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	49	49	40	15	1,474	1.11	2,450	1,997	82%
Total										2,450	1,997	82%

The annual lighting hours of operation verified during the M&V site visit (1,474) are fewer than the annual hours of operation used to calculate ex ante savings (2,000).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 82%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	2,450	1,997	82%	0.38
Total		2,450	1,997	82%	0.38

¹⁷³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 4/14/17 and 5/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016410-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	13	13	60	18	2,353	1.01	8,387	1,292	15%
Total										8,387	1,292	15%

The annual lighting hours of operation verified during the M&V site visit (2,353) are less than the annual hours of operation used to calculate ex ante savings (2,400).

The quantity (13) verified during the M&V site visit is less than the ex ante savings quantity (80). The remaining lamps were in storage. The client stated they are changing the lamps out only when one fails.

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for heating and cooling interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 15%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	8,387	1,292	15%	0.25
Total		8,387	1,292	15%	0.25

¹⁷⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/6/17 and 5/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016608-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012	Lighting	SBDI	26	26	50	7	56	1.11	692	69	10%
016608-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			36	36	72	15	2,864	1.11	1,881	6,509	346%
016608-301132-Lighting-LED <=20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			14	14	72	9	191	1.11	811	187	23%
Total										3,384	6,765	200%

The annual lighting hours of operation verified during the M&V site visit for the first and third line items in the above table (56 and 191, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (950). The second line item above was installed in the main showroom and has hours of operation (2,864) greater than the ex ante estimate.

The ex ante savings estimate used an adjusted base wattage of 35W for the first measure and 70W for the second and third measures by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp for the second and third measures. The base lamp for the first measure (MR16) is exempt from an adjusted wattage calculation.

The measure name for the third line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 200%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	3,384	6,765	200%	1.29
Total		3,384	6,765	200%	1.29

¹⁷⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/19/17 and 5/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016653-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	260	260	53	9	2,559	1.09	45,873	32,041	70%
016653-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			9	9	53	17	235	1.09	1,703	83	5%
				1	1	53	14	8,760	1.09	84	374	445%
Total										47,660	32,498	68%

The annual lighting hours of operation verified during the M&V site visit range between 235 and 8,760. The annual lighting hours of operation for the first and second line items in the table above (2,559 and 235, respectively) are fewer than the hours of operation used to determine ex ante savings (4,056 and 2,180, respectively). The first measure was installed in hallways, stairways, and resident rooms. The second measure was installed within the Chapel with 4 hours of use per week. The annual lighting hours of operation for the third line item (8,760) is greater than the hours of operation used to determine ex ante savings (2,180). This measure is the only lamp within the chapel that remains on 24/7.

The ex ante savings estimate used an adjusted base wattage of 52.5W in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The quantity of the second line item in the above table (9) verified during the M&V site visit is fewer than the ex ante savings quantity (22). The remaining lamps were stored in the basement during the time of the M&V site visit.

The measure names in the above table are not accurate. The baseline lamps were incandescent A-line and PAR, and were replaced with LED A19 and PAR lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned assisted living facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 68%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	47,660	32,498	68%	6.17
Total		47,660	32,498	68%	6.17

¹⁷⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, and verified annual lighting operating hours by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016554-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	24	24	455	100	2,006	1.11	17,934	18,900	105%
Total										17,934	18,900	105%

The annual lighting hours of operation verified during the M&V site visit (2,006) are fewer than the annual hours of operation used to calculate ex ante savings (2,024).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate applied a heating and cooling interactive factor of 1.04.

The verified peak coincident demand reduction was determined by applying the corresponding end use kW factor to the verified kWh savings.¹⁷⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 105%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	17,934	18,900	105%	3.59
Total		17,934	18,900	105%	3.59

¹⁷⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/12/17 and 5/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016155-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	23	23	53	10	3,047	1.14	2,670	3,428	128%
016155-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			25	25	34	14	135	1.14	1,178	77	7%
Total										3,848	3,505	91%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (3,047) is greater than the hours of operation used to calculate ex ante savings (2,517), while the second line item is fewer (135). The T8 lighting referenced in the second line item above was installed in a lightly used storage location that may be repurposed into a room with more consistent usage, which may account for the high ex ante operating hours.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The quantity of the first line item in the table above (23) is less than the ex ante savings estimate quantity (24).

The baseline wattage for the second line item in the table above (34W) was greater than the ex ante savings estimate wattage (32W). The baseline lamps had not been disposed of but remained in storage.

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁷⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 91%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	3,848	3,505	91%	0.67
Total		3,848	3,505	91%	0.67

¹⁷⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016573-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	1,900	1,900	43	10	1,145	0.99	73,532	72,197	98%
Total										73,532	72,197	98%

The annual lighting hours of operation verified during the M&V site visit are equal to the annual hours of operation used to calculate ex ante savings (1,145). The measure was installed in guest rooms.¹⁷⁹

The ex ante savings estimate used an LM adjusted base wattage of 42W by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The measure name in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 0.99, applicable to an electrically heated, air conditioned hotel guest room in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.0.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%.

¹⁷⁹ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

¹⁸⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	73,532	72,197	98%	13.71
Total		73,532	72,197	98%	13.71

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/18/17 and 5/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016512-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	260	260	32	17	7,312	1.17	35,531	33,369	94%
Total										35,531	33,369	94%

The annual lighting hours of operation verified during the M&V site visit (7,312) are fewer than the annual hours of operation used to calculate ex ante savings (8,760). The ex ante savings estimate referred to 24/7 lighting for all installed lighting, while the M&V site visit revealed that some lighting was installed in storage and office locations which are not used continuously.

A heating and cooling interactive factor of 1.17, applicable to an electrically heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 94%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	35,531	33,369	94%	6.34
Total		35,531	33,369	94%	6.34

¹⁸¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/7/17 and 5/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016612-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	64	64	40	18	4,311	1.09	3,426	6,639	194%
Total										3,426	6,639	194%

The annual lighting hours of operation verified during the M&V site visit (4,311) are greater than the annual hours of operation used to calculate ex ante savings (2,340). The facility has two shifts working Monday through Friday as well as 30 Saturdays per year. The ex ante savings estimate hours of operation approximated 9 hour work days, 5 days a week.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing 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 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 194%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	3,426	6,639	194%	1.26
Total		3,426	6,639	194%	1.26

¹⁸² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/11/17 and 5/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016506-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	4	4	43	9	127	1.11	336	19	6%
016506-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			88	88	32	15	3,253	1.11	4,158	5,390	130%
Total										4,494	5,409	120%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (127) are fewer than the hours of operation used to calculate ex ante savings (2,548), while the hours of operations for the second line item is greater (3,253). The first measure is located within storage areas with limited use.

The ex ante savings estimate used an LM adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The quantity of the second line item in the above table (88) verified during the M&V site visit is fewer than the ex ante savings quantity (96).

The measure name for the first line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸³

¹⁸³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 120%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	4,494	5,409	120%	1.03
Total		4,494	5,409	120%	1.03

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/20/17 and 5/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016533-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	555	555	32	17	1,566	1.09	16,710	14,223	85%
Total										16,710	14,223	85%

The annual lighting hours of operation verified during the M&V site visit (1,566) are fewer than the annual hours of operation used to calculate ex ante savings (1,930).

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 95%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	16,710	14,223	85%	2.70
Total		16,710	14,223	85%	2.70

¹⁸⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/10/17 and 5/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016773-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	739	739	32	15	2,957	1.09	43,025	40,670	95%
				4	4	32	12	339	1.09	274	30	11%
				6	6	30	11	7,242	1.09	390	904	232%
Total										43,689	41,603	95%

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the table above (2,957 and 339, respectively) are fewer than the hours of operation used to calculate ex ante savings (3,293), while the third line item was greater (7,242). A portion of the first measure was installed in a lower level of the building with limited use while the second measure was installed in an upstairs restroom. A large portion of the third measure was installed in a 24/7 location with the remaining installed in a restroom.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 95%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	43,689	41,603	95%	7.90
Total		43,689	41,603	95%	7.90

¹⁸⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/19/17 and 5/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016637-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	690	690	32	17	6,155	1.09	94,293	69,710	74%
Total										94,293	69,710	74%

The annual lighting hours of operation verified during the M&V site visit (6,142) are fewer than the annual hours of operation used to calculate ex ante savings (8,760). Less than half of the lamps were installed in 24/7 areas.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned assisted living facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 74%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	94,293	69,710	74%	13.24
Total		94,293	69,710	74%	13.24

¹⁸⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, and verified annual lighting operating hours by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016563-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	40	40	40	15	2,635	1.02	3,000	2,679	89%
Total										3,000	2,679	89%

The annual lighting hours of operation verified during the M&V site visit (2,635) are fewer than the annual hours of operation used to calculate ex ante savings (3,000). The client confirmed that the employees are in the store 2 additional hours from those posted Monday through Friday and only work 24 Saturdays per year. The ex ante annual hours of operation included 52 Saturdays and no holidays.

A heating and cooling interactive factor of 1.02, applicable to an electrically heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The verified peak coincident demand reduction was determined by applying the corresponding end use kW factor to the verified kWh savings.¹⁸⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 89%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	3,000	2,679	89%	0.51
Total		3,000	2,679	89%	0.51

¹⁸⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, and verified annual lighting operating hours by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016647-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	50	50	43	10	2,903	1.14	3,701	5,532	149%
Total										3,701	5,532	149%

The annual lighting hours of operation verified during the M&V site visit (2,903) are greater than the annual hours of operation used to calculate ex ante savings (2,190).

The ex ante savings estimate used an LM adjusted base wattage of 42W by multiplying the provided wattage by 70%. The ex post savings estimate used an adjusted base wattage of 43W to meet EISA 2007 requirements for a 60W incandescent lamp.

The measure name in the table above is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The verified peak coincident demand reduction was determined by applying the corresponding end use kW factor to the verified kWh savings.¹⁸⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 149%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	3,701	5,532	149%	1.05
Total		3,701	5,532	149%	1.05

¹⁸⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/12/17 and 5/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016716-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	82	82	32	17	2,382	1.11	2,460	3,245	132%
				4	4	25	11	1,064	1.11	116	68	59%
				10	10	32	17	1,984	1.18	300	350	117%
Total										2,876	3,663	127%

The annual lighting hours of operation verified during the M&V site visit for the first and third line items in the table above are greater than the hours of operation used to calculate ex ante savings (2,000), while the hours of operation for the second line item are fewer. The second measure is installed in a deli case for a meat and cheese display where lighting is not utilized as the remainder of the store.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail facility in St. Louis, was applied to the ex post lighting energy savings for the first and second line items in the above table. The third measure above was installed within freezer and refrigerated cases where a heating and cooling interactive factor of 1.15 and 1.29, respectively was incorporated. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁸⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 127%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	2,876	3,663	127%	0.70
Total		2,876	3,663	127%	0.70

¹⁸⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/24/17 and 5/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016757-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	SBDI	20	20	53	11	2,058	1.11	1,689	1,915	113%
016757-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			20	20	53	9	2,049	1.11	1,686	1,997	118%
016757-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			11	11	50	7	2,057	1.11	597	1,078	181%
Total										3,972	4,990	126%

The annual lighting hours of operation verified during the M&V site visit (ranging between 2,049 and 2,058) are greater than the hours of operation used to calculate ex ante savings (1,938).

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the first and second line items in the above table and 35W for the third line item by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The base lamps for the third line item (MR16) are exempt from an adjusted wattage calculation.

The quantity of the first line item in the above table (20) verified during the M&V site visit is fewer than the ex ante savings quantity (21).

The measure names in the above table are not accurate. The baseline lamps were incandescent PAR, incandescent A-line, and MR16, and were replaced with LED PAR, LED A19, and LED MR16 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 126%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	3,972	4,990	126%	0.95
Total		3,972	4,990	126%	0.95

¹⁹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, and verified annual lighting operating hours by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016540-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	8	8	65	9	6,482	1.12	2,683	3,264	121%
016540-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			76	76	32	14	6,482	1.12	8,195	9,966	121%
016540-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			48	48	65	9	6,482	1.12	16,246	19,757	121%
016540-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			19	19	65	11	6,482	1.12	6,146	7,475	121%
016540-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			32	32	29	8	6,482	1.12	3,930	5,012	127%
016540-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			7	7	53	13	6,482	1.12	1,677	2,065	122%
Total												38,877

The annual lighting hours of operation verified during the M&V site visit (6,482) are greater than the annual hours of operation used to calculate ex ante savings (5,760).

The ex ante savings estimate used LM adjusted base wattages of 28W and 52.5W for the fifth and sixth line items in the above table respectively by multiplying the provided wattage by 70%. The ex post savings estimate used adjusted base wattages of 29W and 53W for the fifth and sixth line items respectively to meet EISA 2007 requirements for a 40W and 75W incandescent lamp.

The measure names for the fifth and sixth line items in the table above are not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The verified peak coincident demand reduction was determined by applying the corresponding end use kW factor to the verified kWh savings.¹⁹¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 122%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	38,877	47,284	122%	8.98
Total		38,877	47,284	122%	8.98

¹⁹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/28/17 and 5/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016752-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	24	24	65	8	946	1.12	3,557	1,447	41%
016752-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			5	5	53	8	4,006	1.12	879	1,008	115%
016752-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			7	7	50	7	4,006	1.12	775	1,348	174%
016752-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			1	1	53	9	2,506	1.12	1,375	123	9%
Total										6,586	3,926	60%

The annual lighting hours of operation verified during the M&V site visit for the first and fourth line items in the table above (946 and 2,506, receptively) are fewer than the annual hours of operation used to calculate ex ante savings (3,952) due to the majority of the lighting being installed in a basement and closet location with little use. The annual lighting hours of operation for the second and third line items (4,006) are greater than the annual hours of operation used to calculate ex ante savings (3,952).

The ex ante savings estimate used an LM adjusted base wattage of 45.5W for the first line item in the above table, 52.5W for the second and fourth line items, and 35W for the third line item by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used for the second and fourth line items in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The base lamps for the first and third line items (65W BR/R and MR16) are exempt from an adjusted wattage calculation.

The quantity of the fourth line item in the above table (1) verified during the M&V site visit is fewer than the ex ante savings quantity (8). The kitchen area was not updated with new lamps as stated in the application.

The measure names in the above table are not accurate. The baseline lamps were incandescent PAR, incandescent A-line, and incandescent BR/R, and were replaced with LED PAR, LED A19, LED BR/R lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 60%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	6,586	3,926	60%	0.75
Total		6,586	3,926	60%	0.75

¹⁹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/24/17 and 5/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016585-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	75	75	53	9	1,115	1.14	5,938	4,186	71%
016585-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			8	8	65	12	1,667	1.14	488	804	165%
				5	5	53	12	1,667	1.14	369	389	105%
Total										6,795	5,379	79%

The annual lighting hours of operation verified during the M&V site visit for the items in the above table (ranging from 1,231 – 1,667) is fewer than the hours of operation used to calculate ex ante savings (1,820).

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the first and third line items in the above table and 45.5W for the second line item by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The base lamps for the second line item (65W BR/R) are exempt from an adjusted wattage calculation.

The measure names in the above table are not accurate. The baseline lamps were incandescent A-line and BR/R, and were replaced with LED A19 and BR/R lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹³

¹⁹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 79%. The ex ante energy savings estimate was premised on overestimated annual operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	6,795	5,379	79%	1.02
Total		6,795	5,379	79%	1.02

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/17/17 and 6/1/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016480-100408-Lighting-T8 32 Watt Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	28	26	455	222	4,848	1.09	47,104	36,951	78%
016480-100401-Lighting-T8 32 Watt Fixture Replacing T12 Fixture				7	7	164	77	4,029	1.09	1,900	2,684	141%
016480-100402-Lighting-T8 32 Watt Fixture Replacing T12 HO Fixture				4	4	227	144	4,848	1.09	2,244	1,761	78%
Total										51,248	41,395	81%

The annual lighting hours of operation verified during the M&V site visit for the first and third line items above (4,848) are fewer than the annual hours of operation used to calculate ex ante savings (6,000). The second line item has hours of operation (4,029) greater than the hours of operation used to calculate ex ante savings (3,000).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned manufacturing facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 81%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	51,248	41,395	81%	7.86
Total		51,248	41,395	81%	7.86

¹⁹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, and verified annual lighting operating hours by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016604-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	2	2	45	9	2,854	1.11	269	226	84%
016604-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			17	17	53	15	2,854	1.11	2,016	2,042	101%
016604-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			1	1	48	11	2,854	1.11	89	116	129%
016604-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			10	10	29	9	2,854	1.11	1,300	632	49%
				10	10	9	9	2,854	1.11		-	
Total										3,675	3,017	82%

The annual lighting hours of operation verified during the M&V site visit (2,854) are greater than the annual hours of operation used to calculate ex ante savings (2,444).

The ex ante savings estimate used an LM adjusted base wattage of 44.8W for the first line item in the table above, 52.5W for the second line item, 47.6W for the third line item, and 28W for the fourth line item by multiplying the provided wattage by 70%. The ex post savings estimate used an adjusted base wattage of 53W for the second line item and 29W for the fourth line item to meet EISA 2007 requirements for a 75W and 40W incandescent lamp.

During the M&V visit, ADM staff verified that the quantity of installed lamps regarding line items one, two, and four (2, 17, and 20, respectively) are fewer than what was used to determine ex ante savings (3, 22, and 28, respectively). ADM staff also verified that 10 of the baseline lamps regarding the fourth line item were 9W CFLs.

The measure names in the table above are not accurate. The baseline lamps were incandescent BR/R, PAR, and A-line and were replaced with LED BR/R, PAR, and A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The verified peak coincident kW reduction was determined by applying the corresponding end use kW factor to the verified kWh savings.¹⁹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 82%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	3,675	3,017	82%	0.57
Total		3,675	3,017	82%	0.57

¹⁹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/16/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
015913-100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	48	20	112	36	2,453	1.01	13,968	11,557	83%
Total										13,968	11,557	83%

The annual lighting hours of operation verified during the M&V site visit (2,453) are fewer than the annual hours of operation used to calculate ex ante savings (3,000).

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 83%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	13,968	11,557	83%	2.20
Total		13,968	11,557	83%	2.20

¹⁹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/17/17 and 5/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016486-100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	1	1	128	52	6,880	1.06	316	564	175%
				9	7	128	52	2,415	1.06	3,278	2,015	61%
				5	3	64	40	1,988	1.06	832	421	51%
				37	27	128	52	6,880	1.06	13,861	24,275	175%
Total									18,287	27,265	149%	

The annual lighting hours of operation verified during the M&V site visit for the first and fourth line items in the table above (6,880) are greater than the annual hours of operation used to calculate ex ante savings (4,000), while the annual lighting hours of operation for the second and third line items is fewer (2,415 and 1,988, respectively). The first and fourth measures were installed in the customer service area where the lighting is on 19 hours per day. The second was installed in a field service office and the third measure installed in a restroom, both areas are used less than the remainder of the site.

A heating and cooling interactive factor of 1.06, applicable to a gas and electrically heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 149%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	18,287	27,265	149%	5.18
Total		18,287	27,265	149%	5.18

¹⁹⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/1/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016649-201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	SBDI	9	9	30	4	8,760	1.01	2,040	2,053	101%
016649-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			22	44	60	18	3,344	1.01	1,211	1,777	147%
				3	3	34	17	3,008	1.01	117	154	132%
				172	172	40	13	3,008	1.01	9,520	14,058	148%
				1	1	34	17	3,008	1.01	39	51	132%
				92	184	60	18	3,344	1.01	5,067	7,431	147%
Total									17,994	25,526	142%	

The annual lighting hours of operation verified during the M&V site visit for the second and sixth line items in the above table (3,344) and lines three through five (3,008) were greater than the annual hours of operation used to calculate ex ante savings (ranging from 2,050 to 2,295). The first line item equals the ex ante savings hours of operation (8,760).

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned light industrial in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 143%.

¹⁹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	17,994	25,526	142%	4.85
Total		17,994	25,526	142%	4.85

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/3/17 and 6/1/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate	
016383-100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	10	9	112	36	1,757	1.11	2,582	1,547	60%	
016383-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard		92	92	32	18	2,328	1.11	3,483	3,317	95%
					3	3	59	36	4,936	1.11	187	377	202%
					12	12	32	18	8,760	1.11	1,531	1,628	106%
					1	1	59	36	8,760	1.11	210	223	106%
Total									7,991	7,091	89%		

The annual lighting hours of operation for the first and second line item in the table above verified during the M&V site visit (1,757 and 2,328, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,120 and 2,600, respectively), while the third line item (4,936) is greater than the annual hours of operation used to calculate ex ante savings (2,600). The annual lighting hours of operation for the fourth and fifth line items is equal to the annual hours of operation used to calculate ex ante savings (8,760). The third measures hours are greater largely due to one lamp having a 24/7 usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.¹⁹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 89%.

¹⁹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	2,582	1,547	60%	0.29
Standard		5,409	5,544	102%	1.05
Total		7,991	7,091	89%	1.35

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/10/17 and 6/6/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016287-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	20	20	32	14	4,275	1.11	973	1,702	175%
				10	10	25	11	3,727	1.09	379	571	151%
016287-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			500	500	40	15	3,942	1.06	33,800	52,137	154%
Total										35,152	54,410	155%

The annual lighting hours of operation verified during the M&V site visit (ranging between 3,727 and 3,942) are greater than the hours of operation used to calculate ex ante savings (2,600).

A heating and cooling interactive factor (HCIF) of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings regarding lamps installed in office or cubicle locations. An HCIF of 1.09, applicable a non-heated, air conditioned manufacturing facility in St. Louis, was applied to the ex post lighting energy savings regarding lamps installed in the powder machine room location. No HCIF was referenced for lighting installed in storage or maintenance locations since these spaces are unconditioned. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 155%.

²⁰⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	35,152	54,410	155%	10.34
Total		35,152	54,410	155%	10.34

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016703-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	330	330	53	10	2,351	1.17	63,712	39,114	61%
Total										63,712	39,114	61%

The annual lighting hours of operation verified during the M&V site visit (2,351) are fewer than the annual hours of operation used to calculate ex ante savings (4,368). ADM staff verified during the M&V visit that lighting was installed in both guest rooms and hallways. The ex ante hours of use closely represent 12 hours of use per day.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The measure name in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.17, applicable to a gas and electrically heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings. Hallway locations are gas heated while the rest of the facility is electrically heated. The ex ante savings estimate referenced a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 61%.

²⁰¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	63,712	39,114	61%	7.43
Total		63,712	39,114	61%	7.43

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/17/17 and 6/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016745-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	SBDI	59	59	53	11	4,109	1.01	9,615	10,243	107%
				39	39	53	15	4,109	1.01	6,185	6,126	99%
016745-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			24	24	72	9	2,827	1.01	5,749	4,300	75%
Total										21,549	20,668	96%

The annual lighting hours of operation verified during the M&V site visit regarding the first and second line item in the table above (4,109) are greater than the annual hours of operation used to calculate ex ante savings (3,927), while the annual lighting hours of operation regarding the third line item (2,827) are fewer.

The ex ante savings estimate used LM adjusted base wattages of 52.5W for the first and second line items in the above table and 70W for the third line item by multiplying the provided wattage by 70%. Adjusted base wattages of 53W for the first and second line items and 72W for the third line item were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W and 100W incandescent lamp.

The quantity of the second line item in the above table (39) verified during the M&V site visit is fewer than the ex ante savings quantity (42). The remaining lamps were in storage at the time of the M&V visit.

The measure name for the third line item in the above table is not accurate. The baseline lamps were incandescent A-line and were replaced with LED A19 lamps. The lamps are stated correctly in the application.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 96%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	21,549	20,668	96%	3.93
Total		21,549	20,668	96%	3.93

²⁰² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016840-305013-Lighting-<=80 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	144	144	100	52	8,760	1.00	60,549	60,549	100%
Total										60,549	60,549	100%

The annual lighting hours of operation verified during the M&V site visit are equal to the annual hours of operation used to calculate ex ante savings (8,760).

The ex post analysis and ex ante estimate applied a heating and cooling interactive factor of 1.00 due to the lighting being installed in an unconditioned space.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	60,549	60,549	100%	11.50
Total		60,549	60,549	100%	11.50

²⁰³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016923-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	61	61	40	15	8,760	1.13	45,427	15,112	33%
Total										45,427	15,112	33%

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 (8,736).

The quantity of installed lamps (61) verified during the M&V site visit is less than the ex ante savings quantity (200). The remaining lamps are in storage and are expected to be installed later this year in hallway locations.

A heating and cooling interactive factor of 1.13, applicable to an electrically heated, air conditioned assisted living facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 33%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	45,427	15,112	33%	2.87
Total		45,427	15,112	33%	2.87

²⁰⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules. The installation was installed within a protected area where logging was not allowed.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
016956-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	36	36	49	14	4,380	1.03	3,987	5,771	145%
Total										3,987	5,771	145%

The annual lighting hours of operation verified during the M&V site visit (4,380) are greater than the annual hours of operation used to calculate ex ante savings (3,000). Lighting operates for 12 hours per day, year round.

The ex ante savings estimate used an LM adjusted base wattage of 49W for the first line item in the above table by multiplying the provided wattage by 70%.

A heating and cooling interactive factor of 1.03, applicable to an electrically heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 145%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	3,987	5,771	145%	1.10
Total		3,987	5,771	145%	1.10

²⁰⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received New Construction lighting, HVAC, and refrigeration control incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-implementation connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 4/1/17 and 5/7/17.

Analysis Results

New Construction Lighting Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
013289-406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	144	62	33	6,748	1.29	34,429	35,920	104%
				158	316	170	6,748	1.29	192,275	200,602	104%
				8	111	60	6,748	1.29	3,436	3,585	104%
				3	111	60	6,748	1.29	1,289	1,344	104%
				6	184	99	6,748	1.29	4,252	4,436	104%
				4	89	48	6,748	1.29	1,374	1,434	104%
				2	111	60	6,748	1.29	859	896	104%
				28	33	18	6,748	1.29	3,508	3,660	104%
				1	20	11	6,748	1.29	79	82	104%
				2	25	13	6,748	1.29	189	197	104%
				1	25	13	6,748	1.29	94	99	104%
				3	67	36	6,748	1.29	775	809	104%
				1	68	36	6,748	1.29	261	272	104%
				125	62	33	4,667	1.11	29,886	18,491	62%
				13	111	60	4,667	1.11	5,584	3,455	62%
21	24	13	4,667	1.11	1,954	1,209	62%				
Total									280,244	276,491	99%

The lighting energy use of the installed lighting equipment is compared with the estimated lighting energy use associated with the applicable new construction baseline (ASHAE 90.1 2007) to determine realized lighting energy savings. The manufacturing/office building constructed in St. Louis County was subject to the 2009 IECC code in effect during the building design, which allows for 1.2 lighting watts/SF(1.3 light manufacturing and 1.0 office). The code compliant baseline lighting wattage for this project was 72,739 watts (1.2 watts/SF*60,616SF).

The annual lighting hours of operation verified during the M&V site visit (ranging from 4,667 to 6,748) are fewer than the annual hours of operation used as an input to the ex ante savings estimate (8,343). The ex ante estimate was premised upon lighting hours of operation of approximately 23 hours per day,

7 days a week. The measures in rows fourteen through sixteen in the table above were installed in the second floor offices where the lighting hours of use were approximately 12 hours per day. For lines one through thirteen the measures were installed in warehouse/manufacturing areas where the hours of use ranged from 14 to 23 hours per day.

For the measures identified in the first thirteen rows in the above table, a heating and cooling interactive factor of 1.29, applicable to a medium temperature refrigerated space, was applied to the ex post lighting energy savings. The measures identified in the fourteenth through sixteenth rows a heating and cooling interactive factor of 1.11, applicable to a small office facility in St. Louis was applied. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰⁶

HVAC savings for the newly installed 23 ton and 3 ton package roof top units were calculated using the Missouri Statewide Technical Reference Manual. The TRM utilizes an Equivalent Full Load Hour (EFLH) analysis methodology to calculate annual savings, which is a typical industry method for high efficiency HVAC units. The construction of the new refrigerated warehouse was built to IECC 2009 standards. The results of the HVAC analysis are as follows:

New Construction HVAC Savings Calculations

Unit	Make	Model	Cool Cap	Cooling SEER/EER		EFLH	Annual kWh Savings		
				Baseline	As-Built		Ex-Ante	Ex-Post	RR
RTU-1	York	ZF300	270,000	10.0	10.0	1,159	31,884	0	0%
RTU-2	York	ZF036	36,000	13.0	13.0	1,159	535	0	0%
Total							32,419	0	0%

There are zero savings associated with the installation of the two new HVAC units as the efficiency of the installed systems, are equivalent to the minimum efficiency as required by IECC 2009.

The scope of the refrigeration project involved the installation of a KE2 Evaporator Efficiency control system on the facility’s (19) refrigeration units. The KE2 controls system is designed to directly modulate each compressor system’s expansion device for more efficient flow control. This results in a more consistent space temperature and also reduces the amount of defrost cycles that are typically necessary to prevent ice buildup on the system evaporator coils. Savings for the installation of the KE2 system were based on the provided KE2 savings calculator. The calculator showed that the installation of the KE2 control system at Ole Tyme Produce, would result in an average savings of 13% for each refrigeration compressor system. ADM vetted the provided calculator, and determined that the calculator overstated system energy usage when compared to the actual facility bills.

In an effort to triangulate the savings associated with the installation of the KE2 controls, a literature research was performed to determine the typical percentage of total facility kWh consumption

²⁰⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

associated with refrigeration end-uses for a refrigerated warehouse. From the California Commercial End-use Survey²⁰⁷ (CEUS), it was determined that in a typical refrigerated warehouse, the refrigeration system accounts for 67.1% of the total annual consumption. The remaining 32.9% is attributed to other various end-uses including: interior lighting, exterior lighting, miscellaneous equipment, and HVAC. Using billing data and associated weather data, a multivariable regression was performed to determine the typical energy consumption of the facility as a function of temperature and number of days in a billing period. Upon the development of the regression, the results were combined with TMY3 weather for the region in order to determine typical year energy consumption for the facility. Annual savings for the installation of the KE2 Evaporator Efficiency control system is the annual consumption of the facility, multiplied by a consumption factor of 67.1% and a savings factor of 13%. The results of this analysis are presented in the following table:

KE2 Evaporator Efficiency Control Energy Savings

<i>Month</i>	<i># Days</i>	<i>CDD</i>	<i>Monthly kWh</i>	<i>Refrigeration End-Use</i>	<i>kWh Savings</i>
1	31	109	77,459	51,975	6,757
2	28	137	70,734	47,463	6,170
3	31	482	84,944	56,997	7,410
4	30	683	86,555	58,079	7,550
5	31	906	93,476	62,722	8,154
6	30	1,255	98,063	65,801	8,554
7	31	1,422	103,844	69,679	9,058
8	31	1,320	101,794	68,303	8,879
9	30	1,055	94,035	63,097	8,203
10	31	630	87,928	58,999	7,670
11	30	325	79,368	53,256	6,923
12	31	76	76,785	51,523	6,698
Total		8,398	1,054,986	707,895	92,026

The ex ante analysis claimed a savings of 187,017 kWh for the installation of the KE2 controls. The difference in savings can be attributed to the ex ante calculations not utilizing a calculated typical annual energy consumption based on TMY3 weather data. In addition to this, the ex ante analysis multiplied the same 13% savings factor by the total annual consumption of the facility as opposed to just the annual energy consumption of the refrigeration system. These two factors led to the overestimation in savings for this measure.

A table showing the energy savings achieved by each measure evaluated for this site is shown below. The overall realization rate is 74%.

²⁰⁷ <http://capabilities.itron.com/CeusWeb/ChartsSF/Default2.aspx>

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
New Construction	Lighting	280,244	276,491	99%	52.52
	HVAC	31,884	0	0%	0.00
	HVAC	535	0	0%	0.00
	Refrigeration	187,017	92,026	49%	12.49
Total		499,680	368,517	74%	65.01

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-implementation connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

New Construction Lighting Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
014235-406123- Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	78	208	93	5,641	1.10	55,598	55,786	100%
				4	116	52	5,460	1.10	1,594	1,548	97%
				21	259	116	5,460	1.10	18,671	18,131	97%
				3	130	58	366	1.10	1,334	87	6%
				3	136	61	4,004	1.10	1,403	999	71%
				16	63	28	4,339	1.29	3,434	3,098	90%
Total									82,033	79,648	97%

The lighting energy use of the installed lighting equipment is compared with the estimated lighting energy use associated with the applicable new construction baseline (ASHAE 90.1 2007) to determine realized lighting energy savings. The retail building constructed in St. Louis County was subject to the 2009 IECC code in effect during the building design, which allows for 1.5 lighting watts/SF. The code compliant baseline lighting wattage for this project was 23,924 watts (1.5 watts/SF*15,949SF).

The annual lighting hours of operation verified during the M&V site visit (ranging from 366 to 5,641) are fewer than the annual hours of operation used as an input to the ex ante savings estimate (6,205). The ex ante estimate was premised upon lighting hours of operation of approximately 17 hours per day, 7 days a week. The maximum lighting operating hours are 15 hours per day with much of the lighting operating for fewer hours. The measures identified in the fourth row of the table above were installed in equipment rooms in which the lighting operation is limited to a few hours per week.

For the measures identified in the first five rows in the above table, a heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings. The measure identified in the sixth row was installed within coolers and a heating and cooling interactive factor of 1.29 was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰⁸

²⁰⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 97%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
New Construction	Lighting	82,033	79,648	97%	15.13
Total		82,033	79,648	97%	15.13

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-implementation connected loads, and determined usage type of the building for future tenants.

Analysis Results

New Construction Lighting Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
014235-406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	316	1,362	401	3,120	1.00	947,494	947,405	100%
Total									947,494	947,405	100%

The lighting energy use of the installed lighting equipment is compared with the estimated lighting energy use associated with the applicable new construction baseline (ASHAE 90.1 2007) to determine realized lighting energy savings. The warehouse building constructed in St. Louis County was subject to the 2009 IECC code in effect during the building design, which allows for 0.8 lighting watts/SF. The code compliant baseline lighting wattage for this project was 430,400 watts (0.8 watts/SF*538,000SF).

The ex post savings analysis applied the provided annual hours of use (3,120). The facility was unoccupied during the M&V site visit. The hours were deemed at 3,120 as they fall within the low range of similar warehouses from evaluated projects.

The ex post analysis and ex ante estimate applied a heating and cooling interactive factor of 1.00 due to the lighting being installed in an unconditioned space.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁰⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
New Construction	Lighting	947,494	947,405	100%	179.97
Total		947,494	947,405	100%	179.97

²⁰⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-implementation connected loads, determined the lighting operating schedule, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 3/31/17 and 5/2/17.

Analysis Results

New Construction Lighting Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
015018-406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	1,390	640	370	6,541	1.09	2,699,954	2,683,098	99%
Total									2,699,954	2,683,098	99%

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
015018-301918-Lighting-Fixture Mounted Occupancy Sensor Controlling >=201 and <=500 Watts Replacing No Controls	3077	Lighting	New Construction	1,390	370	4,954	4,180	1.09	417,000	423,651	102%
Total									417,000	423,651	102%

The lighting energy use of the installed lighting equipment is compared with the estimated lighting energy use associated with the applicable new construction baseline (ASHAE 90.1 2007) to determine realized lighting energy savings. The warehouse building constructed in St. Charles County was subject to the 2009 IECC code in effect during the building design, which allows for 0.8 lighting watts/SF. The code compliant baseline lighting wattage for this project was 889,294 watts (0.8 watts/SF*1,111,617 SF).

The annual lighting hours of operation verified during the M&V site visit through the photo-sensor loggers (7,200) equal the annual hours of operation used as an input to the ex ante savings estimate.

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the weekends that was applied to the baseline operating model.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned manufacturing facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
New Construction	Lighting	3,116,954	3,106,749	100%	588.91
Total		3,116,954	3,106,749	100%	588.91

²¹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Retro-Commissioning (RCx) incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-implementation connected loads, interviewed facility personnel regarding equipment operation. ADM also reviewed of the provided documentation and data.

The customer repaired several leaks in the compressed air system, totaling 58 cfm, as follows:

Leak Repair Log

TAG	LOCATION	SIZE
550	upstairs	S
551	[company name]	S
552	[company name]	S
553	[company name]	S
554	[company name]R32, R13	M
555	[company name]	M
556	[company name]	S
557	Conveyor P142	M
558	Conveyor zone 35	S
559	Conveyor zone 30	S
600	Tool room	S
601	Tool room	S
602	Tool room	S
603	Tool room	M
604	Weld area	S
605	Wire edm	S
606	Tool room	S
607	Wire	M
608	Wastewater	L
609	Wastewater	M
610	Wastewater	M
611	Wastewater	S
612	Wastewater	M
613	Wastewater	S
614	Plating heat treat	S

TAG	LOCATION	SIZE
615	Air gun heat treat	M
616	Air gun heat treat	S
617	Press room pp451	M
618	Press room pp235	M
619	Press room pp239	S
620	Press room pp403	S
621	Press room pp400	S
622	Press room pp400	S
623	Press room pp72	M
624	Press room pp577	S
625	Press room pp231	S
626	Press room pp201	S
627	Press room pp201	S
628	Press room pp223	S
629	Press room pp450	L
630	Press room pp408	S
631	Press room pp225	S
632	Press room pp229	M
633	Press room pp226	M
634	Press room pp452	M
635	Press room air p-3-5	M
636	Press room air p-3-5	S
637	Press room pp479	S
638	Press room pp478	S
639	Press room pp474	S
640	Press room pp228	S
641	Press room pp479	S
642	Press room pp184	S
643	Press room pp279	M
644	Press room rivet	S
645	PC tron curt bench	S
646	PC tron e - chomller	M
647	Conveyor p110	M
648	Conveyor op	M

TAG	LOCATION	SIZE
649	Conveyor zone 8	M

Correcting these leaks reduced the load on the compressors, resulting in less energy consumption.

ADM reviewed all project documentation, including the “Compressed Air Study” provided by the contractor, and obtained the baseline monitoring data referenced in the study. The monitoring data totaled a week (seven days) in 12 second intervals. Variables monitored included: current (amperage) for each of the two compressors and pressure (psi). Two identical Gardener Denver variable speed air compressors operated during the monitoring period.

Analysis Results

Compressed Air Leak Repair Savings Calculations

ADM estimated energy savings using the facility’s compressed air load profile derived from baseline monitoring data. The current data was used to calculate power, using the following algorithm:

$$P = \frac{\sqrt{3} \times V \times A \times pf}{1,000}$$

Where:

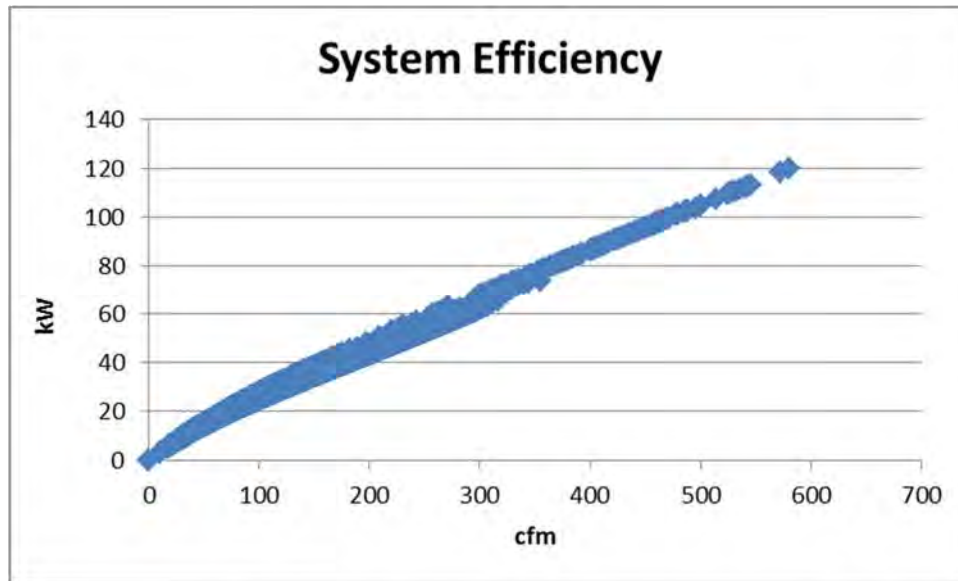
P = Power (kW)

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, ADM created an efficiency curve of kW vs cfm. 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. At which point, ADM plotted the system efficiency.



The system efficiency curve was used to calculate the new load (kW) values for decreasing the post implementation load by the 58 cfm in leaks repaired. This “new” load profile represented the decreased demand as a result of repaired leaks.

Energy savings were calculated by taking the difference in energy requirements of baseline and post-RCx compressed air systems, at each monitoring point, summing over the monitoring period, and scaling to an annual basis. This method assumes the monitoring period represented a typical demand profile at the facility.

The site-level realization rate is 110%. This is primarily due to ex ante converting cfm directly from amps. The methodology used to make the conversion isn’t clear, and it appears to make a few assumptions. The ex post analysis uses the actual CAGI datasheet for the air compressors and a power factor curve to convert amps to kW and kW to cfm.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
RCx	Compressed Air	94,554	104,116	110%	14.1
Total		94,554	104,116	110%	14.1

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/24/17 and 6/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017165-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	300	300	25	15	6,714	1.18	3,572	23,842	667%
				64	64	25	15	8,760	1.18	5,831	6,636	114%
Total										9,403	30,478	324%

The annual lighting hours of operation verified during the M&V site visit regarding the first line item in the table above (6,714) are much greater than the annual hours of operation used to calculate ex ante savings (1,145). The ex ante savings estimate referred to DEER 2005 guest room hours (1,145); however, lighting was not installed in guest rooms but various locations throughout the hotel facility. The annual lighting hours of operation verified during the M&V site visit regarding the second line item is equal to the annual hours of operation used to calculate ex ante savings (8,760).

A heating and cooling interactive factor of 1.18, applicable to a gas heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 324%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	9,403	30,478	324%	5.79
Total		9,403	30,478	324%	5.79

²¹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 12/1/17 and 12/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016684-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	52	52	56	17	2,663	1.01	7,171	5,433	76%
Total										7,171	5,433	76%

The annual lighting hours of operation verified during the M&V site visit (2,663) are fewer than the annual hours of operation used to calculate ex ante savings (3,400).

An adjusted base wattage of 56W was used in the ex ante and ex post savings analysis to meet the EISA 2007 standard lumen equivalent for an 80W incandescent lamp.

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned small 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 76%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	7,171	5,433	76%	1.03
Total		7,171	5,433	76%	1.03

²¹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/20/17 and 11/14/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016693-200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	2	2	65	8	1,104	1.01	195	127	65%
				18	18	65	12	3,491	1.01	1,568	3,369	215%
016693-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			34	34	53	12	1,393	1.01	3,580	1,964	55%
016693-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			32	32	53	8	6,081	1.01	3,702	8,859	239%
				20	20	53	9	2,712	1.01	2,262	2,415	107%
Total										11,307	16,735	148%

The annual lighting hours of operation verified during the M&V site visit for the first and third line items in the table above (1,104 and 1,393, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (2,600), while the second, fourth, and fifth line items are greater (3,491, 6,081, and 2,712, respectively). Thirty-eight percent of the lamps installed were placed within restrooms where the lighting mainly remained on after hours.

The ex ante savings estimate used an adjusted base wattage of 45.5W for the first two line items in the above table and 52.5W for the remaining lines by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used for the third through fifth line items to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The base lamps for the first to measures (BR reflector) are exempt from an adjusted wattage calculation.

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹³

²¹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 148%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	11,307	16,735	148%	3.18
Total		11,307	16,735	148%	3.18

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	240	240	53	8	1,145	1.09	12,718	13,532	106%
				24	24	53	10	1,145	1.09	1,215	1,293	106%
				306	306	53	9	3,423	1.09	43,512	50,436	116%
Total										57,445	65,261	114%

The annual lighting hours of operation verified during the M&V site visit for the third line item (3,423) are greater than the annual hours of operation used to calculate ex ante savings (1,145²¹⁴). Approximately one third of the quantity was installed in continuous use areas. The hours for the first two line items are consistent with those used to calculate ex ante savings (1,145).

The ex ante savings estimate used an adjusted base wattage of 52.5W the three line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The quantity of the third line item in the first table above (306) verified during the M&V site visit is less than the ex ante savings quantity (840). The remaining lamps were located in storage. Subsequent visits revealed no installation.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04

²¹⁴ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 114%. The ex ante energy savings estimate was premised upon underestimated hours of operation and specific installation locations for the third measure and underestimated heating and cooling effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	57,445	65,261	114%	12.40
Total		57,445	65,261	114%	12.40

²¹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	7	7	32	12	8,760	1.11	1,226	1,358	111%
				42	42	114	44	8,760	1.11	25,755	28,525	111%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011		Standard	8	8	43	11	8,760	1.18	2,172	2,637	121%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			26	26	59	17	8,760	1.18	9,612	11,303	118%
Total										38,765	43,823	113%

The annual lighting hours of operation verified during the M&V site visit are consistent with the annual hours of operation used to calculate ex ante savings (8,760).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings for the first two line items in the table above. A factor of 1.18 was applied to the third and fourth line items, applicable to walk-in coolers. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 113%. The ex ante energy savings estimate was premised upon underestimated heating and cooling interactive effects.

²¹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	11,784	13,940	118%	2.65
Custom		26,981	29,883	111%	5.68
Total		38,765	43,823	113%	8.32

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100202-Lighting-Non Linear LED Fixture Replacing T12 HO Fixture	1169	Lighting	Custom	110	40	227	130	4,134	1.00	86,593	81,734	94%
Total										86,593	81,734	94%

The annual lighting hours of operation verified during the M&V site visit (4,134) are fewer than the annual hours of operation used to calculate ex ante savings (4,380).

The measures were installed in an uncooled area so a heating and cooling interactive factor of 1.00, was applied to the ex post and ex ante lighting energy savings.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 94%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	86,593	81,734	94%	15.53
Total		86,593	81,734	94%	15.53

²¹⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016343-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,100	1,100	32	17	3,289	1.11	66,615	60,022	90%
016343-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft				1,500	1,500	32	17	3,669	1.11	90,839	91,298	101%
Total										157,454	151,320	96%

The annual lighting hours of operation verified during the M&V site visit (ranging between 3,289 and 3,669) are fewer than the hours of operation used to calculate ex ante savings (3,882).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.²¹⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 96%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	157,454	151,320	96%	28.75
Total		157,454	151,320	96%	28.75

²¹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	48	48	43	10	3,360	1.09	5,367	5,806	108%
				48	48	43	10	3,360	1.09	5,367	5,806	108%
				240	240	43	9	3,360	1.09	27,676	29,910	108%
305502-Lighting-Linear ft T8 25 Watt (<=7 Watts/ft) Replacing T8 32 Watt Linear ft	3022			750	750	32	25	3,360	1.09	18,346	19,244	105%
				1,200	1,200	32	25	3,088	1.09	29,353	28,337	97%
Total										86,109	89,103	103%

The annual lighting hours of operation verified during the M&V site visit for the fifth line item in the table above (3,153) are fewer than the annual hours of operation used to calculate ex ante savings (3,360). This measure was installed in multiple locations with varying usage. The ex post savings analysis accepted the given annual hours of operation (3,360²¹⁹) since metering was not available due visiting during the summer.

The ex ante savings estimate used an adjusted base wattage of 42W for the first three line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 103%. The ex ante energy savings estimate was premised upon underestimated heating and cooling interactive effects.

²¹⁹ Ex Post savings accepted the application annual hours of operation.

²²⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	86,109	89,103	103%	16.93
Total		86,109	89,103	103%	16.93

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 12/07/17 and 12/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111- Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	17	17	29	9	5,291	1.11	2,215	1,992	90%
200808- Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			39	39	55	7	2,955	1.11	5,116	6,126	120%
200909- Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			24	24	53	8	2,101	1.11	6,696	2,485	37%
Total										14,027	10,603	76%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (25,291) are greater than the annual hours of operation used to calculate ex ante savings (4,004), while the remaining measures have fewer hours (2,955 and 2,101, respectively). Approximately 50% of the first measure lamps are continuously lit (24/7 hours) which account for the higher verified hours. The site also has large windows allowing for natural daylighting so not all measures were in use during store hours.

The ex ante savings estimate used an adjusted base wattage of 29W for the first line item in the above table and 38.5W for the second line item by multiplying the provided wattage by 70%. An adjusted base wattage of 29W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 40W incandescent lamp for the first line item. The base lamps for the second line item (MR16) are exempt from an adjusted wattage calculation. The ex post savings analysis used an adjusted wattage (53W) for the third measure above (BR/R 75W) which does qualify for an EISA 2007 standard reduction.

The quantity of the first line item in the first table above (17) verified during the M&V site visit is less than the ex ante savings quantity (28). The remaining lamps were installed in store display fixtures that were sold to customers along with the lamps.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 76%. The ex ante energy savings estimate was premised on an overestimated quantity of lamps and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	14,027	10,603	76%	2.01
Total		14,027	10,603	76%	2.01

²²¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/03/18 and 1/23/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	50	50	53	10	8,760	1.14	6,149	21,673	352%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			300	300	40	15	3,448	1.14	22,308	29,413	132%
Total										28,457	51,085	180%

The annual lighting hours of operation verified during the M&V site visit (ranging from 3,448 to 8,760) are greater than the annual hours of operation used to calculate ex ante savings (2,860). The ex ante savings estimate was based on the installed location for the project as office. The measures for the first line item in the table above were installed in elevators and gallery archways with continuous usage. The ex ante savings estimate was based on the installed location for the project as office. The lighting measures of the second line item were installed in various locations throughout the building ranging from continuous usage to very little usage and with only 24% actually in office locations.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly in St. Louis, was applied to the ex post lighting energy savings. For the first line items in the table above, the ex ante savings estimate did not account for heating and cooling interactive factors. For the second line item, ex ante savings estimate accounted for a heating and cooling factor of 1.04. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the first line items. On the Microsoft Excel application form, the applicant cut and pasted the location name, and a technical error in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 180%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	28,457	51,085	180%	9.70
Total		28,457	51,085	180%	9.70

²²² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 5/17/17 and 6/7/17.

Analysis Results

Lighting Controls Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Quantity</i>	<i>Controlled Wattage</i>	<i>Baseline Hours</i>	<i>Efficient Hours</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
201618-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >120 Watts	3079	Lighting	Standard	75	237	3,438	2,069	1.09	34,500	26,640	77%
Total									34,500	26,640	77%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours (2,069) are fewer than the hours of operation before occupancy controls were installed (3,438).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. This facility is a large office with a variety of tenants, therefore it was assumed that lights were not turned off during the workday before controls were installed.

The ex post controlled wattage (237W) verified during the M&V site visit is greater than the ex ante energy savings controlled wattage (150W).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 77%.

²²³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	34,500	26,640	77%	6.55
Total		34,500	26,640	77%	6.55

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewed facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 05/02/17 and 06/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017012-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	440	440	32	17	2,423	1.09	13,453	17,446	130%
Total										13,453	17,446	130%

The annual lighting hours of operation verified during the M&V site visit (2,423) are greater than the annual hours of operation used to calculate ex ante savings (1,960).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned educational 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²⁴

A table showing the energy savings achieved by the measure evaluated for this site is shown below. The overall gross realization rate is 130%. The ex ante energy savings was premised on underestimated annual hours of operation and underestimated heating and cooling effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	13,453	17,446	130%	3.31
Total		13,453	17,446	130%	3.31

²²⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	2,000	2,000	32	15	5,123	1.10	127,296	191,995	151%
Total										127,296	191,995	151%

The annual lighting hours of operation verified during the M&V site visit (5,123) are greater than the annual hours of operation used to calculate ex ante savings (3,600). The lamps were installed within a retail mall with usage ranging from 12 to 18 hours per day/ 6 days a week and 8 to 9 hours one day a week.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large retail in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 151%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	127,296	191,995	151%	36.47
Total		127,296	191,995	151%	36.47

²²⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/15/17 and 7/12/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	48	48	83	22	3,864	1.00	32,412	11,313	35%
				60	30	48	18	3,260	1.11	13,937	8,448	61%
Total										46,349	19,761	43%

The annual lighting hours of operation verified during the M&V site visit (3,864 and 3,260, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (8,515 and 5,727, respectively).

The quantity of the first line item in the first table above (48) verified during the M&V site visit is less than the ex ante savings quantity (60). The remaining lamps were located in storage to be used as replacements.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings for the main store area. The shop and shop storage areas were unconditioned. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 43%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and that all quantities were to be installed.

²²⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	46,349	19,761	43%	3.75
Total		46,349	19,761	43%	3.75

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/8/17 and 7/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	30	30	75	36	2,309	1.11	3,263	2,992	92%
				10	10	34	18	4,889	1.11	446	866	194%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			18	18	90	10.5	2,309	1.11	3,991	3,659	92%
Total										7,700	7,518	98%

The annual lighting hours of operation verified during the M&V site visit regarding the first and third line items in the table above (2,309) are fewer than the annual hours of operation used to calculate ex ante savings (2,682), while the annual lighting hours of operation for the second line item (4,889) are greater.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 1.04.

The installed LED lighting referenced in the third line item was found to be BR/R type lamps during the site visit, while the application referred to LED PAR type lamps.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%.

²²⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	7,700	7,518	98%	1.43
Total		7,700	7,518	98%	1.43

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/10/17 and 7/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	3	3	100	14	285	1.14	381	84	22%
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169			8	6	210	39	334	1.14	2,135	550	26%
				6	3	210	50	3,390	1.14	1,639	4,280	261%
				10	6	114	14	2,503	1.14	1,542	3,007	195%
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169			6	5	114	14	285	1.14	892	199	22%
				18	9	114	14	286	1.14	2,818	626	22%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009		Standard		4	4	72	14	334	1.14	331	88
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793				2	2	25	7	8,760	1.14	328	359
Total										10,066	9,193	91%

The annual lighting hours of operation verified during the M&V site visit for the eighth line item in the table above corresponds with the ex ante hours (8,760). For line items one, two, five, six and seven the hours of operation (ranging from 285 – 334) are fewer than the annual hours of operation used to calculate ex ante savings (1,420). The installed locations had infrequent usage. The hours of operation for the third and fourth line items above (3,390 and 2,503, respectively) had greater hours of operation. These measures were installed within gathering areas with frequent usage.

The ex ante savings estimate used an LM adjusted base wattage of 210W for the second and third line items in the above table and 70W for the seventh line item by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis regarding the seventh line item to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 91%. The ex ante hours of operation were premised on the same usage throughout the entire facility.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	659	447	68%	0.08
Custom		9,407	8,746	93%	1.66
Total		10,066	9,193	91%	1.75

²²⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305502-Lighting-Linear ft T8 25 Watt (<=7 Watts/ft) Replacing T8 32 Watt Linear ft	3022	Lighting	Standard	120	120	32	25	5,433	1.14	2,621	5,192	198%
Total										2,621	5,192	198%

The annual lighting hours of operation verified during the M&V site visit (5,433) are greater than 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 gas heated, air conditioned assembly 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²²⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 198%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	2,621	5,192	198%	0.99
Total		2,621	5,192	198%	0.99

²²⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed nine photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/24/17 and 7/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	102	102	40	15	3,884	1.14	8,087	11,265	139%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			169	169	53	10	3,902	1.14	53,530	32,642	61%
Total										61,617	43,907	71%

Primary data were used to develop estimates of annual lighting operating hours. The annual lighting hours of operation verified during the M&V site visit are greater than the annual hours of operation used to calculate ex ante savings (2,964).

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the second line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

The quantity of the second line item in the table above (169) verified during the M&V site visit is less than the ex ante savings quantity (420). The remaining lamps were found to be in storage during the time of the M&V site visit.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. In addition, a factor of 1.18 was used for the walk-in cooler installation. The ex ante savings estimate accounted for a heating and cooling factor of 1.07 for the first line item in the table above and did not account for heating and cooling interactive effects regarding the second line item.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³⁰

²³⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 71%. The ex ante energy savings estimate was premised on an overestimated installed quantity with approximately 60% of the A-line lighting found to be in storage which did not contribute to overall energy savings.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	61,617	43,907	71%	8.34
Total		61,617	43,907	71%	8.34

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	36	36	40	15	8,760	0.99	12,299	7,810	64%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			-	-	53	12	8,760	0.99	11,069	-	0%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			37	37	53	9	1,145	0.99	19,023	1,847	10%
Total										42,391	9,657	23%

The annual lighting hours of operation verified during the M&V site visit for the third line item in the table above (1,145²³¹) are less than the annual hours of operation used to calculate ex ante savings (8,760). These lamps were installed in guest rooms.

An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp for the second and third line items in the table above. The ex ante base wattage of 52.5W was computed within the application by factoring 70% of a 75W incandescent lamp.

The quantity of the first line item in the first table above (36) verified during the M&V site visit is less than the ex ante savings quantity (54). The 18 lamps were not compatible with the fixtures and were located in storage. The ex post quantity for the second line item (0) is less than the ex ante quantity (30). These lamps were also located in storage and had not been installed due to the lower lamp color temperature that the client had requested. The installed quantity of the third line item (37) is fewer than

²³¹ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

the ex post savings quantity (48). The client has these lamps in storage with the intention of installing in guest rooms in the near future as needed.

A heating and cooling interactive factor of 0.99, applicable to an electric heated, air conditioned hotel 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 23%. The ex ante energy savings estimate was premised on overestimated installed quantities and overestimated annual lighting operating hours for one measure.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	42,391	9,657	23%	1.83
Total		42,391	9,657	23%	1.83

²³² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 6/28/17 and 7/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	5	5	164	36	2,032	1.09	1,600	1,423	89%
				12	14	164	36	1,102	1.09	3,660	1,766	48%
				10	12	164	36	2,453	1.09	3,020	3,242	107%
				12	10	164	36	2,629	1.09	4,020	4,627	115%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Standard		3	3	63	17	1,948	1.09	345	294	85%
Total										12,645	11,353	90%

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201618-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >120 Watts	3079	Lighting	Standard	1	392	3,822	2,525	1.09	460	560	122%
				1	392	3,822	2,525	1.09	460	560	122%
Total									920	1,119	122%

The annual lighting hours of operation verified during the M&V site visit for the fourth line item in the first table above (2,629) are greater than the annual hours of operation used to calculate ex ante savings (2,500). The verified hours for the remaining line items (ranging from 1,102 to 2,453) are fewer than those used to calculate ex ante savings (2,500).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the workday and the end of the workday.

The controlled wattage in the second table above verified during the M&V site visit (392W) is greater than the controlled wattage used to calculate the ex ante savings (250W).

The ex ante savings estimate used an adjusted base wattage of 63W for the fifth line item in the first table above by multiplying the provided wattage by 70%. An adjusted base wattage of 63W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 90W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned education facility in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 92%. The ex ante savings estimate was premised upon overestimated hours of operation for four of five line items in the first table above, as well as underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	1,265	1,413	112%	0.23
Custom		12,300	11,058	90%	2.10
Total		13,565	12,472	92%	2.33

²³³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard incentives from Ameren Missouri to replace a 50 gallon storage water heater with an 80 gallon heat pump water heater. The pre-existing water heater was functioning prior to replacement, but did not maintain a high enough water temperature.

During the M&V visit, ADM staff verified equipment installation and specifications, and interviewed facility personnel regarding equipment operation. ADM also reviewed the provided documentation.

Analysis Results

Heat Pump Water Heater Savings Calculations

ADM estimated annual energy savings using the following algorithm, referenced from the Ameren Missouri TRM, measure number 850:

$$\Delta kWh = \frac{\left(\frac{1}{EF_{base}} - \frac{1}{EF_{ee}}\right) * HotWaterUse_{gallons} * \gamma_{Water} * (T_{out} - T_{in}) * 1.0}{3,412} + kWh_{cool} - kWh_{heat}^*$$

$$kWh_{cool} = \frac{\left[\left(1 - \frac{1}{EF_{ee}}\right) * HotWaterUse_{gallons} * \gamma_{Water} * (T_{out} - T_{in}) * 1.0\right] * LF * 53% * LM}{COP_{cool} * 3,412}$$

**no reduction in heating costs are associated with this measure due to only natural gas heating being present*

Where:

- EF_{base} = Baseline equipment efficiency (EF or E_i)
- EF_{ee} = Installed equipment efficiency (EF or E_i)
- $HotWaterUse_{gallons}$ = Annual hot water consumption (gal)
- γ_{Water} = Specific weight of water (8.33 lbs/gal)
- T_{out} = Tank temperature (125 °F)
- T_{in} = Incoming water temperature (57.9 °F)
- 1.0 = Heat capacity of water (1 Btu/lb °F)
- 3,412 = Btu to kWh conversion
- kWh_{cool} = Savings from converting building heat to water heat
- LF = Location factor (1.0 for conditioned install space, 0.0 for unconditioned, and 0.5 for unknown)
- 53% = Portion of waste heat resulting in cooling savings
- COP_{cool} = COP of central air
- LM = Latent multiplier, dependent on location

The efficiency of the baseline unit (EF = 0.936) was estimated based on nameplate of previous water heater which had not been disposed . The efficiency of the installed heat pump water heater (EF = 3.12) was referenced from equipment specification sheets. Annual hot water consumption was estimated using other TRM reference tables for the building type, based on 2012 CBEC data. A central air system COP value of 3.1 was estimated, referencing a SEER value of 12.

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

The site-level realization rate is 29%. The ex ante savings estimate referenced deemed savings for a heat pump water heater between 10 and 50 MBH. The generalized deemed savings value does not specifically account for facility type, equipment efficiency, and equipment capacity.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Water Heating	21,156	6,224	29%	1.13
Total		21,156	6,224	29%	1.13

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/7/17 and 9/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	12	24	60	15	2,024	1.11	1,519	806	53%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			12	12	40	15	3,033	1.11	7,052	1,006	14%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			10	10	60	36	2,956	1.00	1,736	709	41%
				60	60	60	36	2,956	1.00	5,208	4,257	82%
				32	32	32	15	2,890	1.11	1,967	1,739	88%
Total										17,482	8,517	49%

The annual lighting hours of operation verified during the M&V site visit (ranging from 2,024 to 3,033) are fewer than the annual hours of operation used to calculate ex ante savings (3,380).

The efficient quantities of the first, second and third line items in the table above verified during the M&V site visit (24, 12 and 10, respectively) are fewer than the quantities used to calculate ex ante energy savings (28, 78 and 20, respectively). The remaining lamps were placed in storage for future installations.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings for the first, second and fifth line items in the table above. The third and fourth line items were installed in unconditioned areas. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³⁴

²³⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 49%. The ex ante energy savings estimate was premised upon overestimated hours of operation and the installation of all purchased quantities.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	17,482	8,517	49%	1.62
Total		17,482	8,517	49%	1.62

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 12/08/17 and 1/03/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate	
100202-Lighting-Non Linear LED Fixture Replacing T12 HO Fixture	1169	Lighting	Custom	20	40	96	10	2,416	1.00	6,766	3,672	54%	
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1		Standard		32	32	455	88	2,632	1.00	52,275	30,911	59%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026				138	138	34	12	2,452	1.06	14,742	7,924	54%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025				105	105	32	10	1,414	1.09	10,282	4,286	42%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026				10	6	227	125	2,416	1.00	6,766	3,672	54%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025				188	188	32	12	2,681	1.11	18,410	11,150	61%
					42	42	32	14	1,601	1.11	3,365	1,339	40%
Total										112,606	62,954	56%	

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301818-Lighting-Fixture Mounted Occupancy Sensor Controlling >50 and <=200 Watts Replacing No Controls	3077	Lighting	Standard	7	88	3,828	2,416	1.00	2,100	610	29%
Total									2,100	610	29%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (4,280).

The efficient wattage verified during the M&V site visit for the third and sixth line items in the first table above (12W) are greater than the wattage used to calculate ex ante savings (10W).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the workday and the end of the workday.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings for the office areas. The warehouse locations were unconditioned. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 55%. The ex ante energy savings was premised upon overestimated hours of operation and overestimated lighting control savings.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	107,941	59,891	55%	11.68
Custom		6,766	3,672	54%	0.70
Total		114,706	63,563	55%	12.36

²³⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/15/17 and 12/06/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	124	124	53	9	6,401	1.09	10,533	38,219	363%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			165	165	40	20	4,156	1.09	30,847	15,007	49%
Total										41,380	53,226	129%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (6,401) are greater than the annual hours of operation used to calculate ex ante savings (1,825). The second line item hours of operation (4,156) were fewer than the annual hours used to calculate ex ante savings (8,736). Both measures were installed in various locations throughout the facility with hours varying from 1,316 to 8,760.

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned small 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.²³⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 129%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for the first measure and overestimated annual lighting operating hours for the second measure.

²³⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	41,380	53,226	129%	10.11
Total		41,380	53,226	129%	10.11

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/07/17 and 10/31/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	116	116	40	18	2,798	1.11	8,094	7,908	98%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			116	-	40	-	2,798	1.11	14,716	14,379	98%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			12	12	40	18	2,798	1.11	837	818	98%
				8	8	40	18	2,797	1.11	558	545	98%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			12	-	40	-	2,798	1.11	1,522	1,487	98%
				8	-	40	-	2,797	1.11	1,015	991	98%
Total										26,742	26,129	98%

The annual lighting hours of operation verified during the M&V site visit (2,797 and 2,798) are fewer than the annual hours of operation used to calculate ex ante savings (2,964).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings are 26,742 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³⁷

²³⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 98%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	26,742	26,129	98%	4.96
Total		26,742	26,129	98%	4.96

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/17/17 and 11/08/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	1	1	34	18	3,786	1.11	62	67	107%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			1	-	34	-	3,786	1.11	133	143	107%
				82	-	34	-	3,592	1.11	10,889	11,092	102%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			82	82	34	18	3,592	1.11	5,124	5,220	102%
Total										16,208	16,522	102%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings are 16,208 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³⁸

²³⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 102%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	16,208	16,522	102%	3.14
Total		16,208	16,522	102%	3.14

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/17/17 and 11/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	5	5	32	18	3,866	1.11	328	300	91%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			8	-	40	-	1,491	1.11	1,500	529	35%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			49	98	60	18	3,866	1.11	5,511	5,035	91%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			49	-	60	-	3,866	1.11	13,779	12,588	91%
				5	-	32	-	3,866	1.11	750	685	91%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			8	8	40	18	1,491	1.11	825	291	35%
Total										22,693	19,427	86%

The annual lighting hours of operation verified during the M&V site visit (ranging from 1,491 to 3,866) are fewer than the annual hours of operation used to calculate ex ante savings (4,380). For line items two and six in the above table the measures were installed/removed from a basement storage area with infrequent usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings are 22,693 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²³⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 86%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	22,693	19,427	86%	3.69
Total		22,693	19,427	86%	3.69

²³⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewed facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
015455-100107-Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture	1169	Lighting	Custom	20	20	360	156	8,640	1.00	35,741	35,251	99%
				234	234					282,979	412,439	146%
Total										318,720	447,690	140%

The annual lighting hours of operation verified during the M&V site visit (8,640) vary from the annual hours of operation used to calculate ex ante savings (8,760 and 5,928, respectively). The client confirmed the lighting was turned off during their 5 holidays per year.

The ex post savings and ex ante savings estimate did not account for heating and cooling interactive factors since the area was unconditioned.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 140%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for the second measure.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	318,720	447,690	140%	85.04
Total		318,720	447,690	140%	85.04

²⁴⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/17/17 and 11/08/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	10	10	43	9	8,760	1.10	3,093	3,287	106%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	300	300	32	17	7,967	1.10	42,179	39,564	94%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	48	48	65	9	8,760	1.10	25,195	25,987	103%
Total										70,467	68,838	98%

The annual lighting hours of operation verified during the M&V site visit for the second line item in the table above (7,967) are fewer than the annual hours of operation used to calculate ex ante savings (8,760). Approximately 25% of this measure was installed in offices and kitchen area where the usage is not continuous.

The ex ante savings estimate used an adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned hotel common areas 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.²⁴¹

²⁴¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 98%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for one measure.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	70,467	68,838	98%	13.08
Total		70,467	68,838	98%	13.08

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/06/17 and 10/04/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	167	167	72	9	1,430	1.14	10,900	17,111	157%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			87	87	63	15	1,878	1.14	4,468	8,922	200%
Total										15,368	26,032	169%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

The ex ante savings estimate used an adjusted base wattage of 70W for the first line item in the above table and 63W for the third line item by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp for the first line item.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly 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.²⁴²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 169%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

²⁴² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	15,368	26,032	169%	4.95
Total		15,368	26,032	169%	4.95

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 12/02/17 and 12/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	6	6	32	18	4,126	1.11	355	384	108%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			6	-	32	-	4,126	1.11	812	877	108%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			48	96	60	18	4,126	1.11	4,871	5,265	108%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			48	-	60	-	4,126	1.11	12,178	13,162	108%
Total										18,217	19,688	108%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings are 18,217 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 108%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	18,217	19,688	108%	3.74
Total		18,217	19,688	108%	3.74

²⁴³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/08/17 and 8/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	60	60	455	167	8,256	1.09	151,373	156,054	103%
Total										151,373	156,054	103%

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate	
015249-301818-Lighting-Fixture Mounted Occupancy Sensor Controlling >50 and <=200 Watts Replacing No Controls	3077	Lighting	Standard	60	167	8,256	6,681	1.09	18,000	17,268	96%	
Total										18,000	17,268	96%

The annual lighting hours of operation verified during the M&V site visit (8,256) are less than the annual hours of operation used to calculate ex ante savings (8,760).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated little efficient behavior with turning off lighting during the workday and the end of the workday.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴⁴

²⁴⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 102%. The ex ante energy savings estimate was premised upon underestimated hours of operation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	151,373	156,054	103%	29.64
Standard		18,000	17,268	96%	3.28
Total		169,373	173,323	102%	32.92

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/14/17 and 11/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,085	1,085	32	17	1,983	1.09	32,667	35,210	108%
Total										32,667	35,210	108%

The annual lighting hours of operation verified during the M&V site visit (1,983) are greater than the annual hours of operation used to calculate ex ante savings (1,930).

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 108%. The ex ante energy savings estimate was premised upon underestimated hours of operation and underestimated heating and cooling effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	32,667	35,210	108%	6.69
Total		32,667	35,210	108%	6.69

²⁴⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/3/17 and 9/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	36	36	400	205	3,649	1.00	31,539	25,619	81%
Total										31,539	25,619	81%

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
017068-301818-Lighting-Fixture Mounted Occupancy Sensor Controlling >50 and <=200 Watts Replacing No Controls	3077	Lighting	Standard	36	205	3,649	3,207	1.00	10,800	3,265	30%
Total									10,800	3,265	30%

The annual lighting hours of operation verified during the M&V site visit (3,649) are fewer than the annual hours of operation used to calculate ex ante savings (4,320).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the workday and the end of the workday.

The ex ante energy savings estimate was premised upon occupancy sensors with a controlled wattage of 150. The ex post energy savings estimate utilized a controlled wattage of 205, based on the efficient lighting in the first table above.

The measures were installed in an unconditioned space. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 68%. The ex ante energy savings estimate was premised upon overestimated hours of operation, overestimated lighting control savings, and overestimated heating and cooling effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	42,339	28,884	68%	6.92
Total		42,339	28,884	68%	6.92

²⁴⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	91	91	43	10	5,241	1.14	16,596	17,984	108%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp	3008			244	244	90	12	4,477	1.14	108,368	96,931	89%
				12	12	75	12	5,241	1.14	4,305	4,507	105%
				6	6	75	12	5,241	1.14	2,153	2,254	105%
				1	1	50	7	5,241	1.14	245	256	105%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp	3012			67	67	50	7	4,875	1.14	16,422	15,977	97%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp	3007			7	7	65	10	5,241	1.14	2,194	2,295	105%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			17	17	72	12	5,241	1.14	6,944	6,081	118%
				4	4	72	12	8,760	1.00		2,102	
Total										157,227	148,307	94%

The annual lighting hours of operation verified during the M&V site visit ranging between 4,477 and 5,241 are less than the hours of operation used to calculate ex ante savings (5,475 – 5,481). An exception is the last line item which has greater operating hours (8,760). The ex ante annual hours of operation had sequential numbering within the application.

An adjusted base wattage of 43W, 72W, 72W was used in the ex post savings analysis for the first, eighth, and ninth line items, to meet the EISA 2007 standard lumen equivalent for a 60W and 100W incandescent lamp. The ex ante base wattage of 42W, 70W, and 70W was computed within the application by factoring 70% of a 60W and a 100W incandescent lamp.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air-conditioned, assembly 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴⁷ Four of the LED screw in lamps were found operating 24/7 in exterior areas; the ex post kW savings were based on the Miscellaneous End Use for this portion.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 94%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for eight measures.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	155,904	146,205	94%	27.77
Standard	Miscellaneous	1,323	2,102	159%	0.29
Total		157,227	148,307	94%	28.06

²⁴⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/14/17 and 11/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	290	290	32	17	1,659	1.09	17,463	7,903	45%
Total										17,463	7,903	45%

The annual lighting hours of operation verified during the M&V site visit (1,659) are fewer than the annual hours of operation used to calculate ex ante savings (1,930).

The quantity (290) verified during the M&V site visit is less than the ex ante savings quantity (580). The client only installed half of the original quantity, they felt the areas were too bright if all the lamps were installed. The remaining 290 lamps were returned.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned education 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 45%. The ex ante energy savings estimate was premised on the entire quantity of lamps installed and overestimated annual lighting operating hours.

²⁴⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	17,463	7,903	45%	1.50
Total		17,463	7,903	45%	1.50

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/30/17 and 12/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,509	1,509	32	14	3,346	1.09	84,745	99,503	117%
				62	62	32	12	3,789	1.09	3,869	5,144	133%
				20	20	25	11	2,334	1.09	874	716	82%
Total										89,488	105,362	118%

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the table above (3,346 and 3,789, respectively) are greater than the annual hours of operation used to calculate ex ante savings (3,000). The annual lighting hours of operation for the third line item (2,334) were fewer than those used to calculate ex ante savings.

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁴⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 118%. The ex ante energy savings estimate was premised upon underestimated hours of operation for two measures and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	89,488	105,362	118%	20.01
Total		89,488	105,362	118%	20.01

²⁴⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/15/17 and 8/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	90	90	90	17	3,564	1.09	14,581	25,546	175%
				4	4	50	8	3,564	1.09	373	653	175%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			20	20	29	5	3,108	1.09	1,021	1,627	159%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			747	747	32	17	1,961	1.09	24,868	23,964	96%
Total										40,843	51,791	127%

The annual lighting hours of operation verified during the M&V site visit for the fourth line item in the table above (1,961) are fewer than the annual hours of operation used to calculate ex ante savings (2,134). The lamps were installed in multiple locations with varying usage. The remaining measures have annual hours greater than the ex ante.

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 191%. The ex ante energy savings estimate was premised upon underestimated hours of operation for three measures and underestimated heating and cooling effects.

²⁵⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	40,843	51,791	127%	9.84
Total		40,843	51,791	127%	9.84

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/20/17 and 11/14/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	166	166	41	16	1,266	1.11	11,765	5,811	49%
				38	38	41	16	2,755	1.11	2,693	2,895	107%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			166	-	41	-	1,266	1.11	19,295	9,531	49%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			169	169	32	15	3,029	1.11	8,145	9,623	118%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			20	20	41	18	3,680	1.11	1,304	1,872	144%
Total										43,203	29,732	69%

The annual lighting hours of operation verified during the M&V site visit for the first and third line items in the table above (1,266) are fewer than the annual hours of operation used to calculate ex ante savings (2,726). Approximately 58% of this measure was installed in the basement area of the facility with minimal usage. The annual hours for the remaining line items (2,755, 3,029, and 3,680, respectively) are greater than the annual hours used to calculate ex ante savings (2,726).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned 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 1.04.

The total ex ante annual energy savings are 31,061 kWh for the first and third line items in the table above. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 69%. The ex ante energy savings estimate was premised on annual lighting operating hours for the main working area and not the usage of all areas with installed measures.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	43,203	29,732	69%	5.65
Total		43,203	29,732	69%	5.65

²⁵¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/14/17 and 11/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	3,220	3,220	32	17	2,201	1.09	96,948	115,980	120%
Total										96,948	115,980	120%

The annual lighting hours of operation verified during the M&V site visit (2,201) are greater than the annual hours of operation used to calculate ex ante savings (1,930).

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 120%. The ex ante energy savings estimate was premised upon underestimated hours of operation and underestimated heating and cooling effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	96,948	115,980	120%	22.03
Total		96,948	115,980	120%	22.03

²⁵² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/22/17 and 8/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	717	717	88	28	4,986	1.02	219,000	217,624	99%
100504-Lighting-T8 28 Watt Fixture Replacing T8 Fixture				106	106	114	47	4,850	1.02	36,220	35,014	97%
				29	29	114	47	4,850	1.02	9,910	9,580	97%
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture				35	35	88	28	4,850	1.02	9,181	10,334	113%
100504-Lighting-T8 28 Watt Fixture Replacing T8 Fixture				54	54	59	31	4,949	1.02	7,712	7,608	99%
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture				22	22	88	28	4,949	1.02	6,720	6,629	99%
				26	26	88	28	3,196	1.02	6,353	5,058	80%
				18	18	88	28	4,850	1.02	5,498	5,315	97%
				12	12	85	36	4,850	1.02	2,999	2,899	97%
100504-Lighting-T8 28 Watt Fixture Replacing T8 Fixture				19	19	46	19	4,850	1.02	2,616	2,529	97%
				14	14	59	31	5,844	1.02	2,234	2,329	104%
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture				4	4	88	28	4,850	1.02	1,222	1,181	97%
100504-Lighting-T8 28 Watt Fixture Replacing T8 Fixture				4	4	46	19	4,850	1.02	616	532	86%
				2	2	46	19	4,850	1.02	275	266	97%
Total										310,556	306,899	99%

The annual lighting hours of operation verified during the M&V site visit for the eleventh line item above (5,844) are greater than the annual hours of operation used to calculate ex ante savings (5,700). The remaining line items hours of operation (ranging from 3,196 to 4,986) are fewer than the ex ante hours (ranging from 5,100 to 5,700).

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 99%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	310,556	306,899	99%	58.30
Total		310,556	306,899	99%	58.30

²⁵³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/17/2017 and 11/08/2017.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture	1169	Lighting	Custom	80	80	117	24	3,225	1.00	28,242	23,991	85%
Total										28,242	23,991	85%

The annual lighting hours of operation verified during the M&V site visit (3,225) are fewer than the annual hours of operation used to calculate ex ante savings (3,650).

The measures were installed in an unconditioned location. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 85%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	28,242	23,991	85%	4.56
Total		28,242	23,991	85%	4.56

²⁵⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules. ADM staff verified that all installed lighting is operational 24/7 or is controlled with a timer to operate from 6am – 10pm daily.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,150	1,150	32	18	4,437	1.02	88,793	72,613	82%
				47	47	25	12	4,139	1.02	3,370	2,571	76%
Total										92,163	75,184	82%

The annual lighting hours of operation verified during the M&V site visit, ranging between 4,139 and 4,437, are fewer than the hours of operation used to calculate ex ante savings (5,303).

A heating and cooling interactive factor of 1.02, applicable to an electrically, 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 82%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	92,163	75,184	82%	14.28
Total		92,163	75,184	82%	14.28

²⁵⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	82	82	34	11	8,715	1.07	14,367	17,624	123%
				25	25	23	9	8,760	1.07	3,066	3,287	107%
Total										17,433	20,911	120%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (8,715) is fewer than the hours operation used to calculate ex ante (8,760). This is due to one lamp utilizing a dusk-to-dawn schedule.

The wattage of the first line item in the table above (11W) verified during the M&V site visit is less than the ex ante wattage (14W).

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 120%. The ex ante energy savings estimate was premised on underestimated heating and cooling effects and a greater efficient wattage for the first measure than actually installed.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	17,433	20,911	120%	3.97
Total		17,433	20,911	120%	3.97

²⁵⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 7/11/17 and 8/14/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	1169	Lighting	Custom	400	400	40	3.5	1,965	1.13	30,368	32,454	107%
Total										30,368	32,454	107%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates (2,000).

A heating and cooling interactive factor of 1.13, applicable to an electrically heated, air conditioned assisted living 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 107%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	30,368	32,454	107%	6.17
Total		30,368	32,454	107%	6.17

²⁵⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation with data collected between 9/21/17 and 10/30/17. Four photo-sensor loggers monitored the areas with occupancy sensors from 10/5/17 to 10/30/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	170	170	32	12	5,986	1.14	14,552	23,153	159%
Total										14,552	23,153	159%

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate	
201618-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >120 Watts	3079	Lighting	Standard	1	904	5,298	4,897	1	460	363	79%	
				4	119	2,179	1,382	1	1,840	380.29	21%	
				1	119	2,179	1,382	1	460	95.07	21%	
				2	56	796	390	1	920	45.49	5%	
Total										3,680	883	24%

The annual lighting hours of operation verified during the M&V site visit for the first table above (5,986) are greater than the annual hours of operation used to calculate ex ante savings (4,000).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the workday and the end of the workday. The controls were installed in mechanical rooms and storage rooms with infrequent usage for three of the four line items in the second table above.

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 132%. The ex ante savings estimate was premised on underestimated annual hours of use and underestimated heating and cooling effects for the lighting measure. In addition, the occupancy sensor savings was premised on deemed kWh savings per sensor.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	18,232	24,036	132%	5.10
Total		18,232	24,036	132%	5.10

²⁵⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/01/17 and 10/12/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	6	6	32	18	4,620	1.11	394	430	109%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			37	-	60	-	4,304	1.11	10,404	10,584	102%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear	3026			37	74	60	18	4,304	1.11	4,162	4,233	102%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			6	-	32	-	4,620	1.11	900	983	109%
Total										15,860	16,230	102%

The annual lighting hours of operation verified during the M&V site visit for the second and third line items in the above table (4,304) are fewer than the annual hours of operation used to calculate ex ante savings (4,380). The first and fourth line items have hours (4,620) greater than the ex ante.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 total ex ante annual energy savings are 15,860 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁵⁹

²⁵⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 102%. The ex ante energy savings estimate was premised on underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	15,860	16,230	102%	3.08
Total		15,860	16,230	102%	3.08

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/09/17 and 10/04/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	3	3	53	15	4,647	1.07	1,425	575	40%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			60	-	40	-	3,126	1.07	11,248	8,044	72%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			1	1	50	7	3,546	1.07	202	163	81%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft_	3026			6	6	24	12	4,949	1.07	337	382	113%
				60	60	40	18	3,126	1.07	6,186	4,424	72%
				20	20	40	18	5,605	1.07	2,062	2,644	128%
Total										21,460	16,233	76%

The annual lighting hours of operation verified during the M&V site visit for the second, third, and fifth line items in the table above (3,126, 3,546, and 3,126, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (4,380). The ex post hours of operation for the first, fourth, and sixth line items (4,647, 4,949, and 5,605, respectively) are greater than the ex ante hours. The measures were installed in multiple areas with varying usage that was not taken into consideration.

The quantity of the first line item in the first table above (3) verified during the M&V site visit is less than the ex ante savings quantity (8). The remaining lamps were sent to another location.

A heating and cooling interactive factor of 1.17, applicable to a gas heated, air conditioned 24/7 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 total ex ante annual energy savings for the second and fifth line items in the table above are 17,434 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a

heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 76%. The ex ante energy savings estimate was premised with one set annual lighting operating hours for all areas and overestimation of a measures quantity.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	21,460	16,233	76%	3.08
Total		21,460	16,233	76%	3.08

²⁶⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. ADM visited the site twice due to facility flooding, which delayed the installation of efficient lighting. Two of the photo-sensor loggers collected data between 8/22/17 and 9/18/17, while the other two photo-sensor loggers collected data between 11/10/17 and 11/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	120	120	53	12	3,019	1.14	17,036	16,898	99%
Total										17,036	16,898	99%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours are fewer than those used to develop the ex ante energy savings estimates (3,276).

The ex ante savings estimate used an LM adjusted base wattage of 52.5W by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly 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.²⁶¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 99%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

²⁶¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	17,036	16,898	99%	3.21
Total		17,036	16,898	99%	3.21

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed thirteen photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/13/17 and 11/6/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	153	153	32	15	6,256	1.10	20,886	17,957	86%
				32	32	32	15	6,379	1.10	4,369	3,829	88%
				240	240	32	15	6,846	1.10	32,762	30,828	94%
				122	122	32	15	5,578	1.15	16,654	13,261	80%
				2,808	2,808	32	15	7,172	1.10	383,320	377,854	99%
				34	34	32	15	5,755	1.10	4,641	3,671	79%
				4	4	32	15	5,585	1.10	466	357	77%
				60	60	32	15	6,537	1.10	8,191	7,359	90%
				316	316	32	15	7,896	1.10	43,137	46,811	109%
Total										514,427	501,928	98%

The annual lighting hours of operation verified during the M&V site visit (ranging between 5,585 and 7,896) are fewer than those used to develop the ex ante energy savings estimates (8,030).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large retail facility in St. Louis, was applied to the ex post lighting energy savings regarding lighting installed in the main store front. A heating and cooling interactive factor of 1.18, applicable to an in store refrigerated space, was applied to the ex post lighting energy savings regarding lighting installed in the cooler locations. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

²⁶² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	514,427	501,928	98%	95.35
Total		514,427	501,928	98%	95.35

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016364-200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012	Lighting	Standard	14	14	50	7	8,760	1.17	3,434	6,171	180%
016364-201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			5	5	53	13	8,760	1.17	8,651	2,050	24%
016364-301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			84	84	53	9	1,145	1.17	38,367	4,952	13%
Total										50,452	13,173	26%

The annual lighting hours of operation verified during the M&V site visit for the third line item in the table above (1,145²⁶³) are less than the annual hours of operation used to calculate ex ante savings (1,200). These lamps were installed in guest rooms. The annual lighting hours of operation for the remaining line items are accurate.

The ex ante savings estimate used an LM adjusted base wattage of 35W for the first line item in the above table and 52.5W for the second and third line items by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis for the second and third line items to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The base lamps for the first line item (MR16) are exempt from an adjusted wattage calculation.

The quantities of the second and third line items in the first table above (5 and 84, respectively) verified during the M&V site visit and follow up contact at the end of the program year are less than the ex ante savings quantity (25 and 735, respectively). These lamps were found to be in storage during the M&V site visit.

²⁶³ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

A heating and cooling interactive factor of 1.17, applicable to an electrically heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 26%. The ex ante energy savings estimate was premised on the full installation of efficient lighting.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	50,452	13,173	26%	2.50
Total		50,452	13,173	26%	2.50

²⁶⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/3/17 and 10/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	23	23	400	150	5,453	1.00	17,221	31,354	182%
Total										17,221	31,354	182%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (2,995).

The measures were installed in an unconditioned location. The ex post savings analysis corresponds with the ex ante energy savings heating and cooling interactive factor of 1.00.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 182%. The ex ante energy savings estimate was premised upon underestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	17,221	31,354	182%	5.96
Total		17,221	31,354	182%	5.96

²⁶⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	34	34	95	18	8,760	1.07	23,851	24,589	103%
Total										23,851	24,589	103%

The annual lighting hours of operation verified during the M&V site visit are consistent with the annual hours of operation used to calculate ex ante savings (8,760).

A heating and cooling interactive factor of 1.07, applicable to a gas 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 103%. The ex ante energy savings estimate was premised on underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	23,851	24,589	103%	4.67
Total		23,851	24,589	103%	4.67

²⁶⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/20/17 and 10/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	159	159	32	18	5,449	1.17	10,432	14,192	136%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			6	-	32	-	4,378	1.17	900	984	109%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			159	-	32	-	5,449	1.17	23,845	32,439	136%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			6	6	32	18	4,378	1.17	394	430	109%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			15	-	34	-	8,228	1.17	2,390	4,910	205%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			15	15	34	18	8,228	1.17	1,125	2,311	205%
Total										39,086	55,266	141%

The annual lighting hours of operation verified during the M&V site visit for the second and fourth line items in the table above (4,378) correspond with the annual hours of operation used to calculate ex ante savings (4,380) while the remaining line items are greater (5,449 and 8,228). The measures were installed in multiple locations throughout the facility with varying usage.

A heating and cooling interactive factor of 1.17, applicable to a gas heated, air conditioned hotel 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 total ex ante annual energy savings are 39,086 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 141%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	39,086	55,266	141%	10.50
Total		39,086	55,266	141%	10.50

²⁶⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/29/17 and 10/30/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100216-Lighting-Non Linear LED Fixture Replacing Existing Inefficient Lighting Fixture	1169	Lighting	Custom	106	106	143	41	2,683	1.11	35,669	32,310	91%
Total										35,669	32,310	91%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 91%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	35,669	32,310	91%	6.14
Total		35,669	32,310	91%	6.14

²⁶⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed ten photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/10/17 and 10/30/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	2	2	82	32	1,812	1.18	803	213	27%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	328	328	32	15	6,679	1.12	39,508	34,670	88%
				18	18	32	15	8,760	1.10	2,168	2,958	136%
				700	700	32	15	8,130	1.10	84,315	106,777	127%
				2,610	2,610	32	15	7,365	1.10	314,375	360,629	115%
				38	38	32	15	7,111	1.10	4,577	5,069	111%
				34	34	32	15	6,154	1.18	4,096	4,183	102%
Total										449,842	514,499	114%

The annual lighting hours of operation verified during the M&V site visit for the third and fourth line items above (8,760 and 8,130, respectively) are greater than the annual hours of operation used to calculate ex ante savings (8,030). The verified annual lighting hours of operation for the remaining line items (ranging from 1,812 to 7,365) are fewer than those used to calculate ex ante savings (8,030).

The efficient wattage of line items two through seven verified during the M&V site visit (15W) is less than the wattage used to calculate the ex ante energy savings estimate (17W).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large single-story retail in St. Louis, was applied to the ex post lighting energy savings. In addition, a factor of 1.12 and 1.18 was used for measures installed in coolers or walk-in coolers. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁶⁹

²⁶⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 114%. The ex ante was premised on underestimated heating and cooling effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	449,039	514,286	115%	97.70
Custom		803	213	27%	0.04
Total		449,842	514,499	114%	97.74

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/14/17 and 12/4/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	100	100	75	18	3,616	1.11	19,373	22,828	118%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			126	126	32	16	3,457	1.11	6,852	7,720	113%
				51	51	32	18	3,541	1.11	2,427	2,800	115%
Total										28,652	33,348	116%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,268).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate account for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁷⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 116%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	28,652	33,348	116%	6.33
Total		28,652	33,348	116%	6.33

²⁷⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed nine photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/28/17 and 10/18/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	22	22	75	8	593	1.09	4,921	957	19%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			143	143	33	15	2,143	1.09	8,593	6,040	70%
				46	46	38	18	1,575	1.09	3,071	1,587	52%
Total										16,585	8,585	52%

The annual lighting hours of operation verified during the M&V site visit are fewer than the annual hours of operation used to calculate ex ante savings (3,120).

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁷¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 52%. The ex ante energy savings estimate was premised on overestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	16,585	8,585	52%	1.63
Total		16,585	8,585	52%	1.63

²⁷¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/20/17 and 10/23/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	375	375	32	18	5,101	1.06	27,671	28,391	103%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			375	-	32	-	5,101	1.06	63,249	64,893	103%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			27	27	32	18	5,130	1.29	1,992	2,502	126%
Total										92,912	95,786	103%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.02, applicable to an electric heated, air conditioned retail facility in St. Louis, was applied to the ex post lighting energy savings for all interior areas. In addition, heating and cooling interactive factors of 1.29 and 1.15 were applied to measures installed in cooler and freezer cases, respectively. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The total ex ante annual energy savings for the first two line items in the table above are 90,920 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁷²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 103%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated the heating and cooling interactive effects within the cooler and freezer cases.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	92,912	95,786	103%	18.20
Total		92,912	95,786	103%	18.20

²⁷² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/3/17 and 10/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline / Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401- Lighting- Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	190	35	15	3,857	1.10	10,149	16,175	159%
				185	40	15	2,504	1.10	13,253	12,782	96%
Total									23,401	28,957	124%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the above table (3,857) is greater than the hours of operation used to calculate the ex ante savings (2,496). The ex post hours for the second line item (2,504) are fewer than the hours used in the ex ante estimate (2,678).

A heating and cooling interactive factor of 1.10, applicable to a gas heated and 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 kWh savings.²⁷³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 124%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for the first line item.

²⁷³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	23,401	28,957	124%	5.50
Total		23,401	28,957	124%	5.50

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/21/17 and 11/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	SBDI	2	2	60	2	8,760	1.11	984	1,124	114%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			6	6	48	15	188	1.11	857	41	5%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			58	58	48	18	2,472	1.11	7,528	4,758	63%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			58	-	48	-	2,472	1.11	12,045	7,613	63%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			2	4	96	15	2,704	1.11	571	395	69%
Total										21,985	13,931	63%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above corresponds with the ex ante hours (8,760). The remaining line items have annual hours of operation (ranging from 188 - 2,704) which are fewer than the annual hours of operation used to calculate ex ante savings (4,160).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned 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 1.04.

The total ex ante annual energy savings for the third and fourth line item in the table above are 19,573 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁷⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 63%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	21,985	13,931	63%	2.65
Total		21,985	13,931	63%	2.65

²⁷⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/14/17 and 10/09/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	25	25	65	10	6,065	1.12	9,269	9,323	101%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			2	2	30	3	8,760	1.12	506	529	104%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			54	54	40	12	4,578	1.12	6,292	7,737	123%
Total										16,067	17,589	109%

The annual lighting hours of operation verified during the M&V site visit for the second line item in the table above corresponds with the ex ante hours (8,760). The annual hours for the first and third line items (6,065 and 4,578, respectively) are greater than the annual hours of operation used to calculate ex ante savings (3,500).

The quantity of the third line item in the first and third line items in the table above (25 and 54, respectively) verified during the M&V site visit is less than the ex ante savings quantity (45 and 60, respectively). The client has the extra lamps in storage to use as replacements.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned full-service restaurant 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.²⁷⁵

²⁷⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 109%. The ex ante energy savings estimate was premised on overestimated installed lamps and an underestimated heating and cooling interactive factor.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	16,067	17,589	109%	3.34
Total		16,067	17,589	109%	3.34

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/5/17 and 10/30/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline/ Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	800	36	18	4,362	1.10	79,208	69,325	88%
				94	28	12	3,740	1.10	8,273	6,208	75%
				3	23	9	3,740	1.10	231	173	75%
Total									87,712	75,707	86%

The annual lighting hours of operation verified during the M&V site visit (ranging between 3,740 and 4,362), are fewer than the hours of operation used to calculate ex ante savings (5,289).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, electric air conditioned large single-story 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 interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁷⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 86%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	87,712	75,707	86%	14.38
Total		87,712	75,707	86%	14.38

²⁷⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/30/17 and 11/01/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate	
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	11	11	30	21	2,121	1.10	693	232	33%	
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard		16	16	32	15	7,496	1.10	2,184	2,250	103%
					16	16	32	15	8,760	1.10	2,184	2,630	120%
					63	63	32	15	2,380	1.18	8,600	2,997	35%
					98	98	32	15	5,498	1.10	13,378	10,109	76%
					6	6	17	9	8,760	1.10	409	493	121%
					6	6	32	15	6,498	1.10	819	731	89%
					342	342	32	15	7,750	1.12	46,686	50,550	108%
					452	452	32	15	5,523	1.12	61,703	47,569	77%
					102	102	32	15	5,392	1.29	13,924	12,062	87%
					30	30	32	15	5,392	1.29	4,095	3,548	87%
					3,444	3,444	32	15	7,178	1.10	470,140	463,788	99%
					2	2	32	15	2,380	1.18	273	95	35%
					6	3	32	15	2,380	1.18	1,181	411	35%
Total										626,269	597,465	95%	

The annual lighting hours of operation verified during the M&V site visit for the third and sixth line items in the table above (8,760) are greater than the hours used to calculate ex ante savings (8,030). The remaining line items have annual hours (ranging from 2,380 to 7,496) which are less than the ex ante savings hours (8,030).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air-conditioned large retail facility in St. Louis, was applied to the ex post lighting energy savings. In addition, factors of 1.18 and 1.29 were applied to measures installed within coolers and walk-in coolers. 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.²⁷⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 95%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	625,576	597,234	95%	113.45
Custom		693	232	33%	0.04
Total		626,269	597,465	95%	113.50

²⁷⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/23/17 and 12/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	330	330	32	15	1,325	1.11	18,728	8,374	45%
Total										18,728	8,374	45%

The annual lighting hours of operation verified during the M&V site visit (1,325) are fewer than the annual hours of operation used to calculate ex ante savings (3,120). The lamps were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas 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.²⁷⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 45%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	18,728	8,374	45%	1.59
Total		18,728	8,374	45%	1.59

²⁷⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/15/17 and 10/10/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016252-305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	160	160	400	165	4,651	1.09	144,685	191,277	132%
Total										144,685	191,277	132%

The annual lighting hours of operation verified during the M&V site visit (4,651) are greater than the annual hours of operation used to calculate ex ante savings (3,700). This is due to increasing the number of shifts worked per day at the facility from two to three.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁷⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 132%. The ex ante energy savings estimate was premised on underestimated annual hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	144,685	191,277	132%	36.34
Total		144,685	191,277	132%	36.34

²⁷⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/11/17 and 11/08/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	86	88	455	197	8,760	1.00	190,915	190,915	100%
100202-Lighting-Non Linear LED Fixture Replacing T12 HO Fixture				46	56	227	74	8,760	1.00	55,171	55,170	100%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				24	24	455	153	8,760	1.00	63,492	63,492	100%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				15	15	1,080	251	8,760	1.00	108,931	108,931	100%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				40	40	455	197	8,760	1.00	90,403	90,403	100%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				143	143	122	36	3,642	1.11	41,813	49,533	118%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				51	51	455	251	8,760	1.00	91,139	91,139	100%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				10	10	82	28	3,566	1.11	1,836	2,130	116%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				18	18	82	37	8,760	1.00	2,754	7,096	258%
Total										646,455	658,809	102%

The annual lighting hours of operation verified during the M&V site visit for the sixth and eighth line items in the table above (3,642 and 3,566, respectively) are greater than the hours of operation used to calculate ex ante savings (3,400). The remaining measures correspond with the ex ante hours (8,760).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings for all interior office applications. The warehouse was unconditioned and corresponded with the ex ante estimate for heating and cooling (1.00).

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 102%. The ex ante energy savings estimate was premised on underestimated hours of operation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	646,455	658,809	102%	125.15
Total		646,455	658,809	102%	125.15

²⁸⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/26/17 and 10/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	43	43	165	36	8,760	1.00	48,592	48,592	100%
100116-Lighting-Linear Tube LED Fixture Replacing Existing Inefficient Lighting Fixture				36	36	165	36	2,413	1.11	18,576	12,393	67%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft				20	20	32	18	8,760	1.00	2,452	2,453	100%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3025		Standard	215	215	32	18	8,760	1.00	17,157	26,368	154%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft				12	12	22	12	6,827	1.05	1,052	863	82%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			10	10	40	18	5,382	1.00	1,254	1,184	94%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	218		218	32	17	3,130	1.00	28,645	10,234	36%	
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft		113		113	32	18	8,760	1.00	13,858	13,858	100%	
Total										238,037	222,395	93%

The annual lighting hours of operation verified during the M&V site visit for the second, sixth, seventh, and eighth line items in the table above (2,413, 6,827, 5,382, and 3,130, respectively) are fewer than the hours of operation used to calculate ex ante savings (4,000, 8,760, 5,700, 8,760, respectively). The hours of operation for the fifth line item (8,760) are greater than the ex ante hours (5,700). The remaining measures have hours that correspond to the ex ante (8,760).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings for lighting installed in office locations. No heating and cooling interactive effects were accounted for regarding lighting installed in shop locations due to the space being unconditioned. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 93%. The ex ante energy savings estimate was premised on the majority of lighting being operational 24/7 and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	64,419	54,959	85%	10.44
Custom		173,619	167,436	96%	31.81
Total		238,037	222,395	93%	42.25

²⁸¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/29/17 and 12/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	480	480	43	9	2,695	1.14	75,311	49,955	66%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			8	8	400	54	8,760	1.14	25,218	27,538	109%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			21	21	43	9	4,308	1.00	-	3,076	
Total										100,529	80,569	80%

The annual lighting hours of operation verified during the M&V site visit for the first and third line item in the table above (2,695 and 4,308²⁸²) are fewer than the hours of operation used to calculate ex ante savings (4,380). The second measure is consistent with the ex ante hours (8,760).

The third line item in the table above table was added since the quantity (21) was confirmed to be installed exterior and not interior as the remaining of the measures were.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned nursing home facility in St. Louis, was applied to the ex post lighting energy savings for the interior installations. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸³

²⁸² Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php

²⁸³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 80%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for the first and third line items.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	100,529	80,569	80%	15.31
Total		100,529	80,569	80%	15.31

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/12/17 and 01/02/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt BiPin Replacing Bi-Pin Lamp	3009	Lighting	Standard	250	250	53	10	2,140	1.14	96,798	26,125	27%
301132-Lighting-LED 7-20 Watt A-Lamp Replacing A-Lamp				110	110	53	9	7,219	1.14	5,479	39,682	724%
Total										102,277	65,807	64%

The annual lighting hours of operation verified during the M&V site visit for the first line item of Bi-Pin lamps in the table above, (2,140) are fewer than the annual hours of operation used to calculate ex ante savings (8,760). The second measure for screw-in A-lamps had annual hours (7,219) greater than the ex ante hours (1,145). The lamps were installed in multiple locations with varying hours.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned nursing home 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 1.04 for the first line item in the table above and 1.00 for the second line item.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 64%. The ex ante energy savings estimate was premised on inaccurate annual lighting operating hours.

²⁸⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	102,277	65,807	64%	12.50
Total		102,277	65,807	64%	12.50

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/11/18 and 1/30/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	20	20	40	17	8,760	1.13	1,792	4,558	254%
				20	20	40	20	8,760	1.13	1,558	3,964	254%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	240	240	53	10	2,919	1.13	24,117	34,479	143%
				600	600	53	10	755	1.13	30,723	22,304	73%
				150	150	53	10	2,738	1.13	11,739	20,212	172%
Total										69,929	85,518	122%

The annual lighting hours of operation verified during the M&V site visit for the fourth line item (755) are fewer than the annual hours of operation used to calculate ex ante savings (1,145). The hours for the remaining line items (8,760, 8,760, 755, and 2,738, respectively) are greater than those used to calculate ex ante savings (3,640, 3,640, 2,184 and 1,820, respectively).

The ex ante savings estimate used an adjusted base wattage of 52.5W for the third, fourth and fifth line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

A heating and cooling interactive factor of 1.13, applicable to an electrically heated, air conditioned nursing home in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07 for the first three line items in the table above. A factor of 1.04 was applied to ex ante savings for the fourth line item and did not account for heating and cooling interactive effects for the fifth line item.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸⁵

²⁸⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 122%. The ex ante energy savings was premised upon underestimated hours of operation for four measures and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	69,929	85,518	122%	16.25
Total		69,929	85,518	122%	16.25

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/08/17 and 10/02/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	20	20	65	11	4,287	1.09	4,920	5,067	103%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			60	60	43	10	2,326	1.09	8,410	5,040	60%
				96	96	43	10	1,784	1.09	13,994	6,186	44%
				50	50	32	14	6,005	1.09	3,942	5,914	150%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			5	5	32	12	6,005	1.09	469	657	140%
				25	25	32	14	4,700	1.09	2,109	2,314	110%
				25	25	32	14	6,611	1.09	4,100	3,255	79%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			5	5	50	8	6,005	1.09	981	1,380	141%
				10	10	65	11	4,287	1.09	5,062	2,534	50%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			52	52	43	10	3,679	1.09	14,956	6,909	46%
Total										58,943	39,256	67%

The annual lighting hours of operation verified during the M&V site visit for the first, second, third, ninth and tenth line items in the above table (4,287, 2,326, 1,784, 4,287 and 3,679, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (8,760 for the ninth line item, 4,380 for the remaining line items). The hours verified during the site visit for the remaining line items are greater than those used to calculate ex ante savings (4,380).

The ex ante savings estimate used an adjusted base wattage of 42W for the second, third and tenth line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The quantities of the seventh and tenth line items in the table above verified during the M&V site visit (25 and 52, respectively) are fewer than the quantities used to calculate ex ante energy savings (50 and 100, respectively). The remaining lamps were placed in storage to be used as replacements.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04 for the first, third and seventh line items in the table above. The ex ante savings did not account for heating and cooling effects for the second and fourth line items. A factor of 1.07 was applied to the ex ante savings for the remaining line items.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 67%. The ex ante savings estimate was premised upon overestimated hours of operation for five of the ten line items in the above table and overestimated quantity of installed lamps for the seventh and tenth line items.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	58,943	39,256	67%	7.46
Total		58,943	39,256	67%	7.46

²⁸⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/07/17 and 10/31/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	4	4	32	12	4,914	1.10	424	434	102%
				316	316	32	12	6,148	1.10	33,495	42,883	128%
				188	188	32	12	4,952	1.10	19,927	20,547	103%
Total									53,846	63,864	119%	

The annual lighting hours of operation verified during the M&V site visit for the first and third line items in the above table (4,914 and 4,952, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (5,096). The remaining measure had annual hours (6,148) greater than the ex ante savings hours.

A heating and cooling interactive factor of 1.10, applicable to a gas 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 119%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for the second measure and underestimated heating and cooling interactive effects.

²⁸⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	53,846	63,864	119%	12.13
Total		53,846	63,864	119%	12.13

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/12/17 and 11/07/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100107-Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture	1169	Lighting	Custom	375	375	60	25	3,322	1.00	32,400	43,603	135%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard	415	415	32	14	3,113	1.11	29,484	25,722	87%
Total										61,884	69,325	112%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (3,322) are greater than the annual hours of operation used to calculate ex ante savings (2,700). The second measure had hours of operation (3,113) is fewer than the ex ante savings hours (3,500).

The efficient wattage of the first line item in the table above (25) verified during the M&V site visit is less than the wattage used to calculate ex ante energy savings (28).

The efficient quantity of the second line item in the table above (415) verified during the M&V site visit is less than the quantity used to calculate ex ante energy savings (450). The remaining 35 lamps were placed in storage to be used as replacements.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings for the second line item above. The ex ante savings estimate accounted for a heating and cooling factor of 1.04 for office space. The first measure was installed in an unconditioned space and was consistent with the ex ante heating and cooling interactive factor (1.00).

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁸⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 112%. The ex ante energy savings estimate was premised on an overestimated efficient wattage and underestimated annual hours of operation for the first measure

²⁸⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

while the second measure was premised on a total installation of purchased product and fewer hours of operation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	29,484	25,722	87%	4.89
Custom		32,400	43,603	135%	8.28
Total		61,884	69,325	112%	13.17

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/19/17 and 9/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	440	440	53	10	1,905	1.09	36,845	39,908	108%
				38	38	53	10	4,308	1.00	2,939	7,039	240%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			18	18	65	12	581	1.09	1,736	607	35%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			140	140	53	10	2,582	1.09	10,956	17,205	157%
Total										52,476	64,759	123%

The annual lighting hours of operation verified during the M&V site visit for the third line item in the above table (581) are fewer than the annual hours of operation used to calculate ex ante savings (1,820). The verified hours for the first and fourth line items (1,905 and 2,582, respectively) are greater than those used to calculate ex ante savings (1,820). The hours of operation for the second line item above has fixtures using photo cells (4,308²⁸⁹) are greater than the hours of operation used to calculate ex ante savings (1,820).

The ex ante savings estimate used an adjusted base wattage of 52.5W for the first, second and fourth line items in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home in St. Louis, was applied to the ex post lighting energy savings of the first, third and fourth line items in the above table. The second line item was installed in unconditioned spaces. The ex ante savings estimate applied a factor of 1.07 for the first line item, but did not account for heating and cooling interactive effects for the remaining line items. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the last three

²⁸⁹ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

line items. On the Microsoft Excel application form, the applicant cut and pasted the location name, and a technical error in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 123%. The ex ante energy savings estimate was premised upon underestimated annual lighting operating hours for three of four line items in the above table, and underestimated heating and cooling interactive effects for three of the four line items.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	49,537	57,720	117%	10.96
	Exterior	2,939	7,039	240%	0.00
Total		52,476	64,759	123%	10.96

²⁹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/10/17 and 11/06/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	Standard	100	100	50	9	3,534	1.09	19,742	15,864	80%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			18	18	60	6	3,534	1.09	6,448	3,761	58%
				12	12	60	6	3,534	1.09	4,299	2,507	58%
				12	12	50	6	3,534	1.09	3,503	2,043	58%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			200	200	32	17	3,173	1.09	10,015	10,423	104%
				300	300	32	17	3,924	1.09	15,023	19,335	129%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			20	20	50	12	3,534	1.09	5,042	2,941	58%
		12	12	50	12	3,534	1.09	3,025	1,764	58%		
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			30	30	50	9	3,534	1.09	8,160	4,759	58%
305114-Lighting-62-130 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 176-300 Watt Lamp or Fixture	3004-1	Misc.		3	3	310	62	8,760	1.00	6,517	6,517	100%
Total										81,774	69,915	85%

The annual lighting hours of operation verified during the M&V site visit for the tenth line item in the table above is consistent with the ex ante savings estimate (8,760). This measure was installed in the garage with continuous usage. The hours for the fifth and sixth line items (3,173 and 3,924, respectively) are greater than the annual hours of operation used to calculate ex ante savings (3,120). The remaining measures had hours (3,534) which were fewer than the ex ante estimate hours (4,500 for the first line item and 6,200 for the others).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned large office in St. Louis, was applied to the ex post lighting energy savings for all interior applications. The ex ante savings estimate accounted for a heating and cooling factor of 1.07. The tenth line item was consistent with the ex ante savings estimate for an unconditioned measure.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 85%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for seven measures.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	75,256	63,398	84%	12.04
	Miscellaneous	6,517	6,517	100%	0.90
Total		81,774	69,915	85%	12.94

²⁹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/6/17 and 11/1/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	72	72	32	16	2,348	1.01	3,796	2,822	74%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			100	100	40	16	2,427	1.01	46,166	6,016	13%
				36	72	96	16	2,488	1.00	6,084	5,822	96%
Total										56,046	14,660	26%

The annual lighting hours of operation verified during the M&V site visit (2,348, 2,427, and 2,488, respectively) are fewer than the hours of operation used to calculate ex ante savings (2,500, 3,072 and 3,072, respectively).

The base quantity of the second line item in the table above (100) verified during the M&V site visit is less than the ex ante savings quantity (400). The client stated that the baseline quantity on the application was an input error.

A heating and cooling interactive factor of 1.01, 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 26%. The ex ante energy savings estimate was premised upon overestimated hours of operation and overestimated baseline quantity for the second measure.

²⁹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	56,046	14,660	26%	2.78
Total		56,046	14,660	26%	2.78

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, interviewing facility personnel regarding lighting operating schedules, and installed ten photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/30/17 and 9/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	10	10	40	20	1,778	1.09	568	388	68%
				500	500	40	17	1,791	1.09	32,633	22,465	69%
				300	300	40	17	2,296	1.09	19,580	17,279	88%
				300	300	40	17	2,725	1.09	19,580	20,511	105%
				280	280	40	17	947	1.09	13,395	6,656	50%
Total									85,756	67,299	78%	

The annual lighting hours of operation verified during the M&V site visit for the fourth line item in the above table (2,725) are greater than the annual hours of operation used to calculate ex ante savings (2,652). The verified hours for the remaining line items are fewer than those used to calculate ex ante savings (2,652).

A heating and cooling interactive factor of 1.09, applicable to a gas 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 for the first four line items in the above table, and 1.04 for the fifth line item.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 78%. The ex ante energy savings estimate was premised upon underestimated heating and cooling interactive effects as well as overestimated hours of operation for four of the five line items in the table above.

²⁹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	85,756	67,299	78%	12.78
Total		85,756	67,299	78%	12.78

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/30/17 and 9/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,000	1,000	32	17	5,922	1.00	75,000	88,830	118%
				1,300	1,300	32	17	5,557	1.00	85,129	108,362	127%
Total										160,129	197,192	123%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (5,000 and 4,080, respectively).

The measures were installed in an unconditioned space. The ex ante savings estimate accounted for a heating and cooling factor of 1.07 for the second line item in the above table.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 123%. The ex ante energy savings estimate was premised on underestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	160,129	197,192	123%	37.46
Total		160,129	197,192	123%	37.46

²⁹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, annual work schedule, and lighting controller schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	288	288	451	178	5,764	1.09	382,499	496,459	130%
Total										382,499	496,459	130%

The annual lighting hours of operation verified during the M&V site visit (5,764) are more than the ex ante annual hours of 4,858. The lighting operates on a time scheduler, with a schedule for straight time production weeks and overtime production weeks. The ex post applied the annual production schedule with 15 weeks of overtime to the hours of use profile. The building had been warehousing space and completed a gut rehab conversion to manufacturing space. The baseline lighting power density for both the ex ante and ex post were based on the prevailing 2009 IEBC Energy Conservation Code.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, industrial facility in St Louis was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for a heating and cooling interactive factor.

The peak coincident demand reduction was determined by applying the appropriate end use kW factor to the kWh savings for lighting.²⁹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 130%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
New Construction	Lighting	382,499	496,459	130%	94.31
Total		382,499	496,459	130%	94.31

²⁹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, annual work schedule, and lighting controller schedules.

The customer installed (1) variable speed (VS) air compressor, (1) fixed speed load/unload air compressor, (1) cycling refrigerated dryer, and (3) 620 gallon storage tanks. The lower cost alternative for the compressed air system is stated as (1) 200 hp fixed speed air compressor with inlet modulation and (1) non-cycling refrigerated dryer. The installed compressed air system components are listed below:

Compressed Air Components

<i>Description</i>	<i>QTY</i>	<i>Make / Model #</i>	<i>Hp/cfm/gallons</i>	<i>Control Type</i>
Fixed Speed Air Compressor	1	Gardner Denver / L75	75	Load/Unload
Variable Speed Air Compressor	1	Gardner Denver / L75RS	75	VS
Cycling Refrigerated Dryer	1	Gardner Denver / GTRC	1,000	Cycling
Air Storage Tanks	3	-	620	-

ADM reviewed all project documentation provided by the contractor and obtained as-built monitoring data. The as-built monitoring data totaled a week (seven days) in 12 second intervals. The as-built monitoring data totaled 44 days in 5 second intervals. However, the first 9 days were not typical, thus the remaining 35 days were used for the analysis. Variables monitored included: kW for the Gardner Denver L75RS VSD Compressor.

The two compressors were designed for base load and trim load, but the plant is not fully built out in the new space. There is one production line running. Thus, one air VSD compressor supports the load. It is expected that the average day shift is 500 cfm and the average night shift is 300 cfm.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	320	320	577	280	6,609	1.09	607,568	687,007	113%
Total										607,568	687,007	113%

The annual lighting hours of operation verified during the M&V site visit (6,609) are more than the ex ante annual hours of 6,393. The lighting operates on a time scheduler, with more weekend hours for production than when the application was submitted. The building had been warehousing space and

had a gut rehab for conversion to manufacturing space. The baseline lighting power density for both the ex ante and ex post were based on the prevailing 2009 IEBC Energy Conservation Code.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, industrial facility in St Louis was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for a heating and cooling interactive factor.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹⁶

New Compressed Savings Calculations

ADM estimated energy savings using the facility's compressed air load profile derived from as-built monitoring data. The load (cfm) at each monitoring point was determined using the calculated kW values and compressor curves from the UMP²⁹⁷. Only one compressor was operating at the time of the monitoring period and the calculated cfm is less than the expected operating cfm. Thus, the calculated cfm was adjusted to match the expected 500 cfm during the day shift and 300 cfm during the night shift. ADM created an as-built efficiency curve of kW vs adjusted cfm. 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 as-built system kW and cfm. Using the calculated adjusted as-built cfm, the baseline kW was determined. The UMP curve for a compressor using Inlet Modulation without blowdown was used to calculate the baseline kW at each cfm point.

Energy savings for the compressor were calculated by taking the difference in energy requirements of baseline and as-built NC compressed air systems, at each monitoring point, summing over the monitoring period, and scaling to an annual basis. This method assumes the monitoring period represented a typical demand profile at the facility.

For the air dryer savings, ADM compared the installed dryer to a baseline non-cycling refrigerated air dryer. The baseline kW was calculated by assuming the dryer kW was constant whenever there was a cfm demand. The installed dryer kW was calculated by assuming the kW demand scaled linearly with the cfm demand. Using the calculated adjusted as-built cfm, the baseline and as-built dryer kW was calculated.

Energy savings for the compressed air system and dryer were calculated by taking the difference in energy requirements of baseline and as-built NC compressor and dryer systems, at each monitoring point, summing over the monitoring period, and scaling to an annual basis. This method assumes the monitoring period represented a typical demand profile at the facility.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 104%. For the lighting portion the ex ante was premised on underestimated annual hours of operation and underestimated heating and cooling effects. For the compressed air the results are primarily due to the ex ante analysis estimating the day and night shift hours. The ex ante analysis estimated that the day and night shift hours were 8.5 hours each; however,

²⁹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

²⁹⁷ Chapter 22: Compressed Air Evaluation Protocol, The Uniform Methods Project (UMP): Methods for Determining Energy Efficiency Savings for Specific Measures

from the monitoring data, night shift runs from 12am to 6am (6 hours) and day shift runs from 6am to 4pm (10 hours). If the confirmed shift hours were used in the ex ante analysis, the realization rate would have been 100%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
New Construction	Lighting	607,568	687,007	113%	103.51
	Compressed Air	269,466	220,578	82%	30.43
	Dryer	17,728	20,622	116%	2.84
Total		894,752	928,207	104%	136.78

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed sixteen photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/17/17 and 9/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate		
100105-Lighting-Linear Tube LED Fixture Replacing T8 HO Fixture	1169	Lighting	Custom	169	338	160	24	4,749	1.01	94,489	90,363	96%		
				108	108	88	44	4,367	1.09	23,722	22,700	96%		
100116-Lighting-Linear Tube LED Fixture Replacing Existing Inefficient Lighting Fixture				49	49	176	96	6,171	1.09	19,569	26,305	134%		
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture				57	57	82	24	4,386	1.09	16,504	15,859	96%		
				32	68	114	22	1,358	1.09	10,743	3,196	30%		
				19	38	114	24	3,466	1.09	6,260	4,754	76%		
101108-Lighting-New Efficient Lighting Fixture Replacing Metal Halide Fixture				3	4	455	96	4,423	1.09	4,897	4,746	97%		
101113-Lighting-New Efficient Lighting Fixture Replacing CFL Fixture				4	4	18	6	628	1.09	239	33	14%		
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft			3025	Standard	17	17	32	22	1,441	1.09	849	268	32%	
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture			1169	Lighting	Custom	2	2	18	6	3,321	1.09	86	87	101%
						2	2	88	46	3,578	1.09	302	329	109%
						2	2	83	24	5,101	1.09	424	658	155%
	10	10				82	46	4,503	1.09	1,294	1,773	137%		
	8	8				82	26	3,200	1.09	1,610	1,568	97%		
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	13	13			125	60	318	1.09	3,037	294	10%			
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	8	8			164	44	3,321	1.09	3,450	3,487	101%			
	10	10			164	46	2,801	1.09	4,241	3,615	85%			
	18	18			138	46	334	1.09	5,951	606	10%			
	29	29			124	46	4,209	1.09	8,130	10,415	128%			
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Standard			1	1	72	16	3,200	1.09	194	196	101%	
201111-Lighting-LED <=11 Watt Lamp	3011				49	49	43	10	3,170	1.09	5,723	5,692	99%	

Replacing Halogen A 28-52 Watt Lamp												
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1		2	2	400	95	3,578	1.09	2,192	2,387	109%	
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture		1169	Custom	11	11	125	50	2,723	1.09	3,797	2,457	65%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				4	4	164	44	4,241	1.09	2,210	2,227	101%
				12	12	88	44	4,619	1.09	2,431	2,668	110%
				75	75	59	24	5,171	1.09	12,083	14,849	123%
				96	96	124	46	4,536	1.09	34,467	37,157	108%
				10	20	114	22	4,619	1.09	3,222	3,537	110%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011		Standard	1	1	43	6	4,619	1.09	166	187	113%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			20	20	400	96	4,619	1.09	27,986	30,721	110%
Total										300,268	293,133	98%

The annual lighting hours of operation verified during the M&V site visit for fifteen of the line items in the above table (ranging from 318 to 3,578) are fewer than the annual hours of operation used to calculate ex ante savings (3,594). The remaining fifteen line items above have hours (ranging from 4,209 to 6,171) greater than the same ex ante hours. The measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned industrial in St. Louis, was applied to the ex post lighting energy savings. In addition, a factor of 1.01 was applied to the first line item in the table above due to the measures being installed in an apartment within the facility. The ex ante savings did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 96%. The ex ante energy savings estimate was premised on annual lighting operating hours for varying usage installations.

²⁹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	37,110	39,451	106%	7.49
Custom		263,158	253,682	96%	48.19
Total		300,268	293,133	98%	55.68

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/26/17 and 10/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	172	172	400	200	3,235	1.00	192,690	111,284	58%
				39	39	400	200	2,787	1.00	43,691	21,736	50%
Total										236,381	133,021	56%

The annual lighting hours of operation verified during the M&V site visit (3,235 and 2,787, respectively) are fewer than the hours of operation used to calculate ex ante savings (5,386). The site reduced from two shifts to one shift only.

The measures were installed in an unconditioned location. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.²⁹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 56%. The ex ante energy savings estimate was premised on overestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	236,381	133,021	56%	25.27
Total		236,381	133,021	56%	25.27

²⁹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/02/17 and 10/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	60	60	455	154	2,592	1.00	58,601	46,808	80%
Total										58,601	46,808	80%

The annual lighting hours of operation verified during the M&V site visit (2,592) are less than the annual hours of operation used to calculate ex ante savings (3,120).

The measure was installed in an unconditioned warehouse. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁰⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 80%. The ex ante savings estimate was premised on overestimated hours of operation and overestimated heating and cooling effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	58,601	46,808	80%	8.89
Total		58,601	46,808	80%	8.89

³⁰⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom and EMS Pilot Program incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the installation of fluid cooler fan VFDs and EMS controls and interviewed site personnel regarding equipment operation. Data from the energy management system (EMS) were collected where possible. ADM also acquired the Trane Trace energy models and energy calculations used in the ex ante analyses.

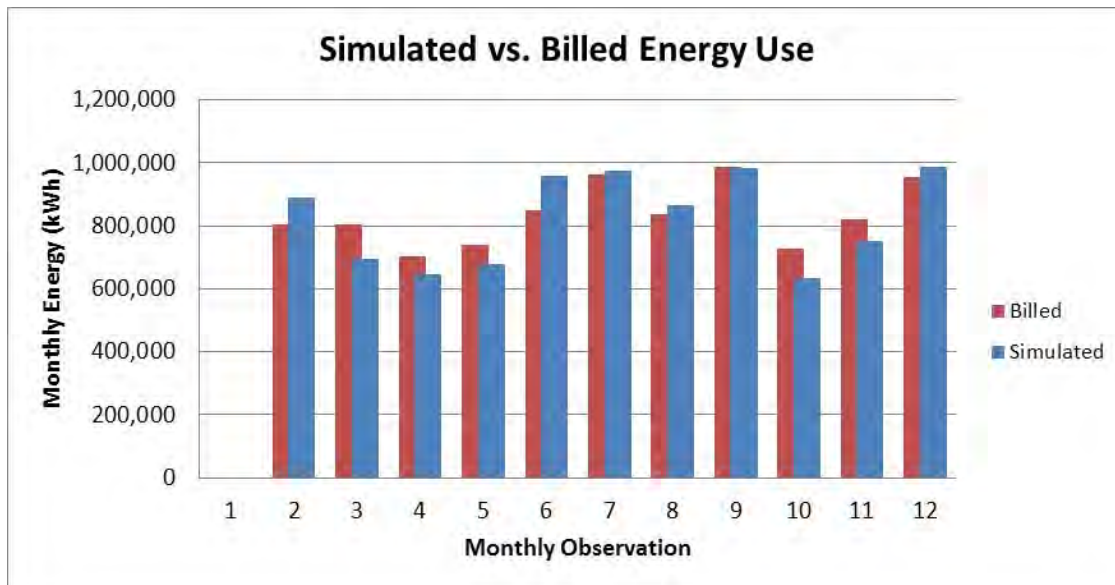
Analysis Results

Fluid Cooler Fan VFDs and EMS Controls Savings Calculations

Energy savings for the installed measures were calculated using IPMVP Option D: Calibrated Simulation. ADM compiled an eQuest model of the baseline facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Upon completion of the initial model, a custom weather file was created using NOAA weather data for the region. Using this weather file and the utility provided billing data for the building, ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

Monthly kWh Calibration



Upon completion of the calibration for the baseline eQuest model, the impacts of the installed measures were added through the uses of parametric runs. Once the parametric runs were defined, the as-built model and parametric runs were simulated using TMY3 weather data. The total realized energy savings are the differences between the baseline and as-built models' energy usages, and the total site-level energy savings by end use can be seen in the following table:

Typical Year Energy Usage (kWh) by End Use

<i>End-Use</i>	<i>Baseline</i>	<i>As-Built</i>	<i>kWh Savings</i>
Lighting	2,646,616	2,646,616	0
Misc. Equipment	1,322,809	1,322,809	0
Heating	2,361,062	2,353,047	8,015
Cooling	1,847,786	1,682,680	165,106
Heat Rejection	229,762	175,735	54,027
Auxiliary (pumps)	846,109	791,639	54,470
Vent Fans	1,119,344	1,109,571	9,773
Domestic Hot Water	188,649	187,755	894
Ext. Lighting	2,036	2,036	0
Total	10,564,173	10,271,887	292,286

Measure level savings are shown in the following table:

Custom and EMS Savings

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
14902 – Fluid Cooler VFD (40 hp)	1169	Cooling	Custom	49,994	52,982	106%
14902 – Fluid Cooler VFD (10 hp)	1169	Cooling	Custom	11,115	11,779	106%
14902 – Fluid Cooler VFD (10 hp)	1169	Cooling	Custom	12,943	13,717	106%
14902 – Fluid Cooler VFD (10 hp)	1169	Cooling	Custom	17,212	18,241	106%
14902 – Fluid Cooler VFD (7.5 hp)	1169	Cooling	Custom	19,133	20,277	106%
15416 – EMS Controls – Cooling	1169	Cooling	EMS Pilot	143,910	139,297	97%
15416 – EMS Controls – Heating	1169	Heating	EMS Pilot	38,255	35,995	94%
Total				292,562	292,286	100%

There were significant differences in the ex ante and ex post analyses for the VFDs installed on fluid cooler fans, with a realization rate of 106%. The ex ante analysis used uncalibrated Trane Trace models. ADM was provided the ex ante models, but it wasn't possible to calibrate the models because

the models didn't simulate the actual buildings. ADM created eQuest models of the entire facility and calibrated the models to actual billing data. This method accounts for interactive effects and building and HVAC system operations better than the ex ante models.

For the EMS controls, the ex ante analysis relies on bin calculations with assumed loads and hours of operation. The same calibrated models from the custom analysis were used in the ex post analysis for the EMS controls. Again, this method accounts for actual interactive effects and building and HVAC system operations instead of assumptions used in the ex ante analysis.

Verified annual savings for the Custom incentives are 116,994 kWh, resulting in a realization rate of 106%. Verified annual savings for the EMS Pilot Program incentives are 175,292 kWh, resulting in a realization rate of 96%. The site-level verified energy savings are 292,286 kWh, resulting in a site-level realization rate of 100%.

A table showing the energy savings achieved by the measures evaluated for this site is shown below.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
14902 – Fluid Cooler VFD (40 hp)	Cooling	49,994	52,982	106%	48.25
14902 – Fluid Cooler VFD (10 hp)	Cooling	11,115	11,779	106%	10.73
14902 – Fluid Cooler VFD (10 hp)	Cooling	12,943	13,717	106%	12.49
14902 – Fluid Cooler VFD (10 hp)	Cooling	17,212	18,241	106%	16.61
14902 – Fluid Cooler VFD (7.5 hp)	Cooling	19,133	20,277	106%	18.47
15416 – EMS Controls – Cooling	Cooling	143,910	139,297	97%	126.86
15416 – EMS Controls – Heating	Heating	38,255	35,995	94%	0.00
Total		292,562	292,286	100%	233.41

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/03/17 and 9/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Name/ ID	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
406123- Lighting- New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	57	57	167	33	6,952	1.09	36,362	57,888	159%
				2	2	167	33	1,515	1.09	1,276	443	35%
				10	10	172	34	1,083	1.09	6,570	1,629	25%
				6	6	172	34	1,713	1.09	3,942	1,546	39%
				4	4	144	29	8,760	1.09	2,200	4,413	201%
				5	5	216	43	8,760	1.09	4,126	8,275	201%
				3	3	216	43	8,760	1.09	2,475	4,965	201%
				1	1	288	58	8,760	1.09	1,100	2,207	201%
				2	2	288	58	8,760	1.09	2,200	4,413	201%
				1	1	288	58	8,760	1.09	1,100	2,207	201%
				1	1	288	58	8,760	1.09	1,100	2,207	201%
				5	5	360	72	579	1.09	6,876	912	13%
				4	4	360	72	4,670	1.09	5,501	5,882	107%
				11	11	360	72	8,760	1.09	15,127	30,343	201%
				1	1	432	86	8,760	1.09	1,650	3,310	201%
				2	2	432	86	8,760	1.09	3,300	6,620	201%
				4	4	504	101	8,760	1.09	7,701	15,447	201%
				6	6	504	101	8,760	1.09	11,551	23,171	201%
				1	1	576	115	8,760	1.09	2,200	4,413	201%
				1	1	576	115	8,760	1.09	2,200	4,413	201%
				2	2	1,008	202	8,760	1.09	7,701	15,447	201%
				25	25	137	27	8,760	1.09	13,083	26,243	201%
				14	14	137	27	8,760	1.09	7,327	14,696	201%
				12	12	137	27	8,760	1.09	6,280	12,597	201%
5	5	137	27	8,760	1.09	2,617	5,249	201%				
55	55	92	19	5,785	1.09	19,434	25,744	132%				
6	6	67	14	8,760	1.09	1,547	3,103	201%				
7	7	480	96	8,760	1.09	12,835	25,745	201%				
16	16	9	2	8,760	1.09	581	1,165	201%				
Total										189,963	314,693	166%

The lighting energy use of the installed lighting equipment is compared with the estimated lighting energy use associated with the applicable new construction baseline (ASHAE 90.1 2007) to determine realized lighting energy savings. The manufacturing facility constructed in St. Louis County was subject to the 2009 IECC code in effect during the building design, which allows for 1.3 lighting watts/SF. The code compliant baseline lighting wattage for this project was 49,712 watts (1.3 watts/SF*38,240SF).

The annual lighting hours of operation verified during the M&V site visit for the second, third, fourth, twelfth, and thirteenth line items in the table above (1,515, 1,083, 1,713, 579, and 4,670, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (4,777). The remaining line items above have hours (ranging from 5,785 to 8,760) greater than the ex ante (4,777). The majority of the measures have continuous usage.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁰¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 166%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for 83% of the project as well as underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
New Construction	Lighting	189,963	314,693	166%	59.78
Total		189,963	314,693	166%	59.78

³⁰¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/9/17 and 10/9/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	Standard	30	30	60	12	3,040	1.09	4,622	4,792	104%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			80	80	50	9	3,659	1.09	10,529	13,141	125%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			180	180	43	10	3,289	1.09	18,779	21,716	116%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			14	14	17	9	4,276	1.09	360	524	146%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			914	914	32	12	2,124	1.09	58,679	42,510	72%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture				40	40	90	12	3,040	1.09	10,015	10,383	104%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	10			10	70	12	3,040	1.09	1,810	1,930	107%	
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			62	62	65	9	5,086	1.09	10,833	19,335	178%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			52	52	90	12	3,040	1.09	13,020	13,498	104%
Total										128,645	127,829	99%

The annual lighting hours of operation verified during the M&V site visit for the fifth line item in the table above (2,124) are fewer than hours of operation used to calculate ex ante savings (3,000). The remaining measures had hours (ranging from 3,040 to 5,086) greater than the ex ante hours (3,000).

An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp for the third line item in the table above. The ex ante base wattage of 42W was computed within the application by factoring 70% of a 60W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned large office 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 1.04 for the seventh and eighth line items in the table above and 1.07 for the remaining measures.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁰²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 99%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	128,645	127,829	99%	24.28
Total		128,645	127,829	99%	24.28

³⁰² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/10/18 and 1/29/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	430	430	40	15	2,316	1.09	33,495	27,157	81%
				770	770	40	15	2,575	1.09	64,264	54,067	84%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			20	20	53	10	4,258	1.09	1,476	4,041	274%
<i>Total</i>										99,235	85,265	86%

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the table above (2,316 and 2,575, respectively) are fewer than the hours of operation used to calculate ex ante savings (2,912 and 3,120, respectively). The third line item had annual hours (4,258) greater than the ex ante hours (1,716).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned education building in St. Louis, was applied to the ex post lighting energy savings. For the third line item in the table above, the ex ante savings estimate did not account for heating and cooling interactive factors. For the first two line items, ex ante savings estimate accounted for a heating and cooling factor of 1.07. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the first three line items. On the Microsoft Excel application form, the applicant cut and pasted the location name, and a technical error in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁰³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 86%. The ex ante energy savings estimate was premised on

³⁰³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

overestimated annual lighting operating hours for two measures and did not account for appropriate heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	99,235	85,265	86%	16.20
Total		99,235	85,265	86%	16.20

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/21/17 and 11/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	150	150	40	15	3,134	0.99	35,150	11,643	33%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp	3008			45	45	90	9	6,553	0.99	34,165	23,661	69%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			432	432	53	7	1,145	0.99	24,082	22,540	94%
Total										93,396	57,843	62%

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the table above (3,134 and 6,553, respectively) are fewer than the hours of operation used to calculate ex ante savings (8,760). These measures were installed in multiple locations with varying usage. The hours of operation for the third line item in the table above (1,145³⁰⁴) are identical to the annual hours of operation used to calculate ex ante savings. These lamps were installed in guest rooms.

A heating and cooling interactive factor of 0.99, applicable to an electric heated, air conditioned hotel 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.³⁰⁵

³⁰⁴ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

³⁰⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 62%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for the first two measures and overestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	93,397	57,843	62%	10.99
Total		93,397	57,843	62%	10.99

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, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/03/17 and 11/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	285	285	30	15	6,499	1.09	90,686	30,402	34%
Total										90,686	30,402	34%

The annual lighting hours of operation verified during the M&V site visit (6,499) are fewer than the annual hours of operation used to calculate ex ante savings (8,760).

The quantity verified during the M&V site visit (285) is fewer than the quantity used to calculate ex ante savings (645). The remaining lamps were placed in storage to be used for future installations.

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁰⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 34%. The ex ante energy savings estimate was premised upon installation of all lamps and overestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	90,686	30,402	34%	5.78
Total		90,686	30,402	34%	5.78

³⁰⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/16/17 and 10/9/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	54	54	400	115	5,077	1.00	52,695	78,128	148%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			15	15	150	36	4,106	1.00	5,855	7,021	120%
Total										58,550	85,149	145%

The annual lighting hours of operation verified during the M&V site visit (ranging between 4,106 and 5,077) are greater than the hours of operation used to calculate ex ante savings (3,200).

The measures were installed in an unconditioned space. 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.³⁰⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 145%. The ex ante savings estimate was premised on underestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	58,550	85,149	145%	16.18
Total		58,550	85,149	145%	16.18

³⁰⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
014559-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Miscellaneous	Custom	217	200	455	216	8,585	1.00	486,487	476,765	98%
014559-100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				380	380	295	216	8,760	1.00	262,975	262,975	100%
Total										749,462	739,740	99%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (8,585) are fewer than the annual lighting hours of operation for the ex ante savings (8,760). The second line item is consistent with the ex ante hours (8,760).

The ex ante savings and ex post savings estimate did not account for heating and cooling interactive factors since the space is unconditioned.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁰⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 99%.

³⁰⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	749,462	739,740	99%	102.04
Total		749,462	739,740	99%	102.04

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	74	44	175	54	4,513	1.00	30,436	36,662	169%
					14			8,760			14,839	
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture				480	480	250	10	1,232	1.14	92,160	161,471	175%
				71	70	250	12	1,463	1.14	13,528	28,138	208%
Total										136,124	241,111	177%

The annual lighting hours of operation verified during the M&V site visit for the first two line items in the above table (4,513 and 8,760, respectively) are greater than the annual hours of operation used to calculate ex ante savings (3,100). These measures were installed in the garage controlled by a timer or with continuous usage. The third and fourth line items also had annual hours (1,232 and 1,463, respectively) greater than the ex ante (800).

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned public assembly facility in St. Louis, was applied to the ex post lighting energy savings for the second and third line items. 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.³⁰⁹ Eleven of the LED fixtures were located in the exterior operating dusk to dawn; the ex post kW savings was based on the Exterior Lighting End Use for this portion.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 177%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects for the interior measures.

³⁰⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	130,366	226,271	174%	43.0
Custom	Ext Lighting	5,758	14,839	258%	0.1
Total		136,124	241,110	177%	43.1

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules and controls. All lighting is operational 24/7 or with non-daylighting photocells.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Misc.	Custom	2	2	1,080	183	8,760	1.00	15,715	15,715	100%
100211-Lighting-Non Linear LED Fixture Replacing High Pressure Sodium Fixture				1	1	138	39	4,308	1.00	867	426	49%
100111-Lighting-Linear Tube LED Fixture Replacing High Pressure Sodium Fixture				18	18	250	73	8,760	1.00	27,909	27,909	100%
				4	4	138	40	4,308	1.00	3,434	1,689	49%
				238	238	138	40	8,760	1.00	204,318	204,318	100%
Total										252,244	250,058	99%

The annual lighting hours of operation verified during the M&V site visit for the second and fourth line items in the table above (4,308³¹⁰) are less than the annual hours of operation used to calculate ex ante savings (8,760). The remaining line items were consistent with the ex ante energy savings hours (8,760).

The measures were installed exterior with no heating or cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³¹¹

³¹⁰ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 99%. The ex ante energy savings estimate was premised upon overestimated annual operating hours for the third and fourth line measures.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	252,244	250,058	99%	34.49
Total		252,244	250,058	99%	34.49

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	30	38	82	51	8,760	1.04	4,573	4,766	104%
				30	38	82	51	8,760	1.04	4,573	4,766	104%
				30	38	82	51	8,760	1.04	4,573	4,766	104%
				34	44	82	51	8,760	1.04	4,765	4,967	104%
				30	38	82	51	8,760	1.04	4,573	4,766	104%
				34	44	82	51	8,760	1.04	4,765	4,967	104%
				34	44	82	51	8,760	1.04	4,765	4,967	104%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	Standard	8	8	60	2	8,760	1.04	4,041	4,212	104%
				8	8	60	2	8,760	1.04	4,041	4,212	104%
				8	8	60	2	8,760	1.04	4,041	4,212	104%
				8	8	60	2	8,760	1.04	4,041	4,212	104%
				8	8	60	2	8,760	1.04	4,041	4,212	104%
				8	8	60	2	8,760	1.04	4,041	4,212	104%
				8	8	60	2	8,760	1.04	4,041	4,212	104%
Total										69,679	72,627	104%

The annual lighting hours of operation verified during the M&V site visit (8,760) are identical to the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.04, applicable to a gas heated, air conditioned multi-family residential 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 1.00.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³¹²

³¹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 104%. The ex ante energy savings estimate was premised on underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	32,327	33,694	104%	6.40
Custom		37,353	38,933	104%	7.40
Total		69,679	72,627	104%	13.80

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed twelve photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/27/17 and 10/17/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100102-Lighting-Linear Tube LED Fixture Replacing T12 HO Fixture	1169	Lighting	Custom	16	16	208	64	5,876	1.27	18,501	17,148	93%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard	49	49	32	15	6,132	1.29	6,913	6,589	95%
				3,829	3,829	32	15	7,500	1.10	540,271	539,204	100%
Total										565,685	562,941	100%

The annual lighting hours of operation verified during the M&V site visit (5,876, 6,132, and 7,500, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (8,030, 8,300 and 8,300, respectively).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large single-story retail in St. Louis, as well as a factor of 1.29, applicable to walk-in coolers, were applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³¹³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

³¹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	547,184	545,793	100%	103.68
Custom		18,501	17,148	93%	3.26
Total		565,685	562,941	100%	106.94

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eleven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/19/17 and 10/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	4	4	32	11	4,745	1.10	753	450	60%
				13	13	46	21	7,651	1.10	2,600	2,744	106%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard	294	294	32	15	8,023	1.16	127,476	46,691	37%
				6	6	32	15	8,030	1.10	894	904	101%
				55	55	32	15	6,649	1.29	8,191	8,020	98%
				16	16	32	15	5,248	1.18	2,383	1,679	70%
				2	2	30	11	8,760	1.10	342	377	110%
				312	312	32	15	6,255	1.13	56,590	37,569	66%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard	6	6	32	15	8,760	1.10	894	986	110%
				Total								

The annual lighting hours of operation verified during the M&V site visit for the seventh and ninth line items in the above table are consistent with those used to calculate ex ante savings (8,760). The remaining measures annual hours (4,745, 7,651, 8,023, 8,030, 6,649, 5,249 and 5,487, respectively) are fewer than the hours of operation used to calculate ex ante savings (8,000 for line item two, 8,760 for the remaining line items).

The quantities of the third and eighth line items in the table above verified during the M&V site visit (294 and 312, respectively) are fewer than those used to calculate ex ante savings (856 and 380, respectively). The remaining lamps were incompatible with the existing fixtures and on subsequent visits had not been updated.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. Factors of 1.18 and 1.29 were applied for installations within walk-in coolers and open wall coolers, respectively. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³¹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 50%. The ex ante energy savings estimate was premised upon an overestimated quantity of installed lamps, overestimated hours of operation, and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	196,770	96,227	49%	18.28
Custom		3,353	3,195	95%	0.61
Total		200,123	99,421	50%	18.89

³¹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, LPD and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed fourteen photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/13/17 and 10/09/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100216-Lighting-Non Linear LED Fixture Replacing Existing Inefficient Lighting Fixture	1169	Lighting	Custom	1085	1085	62	35	4,121	1.09	105,121	135,086	129%
				358	358	42	23	3,636	1.09	23,190	26,377	114%
				20	20	42	23	4,789	1.09	1,296	1,941	150%
				32	32	72	40	4,793	1.09	3,574	5,358	150%
				12	12	76	42	5,078	1.06	1,407	2,171	154%
				20	20	42	23	4,420	1.09	1,296	1,791	138%
				96	96	62	35	4,137	1.09	9,301	12,038	129%
				20	20	76	42	5,221	1.09	2,345	3,830	163%
				21	21	62	35	5,221	1.09	2,035	3,323	163%
Total										149,565	191,916	128%

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
015500-201518-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >50 and <=120 Watts	3080	Lighting	Standard	221	93	4,608	3,912	1.09	125,970	15,743	12%
015500-201718-Lighting-Dual Technology Occupancy Sensor Controlling Lighting Circuit >150 Watts	3016			111	85	4,624	3,922	1.09	13,875	7,229.39	52%
Total									139,845	22,972	16%

The lighting energy use of the installed lighting equipment is compared with the estimated lighting energy use associated with the applicable new construction baseline (ASHAE 90.1 2007) to determine realized lighting energy savings. The retail building constructed in St. Louis County was subject to the 2009 IECC code in effect during the building design, which allows for 1.0 lighting watts/SF. The code compliant baseline lighting wattage for this project was 96,300 watts (1.0 watts/SF*96,300SF).

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,500).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the workday and the end of the workday.

The occupancy sensor connected loads in the second table above (93W and 85W, respectively) verified during the M&V site visit varies from the ex ante connected loads (160W and 70W, respectively).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned large office in St. Louis, was applied to the ex post lighting energy savings. The loading dock area was unconditioned. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³¹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 74%. The ex ante energy savings estimate was premised on underestimated annual operating hours and overestimated occupancy sensor savings.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	139,845	22,972	16%	26.57
Custom		149,565	191,916	128%	36.46
Total		289,410	214,888	74%	63.02

³¹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, annual work schedule, and lighting control.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	48	48	926	398	8,760	1.00	261,066	222,119	85%
Total										261,066	222,119	85%

The annual lighting hours of operation verified during the M&V site visit (8,760) are the same as the ex ante annual hours of 8,760. The lighting operates on a breaker, with the switch remaining on continuously. The prevailing 2012 International Building Code for the city, during the design period includes the Energy Conservation Code specification with a lighting power density of 0.60 watts/SF for warehouse space. The ex ante applied the 2010 ASHRAE 90.1 lighting power density value of 0.66 watts/SF for warehouse space.

A heating and cooling interactive factor of 1.0, applicable to a non-conditioned space, as the ex ante did.

The peak coincident demand reduction was determined by applying the appropriate end use kW factor to the kWh savings for lighting.³¹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 85%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
New Construction	Lighting	261,066	222,119	85%	42.19
Total		261,066	222,119	85%	42.19

³¹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate	
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	10	10	90	60	8,760	1.00	2,628	2,628	100%	
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				1	1	174	40	8,760	1.00	1,174	1,174	100%	
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture				15	15	180	101	8,760	1.00	10,381	10,381	100%	
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025		Standard		58	58	32	15	8,760	1.00	8,496	8,495	100%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1				2	2	455	101	8,760	1.00	6,202	6,202	100%
305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1				1	1	138	30	8,760	1.00	946	946	100%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026				4	4	39	15	8,760	1.00	832	831	100%
305114-Lighting-62-130 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 176-300 Watt Lamp or Fixture	3004-1				Misc.	2	2	295	60	4,308	1.00	4,117	2,025
			2	2		295	100	8,760	1.00	3,416	3,416	100%	

305106-Lighting-62-130 Watt Lamp or Fixture Replacing Interior HID 176-300 Watt Lamp or Fixture	Lighting	32	32	295	101	8,760	1.00	54,382	54,382	100%
		13	13	215	101	8,760	1.00	12,982	12,982	100%
Total								105,556	103,462	98%

The annual lighting hours of operation verified during the M&V site visit for the ninth line item in the table above (4,308³¹⁷) is fewer than the hours of operation used to calculate ex ante savings (8,760). The remaining measures are consistent with the ex ante hours of consistent usage.

All measures were installed in uncontrolled locations. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³¹⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%. The ex ante energy savings estimate was premised upon overestimated hours of operation for the ninth measure.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	83,840	83,839	100%	15.93
	Miscellaneous	7,534	5,441	72%	0.75
Custom	Lighting	14,183	14,182	100%	2.69
Total		105,557	103,462	98%	19.37

³¹⁷ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

³¹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/26/17 and 10/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Lighting	Custom	56	72	455	112	3,549	1.02	45,282	63,009	139%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture				113	113	164	35	542	1.09	38,047	8,680	23%
Total										83,329	71,689	86%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the above table (3,549) are greater than the annual hours of operation used to calculate ex ante savings (2,600). The verified hours for the second line item (542) are fewer than those used to calculate ex ante savings (2,600).

A portion of the quantity of the second line item (91) were installed in un-used office space. The space has yet to be utilized, and will not be utilized for more than one year according to the client.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing facility in St. Louis, was applied to the ex post lighting energy savings. In addition, there were two shop locations that were unconditioned. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³¹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 86%. The ex ante energy savings estimate was premised on all measures being installed and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	

³¹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Custom	Lighting	83,329	71,689	86%	13.62
Total		83,329	71,689	86%	13.62

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/27/17 and 10/17/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	5	5	56	36	7,551	1.12	874	844	97%
				15	15	164	50	7,649	1.12	11,826	14,622	124%
				-	-	164	50	-	-	1,991	-	0%
				-	-	164	50	-	-	1,991	-	0%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture		Exterior	Custom	26	26	48	18	4,308	1.00	3,416	3,360	98%
				8	8	45	10	4,308	1.00	1,226	1,206	98%
				4	4	455	150	4,308	1.00	5,344	5,256	98%
				4	4	1,080	300	4,308	1.00	13,666	13,441	98%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	6	6	1,080	300	4,308	1.00	20,498	20,161	98%
				8	8	40	18	7,656	1.12	1,538	1,506	98%
Total										62,370	60,397	97%

The annual lighting hours of operation verified during the M&V site visit for the first and tenth line items in the above table (7,551 and 7,656, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (8,736). The hours for the fifth through ninth line items (4,308³²⁰) are fewer than those used to calculate ex ante savings (4,380). The hours for the second line item (7,649) are greater than those used to calculate ex ante savings (6,916).

The quantities of the third and fourth line items verified during the M&V site visit (0 and 0, respectively) are fewer than the quantities used to calculate ex ante savings (2 and 2, respectively). These fixtures were placed in storage to be used as replacements.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings for the interior installations. The fifth

³²⁰ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

through ninth line items were installed exterior locations. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kWh factor to the kWh savings.³²¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 97%. The ex ante energy savings estimate was premised upon overestimated hours of operation for seven measures above, as well as quantities installed for two of the ten line items.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	1,538	1,506	98%	0.29
Custom		16,682	15,466	93%	2.94
	Exterior	44,150	43,424	98%	8.25
Total		62,370	60,397	97%	11.47

³²¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/14/17 and 11/20/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	2,590	2,590	32	17	1,892	1.09	77,979	80,197	103%
Total										77,979	80,197	103%

The annual lighting hours of operation verified during the M&V site visit (1,892) are lower than the annual hours of operation used to calculate ex ante savings (1,930).

A heating and cooling interactive factor of 1.09, applicable to a gas 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 103%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	77,979	80,197	103%	15.23
Total		77,979	80,197	103%	15.23

³²² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed nine photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/16/17 and 10/09/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	15	15	400	140	8,760	1.10	32,570	37,704	116%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			34	34	32	17	8,760	1.10	4,260	4,930	116%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			3	3	72	11	8,494	1.10	1,478	1,716	116%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			40	40	32	17	8,760	1.10	5,011	5,801	116%
				712	712	32	17	8,760	1.10	89,191	103,250	116%
				2,046	2,046	32	17	8,615	1.10	256,299	291,779	114%
				34	34	62	17	8,760	1.10	12,777	14,791	116%
				6	6	32	17	8,760	1.10	752	870	116%
				2	1	32	32	7,263	1.15	267	267	100%
				50	50	32	17	8,760	1.10	6,263	7,251	116%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			34	34	104	17	8,760	1.10	24,703	28,597	116%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			34	34	32	17	6,607	1.29	4,260	4,346	102%
				11	11	32	17	8,760	1.10	1,378	1,595	116%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			2	1	40	32	6,304	1.10	400	334	83%

305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			2	2	32	17	6,607	1.10	251	219	87%
				424	424	32	17	5,913	1.16	53,114	43,449	82%
Total										492,974	546,898	111%

The annual lighting hours of operation verified during the M&V site visit for the ninth, twelfth, fourteenth, fifteenth and sixteenth line items in the table above (7,263, 6,607, 6,304, 6,607 and 5,913, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (8,030). The remaining line items have hours of operation that greater than those used to calculate ex ante savings (8,030).

A heating and cooling interactive factor of 1.07, applicable to a gas heated, air conditioned large single-story retail in St. Louis, was applied to the ex post lighting energy savings for the main store. In addition, 1.15 and 1.29 were applied to the ex post energy savings, applicable to walk-in freezers and coolers, respectively. The ex post energy savings estimate used a factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 111%. The ex ante energy savings estimate was premised upon underestimated hours of operation for the majority of measures and underestimated heating and cooling effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	492,974	546,898	111%	103.89
Total		492,974	546,898	111%	103.89

³²³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed twelve photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/16/17 and 9/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	2,750	2,750	32	14	3,636	1.09	240,926	197,081	82%
Total										240,926	197,081	82%

The annual lighting hours of operation verified during the M&V site visit (3,636) are fewer than the annual hours of operation used to calculate ex ante savings (4.680).

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 82%. The ex ante energy savings estimate was premised upon overestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	240,926	197,081	82%	37.44
Total		240,926	197,081	82%	37.44

³²⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/3/17 and 10/25/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1169	Lighting	Custom	120	120	114	50	2,707	1.11	29,393	22,993	78%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1		Standard	41	41	455	150	3,543	1.00	47,859	44,310	93%
Total										77,252	67,303	87%

The annual lighting hours of operation verified during the M&V site visit (2,707 and 3,543, respectively) are fewer than the hours of operation used to calculate ex ante savings (3,680).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings for the interior installations. The warehouse location was unconditioned. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 87%. The ex ante energy savings estimate was premised on overestimated hours of operation.

³²⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	47,859	44,310	93%	8.42
Custom		29,393	22,993	78%	4.37
Total		77,252	67,303	87%	12.79

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169	Lighting	Custom	224	224	32	10	8,760	1.11	45,771	47,324	103%
				420	420	32	10	8,760	1.11	85,821	88,732	103%
				105	105	64	12	8,760	1.11	51,178	52,914	103%
				320	320	32	10	8,760	1.11	65,387	67,605	103%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026		Standard	440	440	40	15	8,760	1.00	102,823	96,360	94%
Total										350,980	352,935	101%

The annual lighting hours of operation verified during the M&V site visit (8,760) are consistent with the annual hours of operation used to calculate ex ante savings.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned hotel in St. Louis, was applied to the ex post lighting energy savings of the first, second, third and fourth line items above. Line item five was installed in unconditioned areas. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 101%. The ex ante savings estimate was premised upon underestimated heating and cooling interactive effects.

³²⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	102,823	96,360	94%	18.30
Custom		248,157	256,575	103%	48.74
Total		350,980	352,935	101%	67.04

Site ID

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, interviewing facility personnel regarding lighting operating schedules, and installed ten photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/18/17 and 11/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	306	306	32	18	1,006	1.09	16,731	4,697	28%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			82	82	34	18	3,377	1.09	5,124	4,826	94%
				12	24	60	18	2,085	1.09	1,125	654	58%
				30	30	34	18	1,013	0.87	1,875	530	28%
				84	84	34	18	5,505	1.09	5,249	8,060	154%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			18	-	32	-	8,760	1.09	2,250	5,497	244%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			18	18	32	18	8,760	1.09	984	2,405	244%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			306	-	32	-	1,006	1.09	38,243	10,735	28%
				12	-	60	-	2,085	1.09	2,812	1,636	58%
				84	-	34	-	5,505	1.09	11,154	17,128	154%
		41	-	34	-	3,377	1.09	5,444	5,128	94%		
Total									90,991	61,296	67%	

The annual lighting hours of operation verified during the M&V site visit for the fifth through seventh and tenth line items in the table above (5,505, 8,760, 8,760, and 5,505, respectively) are greater than the annual hours of operation used to calculate ex ante savings (3,650). These measures either had continuous usage or over half of the quantity had continuous use. The remaining line items above have hours (ranging from 1,013 – 3,377) which is fewer than the ex ante hours. These measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned university 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 total ex ante annual energy savings for the first through third and fifth through eleventh lint items in the table above are 89,116 kWh. ADM notes that, based on the assumptions underlying the ex ante

savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 67%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours which did not associate usage with varying facility locations.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	90,991	61,296	67%	11.64
Total		90,991	61,296	67%	11.64

³²⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/19/17 and 10/16/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,462	1,462	28	16	4,900	1.10	122,319	94,870	78%
Total										122,319	94,870	78%

The annual lighting hours of operation verified during the M&V site visit (4,900) are less than the annual hours of operation used to calculate ex ante savings (6,516). The ex ante hours were determined through an average of store hours across the country.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 78%. The ex ante energy savings estimate was premised upon overestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	122,319	94,870	78%	18.02
Total		122,319	94,870	78%	18.02

³²⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed thirteen photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/31/17 and 11/1/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	337	337	32	12	3,109	1.11	31,501	23,175	74%
				181	181	32	12	2,190	1.11	16,919	8,767	52%
				312	312	32	12	4,049	1.12	29,164	28,271	97%
Total									77,584	60,212	78%	

The annual lighting hours of operation verified during the M&V site visit for (3,109, 2,190 and 4,049, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (4,368).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings of the first two line items in the above table. A factor of 1.14, applicable to a gas heated, air conditioned assembly facility, was applied to the third line item. Additionally, a quantity (32) of the third line item was installed in an unconditioned area. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³²⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 78%. The ex ante energy savings estimate was premised upon overestimated hours of operation as well as underestimated heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	77,584	60,212	78%	11.44
Total		77,584	60,212	78%	11.44

³²⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/25/17 and 11/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	820	820	32	12	1,665	1.09	45,208	29,797	66%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			10	10	70	17	1,769	1.09	1,418	1,023	72%
305234-Lighting-85-225 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 301-500 Watt Lamp or Fixture	3005-1	Misc.		15	15	395	225	1,557	1.09	22,338	4,332	19%
Total										68,964	35,151	51%

The annual lighting hours of operation verified during the M&V site visit (1,665, 1,769 and 1,557, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (2,500, 2500 and 8,760, respectively). The third line item was intended for exterior end use and was instead installed within the interior.

The quantity of the first line item (820) verified during the M&V site visit is fewer than the quantity used to calculate ex ante energy savings (845). The remaining lamps were placed in storage to be used as replacements.

A heating and cooling interactive factor of 1.09, applicable to a gas 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 factor of 1.07 for the first two line items. It did not account for heating and cooling interactive effects for the third line item.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³³⁰

³³⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 51%. The ex ante energy savings estimate was premised upon overestimated hours of operation and quantity of installed lamps.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	46,626	30,820	66%	5.85
	Misc.	22,338	4,332	19%	0.60
Total		68,964	35,151	51%	6.45

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, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/07/17 and 10/31/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	22	22	34	18	2,979	1.10	1,650	1,157	70%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			136	-	60	-	4,099	1.10	38,260	36,918	96%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			136	272	60	18	4,099	1.10	15,304	14,767	96%
				2	2	34	18	767	1.10	150	27	18%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			22	-	34	-	2,979	1.10	3,506	2,459	70%
				2	-	34	-	767	1.10	319	58	18%
Total										59,188	55,386	94%

The annual lighting hours of operation verified during the M&V site visit are fewer than the annual hours of operation used to calculate ex ante savings. For the first and fifth line items in the table above the ex post hours are 2,979, for the second and third line items 4,099 hours, and the fourth and sixth lines items 767 hours; where the ex ante hours were 4,380, 4,382, and 4,381, respectively.

A heating and cooling interactive factor of 1.10, applicable to a gas 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 total ex ante annual energy savings are 59,188 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³³¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 94%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	59,188	55,386	94%	10.52
Total		59,188	55,386	94%	10.52

³³¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/07/17 and 10/31/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,224	1,224	32	16	4,369	1.10	88,010	94,428	107%
				30	30	32	16	3,491	1.10	2,157	1,849	86%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			30	-	32	-	3,491	1.10	4,314	3,699	86%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			44	44	32	16	5,177	1.10	3,164	4,022	127%
Total										97,645	103,997	107%

The annual lighting hours of operation verified during the M&V site visit for the first and fourth line items in the above table (4,369 and 5,177, respectively) are greater than the annual hours of operation used to calculate ex ante savings (4,200). The hours for the second and third line items (3,491) are fewer than the ex ante hours. The measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.10, applicable to a gas 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 total ex ante annual energy savings for the second and third line items in the table above are 6,471 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³³²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 107%. The ex ante energy savings estimate was premised on averaged annual lighting operating hours and not by installed location and an underestimated heating and cooling interactive effect.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	97,645	103,997	107%	19.76
Total		97,645	103,997	107%	19.76

³³² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed a total of five photo-sensor loggers to monitor lighting operation. ADM staff determined that the lighting associated with this project was installed in two buildings with separate addresses. Two of the photo-sensor loggers were installed at the North Broadway address, while the remaining three loggers were installed at the Industrial Drive location. The photo-sensor loggers collected data between 10/12/17 and 10/31/2017 for the North Broadway location, and between 8/18/17 and 9/11/17 for the Industrial Drive location.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	661	661	32	15	6,169	1.09	58,447	75,899	130%
				40	40	32	17	3,710	1.09	3,121	2,416	77%
Total										61,568	78,315	127%

The annual lighting hours of operation for the first line item in the table above (6,169) are greater than the hours of operation used to calculate ex ante savings (4,861), while the annual lighting hours of operation for the second line item (3,710) are fewer.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. No heating or cooling interactive effects were accounted for regarding lighting installed in the loading dock location due to the space being unconditioned. 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.³³³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 127%. The ex ante energy savings estimate was premised on underestimated hours of operation for the first measure and underestimated heating and cooling effects for the project.

³³³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	61,568	78,315	127%	14.88
Total		61,568	78,315	127%	14.88

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 8/01/17 and 9/11/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp	3005-1	Lighting	Standard	24	24	460	200	2,545	1.11	39,836	17,587	44%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	6	12	75	14	2,095	1.00	772	591	77%
				80	80	40	14	1,500	1.11	5,691	3,457	61%
				4	4	40	14	1,011	1.11	285	116	41%
				152	304	110	14	2,095	1.00	34,101	26,115	77%
Total									80,684	47,867	59%	

The annual lighting hours of operation verified during the M&V site visit (ranging between 1,011 and 2,545) are fewer than the hours of operation used to calculate ex ante savings (2,557).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 base and efficient quantity of the first line item in the table above (24) verified during the M&V site visit is less than the ex ante savings quantity (56). There are fixtures that hold the remaining lamps however the client prior to the installation and after the installation does not use those fixtures because of excessive brightness.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³³⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 59%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours, usage of all installed measures, and did not account for appropriate heating and cooling interactive effects.

³³⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	80,684	47,867	59%	9.09
Total		80,684	47,867	59%	9.09

Site ID 5441

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, interviewing facility personnel regarding lighting operating schedules, and installed ten photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/20/17 and 11/14/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	665	665	40	15	1,421	1.14	53,366	26,876	50%
Total										53,366	26,876	50%

The annual lighting hours of operation verified during the M&V site visit (1,421) are fewer than the hours of operation used to calculate ex ante savings (3,000).

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned community assembly 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.³³⁵

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

³³⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	53,366	26,876	50%	5.11
Total		53,366	26,876	50%	5.11

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/10/17 and 11/06/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,686	1,686	32	17	2,381	1.09	52,226	65,704	126%
Total										52,226	65,704	126%

The annual lighting hours of operation verified during the M&V site visit (2,381) are greater than the annual hours of operation used to calculate ex ante savings (1,930).

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³³⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 126%. The ex ante energy savings estimate was premised upon underestimated hours of operation and underestimated heating and cooling effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	52,226	65,704	126%	12.48
Total		52,226	65,704	126%	12.48

³³⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 9/26/17 and 10/19/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	700	700	32	10.5	3,623	1.09	56,624	59,701	105%
Total										56,624	59,701	105%

The annual lighting hours of operation verified during the M&V site visit (3,623) are greater than the annual hours of operation used to calculate ex ante savings (3,600).

The efficient wattage in the table above (10.5W) verified through the review of project documentation is less than the efficient wattage referenced to calculate ex ante savings (11W).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office 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.³³⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 105%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	56,624	59,701	105%	11.34
Total		56,624	59,701	105%	11.34

³³⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/19/17 and 11/07/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	40	40	53	10	5,446	1.09	4,472	10,338	231%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			648	648	40	15	1,619	1.09	45,068	28,613	63%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp	3007			18	18	75	12	2,363	1.09	2,948	2,923	99%
				14	14	90	12	2,893	1.09	2,839	3,447	121%
Total										55,327	45,321	82%

The annual lighting hours of operation verified during the M&V site visit for the second and third line items (1,619 and 2,363, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (2,600). The hours of operation for the first and fourth line items (5,446 and 2,893, respectively) are greater than the annual hours of operation used to calculate ex ante savings.

An adjusted base wattage of 53W was used for the first line item in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The ex ante base wattage of 52.5W was computed within the application by factoring 70% of a 75W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned education facility in St. Louis, was applied to the ex post lighting energy savings. For the first, third, and fourth line items in the table above, the ex ante savings estimate did not account for heating and cooling interactive factors. For the second line item, ex ante savings estimate accounted for a heating and cooling factor of 1.07. ADM notified the implementation contractor that the ex ante savings estimate did not account for heating and cooling interactive factors for the first, third, and fourth line items. On the Microsoft Excel application form, the applicant cut and pasted the location name, and a technical error in the application caused the non-application of the HCIF for these line items. ADM notified the implementation contractor of this technical error.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³³⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 82%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for two measures.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	55,327	45,321	82%	8.61
Total		55,327	45,321	82%	8.61

³³⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/19/17 and 11/07/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	520	520	32	12	5,728	1.11	56,130	65,980	118%
Total										56,130	65,980	118%

The annual lighting hours of operation verified during the M&V site visit (5,728) are greater than the annual hours of operation used to calculate ex ante savings (5,044).

A heating and cooling interactive factor of 1.11, applicable to a gas 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 kWh savings.³³⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall 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-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	56,130	65,980	118%	12.53
Total		56,130	65,980	118%	12.53

³³⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/6/17 and 11/01/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	250	250	40	20	6,008	1.18	46,866	35,554	76%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			24	24	32	17	2,170	1.16	601	925	154%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			20	20	43	10	1,145	1.17	1,085	898	83%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			200	200	40	20	1,145	1.17	6,677	5,359	80%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			109	109	32	17	8,760	1.18	15,325	16,953	111%
Total										70,554	59,689	85%

The annual lighting hours of operation verified during the M&V site visit for the fifth line item in the table above is consistent with the ex ante energy savings hours (8,760). The measures for the third and fourth line items were installed within guest rooms with hours (1145³⁴⁰) fewer than the hours of operation used to calculate ex ante savings (1,560). The first line item was installed in multiple locations with varying usage (6,008) and not with constant operation as the ex ante used (8,760). For the second measure the hours of operation (2,170) were greater than the hours used in the ex ante savings estimate (1,560).

A heating and cooling interactive factor of 1.18, applicable to a gas heated, air conditioned hotel facility in St. Louis, was applied to the ex post lighting energy savings for all common areas. The individual

³⁴⁰ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

guest rooms had an interactive factor of 1.17, applicable to electric heated, air conditioned hotel 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 kWh savings.³⁴¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 85%. The ex ante energy savings estimate was premised on consistent annual lighting operating hours for different locations.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	70,554	59,689	85%	11.34
Total		70,554	59,689	85%	11.34

³⁴¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/26/2017 and 11/21/2017.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
018315-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	553	553	32	20	4,630	1.10	22,012	33,905	154%
				94	94	32	20	4,630	1.10	3,742	5,763	154%
018315-305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			528	528	34	20	4,615	1.10	24,519	37,648	154%
Total										50,273	77,316	154%

The annual lighting hours of operation verified during the M&V site visit (4,630) are greater than the hours of operation used to calculate ex ante savings (3,100).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned large single-story 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.³⁴²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 154%. The ex ante savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Lighting	Lighting	50,273	77,316	154%	14.69
Total		50,273	77,316	154%	14.69

³⁴² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/21/17 and 11/15/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	600	600	32	12	5,471	1.11	66,768	72,715	109%
Total										66,768	72,715	109%

The annual lighting hours of operation verified during the M&V site visit (5,471) are greater than the annual hours of operation used to calculate ex ante savings (5,200).

A heating and cooling interactive factor of 1.11, applicable to a gas 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 kWh savings.³⁴³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 109%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	66,768	72,715	109%	13.81
Total		66,768	72,715	109%	13.81

³⁴³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received New Construction incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the installation of: lighting, compressed air, and process VFDs and interviewed site personnel regarding equipment operation. The process VFDs were installed on a variety of equipment including: refrigeration compressors, mill motors, mixers, pumps, and fans. One time power measurements (OTPMs) and data from the building management system (BMS) were collected where possible.

Analysis Results

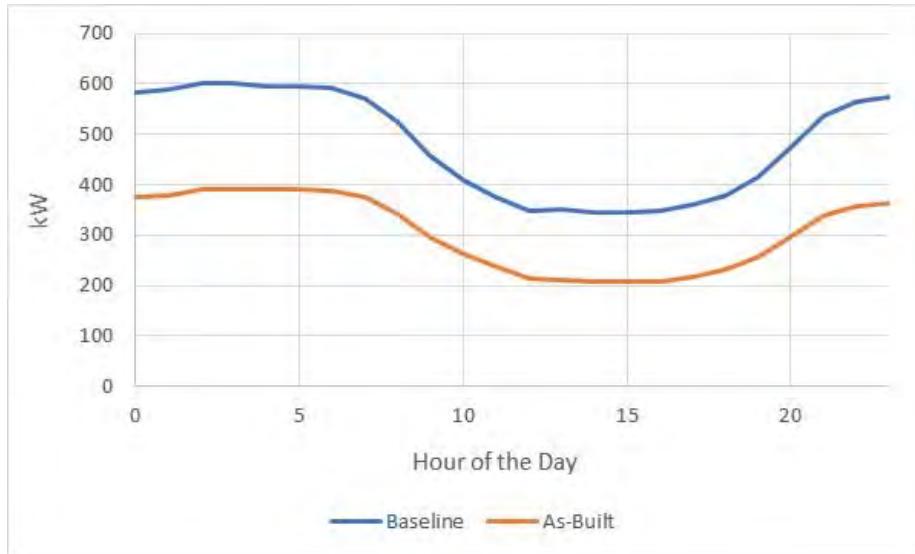
Compressed Air Savings Calculations

Energy savings for the installed compressed air system were calculated using post amperage monitoring data that was collected on-site. Amperage recording of the (3) installed centrifugal air compressors occurred at five minute intervals and encompassed approximately two months of typical air compressor operations.

Using the provided amperage monitoring data, corresponding as-built compressor kW demands were determined for each recorded data point. Upon the calculation of the kW demands for each of the as-built monitoring data points, the corresponding CFM output of the as-built air compressors was calculated by using typical centrifugal compressor efficiency curves. After determining the as-built CFM, baseline CFM was determined by adjusting the as-built CFM to account for additional purge air that would've been required for the baseline alternative. Compressor efficiency curves from Chapter 22 of the Uniform Methods Project were used to determine baseline kW demands. Additional air dryer energy usage for the as-built system were also calculated and included in the energy savings calculations.

Annual energy savings were then determined by extrapolating the baseline and as-built load profiles to an entire year. The kWh savings is then calculated as the difference between the baseline and as-built consumption. The following plot compares the average daily compressor system demand for the as-built and baseline systems for an average weekday:

Baseline vs As-Built Typical Weekday Compressed Air Load Profile

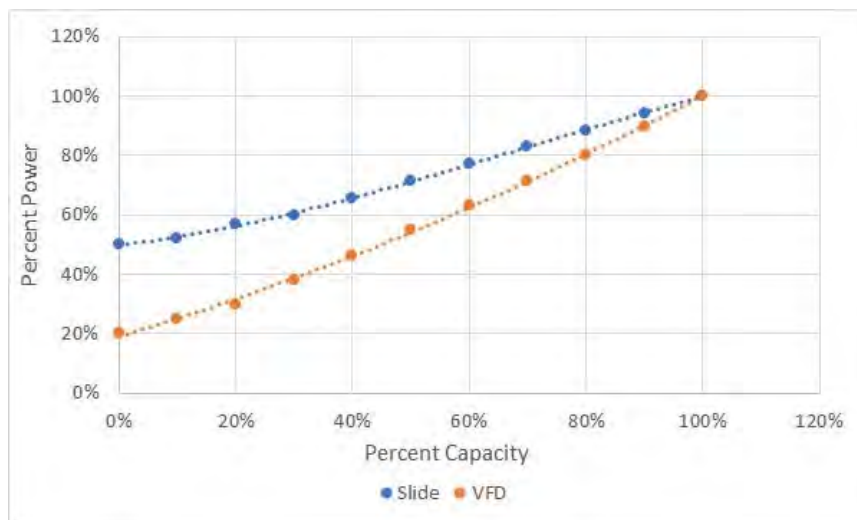


Process VFDs Savings Calculations

Energy savings for the process VFDs were calculated using a variety of: OTMPs, trending data, engineering equations, and Missouri Statewide TRM algorithms. The process VFDs can be categorized into the following equipment types: refrigeration compressors, mill motors, mixers, pumps, and fans.

For the refrigeration compressors with VFDs, ADM developed load profiles in a similar manner as the compressed air methodology. Amp trending data was collected from three days to one week at ten minute intervals. Corresponding as-built compressor kW demands were determined for each recorded data point. Upon the calculation of the kW demands for each of the as-built monitoring data points, the corresponding baseline kW demands were determined using typical efficiency curves for refrigeration compressors. The as-built uses a VFD efficiency curve, and the baseline uses a slide valve curve:

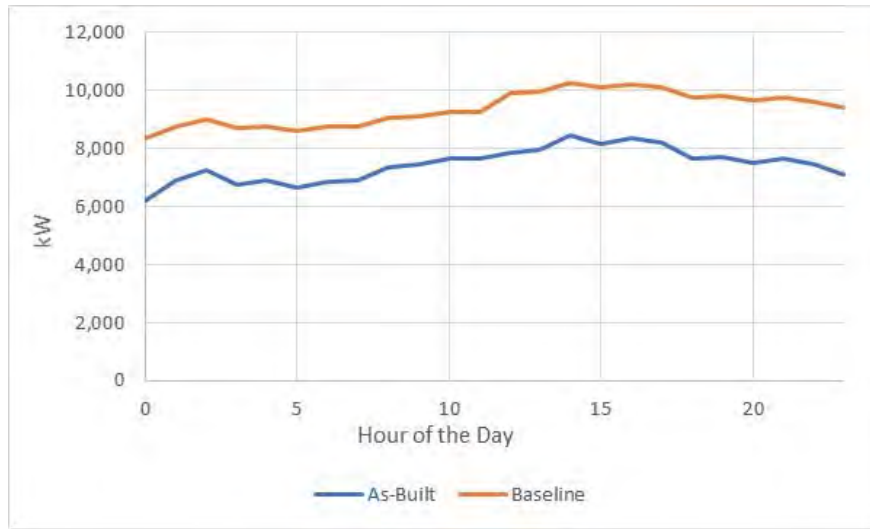
Slide Valve and VFD Refrigeration Compressor Efficiency Curves



Annual energy savings were then determined by extrapolating the baseline and as-built load profiles to an entire year. The kWh savings is then calculated as the difference between the baseline and as-built

consumption. The following plot compares the average daily compressor system demand for the as-built and baseline systems for an average weekday:

Baseline vs As-Built Typical Weekday Refrigeration Compressors Load Profile



For the mill motors, mixers, and like equipment with constant torque loads, the ex post analysis relies on OTMPs and the following engineering equation:

$$\Delta kWh = (hp_{motor} \times 0.7457 / \eta_{motor} \times Hours) \times (LF - \%Speed_{motor})$$

Where:

hp_{motor} = Installed nameplate motor horsepower

0.7457 = Conversion factor from horse-power to kW (kW/hp)

LF = Load Factor
= Actual or 0.65³⁴⁴ if not known.

η_{motor} = Motor efficiency
= Actual or 0.93³⁴⁴ if not known.

Hours = Annual operating hours

$\%Speed_{motor}$ = Average Percent Speed of the motor controlled by VFD

Since the loads are constant torque, horsepower changes linearly with speed.

For VFDs on process pumps and fans, ADM relies on trending data, OTPMs, engineering equations, and TRM values for calculation of ex post energy savings. The following equation is used along with primary and secondary data:

³⁴⁴ Missouri Statewide Technical Reference Manual – 2017 – 2.10.4 Variable Frequency Drives (VFDs) for Process

$$\Delta kWh = (hp_{motor} \times 0.7457/\eta_{motor} \times Hours) \times (LF - \%Speed_{motor}^{2.5 \text{ or } 2.7})$$

Where:

hp_{motor} = Installed nameplate motor horsepower

0.7457 = Conversion factor from horse-power to kW (kW/hp)

LF = Load Factor
= Actual or 0.65³⁴⁴ if not known.

η_{motor} = Motor efficiency
= Actual or 0.93³⁴⁴ if not known.

Hours = Annual operating hours

$\%Speed_{motor}$ = Average Percent Speed of the motor controlled by VFD

2.5 = Affinity exponent for pumps

2.7 = Affinity exponent for fans

From ADM's experience, the affinity exponent for pumps should be 2.5 and 2.7 for fans when data are not available to custom calculate the exponent.

Equipment New Construction Savings

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
181221- Compressed Air Optimization	1169	Compressed Air	New Construction	1,523,755	1,376,480	90%
166021-Motors-VFD for Process Motor Replacing No Existing Equipment	1169	Refrigeration	New Construction	4,502,250	4,615,310	103%
166021-Motors-VFD for Process Motor Replacing No Existing Equipment	1169	Process	New Construction	5,683,275	5,167,877	91%
Total				11,709,280	11,159,667	95%

There were significant differences in the ex ante and ex post analyses for the VFDs' installed on motors, with the realization rate ranging from 90% to 103%. The ex ante analysis simplified all the energy savings for the VFDs to total horsepower converted to kWh with assumed load factors, affinity laws, and efficiencies. But, the affinity laws only apply to fans and pumps. Affinity laws shouldn't be applied to all the equipment receiving VFD incentives, as it was done in the ex ante analysis. Also, the ex ante assigned a single End Use to all the motors.

Verified annual savings for installation of the centrifugal air compressors are 1,376,480 kWh, resulting in a measure-level realization rate of 90%. The 90% realization rate can be attributed to ex post analysis using post-monitoring data; whereas, the ex ante analysis relied on assumed load profiles.

Verified annual savings for the new construction equipment incentives are 11,159,667 kWh, resulting in a site-level realization rate of 95%.

Lighting New Construction Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	249	249	1,084	249	8,751	1.08	1,802,477	1,969,314	109%
				40	40	867	199	8,751	1.08	231,644	253,084	109%
				29	29	434	99	8,751	1.08	83,971	91,743	109%
				76	76	886	203	8,533	1.08	449,421	478,795	107%
				52	52	1,339	307	8,533	1.08	465,035	495,429	107%
				66	66	174	40	8,399	1.08	76,904	80,646	105%
				15	15	305	70	8,399	1.08	30,587	32,075	105%
				14	14	58	13	8,399	1.08	5,383	5,645	105%
				17	17	98	23	8,399	1.08	11,142	11,685	105%
				11	11	122	28	8,399	1.08	8,972	9,409	105%
262	262	218	50	8,399	1.08	381,606	400,176	105%				
Total									3,547,142	3,828,001	108%	

The annual lighting hours of operation verified during the M&V site visit (8,399-8,751) support the single ex ante annual hours of 8,664. The new construction lighting was installed in a new food processing facility that operates 24/7, all days of the year, except for two holidays.

A heating and cooling interactive factor of 1.08, applicable to a gas heated, air-conditioned warehouse in Kirksville, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for a heating and cooling interactive factor.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁴⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall lighting gross realization rate is 108%. The ex ante energy savings estimate was premised on similar annual lighting operating hours but did not consider heating and cooling interactive effects.

³⁴⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
New Construction	Compressed Air	1,523,755	1,376,480	90%	189.88
	Refrigeration	4,502,250	4,615,310	103%	626.47
	Motors	5,683,275	5,167,877	91%	712.88
	Lighting	3,547,142	3,828,001	108%	727.18
Total		15,256,422	14,987,668	98%	2,256.41

The combined realization rate for equipment measures and lighting measures is 98%.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules and controls. All lighting is operational 24/7 or controlled with photocells to operate during non-daylight hours.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Misc.	Custom	78	81	295	33	8,760	1.00	178,153	178,152	100%
		Exterior		126	126	295	66	4,308	1.00	147,444	124,305	84%
		Misc.		42	42	295	66	8,760	1.00	84,254	84,254	100%
		Exterior		234	234	295	33	4,308	1.00	313,284	264,120	84%
200102-Lighting-Linear LED Lamp <=22 Watt Lamp Replacing T8 32 Watt Lamp	3025	Misc.	Standard	110	110	40	15	8,760	1.00	24,090	24,090	100%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Misc.	Custom	104	104	295	33	8,760	1.00	238,692	238,692	100%
				4	4	295	66	8,760	1.00	8,024	8,024	100%
		Exterior		313	313	295	33	4,308	1.00	419,051	353,288	84%
				14	14	295	66	4,308	1.00	16,383	13,812	84%
		Misc.		23	23	295	66	8,760	1.00	46,139	46,139	100%
		Exterior		71	71	295	66	4,308	1.00	83,083	70,045	84%
Total										1,558,597	1,404,922	90%

The annual lighting hours of operation verified during the M&V site visit for the second, fourth, eighth, ninth, and eleventh line items in the table above (4,308³⁴⁶) are fewer than the annual hours of operation used to calculate ex ante savings (5,110). The remaining line items were confirmed to be operational 24/7.

No cooling or heating interactive effects were accounted for due to lighting being installed in non-conditioned spaces.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁴⁷

³⁴⁶ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php

³⁴⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 90%. The ex ante energy savings estimate was premised on overestimated annual non-daylight hours regarding lighting controlled with photocells.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	24,090	24,090	100%	4.58
Custom	Miscellaneous	555,262	555,261	100%	76.59
	Exterior	979,245	825,570	84%	0.00
Total		1,558,597	1,404,922	90%	238.00

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/21/17 and 12/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	24	48	96	12	2,837	1.00	4,714	4,903	104%
				30	60	96	12	2,941	1.11	5,894	7,035	119%
				40	80	96	12	2,941	1.11	7,858	9,380	119%
				20	20	40	12	3,035	1.11	1,528	1,882	123%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			30	-	96	-	2,941	1.11	7,858	9,380	119%
				40	-	96	-	2,941	1.11	10,477	12,506	119%
Total										38,330	45,085	118%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings for the store area. The stock room was unconditioned. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The total ex ante annual energy savings for the second, third, fifth, and sixth line items in the table above are 32,088 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁴⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 118%. The ex ante energy savings estimate was premised on

³⁴⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	38,330	45,085	118%	8.56
Total		38,330	45,085	118%	8.56

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/28/17 and 11/22/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	278	278	32	18	3,517	1.11	9,745	15,141	155%
				5	5	32	18	1,478	1.11	175	114	65%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			188	188	40	15	2,796	1.11	11,768	14,532	123%
				268	268	92	43	3,100	1.11	32,880	45,028	137%
Total										54,568	74,815	137%

Primary data were used to develop estimates of annual lighting operating hours, ranging from 1,478 to 3,100. For all facility areas monitored except for the second line item in the table above, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (2,340).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office 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.³⁴⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 137%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for three measures and heating and cooling interactive effects.

³⁴⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	54,568	74,815	137%	14.21
Total		54,568	74,815	137%	14.21

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/1/17 and 11/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	SBDI	1	1	30	1	8,760	1.00	274	256	93%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	8	96	22	2,336	1.00	668	486	73%
				68	68	40	22	2,210	1.00	3,929	2,705	69%
				20	40	96	22	2,336	1.00	3,338	2,429	73%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			3	3	30	3	8,760	1.00	748	699	93%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			6	12	60	22	379	1.00	296	36	12%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			22	44	96	22	2,290	1.00	3,672	2,620	71%
				188	376	96	22	2,238	1.00	30,126	21,877	73%
Total										43,051	31,108	72%

For the first and fifth line items in the table above the annual lighting operating hours are consistent with the ex ante savings estimate hours (8,760). For the remaining line items, primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates (ranging between 2,880 and 3,000).

No heating and cooling interactive effects were accounted for due to lighting being installed in an unconditioned location. 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.³⁵⁰

³⁵⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 72%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	43,051	31,108	72%	5.91
Total		43,051	31,108	72%	5.91

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/24/17 and 11/14/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	800	800	40	13	4,820	1.09	151,846	113,985	75%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			800	800	32	13	4,072	1.09	106,854	67,767	63%
Total										258,700	181,752	70%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates (6,570).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned office 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.³⁵¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 70%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	258,700	181,752	70%	34.53
Total		258,700	181,752	70%	34.53

³⁵¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed ten photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/28/17 and 11/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	Standard	99	99	43	11	1,308	1.14	1,117	4,714	422%
				19	19	43	11	2,197	1.14	2,768	1,519	55%
201212-Lighting-LED 12-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			4	4	53	12	1,308	1.14	697	244	35%
				3	3	53	12	8,760	1.14	1,064	1,226	115%
200102-Lighting-Linear LED Lamp <=22 Watt Lamp Replacing T8 32 Watt Lamp	3025			80	80	32	10	5,809	1.14	9,884	11,630	118%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			43	43	53	17	5,809	1.14	7,022	10,229	146%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			12	12	29	5	5,809	1.14	1,550	1,903	123%
201212-Lighting-LED 12-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			18	18	72	12	2,558	1.14	4,940	3,143	64%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			32	32	22	5	8,760	1.14	4,765	5,421	114%
				9	9	22	2	8,760	1.14	1,577	1,794	114%
201212-Lighting-LED 12-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			4	4	72	15	515	1.14	444	134	30%
			3	3	72	12	1,308	1.14	63	268	423%	
			3	3	72	20	3,792	1.14	842	673	80%	
200102-Lighting-Linear LED Lamp <=22 Watt Lamp Replacing T8 32 Watt Lamp	3025	153	153	32	17	3,894	1.14	12,889	10,165	79%		
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Custom	7	7	164	44	8,760	1.14	7,358	8,370	114%	
			25	25	164	44	4,526	1.14	16,848	15,446	92%	
			12	12	164	49	801	1.14	7,750	1,257	16%	
			2	2	164	44	2,240	1.14	1,136	611	54%	
			3	3	164	55	5,809	1.14	1,836	2,161	118%	

				2	2	82	43	8,760	1.14	684	777	114%
				8	8	82	40	8,760	1.14	2,943	3,348	114%
				9	9	122	44	2,460	1.14	3,942	1,964	50%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture				33	20	455	144	4,685	1.14	57,423	64,673	113%
100216-Lighting-Non Linear LED Fixture Replacing Existing Inefficient Lighting Fixture				3	3	330	27	515	1.14	1,833	533	29%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Exterior	Standard	35	35	53	17	4,308	1.00	5,343	5,428	102%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	1169	Lighting	Custom	3	3	164	43	5,809	1.14	2,039	2,399	118%
Total										158,758	160,029	101%

The annual lighting hours of operation verified during the M&V site visit range between 515 and 8,760 while the hours of operation used to calculate ex ante savings range between 364 and 8,760. The annual hours of operation referenced in the table above exceed the annual lighting hours of operation used to calculate ex ante savings for the first, fifth, sixth, seventh, twelfth, nineteenth, twenty fifth and twenty sixth line items. The annual hours of operation for the remaining line items are fewer than the annual lighting hours of operation used to calculate ex ante savings, excluding line items referencing exit signs which were verified to operate 24/7.

The ex ante savings estimate used an LM adjusted base wattage of 42W for the first and second line items in the table above, 52.5W for the third, fourth, sixth, and twenty fifth line items, 28W for the seventh line item, and 70W for the eighth, eleventh, twelfth, and thirteenth line items by multiplying the provided wattage by 70%. An adjusted base wattage of 43W, 53W, 29W, and 72W were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W, 75W, 40W and 100W incandescent lamp.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. No heating or cooling interactive effects were accounted for regarding lighting installed in the exterior of the facility. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 101%.

³⁵² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	54,966	58,490	106%	8.15
Custom		103,792	101,539	98%	22.25
Total		158,758	160,029	101%	30.40

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/17/17 and 12/06/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	9	9	43	9	472	1.01	594	146	25%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			8	8	40	18	3,405	1.01	510	606	119%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			243	243	32	18	2,913	1.01	9,865	10,028	102%
Total										10,969	10,781	96%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (472) is fewer than the hours of operation used to calculate ex ante savings (2,900). The second and third line items had hours (3,405 and 2,913, respectively) greater than used for the ex ante hours (2,900).

The ex ante savings estimate used an LM adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned office facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours regarding the first line item.

³⁵³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	10,969	10,781	98%	2.05
Total		10,969	10,781	98%	2.05

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/20/2017 and 12/28/2017.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
016893-201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	8	8	43	9	213	1.11	920	64	7%
016893-305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			240	240	32	15	3,129	1.11	14,215	14,139	99%
Total										15,135	14,203	94%

The annual lighting hours of operation verified during the M&V site visit (213 and 3,129, respectively) are less than the hours of operation used to calculate ex ante savings (3,350). The first line item in the table above was installed in infrequently used restrooms and electrical/storage rooms.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 94%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	15,135	14,203	94%	2.70
Total		15,135	14,203	94%	2.70

³⁵⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules. The majority of lighting operates according to a timer set to operate from 5am – 5:30pm M-F, while the remaining lighting is operational 24/7.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100202-Lighting-Non Linear LED Fixture Replacing T12 HO Fixture	1169	Lighting	Custom	468	234	245	82	3,518	1.10	421,788	368,070	87%
Total										421,788	368,070	87%

The annual lighting hours of operation verified during the M&V site visit (3,518) are fewer than the annual hours of operation used to calculate ex ante savings (4,248).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned storage 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 87%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	421,788	368,070	87%	69.92
Total		421,788	368,070	87%	69.92

³⁵⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/16/17 and 12/5/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture_201766-16140_4-200909	3007	Lighting	SBDI	148	148	65	9	2,785	1.11	21,549	25,527	118%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			8	8	65	12	2,037	1.11	1,102	955	87%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			78	78	65	9	2,785	1.11	11,357	13,453	118%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			24	24	50	7	2,308	1.11	1,778	2,665	150%
Total										35,786	42,601	119%

The annual lighting hours of operation verified during the M&V site visit range between 2,037 and 2,785. The annual lighting hours of operation referenced in the first and third line items in the table above are greater than the annual hours of operation used to calculate ex ante savings (2,500), while the remaining line items are fewer.

The ex ante savings estimate used an adjusted base wattage of 35W for the fourth line item in the above table by multiplying the provided wattage by 70%. The base lamps for these measures (MR16) are exempt from an adjusted wattage calculation.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office 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 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵⁶

³⁵⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 119%. The ex ante savings estimate was premised on underestimated annual operating hours for two measures and underestimated heating and cooling effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	35,786	42,601	119%	8.09
Total		35,786	42,601	119%	8.09

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture_201751-13533_4-200909	3007	Lighting	SBDI	0	0	65	8	-	-	9,322	-	0%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp_201751-13533_5-201111	3011			227	227	29	9	1,749	1.00	6,728	7,938	118%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft_201751-13534_35-305401	3026			58	58	40	18	8,760	1.11	11,594	12,366	107%
				2	2	40	18	8,760	1.11	400	426	107%
Total										28,044	20,730	74%

The annual lighting hours of operation verified during the M&V site visit for the second line item above (1,749) are fewer than the annual hours of operation used to calculate ex ante savings (1,500). The third and fourth line items above had hours of operation (8,760) greater than the hours of operation used to calculate ex ante savings (8,736). These lamps were installed in common areas with continuous usage.

The quantity of the first line item in the first table above (0) verified during the M&V site visit is less than the ex ante savings quantity (18). The client had no knowledge of any reflector lamps installed as a baseline or post lamp. There were no BR lamps in storage or found anywhere within the facility.

An adjusted base wattage of 29W was used for the first second line item above in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp. The ex ante base wattage of 28W was computed within the application by factoring 70% of a 40W incandescent lamp.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned hotel St. Louis, was applied to the ex post lighting energy savings for common areas. A heating and cooling factor of 0.99 was applied to the ex post lighting energy savings for guest rooms. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 74%. The ex ante energy savings estimate was premised on installation of all measures stated in the application

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post Peak kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	28,044	20,730	74%	3.94
Total		28,044	20,730	74%	3.94

³⁵⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/11/18 and 1/30/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	55	55	85	13	2,989	1.11	13,000	13,111	101%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			2	2	40	18	2,841	1.11	145	138	95%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			2	2	40	18	3,855	1.11	144	188	130%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			2	-	40	-	2,841	1.11	263	252	96%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			16	16	75	36	2,989	1.11	2,048	2,066	101%
Total										15,601	15,755	101%

The annual lighting hours of operation verified during the M&V site visit for the first, second, fourth, and fifth line items in the table above (2,989, 2,841, 2,841, and 2,989, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,068). The third line item has greater hours of operation (3,855) than the ex ante hours.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings for the second and fourth line item in the table above are 408 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁵⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 101%. The ex ante energy savings estimate was premised on underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	15,601	15,755	101%	2.99
Total		15,601	15,755	101%	2.99

³⁵⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/06/17 and 11/06/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate		
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	118	118	455	165	3,406	1.00	112,702	116,545	103%		
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear	3026			252	252	40	17	3,083	1.11	19,089	19,765	104%		
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			20	20	20	5	8,760	1.11	2,812	2,907	103%		
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3084			28	28	32	17	3,310	1.11	1,383	1,538	111%		
305801-Lighting-Delamping Replacing T12 <=40 Watt	3077			182	182	32	17	3,155	1.00	8,991	8,614	96%		
				252	-	40	-	3,083	1.11	33,198	34,374	104%		
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture	1169			14	-	32	-	3,310	1.11	1,475	1,640	111%		
				20	20	82	40	1,208	1.11	2,767	1,122	41%		
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	3084			Exterior Lighting	Custom	4	4	295	60	3,586	1.00	3,096	3,371	109%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169					18	18	295	60	4,308	1.00	18,527	18,224	98%
305802-Lighting-Delamping Replacing T8 32 Watt	3077	Lighting	Standard	9	9	455	120	4,308	1.00	13,206	12,990	98%		
100207-Lighting-Non Linear LED Fixture Replacing T5 HO Fixture	1169		Standard	100	-	32	-	3,155	1.00	10,539	10,097	96%		
			Custom	8	8	220	40	1,224	1.11	4,743	1,949	41%		
			Custom	77	20	227	165	3,712	1.00	46,698	52,626	113%		
Total										279,227	285,764	102%		

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301818-Lighting-Fixture Mounted Occupancy Sensor Controlling >50 and <=200 Watts Replacing No Controls	1169	Lighting	Standard	118	165	3,406	2,971	1.00	41,400	8,457	20%
				20	66	3,128	2,652	1.00		631	
Total									41,400	9,088	22%

The annual lighting hours of operation verified during the M&V site visit for the third line item in the first table above corresponds with the ex ante hours (8,760). The tenth and eleventh line items were installed using photo cells (4,308³⁵⁹) are fewer than the hours of operation used to calculate ex ante savings (4,380). For the eighth and thirteenth line items the annual hours (1,208 and 1,224) are fewer than the annual hours of operation used to calculate ex ante savings (3,078), while the remaining line items had hours (ranging from 3,083 – 3,712) which are greater than the ex ante.

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the workday and the end of the workday.

The quantity of the first line item in the second table above (118) verified during the M&V site visit is less than the ex ante savings quantity (138), controlling a wattage of 165W per sensor. The second line was added to show the remaining quantity (20) controlling a wattage of 66.3W per sensor.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings for the interior of the facility. The warehouse was unconditioned as well as the exterior measures. The ex ante savings estimate accounted for a heating and cooling factor of 1.07.

The total ex ante annual energy savings for the second, fourth through seventh, and twelfth line items in the first table are 74,676 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly distributed across measures. This error relates to the matter of how to allocate project energy savings between delamping measures and new lighting. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures, thus creating the discrepancy. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁶⁰

³⁵⁹ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

³⁶⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 92%. The ex ante energy savings estimate was premised on overestimated savings from the occupancy sensors.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	231,590	204,569	88%	38.86
Custom		57,303	59,069	103%	11.22
	Exterior Lighting	31,733	31,214	98%	0.00
Total		320,627	294,852	92%	50.08

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor logger collected data between 10/31/17 and 11/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	147	147	65	8	2,390	1.11	16,003	22,183	139%
			Standard	12	12	65	8	2,390	1.11	1,306	1,811	139%
				6	6	50	7	2,390	1.11	493	683	139%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009		Standard	125	125	72	9	2,390	1.11	14,563	20,849	143%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026		Standard	6	6	40	18	2,390	1.11	252	349	139%
Total										32,617	45,876	141%

The annual lighting hours of operation verified during the M&V site visit (2,794) are greater than the annual hours of operation used to calculate ex ante savings (1,785).

The ex ante savings estimate used an adjusted base wattage of 70W for the fourth line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp.

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁶¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 141%. The ex ante energy savings estimate was premised upon underestimated hours of operation and underestimated heating and cooling effects.

³⁶¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	16,614	23,692	143%	4,.50
SBDI		16,003	22,183	139%	4.21
Total		32,617	45,876	141%	8.71

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/14/17 and 12/4/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
100107-Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture	1169	Lighting	Custom	304	304	432	212	7,740	1.09	628,043	567,302	90%
				51	51	325	159	7,196	1.09	79,266	66,561	84%
Total										707,309	633,863	90%

The annual lighting hours of operation verified during the M&V site visit (ranging between 7,196 and 7,740) and are fewer than the hours of operation used to calculate ex ante savings (8,760).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing 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.³⁶²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 90%. The ex ante energy savings estimate was premised on overestimated hours of operation and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>incentive</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Lighting	707,309	633,863	90%	120.41
Total		707,309	633,863	90%	120.41

³⁶² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 12/1/17 and 1/7/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	SBDI	2	2	30	3	8,760	1.03	499	482	97%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			132	132	40	12	3,556	1.03	11,864	13,583	114%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			2	2	53	15	8,760	1.18	241	783	325%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			1	1	30	1	8,760	1.03	274	264	97%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			1	1	72	16	3,475	1.03	173	201	116%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			13	13	65	9	2,220	1.03	2,337	1,670	71%
Total												15,388

The annual hours of operation verified during the M&V site visit for the first and fourth line items in the table above are consistent with the ex ante energy savings hours (8,760). The sixth line item had hours (2,220) fewer than those used to calculate ex ante savings (3,000), while the remaining measures had operating hours greater.

The ex ante savings estimate used an LM adjusted base wattage of 52.5W for the third line item in the above table and 70W for the fifth line item by multiplying the provided wattage by 70%. An adjusted base wattage of 53W and 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W and 100W incandescent lamp.

A heating and cooling interactive factor of 1.03, applicable to an electrically heated, air conditioned restaurant facility in St. Louis, was applied to the ex post lighting energy savings. A heating and cooling interactive factor of 1.18 was applied to the ex post energy savings for the third line item in the table

above due to lighting being installed in a refrigerated space. 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.³⁶³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 110%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for three line items.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	15,388	16,984	110%	3.23
Total		15,388	16,984	110%	3.23

³⁶³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/2/18 and 2/22/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	237	237	43	9	3,235	1.11	23,064	28,868	125%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			40	40	40	15	3,235	1.11	2,949	3,582	121%
Total										26,013	32,450	125%

The annual lighting hours of operation verified during the M&V site visit (3,235) are greater than the annual hours of operation used to calculate ex ante savings (2,756). The latter value was found using the hours the facility is open to public. It does not account for hours in which employees arrive and leave before and after the hours of operation.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in Cape Girardeau, MO, was applied to the ex post lighting energy savings. The ex ante savings accounted for a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁶⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 125%. The ex ante energy savings estimate was premised on underestimated annual hours of operation.

³⁶⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	26,013	32,450	125%	6.16
Total		26,013	32,450	125%	6.16

Data Collection

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

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/02/17 and 11/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate		
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,028	1,028	32	16	5,280	1.02	77,437	88,281	114%		
				78	78	17	9	4,805	1.02	2,938	3,048	104%		
				121	198	32	16	5,280	1.02	3,239	3,693	114%		
				79	79	32	16	5,144	1.02	5,951	6,609	111%		
				3	4	25	13	4,382	1.02	108	102	95%		
				680	680	32	16	4,768	1.02	51,223	52,730	103%		
				156	156	32	16	5,280	1.02	11,751	13,397	114%		
305802-Lighting-Delamping Replacing T8 32 Watt	3084	Lighting	Standard	53	-	32	-	5,280	1.02	7,947	9,060	114%		
				1	-	25	-	4,382	1.02	118	111	95%		
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	1169			Custom	779	779	72	42	5,158	1.02	110,026	122,532	111%	
Total										270,738	299,563	111%		

Primary data were used to develop estimates of annual lighting operating hours. The estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (4,400), except for line items five and nine in the tables above.

The total ex ante annual energy savings regarding line items three, five, eight, and nine are 11,412 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

A heating and cooling interactive factor of 1.02, applicable to an electrically 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 kWh savings.³⁶⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 111%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and overestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	160,712	177,031	110%	33.63
Custom		110,026	122,532	111%	23.28
Total		270,738	299,563	111%	56.91

³⁶⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Exterior	Custom	29	29	1,080	286	4,308	1.00	100,854	99,198	98%
				5	5	455	80	4,308	1.00	8,213	8,078	98%
				43	43	455	143	4,308	1.00	58,762	57,797	98%
100214-Lighting-Non Linear LED Fixture Replacing Inefficient Signage Fixture				12	10	500	40	4,308	1.00	24,528	24,125	98%
Total										192,356	189,198	98%

The annual lighting hours of operation for the fixtures using photo cells (4,308³⁶⁶) are less than the hours of operation used to calculate ex ante savings (4,380).

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁶⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 98%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Lighting	192,356	189,198	98%	0.00
Total		192,356	189,198	98%	0.00

³⁶⁶ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

³⁶⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/31/17 and 11/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	63	63	65	8	4,617	1.01	16,783	16,679	99%
Total										16,783	16,679	99%

The annual lighting hours of operation verified during the M&V site visit (4,617) are greater than the annual hours of operation used to calculate ex ante savings (4,368).

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned small 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.³⁶⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 99%. The ex ante energy savings estimate was calculated using an overestimated heating and cooling interactive factor.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	16,783	16,679	99%	3.17
Total		16,783	16,679	99%	3.17

³⁶⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/24/17 and 11/14/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	52	52	65	8	4,552	1.12	17,364	15,083	87%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			7	7	65	13	4,552	1.12	2,153	1,870	87%
Total										19,517	16,953	87%

The annual lighting hours of operation verified during the M&V site visit (4,552) are less than the annual hours of operation used to calculate ex ante savings (5,475).

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned full-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 interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁶⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 87%. The ex ante energy savings estimate was premised upon overestimated hours of operation.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	19,517	16,953	87%	3.22
Total		19,517	16,953	87%	3.22

³⁶⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel that the measure was on a photo-cell.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Exterior	Custom	70	70	1,080	209	4,309	1.00	267,049	262,723	98%
Total										267,049	262,723	98%

The annual lighting hours of operation verified during the M&V site visit for the above fixtures using photo cells (4,309³⁷⁰) are less than the hours of operation used to calculate ex ante savings (4,380).

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁷¹ The measure has an end use of exterior.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 98%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Exterior	267,049	262,723	98%	0.00
Total		267,049	262,723	98%	0.00

³⁷⁰ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

³⁷¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel which confirmed use of photo cells.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Exterior	Custom	60	60	1,080	298	4,307	1.00	205,536	202,112	98%
Total										205,536	202,112	98%

The annual lighting hours of operation verified during the M&V site visit (4,307³⁷²) are fewer than the annual hours of operation used to calculate ex ante savings (4,380).

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁷³ An exterior end use was applied.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 98%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Exterior	205,536	202,112	98%	0.00
Total		205,536	202,112	98%	0.00

³⁷² Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php

³⁷³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305013-Lighting-<=80 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 100-175 Watt Lamp or Fixture	3006-1	Misc.	Standard	386	386	138	56	8,760	1.00	277,272	277,272	100%
Total										277,272	277,272	100%

All installed lighting was verified to operate 24/7, which is consistent with the annual hours of operation used to develop the ex ante energy savings estimate (8,760).

No heating or cooling interactive effects were accounted for due to lighting being installed in an unconditioned space.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁷⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 100%.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	277,272	277,272	100%	38.25
Total		277,272	277,272	100%	38.25

³⁷⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/15/17 and 12/4/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	114	114	32	15	6,716	1.11	13,587	14,415	106%
Total										13,587	14,415	106%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (6,552).

A heating and cooling interactive factor of 1.11, applicable to a gas 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 kWh savings.³⁷⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 106%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	13,587	14,415	106%	2.74
Total		13,587	14,415	106%	2.74

³⁷⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/18/17 and 12/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	2	2	43	9.5	5,493	1.10	407	404	99%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			104	104	40	15	5,493	1.10	16,068	15,694	98%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			1	1	30	3	8,760	1.10	253	260	103%
Total										16,728	16,358	98%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates (5,766 and 5,776). The installed LED exit signs were verified to operate 24/7.

The ex ante savings estimate used an LM adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The efficient wattage of the first line item in the table above (9.5W) verified during the M&V site visit is greater than the ex ante savings efficient wattage (9W).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned restaurant 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.³⁷⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 98%. The ex ante energy savings estimate was premised on

³⁷⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

overestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	16,728	16,358	98%	3.11
Total		16,728	16,358	98%	3.11

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/18/17 and 12/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft)	3026	Lighting	SBDI	76	76	40	15	5,638	1.10	11,742	11,772	100%
Replacing T12 <=40 Watt Linear ft				2	2	40	12	5,626	1.10	346	346	100%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			4	4	43	9.5	5,177	1.10	816	762	93%
Total										12,904	12,880	100%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates (5,776).

The ex ante savings estimate used an LM adjusted base wattage of 42W for the third line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The efficient wattage of the third line item in the table above (9.5W) verified during the M&V site visit is greater than the ex ante efficient wattage (9W).

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned restaurant 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.³⁷⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 100%.

³⁷⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	12,904	12,880	100%	2.45
Total		12,904	12,880	100%	2.45

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/9/17 and 11/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	278	278	32	18	2,429	1.09	11,910	10,341	87%
				4	4	32	18	399	1.09	171	24	14%
Total										12,082	10,366	86%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours are fewer than those used to develop the ex ante energy savings estimates (2,860).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing 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.³⁷⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 86%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	12,082	10,366	86%	1.97
Total		12,082	10,366	86%	1.97

³⁷⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/26/17 and 11/13/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	167	167	40	15	2,203	1.09	13,402	9,989	75%
				177	177	40	15	2,097	1.09	14,285	10,077	71%
				4	4	30	9	1,839	1.09	180	168	93%
Total										27,867	20,235	73%

The annual lighting hours of operation verified during the M&V site visit (2,245, 2,143, and 1,839, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,000, 3,000, and 2,000, respectively).

The quantity of the second line item in the table above (177) verified during the M&V site visit is less than the ex ante savings quantity (178). The remaining lamp was found to be in storage to be used as a replacement lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas 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 kWh savings.³⁷⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 73%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

³⁷⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	27,867	20,235	73%	3.84
Total		27,867	20,235	73%	3.84

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/30/17 and 12/26/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	278	278	32	14	2,462	1.11	13,653	13,628	100%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			45	45	32	14	2,487	1.11	2,210	2,228	101%
				6	12	96	14	3,561	1.11	1,114	1,607	144%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			10	10	40	14	3,561	1.11	709	1,024	144%
Total										17,686	18,487	105%

The annual lighting hours of operation verified during the M&V site visit (ranging from 2,462 and 3,561) vary from the hours of operation used to calculate ex ante savings (2,550).

A heating and cooling interactive factor of 1.11, applicable to a gas 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 interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 105%. The ex ante energy savings estimate was calculated using an underestimated heating and cooling interactive factor.

³⁸⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	17,686	18,487	105%	3.51
Total		17,686	18,487	105%	3.51

Data Collection

The participant received Custom lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Exterior	Custom	40	1	455	2,820	4,308	1.00	78,592	66,251	84%
Total										78,592	66,251	84%

The annual lighting hours of operation verified during the M&V site visit (4,308³⁸¹) are less than the annual hours of operation used to calculate ex ante savings (5,110).

The measure was an exterior installation with no heating and cooling interactive factor applied.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 84%. The ex ante energy savings estimate was premised upon overestimated hours of operation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Exterior	78,592	66,251	84%	0.00
Total		78,592	66,251	84%	0.00

³⁸¹ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php

³⁸² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	500	500	40	15	8,760	1.11	116,844	121,139	104%
Total										116,844	121,139	104%

The annual lighting hours of operation verified during the M&V site visit are greater than the annual hours of operation used to calculate ex ante savings (8,736).

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 104%. The ex ante energy savings estimate was calculated using an underestimated heating and cooling interactive factor.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	116,844	121,139	104%	23.01
Total		116,844	121,139	104%	23.01

³⁸³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed one photo-sensor logger to monitor lighting operation. The photo-sensor loggers collected data between 11/8/17 and 11/28/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	40	40	65	8	4,327	1.12	9,388	11,028	117%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			14	14	43	9	4,297	1.12	1,902	2,286	120%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			34	34	65	7	3,911	1.12	8,119	8,622	106%
Total										19,409	21,936	113%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,848).

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned full-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 interactive factor of 1.07.

The ex ante savings estimate used an adjusted base wattage of 42W for the second line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸⁴

³⁸⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 113%. The ex ante energy savings estimate was premised upon underestimated annual hours of operation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	19,409	21,936	113%	4.17
Total		19,409	21,936	113%	4.17

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/16/17 and 12/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	96	96	70	8	2,447	1.11	16,558	16,130	97%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			10	10	42	17	2,550	1.11	696	706	102%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			10	-	42	-	4,680	1.11	1,168	2,177	186%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			10	10	42	17	4,680	1.11	696	1,296	186%
Total										19,118	20,308	106%

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the table above (2,595 and 2,550, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (2,600). The remaining line items had hours (4,660) greater than the ex ante savings hours.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings for the third and fourth line items in the table above are 1,864 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 106%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for two measures and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	19,118	20,308	106%	3.86
Total		19,118	20,308	106%	3.86

³⁸⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

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, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/11/17 and 12/04/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	400	400	50	15	8,117	1.09	131,225	124,358	95%
Total										131,225	124,358	95%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were fewer than those used to develop the ex ante energy savings estimates (8,760).

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home 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.³⁸⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 95%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	131,225	124,358	95%	23.62
Total		131,225	124,358	95%	23.62

³⁸⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/23/17 and 12/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	SBDI	18	18	53	8	4,112	1.11	2,852	3,689	129%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			4	-	40	-	4,053	1.11	569	718	126%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			208	208	40	17	4,112	1.11	17,035	21,785	128%
				2	2	40	17	4,053	1.11	164	206	126%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			90	90	40	17	4,279	1.11	7,371	9,810	133%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			2	-	40	-	4,053	1.11	285	359	126%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			52	52	40	17	4,175	1.11	4,259	5,531	130%
Total										32,535	42,098	129%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 total ex ante annual energy savings for the second, fourth, sixth, and seventh line items in the table above are 5,277 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's

assessment. The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 129%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	32,535	42,098	129%	8.00
Total		32,535	42,098	129%	8.00

³⁸⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/11/17 and 12/4/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	Standard	12	12	35	4	8,760	1.09	3,477	3,565	103%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			1,174	1,174	32	12	4,615	1.09	161,997	118,523	73%
Total										165,474	122,087	74%

The annual lighting hours of operation verified during the M&V site visit (8,760 and 4,615, respectively) vary from the hours of operation used to calculate the ex ante savings (8,736 and 6,448, respectively). The measures for the second line item in the table above were installed in multiple locations with various usage.

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁸⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 74%. The ex ante energy savings estimate was premised upon overestimated hours of operation for the second measure.

³⁸⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	165,474	122,087	74%	23.19
Total		165,474	122,087	74%	23.19

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/29/17 and 12/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	960	960	53	9	3,653	1.09	287,261	168,855	64%
				105	105	53	9	3,442	1.00		15,902	
Total										287,261	184,757	64%

The annual lighting hours of operation verified during the M&V site visit (3,653 and 3,442) are fewer than the annual hours of operation used to calculate ex ante savings (5,795).

The ex ante energy savings was based on one measure with an interior installation. The client installed a portion (105) of the lamps in exterior porch fixtures. The ex post savings analysis divided the interior and exterior installations.

An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The ex ante base wattage of 52.5W was computed within the application by factoring 70% of a 75W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned nursing home facility in St. Louis, was applied to the ex post lighting energy savings for the interior installation. 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.³⁸⁹ 105 of the LED screw in lamps were installed in exterior areas; the ex post kW savings is based on the Exterior Lighting End Use for this portion.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 64%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

³⁸⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	258,939	168,855	65%	32.08
	Ext Lighting	28,322	15,902	56%	0.09
Total		287,261	184,757	64%	32.17

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/14/17 and 12/05/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	67	67	65	8	3,231	1.14	13,599	14,037	103%
201317-Lighting-LED or Electroluminescent Replacing CFL Exit Sign	8001			11	11	40	5	8,760	1.14	1,371	3,836	280%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			72	72	40	18	3,961	1.14	5,641	7,137	127%
Total										20,611	25,011	121%

The annual lighting hours of operation verified during the M&V site visit for the first line item above (3,231) are less than the annual hours of operation used to calculate ex ante savings (3,328). The hours of operation verified during the site visit for the second and third line items (8,760 and 3,961, respectively) are greater than the those used to calculate the ex ante savings (3,328). The second line item has continuous usage due to being exit signage.

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 121%. The ex ante energy savings estimate was premised upon underestimated hours of operation for two measures.

³⁹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	20,611	25,011	121%	4.75
Total		20,611	25,011	121%	4.75

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/07/17 and 11/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	728	728	40	11.5	4,089	1.03	79,387	87,423	110%
Total										79,387	87,423	110%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,120).

The quantity in the table above verified during the M&V site visit (728) is less than the quantity used to calculate ex ante energy savings (820). The 92 extra lamps were placed in storage to be used as replacements.

The efficient wattage in the table above verified during the M&V site visit (11.5W) is greater than the efficient wattage used to calculate the ex ante savings estimate (11W).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings for measures installed in the office areas. All warehouse areas were unconditioned. 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.³⁹¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 110%. The ex ante energy savings estimate was premised upon underestimated hours of operation.

³⁹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	79,387	87,423	110%	16.61
Total		79,387	87,423	110%	16.61

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, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/31/17 and 11/21/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	371	371	40	11.5	7,885	1.01	54,240	84,225	155%
				125	125	40	17	4,049	1.07	19,471	12,418	64%
				160	160	40	20	5,013	1.08	27,563	17,259	63%
Total										101,274	113,902	112%

The annual lighting hours of operation verified during the M&V site visit for the second item (4,049) is fewer than the annual hours of operation used to calculate ex ante savings (4,600). The remaining line items have hours of operation greater than the hours of operation used to calculate ex ante savings.

The quantity of the line items in the table above (371, 125, and 160, respectively) verified during the M&V site visit is less than the ex ante savings quantities (380, 172, and 280, respectively). The remaining lamps were found in storage to be used as replacements.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned large office facility in St. Louis, was applied to the ex post lighting energy savings. In addition, the shop storage area was unconditioned. The ex ante savings estimate accounted for a heating and cooling factor of 1.07 for all measures.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 112%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for two measures and underestimated heating and cooling interactive effects.

³⁹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	101,274	113,902	112%	21.64
Total		101,274	113,902	112%	21.64

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed seven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/10/17 and 11/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	800	800	28	15	3,103	1.15	84,573	37,038	44%
Total										84,573	37,038	44%

The annual lighting hours of operation verified during the M&V site visit (3,103) are fewer than the annual hours of operation used to calculate ex ante savings (3,952).

The baseline wattage verified during the M&V site visit (28W) was less than the wattage used to calculate the ex ante energy savings (40W). The lamps were 4' T8's and not 4' T12s and were located in storage.

A heating and cooling interactive factor of 1.15, applicable to an electrically 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 interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 44%. The ex ante energy savings estimate was premised upon overestimated hours of operation and an overestimated baseline wattage.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Standard	Lighting	84,573	37,038	44%	7.04
Total		84,573	37,038	44%	7.04

³⁹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/7/17 and 11/27/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	Standard	96	96	72	10	3,819	0.98	26,995	22,329	83%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			654	654	40	14	1,792	0.98	82,250	29,929	36%
				10	20	96	14	3,373	0.98	2,484	2,253	91%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			6	6	65	10	3,332	0.98	1,547	1,080	70%
Total										113,276	55,590	49%

The annual lighting hours of operation verified during the M&V site visit (ranging from 1,792 to 3,819) are fewer than the annual hours of operation used to calculate ex ante savings (4,380). The ex ante hours were based on all measures illuminated 12 hours per day, seven days a week.

The ex ante savings estimate used an adjusted base wattage of 70W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp.

The quantity of the second line item in the above table verified during the M&V site visit (654) is fewer than the quantity used to calculate ex ante energy savings (675). The remaining lamps were placed in storage to be used as replacements.

The efficient wattage (14W) and quantity (20) of the third line item in the above table verified during the M&V site visit differs from the ex ante energy savings wattage (43W) and quantity (10). The contractor provided 4' efficient lamps instead of 8' efficient lamps.

A heating and cooling interactive factor of 0.98, applicable to an electrically 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 interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 49%. The ex ante energy savings estimate was premised upon overestimated hours of operation, all quantities being installed, and heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	113,276	55,590	49%	10.56
Total		113,276	55,590	49%	10.56

³⁹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/15/17 and 12/04/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	47	47	65	8	4,640	1.11	15,743	13,766	87%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			8	-	32	-	5,935	1.11	969	1,683	174%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			16	16	32	18	5,935	1.11	848	1,472	174%
Total										17,560	16,921	96%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

The quantity of the first line item in the first table above (47) verified during the M&V site visit is less than the ex ante savings quantity (73). There were no additional lamps in storage and the customer had no knowledge of the discrepancy.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings for the second and third line items in the table above are 1,817 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 96%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and an inaccurate installed quantity.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	17,560	16,921	96%	3.21
Total		17,560	16,921	96%	3.21

³⁹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/10/17 and 11/29/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	70	70	65	8	4,511	1.11	15,096	19,936	132%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			6	-	32	-	4,626	1.11	727	984	135%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			5	-	42	-	4,626	1.11	795	1,076	135%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			10	10	42	17	4,626	1.11	946	1,281	135%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			12	12	32	17	5,245	1.11	681	1,046	154%
Total										18,245	24,322	133%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 total ex ante annual energy savings for the second through fifth line items in the table above are 3,149 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 133%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	18,245	24,322	133%	4.62
Total		18,245	24,322	133%	4.62

³⁹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/08/17 and 11/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	4	4	42	18	6,650	1.11	363	707	195%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			70	70	65	8	4,232	1.11	15,096	18,702	124%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			9	-	32	-	4,610	1.11	1,090	1,471	135%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			18	18	32	18	4,792	1.11	953	1,338	140%
Total										17,502	22,217	127%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 total ex ante annual energy savings for the third and fourth line items in the table above are 2,043 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.³⁹⁷

³⁹⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 127%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	17,502	22,217	127%	4.22
Total		17,502	22,217	127%	4.22

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed nine photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/4/17 and 11/27/17.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	Standard	800	800	40	17	7,114	1.18	71,664	154,945	216%
Total										71,664	154,945	216%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates (3,640). The site is a 24/7 facility where the measures were mainly installed in common areas.

A heating and cooling interactive factor of 1.18, applicable to a gas heated, air conditioned hotel 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.³⁹⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 216%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	71,664	154,945	216%	29.43
Total		71,664	154,945	216%	29.43

³⁹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/6/17 and 11/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	SBDI	13	13	400	185	2,784	1.00	9,331	7,780	83%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			26	26	400	185	2,784	1.00	18,662	15,561	83%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1			27	27	32	15	2,405	1.11	1,532	1,221	80%
Total										29,525	24,562	83%

The annual lighting hours of operation verified during the M&V site visit (ranging between 2,405 and 2,784) are fewer than the hours of operation used to calculate ex ante savings (3,120).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, respectively, was applied to the ex post lighting energy savings for measures installed in the office. The first two line items in the table above were installed in an unconditioned warehouse space. 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.³⁹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 83%. The ex ante energy savings estimate was premised on overestimated annual hours of operation.

³⁹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	29,525	24,562	83%	4.67
Total		29,525	24,562	83%	4.67

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eleven photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 11/9/17 and 11/28/17.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	34	34	43	9	523	1.09	2,641	660	25%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			16	16	96	43	429	1.09	1,996	397	20%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			259	259	40	15	2,514	1.09	15,242	17,755	116%
				734	734	32	14	2,099	1.09	31,102	28,851	93%
Total										50,981	47,662	93%

The annual lighting hours of operation verified during the M&V site visit for the first, second and fourth line items in the table above (523, 429 and 2,099, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (2,200). The hours for the third line item (2,514) are greater than those used to calculate ex ante savings (2,200).

The ex ante savings estimate used an adjusted base wattage of 42W for the first line item in the above table by multiplying the provided wattage by 70%. An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas 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 interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁰⁰

⁴⁰⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 93%. The ex ante energy savings estimate was premised upon overestimated hours of operation.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	50,981	47,662	93%	9.05
Total		50,981	47,662	93%	9.05

Data Collection

The participant received Standard lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules. ADM staff verified that all installed lighting operates on a 24/7 schedule.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	Standard	1,046	1,046	32	11.5	8,760	1.00	196,087	187,841	96%
Total										196,087	187,841	96%

The annual lighting hours of operation verified during the M&V site visit are consistent with the annual hours of operation used to calculate ex ante savings (8,760).

The efficient wattage in table above (11.5W) verified during the M&V site visit is less than the efficient wattage used to develop ex ante savings (12W).

No heating or cooling interactive effects were accounted for due to lighting being installed in an unconditioned space. 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.⁴⁰¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 96%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	196,087	187,841	96%	35.68
Total		196,087	187,841	96%	35.68

⁴⁰¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received EMS incentives from Ameren Missouri.

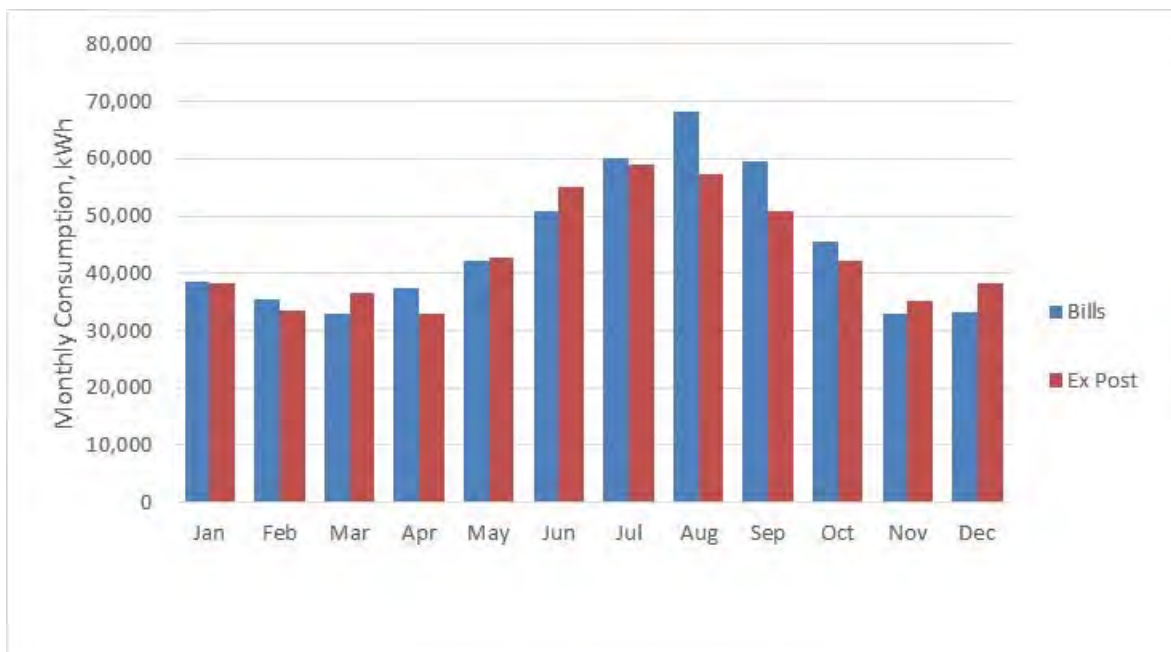
During the M&V visit, ADM staff verified the implemented EMS measures including: demand controlled ventilation (DCV), VFD control, and temperature set-backs. Field staff also collected specifics about the construction of the facility, occupancy rates, internal loads, HVAC equipment, and HVAC operation.

Analysis Results

EMS Savings Calculations

Energy savings for the implemented EMS measures were calculated using IPMVP Option D, Calibrated Simulation. This was completed using Trane Trace 700 energy simulation. ADM was provided the Trane Trace archived model used to estimate ex ante energy savings. ADM reviewed the model's inputs and adjusted the model based on information collected during the on-site visit. The model was then run using 2016 weather data for the St. Louis region to ensure that the model was properly calibrated to the billed energy consumption of the facility. The results of the calibration effort can be seen in the following plot:

2016 Trane Trace Model Calibration



Upon the calibration of the ex pot baseline model, an alternative model run was utilized in Trane Trace to determine the impacts of the EMS measures on energy consumption. The two models were run using TMY3 weather for the region to determine the typical annual savings for the project. The annual savings are the difference between the annual consumption of the baseline and as-built models. The energy savings results from the model are presented in the following table:

EMS Energy Savings

Month	TMY3 Savings		
	Baseline	As-Built	Savings
January	38,742	24,174	14,569
February	34,701	21,355	13,347
March	38,436	21,879	16,557
April	40,552	24,418	16,134
May	43,341	26,979	16,362
June	54,984	39,467	15,517
July	58,679	43,869	14,809
August	56,409	41,703	14,705
September	47,537	32,387	15,151
October	38,802	21,359	17,443
November	36,157	20,558	15,600
December	38,559	23,533	15,026
Total	526,899	341,679	185,221

Verified annual savings for implementation of the EMS measures are 185,221 kWh, resulting in a site-level realization rate of 82%. The difference in realized savings can be attributed to changes being made in the provided Trane Trace model. The adjustments to the model included: specifying HVAC cooling capacities and efficiencies and specifying the design square footage and number of people for each zone. The ex ante model auto-sized the cooling equipment, which resulted in some areas being under cooled while equipment in other areas were oversized. The largest difference was for RTU 5, Gathering RTU. The ex ante model sized the unit at 39 tons, while the actual nameplate tonnage is only 15. Furthermore, it was determined during M&V that this unit wasn't included in the scope of the EMS project, so it realized 0 kWh savings. The ex ante model included 28,283 kWh in cooling savings for the Gathering RTU.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
EMS	HVAC	128,776	129,113	100%	57.32
	Cooling	97,147	56,107	58%	51.10
Total		225,923	185,221	82%	108.42

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/03/18 and 2/22/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	35	35	65	11	3,640	1.11	4,920	7,619	155%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			77	77	40	14	3,314	1.11	5,211	7,348	141%
				2	2	40	14	2,682	1.11	135	154	114%
				6	6	75	36	103	1.00	609	24	4%
				36	36	40	14	103	1.00	2,437	96	4%
				3	3	40	14	2,682	1.00	203	209	103%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			4	4	32	14	2,583	1.14	187	212	113%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			24	24	40	14	6,057	1.11	1,625	4,186	258%
				9	9	40	14	356	1.11	609	92	15%
				1	1	75	36	103	1.00	102	4	4%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			36	-	40	-	103	1.00	3,748	148	4%
				24	-	40	-	6,057	1.11	2,499	6,440	258%
				77	-	40	-	3,314	1.11	8,018	11,304	141%
				6	-	75	-	103	1.00	1,171	46	4%
				9	-	40	-	356	1.11	937	142	15%
Total									32,411	38,025	117%	

The annual lighting hours of operation verified during the M&V site visit for the first, second, third, sixth, eighth, twelfth, and thirteenth line items in the table above (3,640, 3,314, 2,682, 2,682, 6,057, 6,057, and 3,314, respectively) are greater than the annual hours of operation used to calculate ex ante savings (2,503). The hours of operation for line items four, five, nine, ten, eleven, fourteen, and fifteen (ranging from 103 to 356) are fewer than the ex ante hours. These measures were installed in infrequently used storage rooms.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail in Cape Girardeau, was applied to the ex post lighting energy savings for the main floor installations. In addition, a factor of 1.18 was applied to the walk-in cooler. The second floor of the facility was an

unconditioned space where a factor of 1.00 was used for these measures. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The total ex ante annual energy savings for the second, fourth, fifth, eighth, ninth, and eleventh through fifteenth line items in the table above are 26,864 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁰²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 117%. The ex ante energy savings estimate was premised on averaged annual lighting operating hours and not for specific area usage.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	32,411	38,025	117%	7.22
Total		32,411	38,025	117%	7.22

⁴⁰² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/19/18 and 2/07/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	SBDI	16	16	53	11	2,647	1.11	1,939	1,970	102%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			14	14	80	36	2,647	1.11	1,799	1,806	100%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			11	11	50	7	2,647	1.11	899	1,387	154%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			7	7	29	9	1,665	1.11	388	258	67%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			5	5	64	8	2,647	1.11	818	821	100%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			38	-	40	-	2,647	1.11	4,439	4,456	100%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			50	50	40	18	2,647	1.11	3,212	3,225	100%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			2	-	80	-	2,647	1.11	467	469	100%
Total										13,961	14,392	103%

The annual lighting hours of operation verified during the M&V site visit (ranging from 1,665 to 2,647) are fewer than the annual hours of operation used to calculate ex ante savings (2,808).

An adjusted base wattage of 53W and 29W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for the first and fourth line items in the table above. The ex ante base wattage of 52.5W and 28W was computed within the application by factoring 70% of a 75W and 40W incandescent lamp. The base lamps for the third line item (MR16) are exempt from an adjusted wattage calculation. A base wattage of 35W was used in the ex ante energy savings estimate.

A heating and cooling interactive factor of 1.11, applicable to a gas 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 1.04.

The total ex ante annual energy savings for the second and sixth through eighth line items in the above table are 9,917 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁰³

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 103%. The ex ante energy savings estimate was premised on underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	13,961	14,392	103%	2.73
Total		13,961	14,392	103%	2.73

⁴⁰³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/07/18 and 2/26/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	2	2	65	8	3,860	1.11	296	490	165%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			78	78	40	15	3,789	1.11	6,694	8,231	123%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			-	-	-	-	-	1.11	104	-	0%
Total										7,094	8,722	123%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

The quantity of the second and third line items in the table above (78 and 0, respectively) verified during the M&V site visit is fewer than the ex ante savings quantity (103 and 1, respectively).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The total ex ante annual energy savings for the second and third line items in the table above are 6,798 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁰⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 123%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	7,094	8,722	123%	1.66
Total		7,094	8,722	123%	1.66

⁴⁰⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/6/18 and 2/27/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	70	70	53	9	1,113	1.15	6,516	3,950	61%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			8	8	72	36	1,908	1.00	616	550	89%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			4	4	81	15	88	1.15	561	27	5%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			20	20	72	36	1,134	1.15	1,541	941	61%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			5	5	65	8	987	1.15	610	324	53%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			12	12	40	12	318	1.15	719	123	17%
				40	40	40	15	1,722	1.15	2,140	1,984	93%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			46	46	65	8	961	1.15	5,977	2,888	48%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			21	-	40	-	1,722	1.15	1,798	1,667	93%
Total												20,478

The annual lighting hours of operation verified during the M&V site visit (ranging between 88 and 1,908) are fewer than the hours of operation used to calculate ex ante savings (2,000).

An adjusted base wattage of 53W was used for the first line item in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The ex ante base wattage of 52.5W was computed within the application by factoring 70% of a 75W incandescent lamp. An adjusted base wattage of 80.5W was used for the second line item in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 115W incandescent lamp.

The quantity of the eighth line item in the first table above (46) verified during the M&V site visit, is less than the ex ante savings quantity (49).

A heating and cooling interactive factor of 1.15, applicable to a gas heated, air conditioned community assembly facility in Jefferson City, 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.⁴⁰⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 61%. The ex ante energy savings estimate was premised on the entire quantity of lamps installed and overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	20,478	12,452	61%	2.37
Total		20,478	12,452	61%	2.37

⁴⁰⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/19/18 and 2/07/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	10	10	65	8	1,664	1.11	732	1,050	143%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			1	-	40	-	442	1.11	43	20	46%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			8	8	32	17	2,935	1.11	128	390	305%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			10	10	75	43	2,917	1.11	342	1,034	302%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			1	1	32	17	442	1.11	16	7	46%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			1	1	40	17	442	1.11	24	11	47%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			8	-	32	-	2,935	1.11	274	832	304%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	40	17	2,917	1.11	98	297	302%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			3	-	32	-	442	1.11	103	47	46%
Total												1,760

The annual lighting hours of operation verified during the M&V site visit for the first, third, fourth, seventh, and eighth (ranging from 1,664 to 2,935) are greater than the annual hours of operation used to calculate ex ante savings (1,000). The measures installed in the restrooms for line items two, five, six, and nine had annual operating hours (442) fewer than the hours used to calculate ex ante savings.

The quantity of the first line item in the first table above (10) verified during the M&V site visit is less than the ex ante savings quantity (12). There were 2 lamps located in storage that the client was to use as replacements.

A heating and cooling interactive factor of 1.11, applicable to a gas 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.⁴⁰⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 210%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	1,760	3,689	210%	0.70
Total		1,760	3,689	210%	0.70

⁴⁰⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/20/18 and 2/12/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	4	4	53	9	2,597	1.11	387	506	131%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			80	80	42	14	2,463	1.11	4,985	6,103	122%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			46	46	75	8	14	1.11	7,456	47	1%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			48	-	42	-	2,463	1.11	4,487	5,492	122%
				4	4	75	8	4,308	1.00	-	1,155	
Total										17,315	13,303	77%

The annual lighting hours of operation verified during the M&V site visit for the first, second, fourth, and fifth line items in the table above (2,597, 2,463, 2,363, and 4,308⁴⁰⁷, respectively) are greater than the annual hours of operation used to calculate ex ante savings (2,080). The third line item was installed in an infrequently used space.

An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The ex ante base wattage of 52.5W was computed within the application by factoring 70% of a 60W incandescent lamp.

The quantity of the third line item in the first table above (46) verified during the M&V site visit is less than the ex ante savings quantity (50).

⁴⁰⁷ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

The ex post savings analysis added the fifth line item in the table above to include the kWh savings for the product. The actual installation for this measure was found to be exterior which is not included as part of the incentive program that it was applied under.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned 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 total ex ante annual energy savings for the second and fourth line items in the table above are 9,472 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁰⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 77%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for an infrequently used space.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	17,315	13,303	77%	2.53
Total		17,315	13,303	77%	2.53

⁴⁰⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/06/18 and 2/25/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	3	3	65	8	2,877	1.11	366	548	150%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			2	2	80	36	1,399	1.00	188	123	65%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			32	-	40	-	2,877	1.11	2,739	4,102	150%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			96	96	40	15	2,877	1.11	5,136	7,692	150%
Total										8,429	12,465	148%

The annual lighting hours of operation verified during the M&V site visit for the first, third, and fourth line items in the table above (2,877) are greater than the annual hours of operation used to calculate ex ante savings (2,000). The hours verified for the second line item (1,399) are fewer than the ex ante estimate. This measure was located in an area where the lighting was not constantly utilized due to natural sunlight.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in Jefferson City, was applied to the ex post lighting energy savings for the interior of the facility. The measure for the second line item in the table above was installed within an unconditioned space. 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.⁴⁰⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 148%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for three of the above line items.

⁴⁰⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	8,429	12,465	148%	2.37
Total		8,429	12,465	148%	2.37

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/20/18 and 2/12/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008	Lighting	SBDI	5	5	53	11	3,283	1.01	675	694	103%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			7	7	75	8	3,283	1.01	1,527	1,549	101%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			3	3	40	17	3,124	1.01	225	217	96%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			48	-	40	-	3,137	1.01	6,249	6,059	97%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			48	48	40	17	3,137	1.01	3,593	3,484	97%
Total										12,270	12,001	98%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned small 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 total ex ante annual energy savings for the fourth and fifth line items in the table above are 9,843 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴¹⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 98%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	12,270	12,001	98%	2.28
Total		12,270	12,001	98%	2.28

⁴¹⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/03/18 and 2/22/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	2	2	65	11	494	1.10	265	59	22%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			2	-	40	-	2,228	1.10	196	197	100%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			3	3	72	9	2,161	1.10	1,648	451	27%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			98	98	40	15	2,150	1.10	6,016	5,820	97%
				8	8	40	6	494	1.10	-	148	
Total										8,125	6,676	82%

The annual lighting hours of operation verified during the M&V site visit (ranging from 494 to 2,228) are fewer than the annual hours of operation used to calculate ex ante savings (2,295). The installed locations for first and fifth line items in the table above had infrequent usage.

An adjusted base wattage of 72W was used in the ex post savings analysis for the third line item in the table above to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp. The ex ante base wattage of 70W was computed within the application by factoring 70% of a 60W incandescent lamp.

The quantity of the third line item in the first table above (3) verified during the M&V site visit is less than the ex ante savings quantity (11).

The ex post savings analysis added the fifth line item in the table above to include the kWh savings for the product. The actual installed measure were G25 Globe lamps not incandescent lamps as stated in the application under the third line item in the above table.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned small office in Cape Girardeau, 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.⁴¹¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 82%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and an overestimated installed quantity for the third measure.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	8,125	6,676	82%	1.27
Total		8,125	6,676	82%	1.27

⁴¹¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/20/18 and 2/12/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	27	27	65	13	4,524	1.12	6,032	7,101	118%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			21	-	40	-	4,524	1.12	3,609	4,248	118%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			51	51	40	15	4,721	1.12	5,477	6,728	123%
Total										15,118	18,077	120%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned 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 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴¹²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 120%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

⁴¹² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	15,118	18,077	120%	3.43
Total		15,118	18,077	120%	3.43

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/23/18 and 2/12/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	43	43	65	8	1,657	1.11	5,329	4,491	84%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			43	43	43	9	1,875	1.11	3,132	3,077	98%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			68	-	34	-	1,720	1.11	5,027	4,399	88%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			76	76	34	15	1,653	1.11	3,140	2,640	84%
Total										16,628	14,607	88%

The annual lighting hours of operation verified during the M&V site visit (ranging from 1,653 to 1,875) are fewer than the annual hours of operation used to calculate ex ante savings (2,032).

For the second line item in the table above an adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp. The ex ante base wattage of 42W was computed within the application by factoring 70% of a 60W incandescent lamp.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned 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.⁴¹³

⁴¹³ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 88%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	16,628	14,607	88%	2.77
Total		16,628	14,607	88%	2.77

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/02/18 and 3/15/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	20	20	72	11	3,092	1.11	3,157	4,178	132%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			8	8	65	11	1,532	1.11	1,156	733	63%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	70	36	1,724	1.11	364	260	71%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			57	-	40	-	3,092	1.11	6,099	7,808	128%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			57	57	40	15	3,092	1.11	3,812	4,880	128%
Total										14,587	17,859	122%

The annual lighting hours of operation verified during the M&V site visit for the second and third line items in the above table (1,532 and 1,724, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (2,500). The remaining line items had annual hours of operation (3,092) greater than the ex ante savings hours.

An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp. The ex ante base wattage of 70W was computed within the application by factoring 70% of a 100W incandescent lamp.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail in Cape Girardeau, 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.⁴¹⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 122%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for three measures and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	14,587	17,859	122%	3.39
Total		14,587	17,859	122%	3.39

⁴¹⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/27/18 and 2/19/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	SBDI	12	12	15	2	8,760	1.09	347	1,496	431%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft)	3026			80	80	40	18	993	1.09	3,917	1,914	49%
Replacing T12 <=40 Watt Linear ft				112	112	40	12	1,356	1.09	6,979	4,654	67%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			44	44	72	9	1,447	1.09	5,974	4,392	74%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			10	10	65	11	1,583	1.09	1,202	936	78%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			34	34	32	14	462	1.09	1,362	309	23%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	40	18	1,014	1.09	196	98	50%
				68	68	30	12	388	1.09	2,724	520	19%
				78	78	20	9	441	1.09	1,910	414	22%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			4	-	40	-	1,014	1.09	356	178	50%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			50	50	40	12	1,583	1.09	3,116	2,426	78%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084	80	-	40	-	993	1.09	7,122	3,480	49%		
Total										35,205	20,818	59%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (8,760) are greater than the annual hours of operation used to calculate ex ante savings (2,080). This measure is Exit Signage that has continuous usage. The remaining line items above had fewer hours of operation (ranging from 441 to 1,583) than the ex ante estimate. The majority of the measures were installed in areas with infrequent usage.

An adjusted base wattage of 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W incandescent lamp for the fourth line item in the table above. The ex ante base wattage of 70W was computed within the application by factoring 70% of a 100W lamp.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned small 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.⁴¹⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 59%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	35,205	20,818	59%	3.95
Total		35,205	20,818	59%	3.95

⁴¹⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/10/18 and 3/5/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	SBDI	4	4	30	3	8,760	1.11	997	1,031	103%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			2	2	40	22	2,378	1.11	86	95	110%
				72	72	40	22	1,231	1.11	3,065	1,765	58%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp	3007			4	4	65	9	1,860	1.11	530	461	87%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			29	29	43	9	1,514	1.11	2,263	1,651	73%
				3	3	29	9	2,378	1.11	135	158	117%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			16	16	32	22	2,378	1.11	378	421	111%
				52	52	32	12	2,300	1.11	2,459	2,646	108%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			72	72	40	-	1,231	1.11	6,810	3,922	58%
305802-Lighting-Delamping Replacing T8 32 Watt				16	16	32	-	2,378	1.11	1,211	1,346	111%
Total										17,934	13,495	75%

The annual lighting hours of operation verified during the M&V site visit ranging between 1,231 and 1,860 are less than the hours of operation used to calculate ex ante savings (2,210).

An adjusted base wattage of 43W and 29W was used for the fifth and seventh line items, respectively in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W and 40W incandescent lamp. The ex ante base wattage of 42W and 28W was computed within the application by factoring 70% of a 60W and 40W incandescent lamp.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office 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.⁴¹⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 75%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	17,934	13,495	75%	2.56
Total		17,934	13,495	75%	2.56

⁴¹⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/27/18 and 2/19/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	7	7	72	9	2,246	1.14	1,088	1,127	104%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			6	6	53	15	3,417	1.14	764	886	116%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			52	40	45	18	3,073	1.14	4,127	5,663	134%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3012			12	12	50	7	3,363	1.14	856	1,974	231%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			57	57	65	8	2,422	1.14	5,446	8,953	164%
Total										12,281	18,603	151%

The annual lighting hours of operation verified during the M&V site visit range between 2,246 and 3,417. The annual lighting hours of operation for the first and fifth line items in the table above are fewer than the hours of operation used to calculate ex ante savings, while the remaining line items are greater (2,548).

The ex ante savings estimate used an LM adjusted base wattage of 70W, 52.5W, 35W, and 45.5W for the first, second, fourth, and fifth line items in the table above, respectively, by multiplying the provided wattage by 70%. Adjusted base wattages of 72W and 53W were used for the first and second line items in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W and 75W incandescent lamp. The base lamps for the fourth and fifth line items (65W BR reflector and MR16) are exempt from an adjusted wattage calculation.

The quantity of the second line item in the first table above (6) verified during the M&V site visit is less than the ex ante savings quantity (8). The remaining lamps were found in storage to be used as replacement lamps.

A heating and cooling interactive factor of 1.14, applicable to a gas heated, air conditioned assembly facility in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive factors.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴¹⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 151%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for three line items and did not account for heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	12,281	18,603	151%	3.53
Total		12,281	18,603	151%	3.53

⁴¹⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/2/18 and 2/22/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	32	32	75	8	4,228	1.12	8,348	10,164	122%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			40	40	40	18	5,022	1.12	3,427	4,955	145%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			10	10	53	9	5,231	1.18	1,694	2,606	154%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			25	25	63	11	4,349	1.12	5,062	6,339	125%
Total										18,530	24,064	130%

The annual lighting hours of operation verified during the M&V site visit (ranging from 4,228 to 5,231) are greater than the hours of operation used to calculate ex ante savings (3,744).

A heating and cooling interactive factor of 1.12, applicable to a gas heated, air conditioned restaurant in Cape Girardeau, was applied to the ex post lighting energy savings for all interior measures. In addition, a factor of 1.18 was used for the installations within the walk-in freezer and cooler. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴¹⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 130%.

⁴¹⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	18,530	24,064	130%	4.57
Total		18,530	24,064	130%	4.57

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/31/18 and 2/19/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	4	4	43	10	550	1.11	306	80	26%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			18	18	32	17	2,155	1.11	645	644	100%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			5	10	96	22	179	1.11	621	51	8%
				18	18	40	15	179	1.11	1,074	89	8%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			18	-	32	-	2,155	1.11	1,375	1,373	100%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			26	26	32	17	722	1.11	931	312	33%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			2	2	30	4	8,760	1.11	474	504	106%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			5	-	96	-	179	1.11	1,146	95	8%
Total										6,570	3,147	48%

The annual lighting hours of operation verified during the M&V site visit for the seventh line item in the table above corresponds with the annual hours of operation used to calculate ex ante savings (8,760). The remaining line items have verified hours (ranging from 179 – 2,155) that are fewer than the ex ante hours of operation (2,295). The site visit confirmed natural lighting usage in areas along with infrequent usage of installed locations.

An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp. The ex ante base wattage of 42W was computed within the application by factoring 70% of a 60W incandescent lamp.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned 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 1.04.

The total ex ante annual energy savings for the second, third, fifth, and eighth line items in the table above are 3,786 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴¹⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 48%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	6,570	3,147	48%	0.60
Total		6,570	3,147	48%	0.60

⁴¹⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/31/18 and 2/19/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	Lighting	SBDI	8	8	65	10	2,830	1.11	1,050	1,377	131%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			4	4	43	10	801	1.11	306	117	38%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			90	90	32	17	2,842	1.11	3,223	4,243	132%
				30	30	32	17	2,830	1.11	1,074	1,409	131%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			3	3	30	2	8,760	1.11	765	814	106%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			14	-	32	-	2,830	1.11	1,069	1,402	131%
Total										7,487	9,362	125%

The annual lighting hours of operation verified during the M&V site visit for the second line item in the table above (801) are fewer than the annual hours of operation used to calculate ex ante savings (2,295). This measure was installed in an area with infrequent usage. The fifth line item above corresponded with the ex ante hours (8,760) for Exit Signage. The remaining line items had hours of operation (ranging from 2,830 – 2,842) which are greater than the ex ante savings hours (2,295).

An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp. The ex ante base wattage of 42W was computed within the application by factoring 70% of a 60W incandescent lamp.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned 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 1.04.

The total ex ante annual energy savings for the fourth and sixth line items in the table above are 2,143 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a

heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴²⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 125%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for four of the measures and underestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	7,487	9,362	125%	1.78
Total		7,487	9,362	125%	1.78

⁴²⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/7/18 and 2/25/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	SBDI	13	13	400	100	2,725	1.00	10,140	10,626	105%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			336	336	40	18	2,636	1.04	19,219	19,868	103%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			9	9	75	8	2,497	1.11	1,568	1,678	107%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			1	1	43	9	2,497	1.11	86	95	110%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp				1	1	43	9	2,497	1.11	86	95	110%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			5	5	75	8	2,497	1.11	871	932	107%
Total												31,970

The annual lighting hours of operation verified during the M&V site visit for the first and second line items in the table above (2,725 and 2,636, respectively) are greater than the hours of operation used to calculate ex ante savings (2,500). These measures were installed in multiple locations with varying usage.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small retail in Jefferson City, was applied to the ex post lighting energy savings for all measures installed within the store. The warehouse portion of the facility was an unconditioned space. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴²¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 104%.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	31,970	33,293	104%	6.32
Total		31,970	33,293	104%	6.32

⁴²¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	86	86	29	9	1,145	0.99	3,201	1,951	61%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			9	9	40	18	8,760	1.17	1,799	2,030	113%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			3	-	40	-	8,760	1.17	1,090	1,230	113%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft_	3026			30	30	40	18	2,922	1.03	1,030	1,991	193%
				22	22	29	9	4,308	1.00		1,895	
Total										7,120	9,097	128%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (1,145⁴²²) are less than the annual hours of operation used to calculate ex ante savings (1,500). These lamps were installed in guest rooms. The second and third line items have continuous usage. The fourth measure was installed in both guest rooms and common areas with an average annual usage (2,922) which is greater than the ex ante hours (1,500). The annual lighting hours of operation for the fifth line item above with fixtures using photo cells (4,311⁴²³) are greater than the hours of operation used to calculate ex ante savings (1,500).

An adjusted base wattage of 29W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 40W incandescent lamp. The ex ante base wattage of 28W was computed within the application by factoring 70% of a 60W incandescent lamp.

⁴²² The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

⁴²³ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

The quantity of the first line item in the first table above (86) verified during the M&V site visit is less than the ex ante savings quantity (108).

The ex post savings analysis added the fifth line item in the table above to include the kWh savings for the product. The actual installation for this measure was found to be exterior which is not included as part of the incentive program that it was applied under.

A heating and cooling interactive factor of 0.99, applicable to an electric heated, air conditioned guest rooms in St. Louis, was applied to the ex post lighting energy savings. For all interior common areas, a factor of 1.17 was applied. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The total ex ante annual energy savings for the second and third line items in the table above are 2,889 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴²⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 128%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours and underestimated heating and cooling interactive effects for the common areas of the facility.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	6,468	7,202	111%	1.37
SBDI	Lighting	652	1,895	291%	0.01
Total		7,120	9,097	128%	1.38

⁴²⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/08/18 and 2/27/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	3	3	43	8	3,508	1.01	360	373	104%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			2	2	65	8	3,508	1.01	402	405	101%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	34	18	3,508	1.01	226	227	101%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			18	18	40	15	4,605	1.01	1,587	2,097	132%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			7	7	43	9	3,508	1.01	827	857	104%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			1	1	65	8	3,508	1.01	201	202	101%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			8	8	40	15	4,605	1.01	705	932	132%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			6	6	65	8	399	1.01	1,241	138	11%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			26	26	40	15	3,508	1.01	2,358	2,307	98%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			1	1	43	9	3,508	1.01	122	122	100%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			2	2	40	18	3,508	1.01	159	156	98%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			18	18	40	15	3,508	1.01	1,633	1,598	98%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007	2	2	65	8	3,508	1.01	414	405	98%		
Total										10,235	9,818	96%

The annual lighting hours of operation verified during the M&V site visit for the seventh line item in the table above (399) are fewer than the annual hours of operation used to calculate ex ante savings

(3,390). This measure was installed in an infrequently used board room. The remaining annual hours of operation (ranging from 3,508 to 4,605) are greater than the ex ante hours (3,390).

An adjusted base wattage of 43W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W incandescent lamp for the first, fifth, and tenth line items in the table above. The ex ante base wattage of 42W was computed within the application by factoring 70% of a 60W incandescent lamp.

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned 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 1.04 for the first seven line items above and 1.07 for the remaining measures.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴²⁵

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 96%. The ex ante energy savings estimate was premised on overestimated heating and cooling interactive effects.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	10,235	9,818	96%	1.86
Total		10,235	9,818	96%	1.86

⁴²⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/03/17 and 2/22/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	5	5	53	11	659	1.06	489	147	30%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			54	54	40	22	1,502	1.00	2,293	1,460	64%
				19	19	75	36	2,544	1.10	1,748	2,083	119%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			5	5	40	1	8,760	1.10	460	1,888	410%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			12	12	40	22	2,544	1.10	509	607	119%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			19	-	75	-	2,544	1.10	3,362	4,006	119%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			44	44	40	22	2,544	1.10	1,868	2,226	119%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			44	-	40	-	2,544	1.10	4,152	4,947	119%
				12	-	40	-	2,544	1.10	1,132	1,349	119%
Total										16,013	18,713	117%

The annual lighting hours of operation verified during the M&V site visit for the fourth line item in the table above (8,760) are greater than the annual hours of operation used to calculate ex ante savings (2,268). This measure was Exit Signage with continuous usage. The hours for the first and second line items (ranging from 659 – 1,502) are less than the ex ante hours with installed areas of infrequent usage. The remaining line items had annual lighting hours of operation (2,544) greater than the ex ante hours (2,268).

An adjusted base wattage of 53W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 75W incandescent lamp. The ex ante base wattage of 52.5W was computed within the application by factoring 70% of a 75W incandescent lamp.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned office in Cape Girardeau, was applied to the ex post lighting energy savings for all office and common areas. The shop areas were unconditioned. The ex ante savings estimate accounted for a heating and cooling factor of 1.04.

The total ex ante annual energy savings for the third, and fifth through ninth line items in the table above are 12,771 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴²⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 117%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for seven of the line items above.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	16,013	18,713	117%	3.55
Total		16,013	18,713	117%	3.55

⁴²⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed eight photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/13/18 and 3/5/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793	Lighting	SBDI	4	4	30	3.4	8,760	1.07	997	999	100%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			65	65	34	17	3,366	1.07	3,316	3,988	120%
				85	85	34	17	3,852	1.07	4,337	5,967	138%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	3008			1	1	65	13	129	1.07	3	7	258%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			7	7	30	0.8	8,760	1.07	1,916	1,920	100%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011			7	7	43	9	44	1.07	297	11	4%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			4	4	72	15	40	1.07	12	10	82%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			54	54	34	17	2,867	1.07	2,755	2,822	102%
				54	54	34	17	1,903	1.07	2,755	1,873	68%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			85	-	34	-	3,852	1.07	8,674	11,934	138%
		65	-	34	-	3,366	1.07	6,633	7,977	120%		
Total										31,695	37,509	118%

The annual lighting hours of operation verified during the M&V site visit for the first and fifth line items in the above table are consistent with the annual hours of operation used to calculate ex ante savings (8,760). The verified hours for the sixth, seventh and ninth line items (44, 40 and 1,903, respectively) are fewer than those used to calculate ex ante savings (1,200, 50 and 2,805, respectively). The hours of the remaining line items (ranging from 129 to 3,852) are greater than those used to calculate ex ante savings (50 for the fourth line item, and 2,805 for the remaining line items).

The ex ante savings estimate used an adjusted base wattage of 42W for the sixth line item in the above table and 70W for the seventh line item by multiplying the provided wattages by 70%. Adjusted base wattages of 43W and 72W were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for 60W and 100W incandescent lamps.

A heating and cooling interactive factor of 1.07, applicable to a gas heated, air conditioned medical facility in St. Louis, was applied to the ex post lighting energy savings which was consistent with the ex ante savings estimate.

The total ex ante annual energy savings between the second and eleventh line items is 9,949, and between the third and tenth line items is 13,011. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴²⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 118%. The ex ante savings estimate was premised upon underestimated hours of operation for six of the eleven line items in the above table.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	31,695	37,509	118%	7.13
Total		31,695	37,509	118%	7.13

⁴²⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/09/18 and 2/28/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	44	44	59	43	2,469	1.07	1,568	1,855	118%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			40	40	41	17	2,782	1.11	2,093	2,892	138%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			40	-	41	-	2,782	1.11	3,605	4,985	138%
Total										7,266	9,733	134%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in St. Louis, was applied to the ex post lighting energy savings for all occupied areas. The storage area was unconditioned. 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.⁴²⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 134%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

⁴²⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	7,266	9,733	134%	1.85
Total		7,266	9,733	134%	1.85

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/13/18 and 3/5/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	58	58	40	22	1,730	1.11	2,788	2,000	72%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			58	58	40	-	1,730	1.11	6,196	4,445	72%
Total												8,984

The annual lighting hours of operation verified during the M&V site visit (1,730) are fewer than the annual hours of operation used to calculate ex ante savings (2,496).

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small 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 kWh savings.⁴²⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 72%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours.

⁴²⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	8,984	6,446	72%	1.22
Total		8,984	6,446	72%	1.22

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, baseline and the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed six photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/20/18 and 3/02/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3011	Lighting	SBDI	75	75	43	9	535	1.14	3,030	1,553	51%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			16	16	40	18	732	1.14	431	293	68%
201317-Lighting-LED or Electroluminescent Replacing CFL Exit Sign	8001			4	4	40	5	8,760	1.14	171	1,395	814%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			4	4	40	18	253	1.14	108	25	23%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009			1	1	72	14	547	1.14	69	36	52%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			34	34	32	18	1,426	1.14	583	772	133%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3007			2	2	65	8	15	1.14	140	2	1%
Total										4,532	4,077	90%

The annual lighting hours of operation verified during the M&V site visit for the third and sixth line items in the above table (8,760 and 1,426, respectively) are greater than the annual hours of operation used to calculate ex ante savings (1,144). The verified hours for the remaining line items (ranging from 15 to 732) are fewer than those used to calculate ex ante savings (1,144). The third measure were Exit Signage with continuous usage.

The ex ante savings estimate used an adjusted base wattage of 42W for the first line item in the above table and 70W for the fifth line item by multiplying the provided wattage by 70%. An adjusted base wattage of 43W and 72W was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 60W and 100W incandescent lamp.

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

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴³⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 90%. The ex ante energy savings estimate was premised upon overestimated hours of operation for five measures.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	4,532	4,077	90%	0.77
Total		4,532	4,077	90%	0.77

⁴³⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/11/18 and 2/26/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	51	51	40	15	3,704	1.11	4,093	5,261	129%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			27	-	40	-	2,879	1.11	5,393	3,465	64%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			42	42	40	15	3,109	1.11	3,371	3,638	108%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			50	-	40	-	3,704	1.11	6,420	8,253	129%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			39	39	40	15	3,524	1.11	3,130	3,828	122%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			-	-	-	-	-	-	1,027	-	0%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			7	7	40	15	3,524	1.11	562	687	122%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			-	-	-	-	-	-	5,264	-	0%
Total										29,259	25,131	86%

The annual lighting hours of operation verified during the M&V site visit for the second, sixth, and eighth line item in the table above (2,879, 0, 0, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,000). The remaining line items (ranging from 3,109 to 3,704) are greater than the ex ante hours.

The quantity of the second, sixth, and eighth line items in the table above (27, 0, 0, respectively) verified during the M&V site visit is less than the ex ante savings quantity (42, 8, 41, respectively). There was no delamping performed in the area. The client confirmed no delamping or removal of fixtures occurred.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned retail in Jefferson City, 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 total ex ante annual energy savings are 29,259 kWh. ADM notes that, based on the assumptions underlying the ex ante savings calculation, the total ex ante energy savings were incorrectly calculated. The implementation contractor did not apply a heating and cooling factor to the delamping savings but did for the new lamp measures. ADM communicated this finding to implementation contractor staff, who agreed with ADM's assessment.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴³¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 86%. The ex ante energy savings estimate was premised on overestimated delamping in the facility.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	29,259	25,131	86%	4.77
Total		29,259	25,131	86%	4.77

⁴³¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/23/18 and 2/12/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	2	2	72	9	467	1.29	513	76	15%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			40	40	81	43	4,142	1.01	6,385	6,333	99%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			2	-	81	-	4,142	1.01	681	675	99%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3009			1	1	43	9	434	1.01	53	15	28%
Total										7,631	7,099	93%

Lighting Controls Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Quantity	Controlled Wattage	Baseline Hours	Efficient Hours	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate	
201518-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >50 and <=120 Watts	3080	Lighting	SBDI	1	9	434	175	1	125	2	0	
Total										125	2	0

The annual lighting hours of operation verified during the M&V site visit for the first and fourth line item in the first table above (467 and 434, respectively) are fewer than the annual hours of operation used to calculate ex ante savings (3,826 and 1,500, respectively). The second and third line items have hours (4,142) greater than the ex ante hours (3,926).

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey indicated some efficient behavior with turning off lighting during the workday and the end of the workday. The second table above shows the infrequent use of the room.

An adjusted base wattage of 72W for the first line item in the first table and 43W for the fourth line item was used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for a 100W

and 60W incandescent lamp. The ex ante base wattage of 70W and 42W was computed within the application by factoring 70% of a 60W incandescent lamp.

The controlled wattage of the lighting controls in the second table verified during the M&V site visit (9W) is fewer than the wattage in the ex ante savings estimate (60W).

A heating and cooling interactive factor of 1.01, applicable to an electric heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings for the interior of the facility. In addition, an interactive factor of 1.29 was used for the cooler installation in the first line item of the first table. 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.⁴³²

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 92%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for three measures and an overestimated controlled wattage for the lighting control.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	7,756	7,099	92%	1.37
Total		7,756	7,101	92%	1.37

⁴³² Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/9/18 and 2/28/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	3026	Lighting	SBDI	35	35	43	9	2,067	0.98	3,599	2,411	67%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3012			12	12	40	12	3,718	1.01	1,048	1,258	120%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	3007			2	2	35	7	3,718	1.01	174	209	120%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3009			14	14	65	7	1,645	1.01	2,530	1,344	53%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3026			12	12	53	9	1,145	0.94	1,626	569	35%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3007			48	48	40	14	3,718	1.01	3,888	4,668	120%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	3025			11	11	75	11	3,718	1.01	2,296	2,633	115%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3020			6	6	32	14	2,685	1.01	336	292	87%
Total												15,497

The annual lighting hours of operation verified during the M&V site visit for the first, fourth, fifth and eighth line items in the above table (2,067, 1,645, 1,145⁴³³ and 2,685, respectively) are fewer than the

⁴³³ The ex post savings analysis cites the DEER 2005 guest room lighting operation estimate 1,145. This average value has been corroborated through ADM’s extensive fixture-level and circuit-level monitoring of guest room lighting operation.

annual hours of operation used to calculate ex ante savings (2,912). The verified hours for the remaining line items are greater than those used to calculate ex ante savings (2,912).

The ex ante savings estimate used an adjusted base wattage of 42W, 35W and 52.5W for the first, third and fifth line items in the above table, respectively, by multiplying the provided wattages by 70%. Adjusted base wattages of 43W, 35W and 53W, respectively, were used in the ex post savings analysis to meet the EISA 2007 standard lumen equivalent for 60W, 50W and 75W incandescent lamps, respectively.

The wattage verified during the M&V site visit for the seventh line item in the above table (11W) is greater than that used to calculate ex ante savings (8W).

A heating and cooling interactive factor of 1.01, applicable to an electrically heated, air conditioned small retail in St. Louis, was applied to the ex post lighting energy savings for the store installations. A factor of 0.94 was applied to the measures installed within the apartment. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴³⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 86%. The ex ante energy savings estimate was premised upon overestimated hours of operation for four of eight line items in the above table, as well as the installation of higher wattage lamps for one line item.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	15,497	13,385	86%	2.54
Total		15,497	13,385	86%	2.54

⁴³⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/10/18 and 3/06/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	SBDI	12	12	400	200	2,174	1.00	1,926	5,217	271%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			1	2	96	12	223	1.00	77	16	21%
				4	8	96	22	2,174	1.00	222	452	204%
				8	8	40	12	80	1.11	528	20	4%
				22	22	40	22	1,818	1.11	931	796	85%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			22	-	40	-	1,818	1.11	2,072	1,769	85%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			14	14	40	22	1,785	1.11	270	498	184%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			4	-	96	-	2,174	1.00	411	835	203%
		1	-	96	-	223	1.00	103	21	21%		
Total										6,540	9,624	147%

The annual lighting hours of operation verified during the M&V site visit for the first, third, and eighth line items in the above table (2,174) are greater than the annual hours of operation used to calculate ex ante savings (750, 1,000, and 1,000, respectively). The verified hours for the remaining line items (ranging from 80 to 1,818) are fewer than those used to calculate ex ante savings (1,000 for the second, eighth and ninth line items and 2,200 for the fourth, fifth and sixth line items).

The first, second, third, eighth, and ninth line items in the above table were installed in unconditioned areas. A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned small office in St. Louis, was applied to the ex post lighting energy savings of the remaining line items. The ex ante savings estimate accounted for a heating and cooling interactive factor of 1.07.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴³⁵

⁴³⁵ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 147%. The ex ante savings estimate was premised upon underestimated hours of operation for three line items in the above table, as well as overestimated heating and cooling interactive effects for four of the line items.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	6,539	9,624	147%	1.83
Total		6,539	9,624	147%	1.83

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/21/18 and 2/19/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	282	282	36	15	2,514	1.09	14,542	16,304	112%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			282	-	36	-	2,514	1.09	24,930	27,949	112%
Total										39,472	44,253	112%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned 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.⁴³⁶

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 112%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	39,472	44,253	112%	8.41
Total		39,472	44,253	112%	8.41

⁴³⁶ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/27/18 and 2/19/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft)	3026	Lighting	SBDI	76	76	40	18	2,648	1.09	4,186	4,842	116%
Replacing T12 <=40 Watt Linear ft				2	2	40	18	2,577	1.09	110	124	113%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			2	-	40	-	2,577	1.09	200	226	113%
Total										4,497	5,192	115%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours exceeded those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.09, applicable to a gas heated, air conditioned light manufacturing 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.⁴³⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 115%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
SBDI	Lighting	4,497	5,192	115%	0.99
Total		4,497	5,192	115%	0.99

⁴³⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed four photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/20/18 and 2/20/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025	Lighting	SBDI	100	100	75	43	2,921	1.10	8,355	10,246	123%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			24	-	40	-	2,795	1.10	2,506	2,941	117%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			24	24	40	17	2,795	1.10	1,441	1,691	117%
				2	2	40	12	2,795	1.10	146	172	117%
				34	34	40	17	2,268	1.10	2,042	1,944	95%
Total									14,490	16,992	117%	

The annual lighting hours of operation verified during the M&V site visit for the fifth line item in the table above (2,268) are fewer than the annual hours of operation used to calculate ex ante savings (2,440). The remaining line items had hours of operation (ranging from 2,795 – 2,921) greater than the ex ante hours.

A heating and cooling interactive factor of 1.10, applicable to a gas 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.⁴³⁸

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 117%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for four of the line items in the above table.

⁴³⁸ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	14,490	16,992	117%	3.23
Total		14,490	16,992	117%	3.23

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed two photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 1/23/18 and 2/12/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026	Lighting	SBDI	54	54	82	43	2,497	1.10	5,680	5,763	101%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	3025			30	30	32	15	2,781	1.10	1,374	1,555	113%
305802-Lighting-Delamping Replacing T8 32 Watt	3084			30	-	32	-	2,781	1.10	2,589	2,926	113%
Total										9,643	10,244	106%

The annual lighting hours of operation verified during the M&V site visit for the first line item in the table above (2,497) are fewer than the annual hours of operation used to calculate ex ante savings (2,520). For the second and third line items above the ex post hours (2,781) are greater than the ex ante savings.

A heating and cooling interactive factor of 1.10, applicable to a gas 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.⁴³⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 106%. The ex ante energy savings estimate was premised on underestimated annual lighting operating hours for two measures and underestimated heating and cooling interactive effects.

⁴³⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	9,643	10,244	106%	1.95
Total		9,643	10,244	106%	1.95

Data Collection

The participant received SBDI lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed five photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 2/07/18 and 2/25/18.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	3009	Lighting	SBDI	1	1	72	9	2,500	1.11	131	175	134%
				17	17	72	9	992	1.11	2,219	1,180	53%
305801-Lighting-Delamping Replacing T12 <=40 Watt	3084			65	-	40	-	2,500	1.11	5,564	7,218	130%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	793			3	3	25	4	8,760	1.11	591	613	104%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3026			170	170	40	17	1,669	1.11	8,367	7,247	87%
				41	41	40	17	2,500	1.11	2,018	2,618	130%
Total										18,890	19,051	101%

The annual lighting hours of operation verified during the M&V site visit for the fourth line item in the table above corresponds with the ex ante hours (8,760). The second and fifth line items have annual hours of operation (992 and 1,669, respectively) which are fewer than the annual hours of operation used to calculate ex ante savings (2,000). These measures were installed in locations with infrequent usage. The remaining measures had hours of operation (2,500) greater than the ex ante hours.

A heating and cooling interactive factor of 1.11, applicable to a gas heated, air conditioned office in Jefferson City, 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.⁴⁴⁰

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 101%.

⁴⁴⁰ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
SBDI	Lighting	18,890	19,051	101%	3.62
Total		18,890	19,051	101%	3.62

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Controls Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Quantity</i>	<i>Controlled Wattage</i>	<i>Baseline Hours</i>	<i>Efficient Hours</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
103521-Lighting-Dimming Occupancy Sensor Replacing No Existing Equipment or Replacing Failed Equipment	1169	Lighting	New Construction	138	578	7,446	3,961	1.07	277,935	208,214	75%
Total									277,935	208,214	75%

During the M&V site visit, the baseline behavior for controlling lighting was determined by survey questions per usage area. The survey along with the lighting drawings indicated that the measures installed within the patient rooms were not controlled by the new lighting system, only monitored.

A heating and cooling interactive factor of 1.07, applicable to a gas heated, air conditioned hospital in St. Louis, was applied to the ex post lighting energy savings. The ex ante savings estimate did not account for heating and cooling interactive effects.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁴¹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 75%. The ex ante energy savings estimate was premised upon usage of all installed lighting controlled by the system.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
New Construction	Lighting	277,935	208,214	75%	39.55
Total		277,935	208,214	75%	39.55

⁴⁴¹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Data Collection

The participant received EMS Pilot Program incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the implemented EMS measures. Field staff also collected specifics about the construction of the facility, occupancy rates, internal loads, HVAC equipment, and HVAC operation. ADM also acquired the ex ante Trane Trace energy models used for energy savings estimates.

Analysis Results

EMS Savings Calculations

Energy savings for the implemented EMS measures were calculated using IPMVP Option D, Calibrated Simulation. This was completed using Trane Trace 700 energy simulation. ADM was provided the Trane Trace archived model used to estimate ex ante energy savings. ADM reviewed the baseline model's inputs and adjusted the model based on information collected during the on-site visit. The model was then run using weather data for the St. Louis region to ensure that the model was properly calibrated to the billed energy consumption of the facility. The results of the calibration effort can be seen in the following plot:

Trane Trace Model Calibration



Upon the calibration of the baseline model, an alternative model run was utilized in Trane Trace to determine the impacts of the EMS measures on energy consumption. The two models were run using typical weather for the region to determine the typical annual savings for the project. The annual savings are the difference between the annual consumption of the baseline and as-built models. The energy savings results from the model are presented in the following table:

EMS Energy Savings

Month	TMY3 Savings		
	Baseline	As-Built	Savings
January	73,217	58,816	14,401
February	63,758	51,119	12,639
March	57,440	46,959	10,481
April	42,573	39,474	3,099
May	32,047	28,010	4,037
June	41,655	32,744	8,911
July	46,625	30,176	16,449
August	52,180	42,384	9,795
September	43,420	39,351	4,069
October	34,366	32,580	1,786
November	44,158	36,303	7,855
December	80,696	63,131	17,565
Total	612,133	501,046	111,087

Measure level savings are shown in the following table:

EMS Savings

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
16899 – EMS Controls – Heating	1169	Heating	EMS Pilot	71,941	55,311	77%
16899 – EMS Controls – Cooling	1169	Cooling	EMS Pilot	46,151	42,008	91%
16899 – EMS Controls – HVAC	1169	HVAC	EMS Pilot	17,646	13,768	78%
Total				135,738	111,087	82%

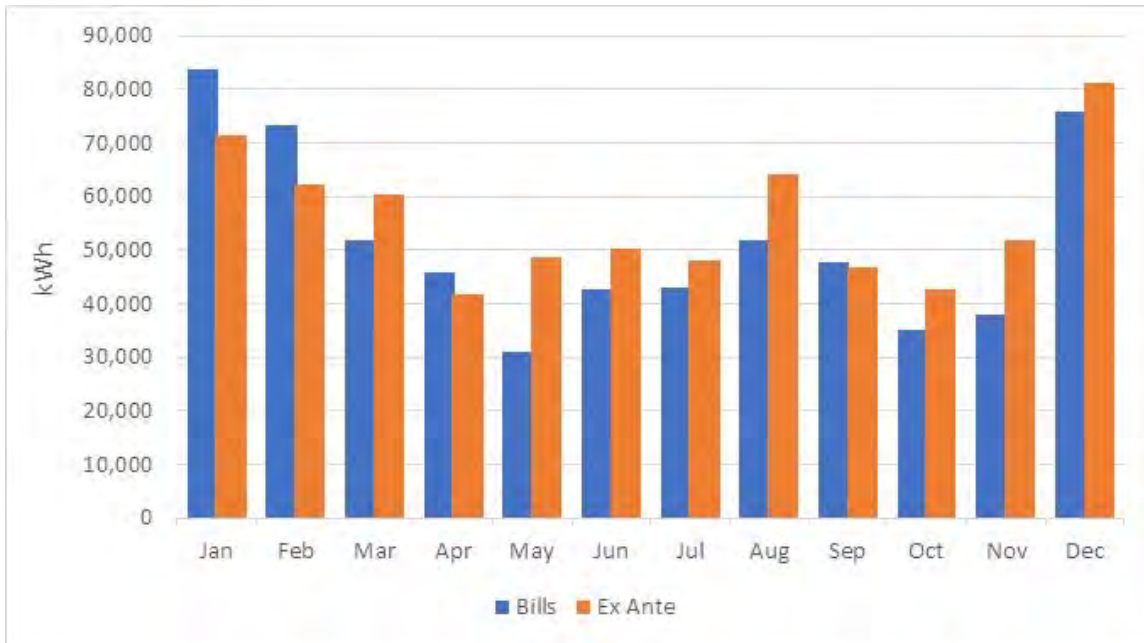
Verified annual savings for implementation of the EMS measures are 111,087 kWh, resulting in a site-level realization rate of 82%. The differences in realized savings can be attributed to calibration of the provided Trane Trace model. The calibration adjustments to the model included: adjusting lighting and occupancy schedules and modifying heating and cooling set-points.

ADM made slight adjustments the baseline heating and cooling schedules for model calibration based on information collected on site. The ex post model calibration resulted in less savings for the three end use categories. The cooling and ventilation savings went down because schedules were reduced during summer months, and the baseline cooling set-point was increased 1°F. The heating savings

also decreased because ADM increased the heating set-point by 1°F, and the reduced lighting and occupancy schedules decreased the amount of heat in the spaces, which then required more heating.

The ex ante model used assumed thermostat set-points and lighting and occupancy schedules. As a result, the models calibration was significantly off and can be seen in the following figure:

Monthly Energy Usage of Ex Ante Model vs. Utility Bills



A table showing the energy savings achieved by the measures evaluated for this site is shown below.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
EMS	Heating	71,941	55,311	77%	0.00
	Cooling	46,151	42,008	91%	38.26
	HVAC	17,646	13,768	78%	6.11
Total		135,738	111,087	82%	44.37

Data Collection

The participant received Custom and EMS Pilot Program incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the installation of EMS controls and interviewed site personnel regarding equipment operation and school schedules. ADM also collected information on building construction and HVAC equipment that were necessary for energy modeling purposes.

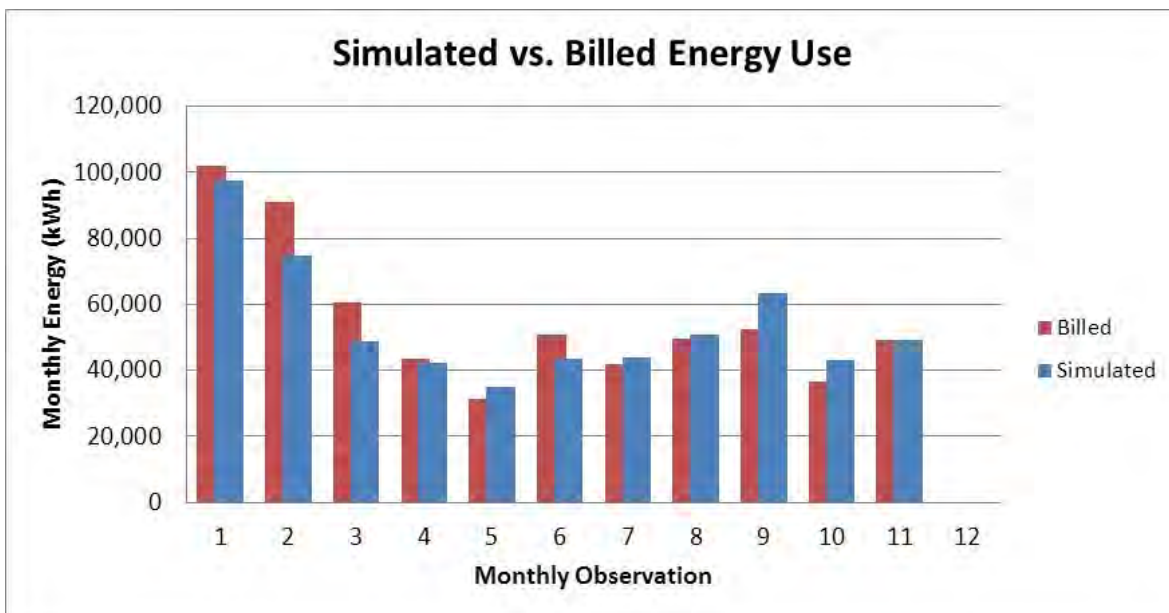
Analysis Results

EMS Controls Savings Calculations

Energy savings for the installed measures were calculated using IPMVP Option D: Calibrated Simulation. ADM compiled an eQuest model of the baseline facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Upon completion of the initial model, a custom weather file was created using 2016 NOAA weather data for the region. Using this weather file and the utility provided billing data for the building, ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2016 Monthly kWh Calibration



Upon completion of the calibration for the baseline eQuest model, the impacts of the installed measures were added through the uses of parametric runs. Once the parametric runs were defined, the as-built model and parametric runs were simulated using TMY3 weather data. The total realized energy savings are the differences between the baseline and as-built models' energy usages, and the total site-level energy savings by end use can be seen in the following table:

Typical Year Energy Usage (kWh) by End Use

<i>End-Use</i>	<i>Baseline</i>	<i>As-Built</i>	<i>kWh Savings</i>
Lighting	219,101	219,101	0
Miscellaneous Equipment	51,918	51,918	0
Heating	192,292	159,503	32,789
Supplemental Heating	106,850	90,208	16,642
Cooling	124,433	108,188	16,245
Heat Rejection	0	0	0
Pumps	2,951	3,323	-371
Fans	62,214	55,652	6,562
Domestic Hot Water	0	0	0
Exterior Lighting	0	0	0
Total	759,760	687,892	71,868

Measure level savings are shown in the following table:

Custom and EMS Savings

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
16904 – EMS Controls – Cooling	1169	Cooling	EMS Pilot	14,608	16,245	111%
16904 – EMS Controls – HVAC	1169	HVAC	EMS Pilot	36,519	6,191	17%
16904 – EMS Controls – Heating	1169	Heating	EMS Pilot	15,272	49,432	324%
Total				66,399	71,868	108%

There were significant differences in the ex ante and ex post analyses for the EMS controls, and the site-level realization rate is 108%. The ex ante analysis used bin calculations with assumed loads and hours of operation. The ex post energy simulations resulted in less ventilation (HVAC) savings and more heating and cooling savings. ADM created eQuest models of the entire school and calibrated the models to actual billing data. This method accounts for interactive effects and building and HVAC system operations better than the ex ante weather bin calculations.

The site-level verified energy savings are 71,868 kWh, resulting in a site-level realization rate of 108%.

A table showing the energy savings achieved by the measures evaluated for this site is shown below.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
16904 – EMS Controls – Cooling	Cooling	14,608	16,245	111%	14.79
16904 – EMS Controls – HVAC	HVAC	36,519	6,191	17%	2.75
16904 – EMS Controls – Heating	Heating	15,272	49,432	324%	0.00
Total		66,399	71,868	108%	17.54

Data Collection

The participant received EMS Pilot Program incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the implemented EMS measures. Field staff also collected specifics about the construction of the facility, occupancy rates, internal loads, HVAC equipment, and HVAC operation. ADM also acquired the ex ante Trane Trace energy models used for energy savings estimates.

Analysis Results

EMS Savings Calculations

Energy savings for the implemented EMS measures were calculated using IPMVP Option D, Calibrated Simulation. This was completed using Trane Trace 700 energy simulation. ADM was provided the Trane Trace archived model used to estimate ex ante energy savings. ADM reviewed the baseline model's inputs and adjusted the model based on information collected during the on-site visit. The model was then run using 2016 weather data for the St. Louis region to ensure that the model was properly calibrated to the billed energy consumption of the facility. The results of the calibration effort can be seen in the following plot:

2016 Trane Trace Model Calibration



Upon the calibration of the baseline model, an alternative model run was utilized in Trane Trace to determine the impacts of the EMS measures on energy consumption. The two models were run using typical weather for the region to determine the typical annual savings for the project. The annual savings are the difference between the annual consumption of the baseline and as-built models. The energy savings results from the model are presented in the following table:

EMS Energy Savings

Month	TMY3 Savings		
	Baseline	As-Built	Savings
January	56,499	52,548	3,951
February	50,352	47,197	3,155
March	61,254	51,921	9,333
April	60,542	47,135	13,407
May	76,522	52,213	24,309
June	71,632	38,925	32,708
July	86,029	52,694	33,335
August	87,965	56,153	31,812
September	85,844	64,318	21,526
October	67,901	56,524	11,377
November	62,829	54,807	8,022
December	80,156	30,965	49,191
Total	847,525	605,399	242,126

Measure level savings are shown in the following table:

EMS Savings

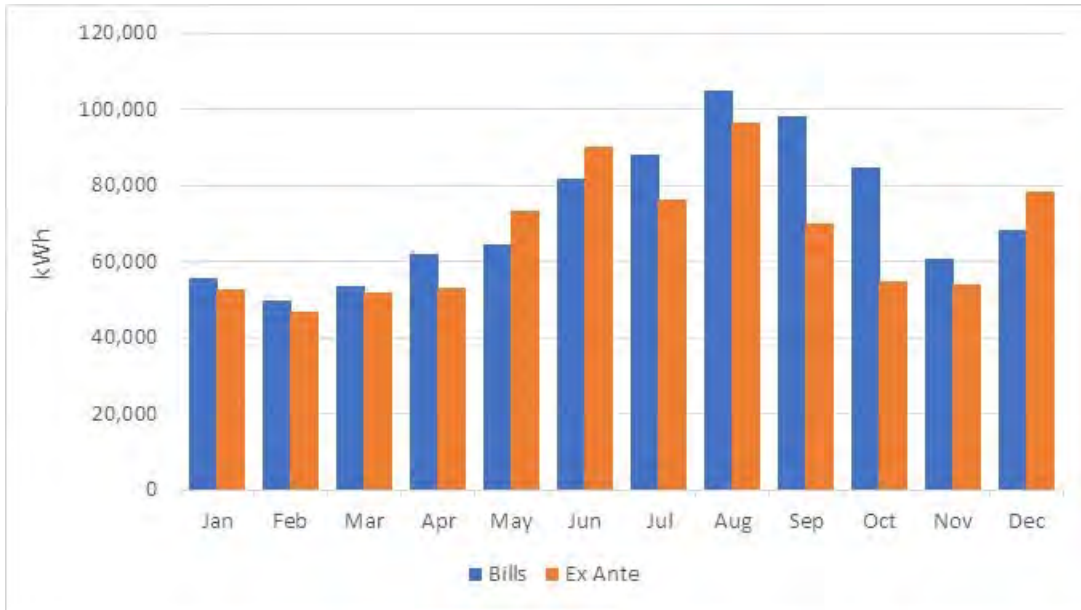
Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
16902 – EMS Controls – Cooling	1169	Cooling	EMS Pilot	111,293	113,495	102%
16902 – EMS Controls – HVAC	1169	HVAC	EMS Pilot	14,516	22,691	156%
16902 – EMS Controls – Heating	1169	Heating	EMS Pilot	116,132	106,603	92%
Total				241,941	242,789	100%

Verified annual savings for implementation of the EMS measures are 242,789 kWh, resulting in a site-level realization rate of 100%. The differences in realized savings can be attributed to calibration of the provided Trane Trace model. The calibration adjustments to the model included: adjusting lighting and occupancy schedules and modifying internal loads.

ADM made slight adjustments the lighting and occupancy schedules and internal loads based on ADM's calibration experience and information collected on site. The ex post model calibration resulted in less savings for the heating but more savings for cooling and ventilation (HVAC). The cooling and ventilation savings went up because schedules were reduced during summer months, and internal loads were increased. Since there were not setbacks in the baseline, the decreased summer operations create more energy savings opportunities for the setbacks. The increase in internal loads also creates larger cooling loads and more opportunities for savings. The heating savings decreased because ADM increased the internal loads, and lighting schedules were extended during the fall when school is back in session, which creates more heat in the spaces and less heating requirements.

The ex ante model used assumed internal loads and lighting and occupancy schedules. As a result, the models calibration was significantly off and can be seen in the following figure:

Monthly Energy Usage of Ex Ante Model vs. Utility Bills



A table showing the energy savings achieved by the measures evaluated for this site is shown below.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
EMS	Cooling	111,293	113,495	102%	103.36
	HVAC	14,516	22,691	156%	10.07
	Heating	116,132	106,603	92%	0.00
Total		241,941	242,789	100%	113.43

Data Collection

The participant received Custom and EMS Pilot Program incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the installation of EMS controls and interviewed site personnel regarding equipment operation and school schedules. ADM also collected information on building construction and HVAC equipment nameplates that were necessary for energy modeling purposes.

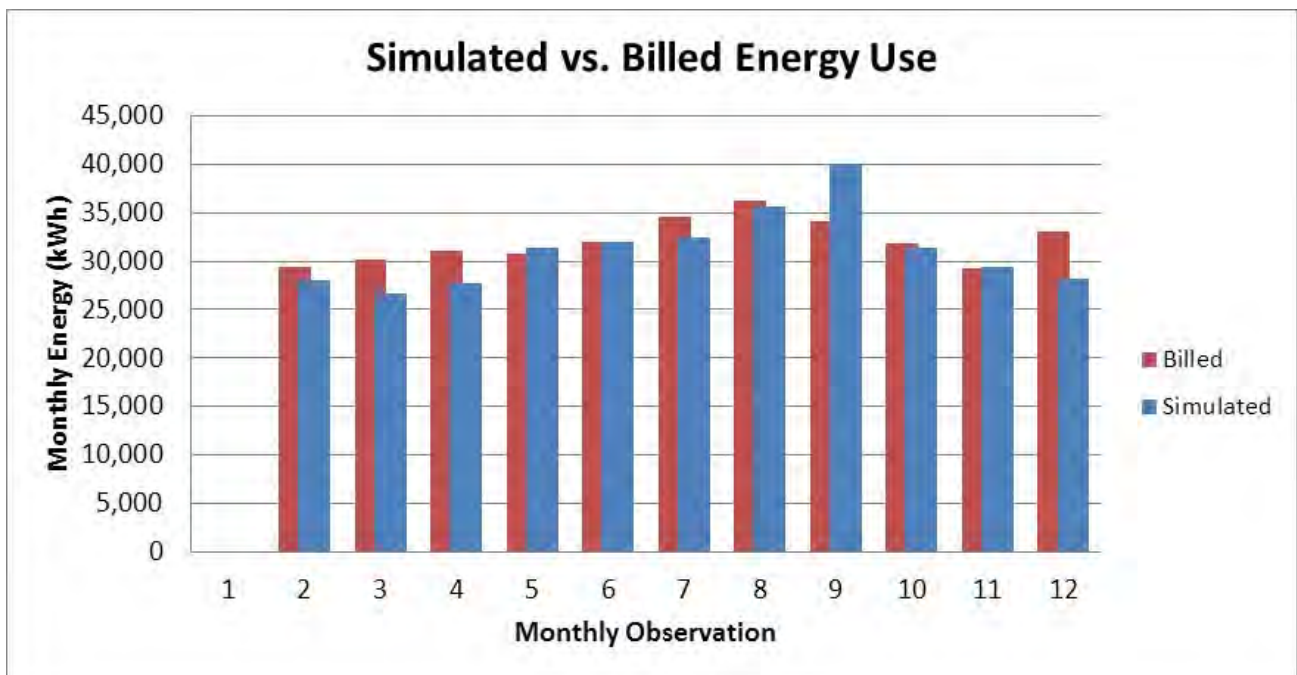
Analysis Results

EMS Controls Savings Calculations

Energy savings for the installed measures were calculated using IPMVP Option D: Calibrated Simulation. ADM compiled an eQuest model of the baseline facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Upon completion of the initial model, a custom weather file was created using 2016 NOAA weather data for the region. Using this weather file and the utility provided billing data for the building, ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2016 Monthly kWh Calibration



Upon completion of the calibration for the baseline eQuest model, the impacts of the installed measures were added through the uses of parametric runs. Once the parametric runs were defined, the as-built model and parametric runs were simulated using TMY3 weather data. The total realized energy savings are the differences between the baseline and as-built models' energy usages, and the total site-level energy savings by end use can be seen in the following table:

Typical Year Energy Usage (kWh) by End Use

<i>End-Use</i>	<i>Baseline</i>	<i>As-Built</i>	<i>kWh Savings</i>
Lighting	73,560	73,560	0
Miscellaneous Equipment	49,905	49,905	0
Heating	32,838	30,201	2,638
Supplemental Heating	4,169	3,951	218
Cooling	106,605	101,092	5,513
Heat Rejection	0	0	0
Pumps	2,718	2,834	-115
Fans	79,978	74,025	5,953
Domestic Hot Water	0	0	0
Exterior Lighting	12,757	12,757	0
Total	362,530	348,323	14,207

Measure level savings are shown in the following table:

Custom and EMS Savings

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
17143 – EMS Controls – Cooling	1169	Cooling	EMS Pilot	8,550	5,513	64%
17143 – EMS Controls – HVAC	1169	HVAC	EMS Pilot	2,850	5,838	205%
17143 – EMS Controls – Heating	1169	Heating	EMS Pilot	2,850	2,856	100%
Total				14,250	14,207	100%

There were significant differences in the ex ante and ex post analyses for the EMS controls; however, the site-level realization rate is 100%. The ex ante analysis used bin calculations with assumed loads and hours of operation. The ex post energy simulations resulted in less cooling savings and more ventilation (HVAC) savings. ADM created eQuest models of the entire school and calibrated the models to actual billing data. This method accounts for interactive effects and building and HVAC system operations better than the ex ante calculations.

The site-level verified energy savings are 14,207 kWh, resulting in a site-level realization rate of 100%. A table showing the energy savings achieved by the measures evaluated for this site is shown below.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
17143 – EMS Controls – Cooling	Cooling	8,550	5,513	64%	5.02
17143 – EMS Controls – HVAC	HVAC	2,850	5,838	205%	2.59
17143 – EMS Controls – Heating	Heating	2,850	2,856	100%	0.00
Total		14,250	14,207	100%	7.61

Data Collection

The participant received Custom and EMS Pilot Program incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the installation of EMS controls and interviewed site personnel regarding equipment operation and church schedules. ADM also collected information on building construction and HVAC equipment nameplates that were necessary for energy modeling purposes.

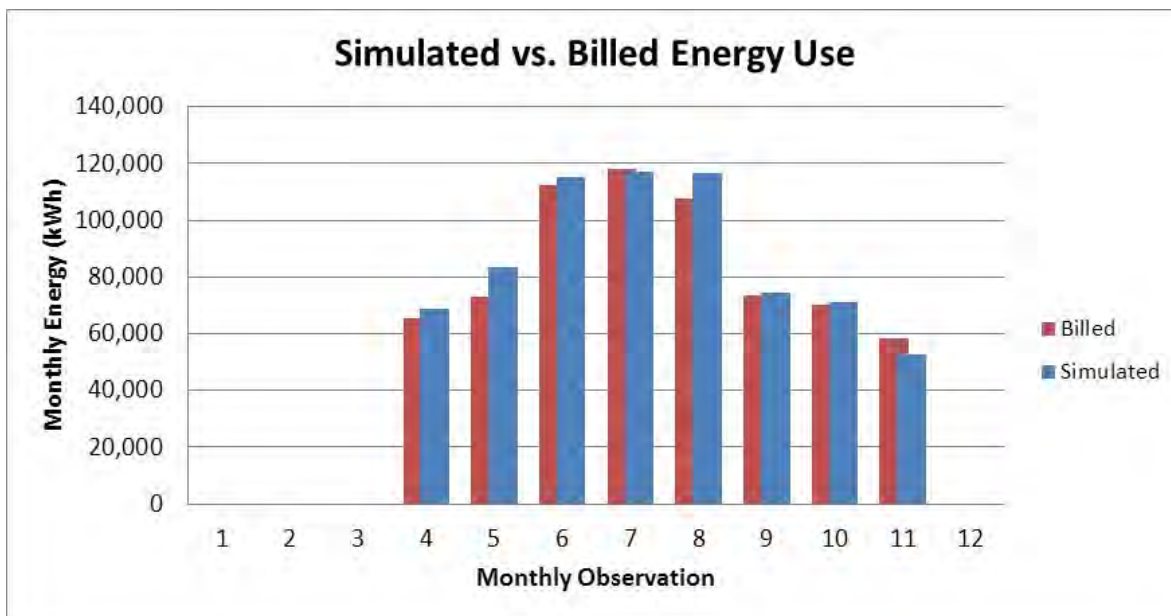
Analysis Results

EMS Controls Savings Calculations

Energy savings for the installed measures were calculated using IPMVP Option D: Calibrated Simulation. ADM compiled an eQuest model of the baseline facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Upon completion of the initial model, a custom weather file was created using 2016 NOAA weather data for the region. Using this weather file and the utility provided billing data for the building, ADM ensured that the model's energy load shape matched that of the bills. Due to some missing data and the date ranges of the bills, ADM was only able to calibrate nine months. The results of this calibration effort can be seen below:

2016 Monthly kWh Calibration



Upon the calibration for the baseline eQuest model, the impacts of the installed measures were added through the uses of parametric runs. Once the parametric runs were defined, the as-built model and parametric runs were simulated using TMY3 weather data. The total realized energy savings are the differences between the baseline and as-built models' energy usages, and the total site-level energy savings by end use can be seen in the following table:

Typical Year Energy Usage (kWh) by End Use

<i>End-Use</i>	<i>Baseline</i>	<i>As-Built</i>	<i>kWh Savings</i>
Lighting	273,563	273,563	0
Miscellaneous Equipment	106,319	106,319	0
Heating	0	0	0
Supplemental Heating	0	0	0
Cooling	203,093	195,146	7,947
Heat Rejection	5,628	5,621	6
Pumps	15,096	15,129	-33
Fans	279,521	249,631	29,890
Domestic Hot Water	0	0	0
Exterior Lighting	0	0	0
Total	883,218	845,408	37,810

Measure level savings are shown in the following table:

Custom and EMS Savings

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
18657 – EMS Controls – HVAC	1169	HVAC	EMS Pilot	34,725	37,810	109%
Total				34,725	37,810	109%

There were significant differences in the ex ante and ex post analyses for the EMS controls, and the site-level realization rate is 109%. The ex ante analysis used bin calculations with assumed loads, hours of operation, and reduced fan hours. The ex post analysis relies on eQuest models of the entire facility, and the models were calibrated to actual billing data. This method accounts for interactive effects and building and HVAC system operations better than the ex ante calculations. ADM also used the fan schedules that were verified during the M&V site visit.

The site-level verified energy savings are 37,810 kWh, resulting in a site-level realization rate of 109%.

A table showing the energy savings achieved by the measures evaluated for this site is shown below.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
18657 – EMS Controls – HVAC	HVAC	34,725	37,810	109%	16.79
Total		34,725	37,810	109%	16.79

Data Collection

The participant received Retro-Commissioning (RCx) incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation and post-implementation connected loads, interviewed facility personnel regarding equipment operation. ADM also reviewed of the provided documentation and data.

The customer repaired several leaks in the compressed air system, totaling 296.62 cfm, as follows:

Leak Repair Log

<i>Size</i>	<i>Amount</i>	<i>CFM</i>	<i>Total CFM</i>
Small	32	0.41	13.12
Medium	25	1.2	30.00
Large	19	6.5	123.50
Extra Large	5	26	130.00
Total	81		296.62

Correcting these leaks reduced the load on the compressors, resulting in less energy consumption.

ADM reviewed all project documentation, including the “Compressed Air Study” provided by the contractor, and obtained baseline and as-built monitoring data. The baseline monitoring data totaled a week (seven days) in 12 second intervals. The as-built monitoring data totaled a week (seven days) in 20 second intervals. Variables monitored included: current (amperage) for each of the eight compressors. A list of the compressor installed can be seen blow:

Compressor List

<i>Location</i>	<i>Brand</i>	<i>Capacity Control</i>	<i>HP</i>	<i>CFM</i>
Main Compressor Room	Gardner Denver	Inlet Modulation	75	355
Main Compressor Room	Gardner Denver	Inlet Modulation	75	355
Main Compressor Room	Gardner Denver	Load/Unload	50	238
Main Compressor Room	Gardner Denver	Load/Unload	100	450
Main Compressor Room	Gardner Denver	Inlet Modulation	50	212
Main Compressor Room	Gardner Denver	Variable Speed Drive	100	436
Remote Compressor Room	Ingersoll Rand	Variable Speed Drive	75	372
Remote Compressor Room	Ingersoll Rand	Inlet Modulation	100	434

Analysis Results

Compressed Air Leak Repair Savings Calculations

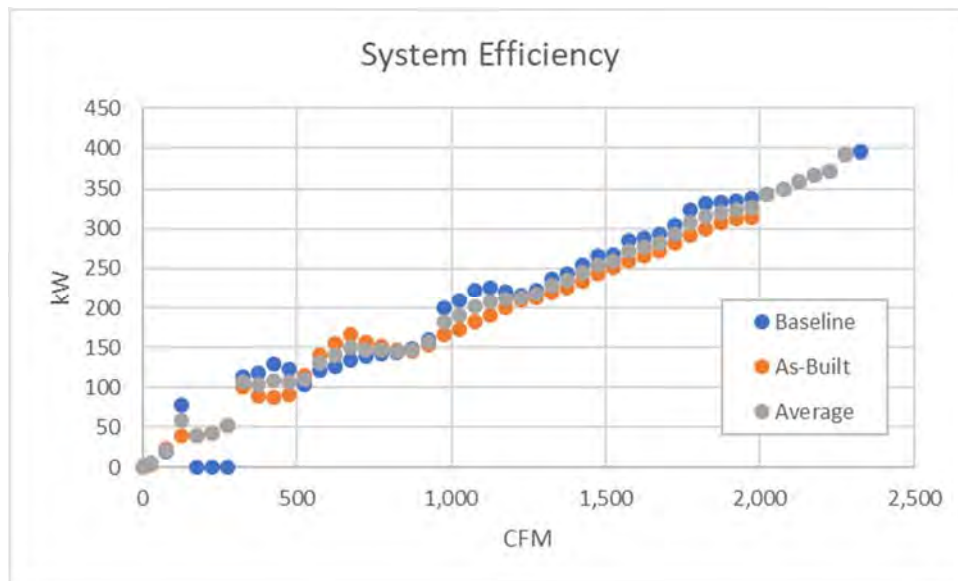
ADM estimated energy savings using the facility’s compressed air load profile derived from baseline monitoring data. The current data was used to calculate power, using the following algorithm:

$$P = \frac{\sqrt{3} \times V \times A \times pf}{1,000}$$

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 compressor curves from the UMP⁴⁴². From the UMP curves, ADM created baseline and as-built efficiency curves of kW vs cfm. The curves were used to determine the cfm at each data point. The cfm and kW values were summed for each air compressor to get total baseline and as-built system kW and cfm. Because the measures implemented only affected the CFM demand, the baseline and as-built kW vs CFM curves should be nearly equivalent. Thus, the baseline and as-built system efficiency curves were averaged to develop the kW vs CFM curve used in the savings analysis. A plot of the baseline, as-built, and averaged system efficiency can be seen below:



The average system efficiency curve was used to calculate the new load (kW) values for decreasing the post-implementation load by the 296.62 cfm in leaks repaired. This “new” load profile represented the decreased demand as a result of repaired leaks.

Energy savings were calculated by taking the difference in energy requirements of baseline and as-built RCx compressed air systems, at each monitoring point, summing over the monitoring period, and scaling to an annual basis. This method assumes the monitoring period represented a typical demand profile at the facility.

The site-level realization rate is 92%. This is primarily due to ex ante using 307 CFM as the repaired leak amount. When adding the leaks repaired identified in the “Compressed Air Study” provided by the contractor, the leaks totaled 296.62 CFM. Additionally, the ex ante analysis uses estimated compressor

⁴⁴² Chapter 22: Compressed Air Evaluation Protocol, The Uniform Methods Project (UMP): Methods for Determining Energy Efficiency Savings for Specific Measures

staging at specific CFMs to determine compressor load and kW. The ex post analysis uses the compressor monitoring data to determine the compressor load and kW. While the monitored compressor staging closely follows the ideal staging outlined in the ex ante analysis, the actual usage varies slightly representing the actual compressor usage. Finally, the ex ante used the monitored CFM to calculate system efficiency. However, the monitored CFM was unreliable and needed to be “scaled” by a factor of 1.37 for the main compressor room and 1.1 for the remote compressor room. The ex ante analysis used the “scaled” monitored CFM while the ex post analysis used the CFM calculated using the UMP curves. The combination of slightly less CFM leaks repaired, real vs ideal compressor staging, and “scaled monitored CFM vs calculated CFM contributed to the reduced savings.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
RCx	Compressed Air	507,413	465,686	92%	64.24
Total		507,413	465,686	92%	64.24

Data Collection

The participant received Custom incentives from Ameren Missouri for air handler and chiller optimization including adjusting air handler unit’s scheduling, temperature resets, static pressure resets, and economizer setpoint. Additional air handlers received direct digital controls and were converted to variable air volume units. Finally, VFDs were installed on chilled water pumps, and chiller sequencing, chilled water temperature schedules, and condenser water reset schedules were optimized.

During the M&V visit, ADM staff verified equipment installation, interviewed facility personnel regarding equipment operation, and took photos of equipment associated with the incentive. All project documentation was also reviewed.

ADM obtained billing data for the electric utility meter serving the facility, which was used in the billing regression discussed in the “Analysis Results” section below.

Analysis Results

ADM estimated energy savings using an IPMVP⁴⁴³ Option C: Whole Facility analysis methodology. The hourly pre/post billing data regression compares weather data from the St. Louis Lambert International Airport NOAA weather station and a pre/post-implementation binary flag, against hourly billing data to determine how energy consumption of the facility varied with changes in weather and the implemented measures. Dry bulb and dew point temperatures during the billing period were used with other variables in an electric usage regression resulting in an R² of 0.974 and adjusted R² of 0.974. From the regression, the following equation was derived and used to calculate hourly energy consumption for the pre and post configurations:

$$kW_{hourly} = 0.83 * Year - 13.67 * Month + 9.32 * Hour - 2.38 * DB + 13.73 * DP - 195.79 * PrePost$$

Where:

- kWh_{hourly}* = Hourly kW consumption
- Year* = Year of data point
- Month* = Month of data point
- Hour* = Hour of data point
- DB* = Dry bulb temperature
- DP* = Dewpoint
- PrePost* = Pre/Post-implementation binary flag

⁴⁴³ International Performance, Measurement, and Verification Protocol. “Concepts and Options for Determining Energy and Water Savings”, Volume 1. January 2012.

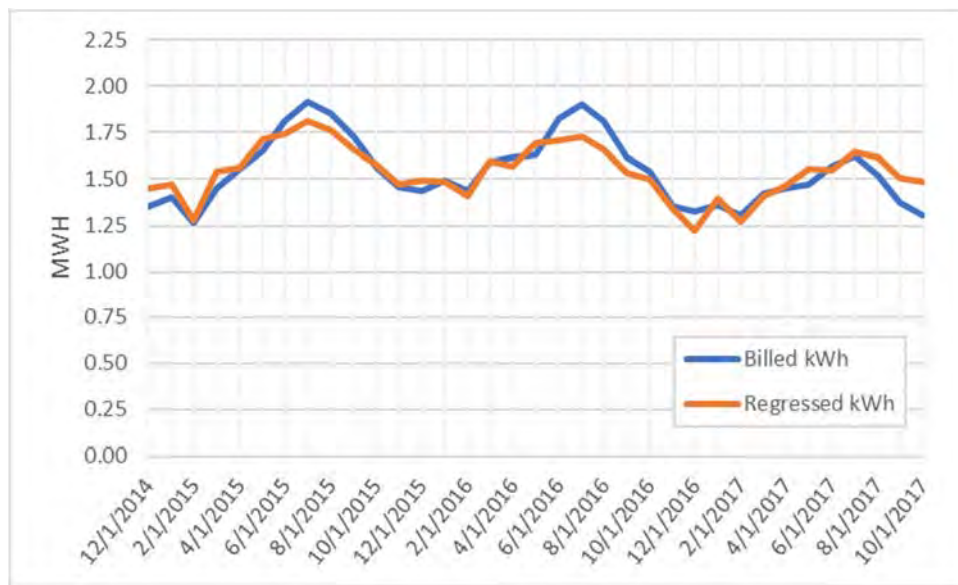
The following table presents the T-Stats for the regression variables:

Significance of kWh Regression Variables

Variable	T-Stat
Year	210.95
Month	-21.51
Hour	29.59
Temp	-8.90
Dew Point	49.18
PrePost	-45.20

Electric energy usage values were calculated using the derived regression equation and summed on a monthly basis. The following graph compares the monthly billed kWh to the calculated kWh:

Billed Vs. Regressed Monthly kWh



Annual kWh savings for the installed measures were determined by using the derived equation. Using the derived equation to calculate baseline and as-built energy consumption will result in identical baseline and as-built equations differing by only a single PrePost variable. Thus, because a single PrePost variable was used in the equation, annual kWh savings are the PrePost coefficient multiplied by the annual hours; 8,760. This savings value represents the difference between baseline and as-built energy consumption for the facility.

The site-level realization rate is 109%. This is primarily due to different calculation approaches. The ex ante analysis used bin calculators and engineering equations while the ex post analysis used actual building billed interval metering data. Thus, the difference in savings is due to the slight differences in actual versus theoretical savings. While sophisticated, a bin analysis and engineering calculations cannot predict every situation which may affect the energy use, contributing to the difference in savings.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
RCx	HVAC Optimization - Airside	665,413	724,166	109%	321.52
	Water Cooled Chiller	910,567	990,966	109%	902.45
Total		1,575,980	1,715,131	109%	1,223.97

Data Collection

The participant received New Construction lighting incentives from Ameren Missouri.

During the M&V visit, ADM staff verified equipment installation, the post-retrofit connected loads, interviewing facility personnel regarding lighting operating schedules, and installed three photo-sensor loggers to monitor lighting operation. The photo-sensor loggers collected data between 10/6/2017 and 2/8/2018.

Analysis Results

Lighting Retrofit Savings Calculations

Measure Number/Name	TRM Measure Reference Number	End Use Category	Program	Baseline Quantity	Efficient Quantity	Baseline Wattage	Efficient Wattage	Annual Hours of Operation	Heating Cooling Interaction Factor	Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross kWh Realization Rate
406123-Lighting-New Construction Lighting Power Density (LPD)	3000	Lighting	New Construction	235	235	551	240	5,984	1.10	511,560	480,132	94%
Total										511,560	480,132	94%

Primary data were used to develop estimates of annual lighting operating hours. For all facility areas monitored, the estimated annual operating hours were less than those used to develop the ex ante energy savings estimates.

A heating and cooling interactive factor of 1.10, applicable to a gas heated, air conditioned light industrial building in Jefferson City, was applied to the ex post lighting energy savings. The ex ante savings estimate did not utilize a heating and cooling interactive factor.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁴⁴

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 94%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and did not account for heating and cooling interactive effects. The ex ante hours of use estimate was created during the design phase of this new construction project. The ex post metered the usage for 126 days to create the lighting profiles for weekdays, weekends and holidays.

⁴⁴⁴ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
New Construction	Lighting	511,560	480,132	94%	91.21
Total		511,560	480,132	94%	91.21

Data Collection

The participant received custom incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the completion of the retro-commissioning measures. The school implemented weekend temperature setbacks and summer recess temperature setbacks on (3) air handler units, (3) rooftop units, and multiple split systems. ADM staff collected hourly interval meter data for the facility and electricity produced by solar panels.

Analysis Results

Retro-Commissioning Savings Calculations

Energy savings for the retro-commissioning project at this facility are calculated using IPMVP⁴⁴⁵ Option C: Whole Facility analysis methodology, using electric meter interval data.

ADM created a regression model where the facility energy consumption depends on heating and cooling degree days, weekday vs weekend, school occupancy, and interactive effects of those variables. The resulting equation used for calculating energy savings can be seen below:

$$kWh = A \times HDD_{Post} + B \times CDD_{Post} + C \times HDD + D \times CDD + E \times Wk_{Post} + F \times Wk + G \times SchoolDay$$

Where,

kWh	Daily kWh
HDDPost	Heating Degree Days after Retro-Commissioning
CDDPost	Cooling Degree Days after Retro-Commissioning
HDD	Heating Degree Days
CDD	Cooling Degree Days
WkPost	Weekend indicator after Retro-Commissioning
Wk	Weekend indicator
SchoolDay	School Day indicator

ADM used 1 hour interval data along with weather data from the St Louise Lambert International Airport and actual school calendar data to create a regression which has R-square of 0.9644. the regression parameters are summarized below:

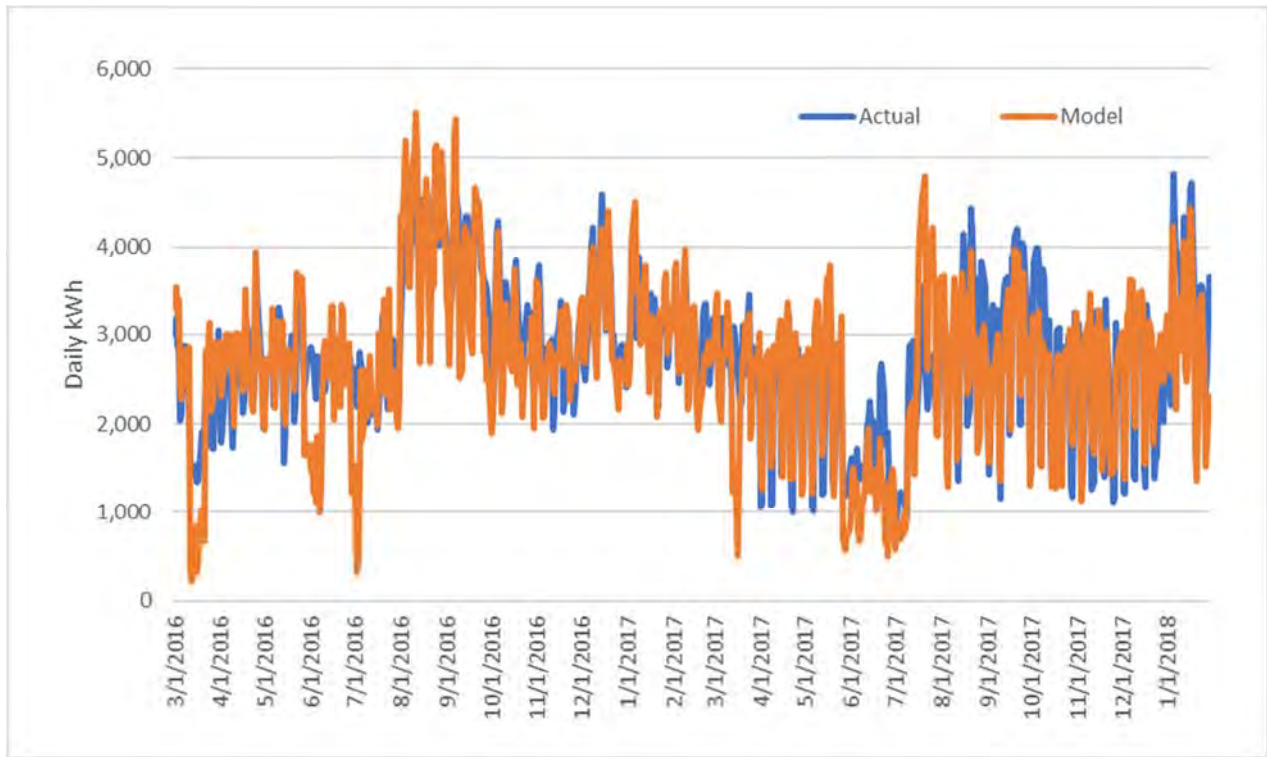
⁴⁴⁵ International Performance, Measurement, and Verification Protocol. “Concepts and Options for Determining Energy and Water Savings”, Volume 1. January 2012.

Regression Parameters

	A	B	C	D	E	F	G
Coefficient	-5.431	-53.015	41.151	138.983	-691.400	1,644.401	2,307.201
Standard Error	2.795	4.594	2.233	3.246	84.312	59.609	38.628
T-Stat	-1.943	-11.540	18.431	42.816	-8.200	27.586	59.728

Using the regression model, ADM compared actual energy consumption and the model's predicted energy consumption.

Actual vs Model Daily kWh



Energy savings from this project come from weekend setbacks which are based on heating and cooling degree days and the number of weekend days in a month outside summer recess. The graph above shows the plot swing increases after April 2017. The drops in the plot are happening over weekends due to the weekend setup temperature implemented during retro-commissioning.

ADM used TMY3 weather data to calculate the typical year savings. The following table presents the typical year savings by month:

Retro-Commissioning Energy Savings

<i>Month</i>	<i>CDD</i>	<i>HDD</i>	<i>Weekend outside Summer Recess</i>	<i>Savings</i>
January	0.08	1,114.08	12	67,360.10
February	0.75	843.13	10	51,616.13
March	33.46	509.08	9	33,393.24
April	68.54	289.00	11	23,298.92
May	107.88	131.83	6	11,723.40
June	369.08	13.96	0	2,744.55
July	493.08	1.13	6	6,886.06
August	393.00	3.08	8	7,829.11
September	199.71	45.04	10	10,386.52
October	34.50	334.83	11	25,543.88
November	7.38	617.96	11	40,406.36
December	0.00	1,040.67	16	66,233.08
Total	1,707.46	4,943.79	110	347,421.35

Verified annual savings for the retro-commissioning project is 347,421 kWh, which results in a 97% realization rate. The difference in savings can be attributed to differences in calculation methodologies. The ex-ante analysis used an IPMVP Option A approach using temperature bins to calculate savings for each HVAC unit while ADM used an IPMVP Option C approach which calculates the whole building energy savings. ADM noticed increased savings during the winter which can be attributed to the school leaving the HVAC systems operating during holiday breaks in the baseline. Now, with automated setbacks, the facility can set back the temperature during holiday breaks when the facility is unoccupied.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	HVAC	357,664	347,421	97%	0.00
Total		357,664	347,421	97%	0.00

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, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
017313-305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	3006-1	Lighting	Standard	13	13	175	72	4,308	1.00	6,447	5,768	89%
Total										6,447	5,768	89%

The annual lighting hours of operation (4,308⁴⁴⁶) are fewer than the hours of operation used to calculate ex ante savings (4,500). The measure is controlled by a photo cell and operates only during non-daylight hours.

No heating and cooling factor was referenced for the ex post savings estimate due to lighting being installed in an unconditioned space. The ex ante savings estimate referenced a heating and cooling interactive factor of 1.07.

The peak coincident kW reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁴⁷

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall realization rate is 89%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours and a heating and cooling interactive factor for an unconditioned space.

⁴⁴⁶ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

⁴⁴⁷ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	6,447	5,768	89%	1.10
Total		6,447	5,768	89%	1.10

Data Collection

The participant received custom incentives from Ameren Missouri.

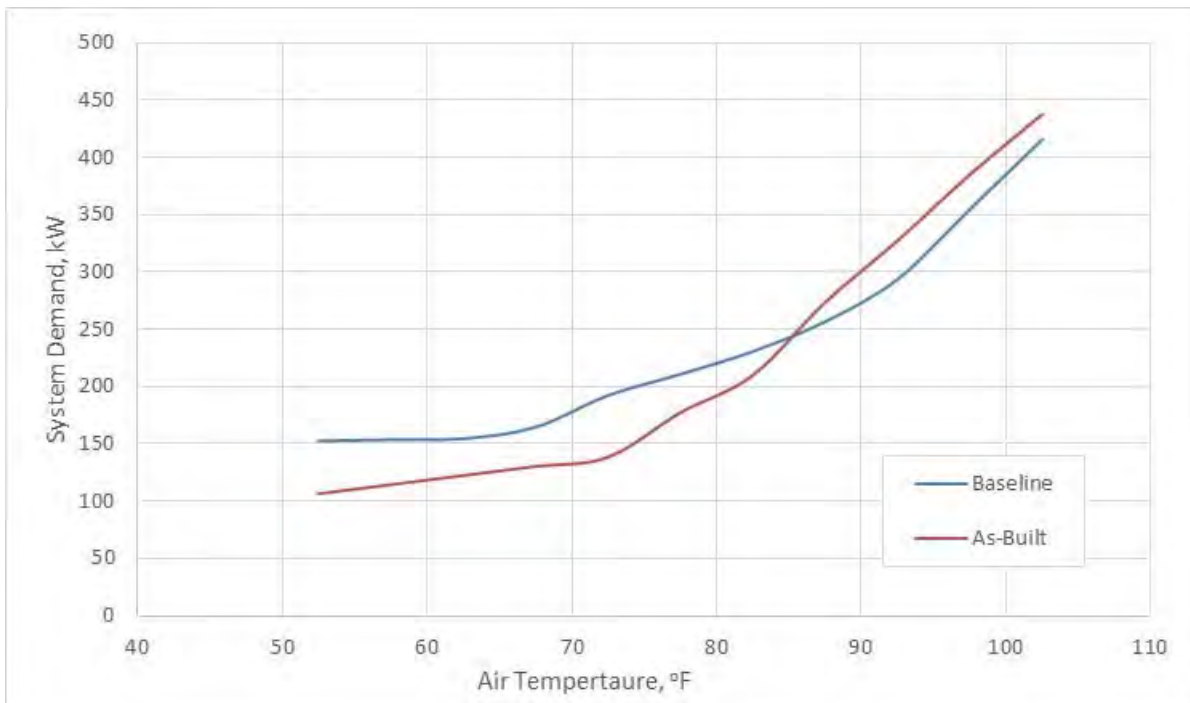
During the M&V visit, ADM staff verified the installation of (3) Adaptive Frequency Drives (AFDs) on (3) existing water-cooled chillers. The existing chilled water system consisted of (2) 600 Ton Trane CenTraVac chillers and (1) 300 Ton Trane CenTraVac chiller. The new AFDs allow for the chillers to operate a more efficiency part loads, thus reducing energy consumption of the system. While on site, ADM staff also collected a little over a month worth of EMS trending data for each of the chillers.

Analysis Results

Chiller AFD Savings Calculations

Energy savings for the installation of the AFDs was calculated using a temperature bin analysis informed by pre- and post-retrofit monitoring data provided by the facility's EMS. Each trend for the pre- and post- retrofit chillers consisted of 10 minute interval recordings of a given chillers amps, volts, and power factor. Using standard engineering power equations, these recordings were then converted to kW demand. The determined kW demand for each interval recording was compared to weather data from the closest NOAA weather station. Using five degree temperature bins, the average chilled water system demand was determined for both the pre- and post-retrofit monitoring periods. Upon determining the average kW demand of each system for each five degree temperature bin, corresponding typical annual hours for each temperature bin were sourced from TMY3 weather files for the St. Louis region. The annual savings for a given temperature bin is the difference between the average baseline and as-built kW demand, multiplied by the number of hours in a typical year. The total annual savings for the project is the sum of the savings for each five degree temperature bin. The following graph compares the efficiency of the baseline chillers with AFDs to the as-built chillers with AFDs:

Baseline vs As-Built System Efficiency



The following table presents the results of the temperature bin analysis:

AFD Energy Savings

Temperature			Annual Hours	kW Demand		Annual kWh		
High	Low	Average		Baseline	As-Built	Baseline	As-Built	Savings
105	100	102.5	1	415.59	437.55	416	438	-22
100	95	97.5	46	354.59	384.99	16,311	17,710	-1,399
95	90	92.5	154	293.59	327.25	45,212	50,396	-5,183
90	85	87.5	297	256.72	273.50	76,246	81,230	-4,984
85	80	82.5	551	230.59	209.82	127,054	115,609	11,445
80	75	77.5	687	210.79	177.23	144,815	121,755	23,060
75	70	72.5	917	192.25	138.38	176,295	126,897	49,398
70	65	67.5	765	164.61	130.40	125,924	99,755	26,169
65	60	62.5	692	154.57	122.42	106,959	84,711	22,248
60	55	57.5	578	153.57	114.43	88,765	66,142	22,624
55	50	52.5	569	152.58	106.45	86,819	60,569	26,250
Total			5,257	-	-	994,818	825,212	169,606

Verified annual savings for installation of the AFDs is 169,606 kWh, resulting in a site-level realization rate of 54%. The difference in savings can be attributed to the assumptions made in the ex ante analysis. Like the ex post analysis, the ex ante analysis utilized a temperature bin methodology to calculate the savings. The ex ante bin analysis assumed that at the highest temperature bin the chilled water system would have a total load of 900 Tons. The load would then decrease linearly until the 50F

degree bin, which is when the chillers are set to not operate. The pre and post chiller system efficiencies, kW/ton, were hard coded and no supporting calculations were provided. On the other hand, the ex post analysis relied on pre- and post-retrofit monitoring data of each of the (3) chillers to determine the average system kW demand for each temperature bin.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	Cooling	315,000	169,606	54%	286.87
Total		315,000	169,606	54%	286.87

Data Collection

The participant received custom incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the installation of the new Gardner Denver L55RS VFD equipped air compressor which replaced the need for two existing Gardner Denver ST50 and a single Gardner Denver ST60 air compressor. Through interviews with site contacts it was determined that the new VFD equipped compressor acts as the trim compressor while an existing Gardner Denver ST60 air compressor base loads.

Analysis Results

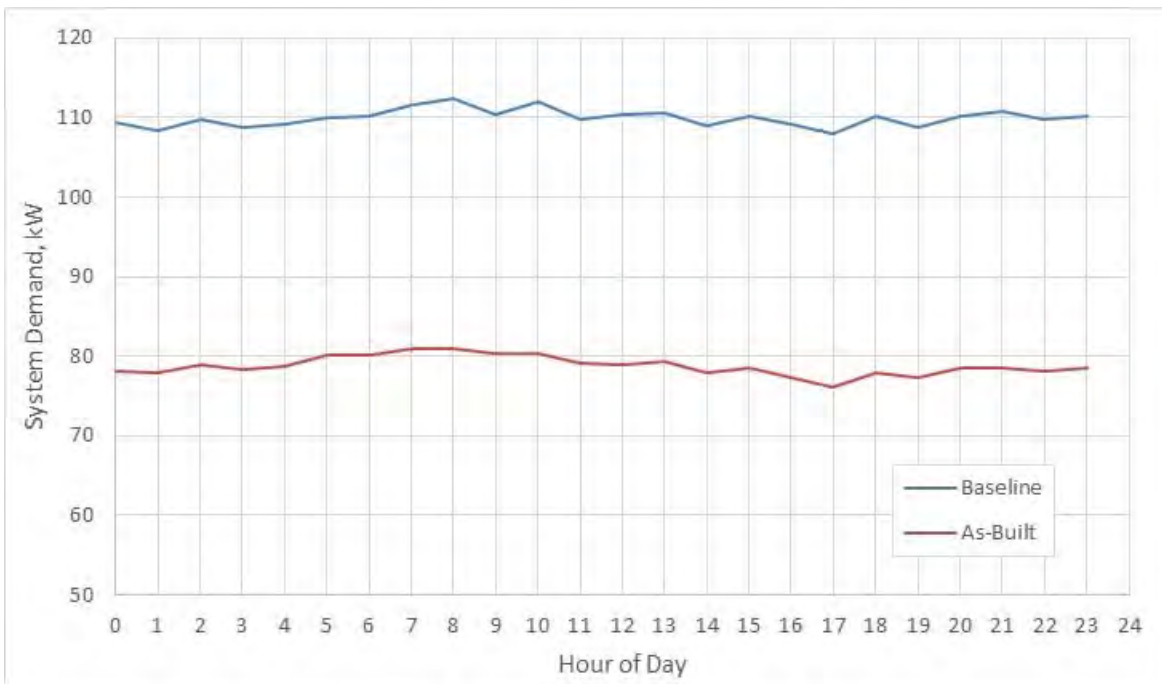
VFD Air Compressor Savings Calculations

Energy savings for the installation of the new variable speed air compressor were calculated using baseline amperage monitoring data that was collected and provided by the trade ally. Amperage recording of the (3) baseline air compressors occurred at one second intervals and encompassed approximately seven days of typical air compressor operation.

Using the provided amperage monitoring data, corresponding baseline compressor kW demands were determined for each recorded data point. This was accomplished using Department of Energy (DOE) power factor curves, which utilize percent full load amps to estimate the corresponding power factor of the system. Upon the calculation of the kW demands for each baseline monitoring data points, the corresponding CFM output of the baseline compressors was calculated using compressor efficiency curves from Chapter 22 of the Uniform Methods Project. Assuming that the CFM for the pre- and post-retrofit compressor system remains the same, the demand of the as-built system was determined through the use of CAGI compressor curves for the newly installed L55RS air compressor and UMP compressor curves for the existing ST60 air compressor. It was assumed that the ST60 air compressor would operate fully loaded while the new L55RS air compressor acts as trim.

Annual energy savings was then determined by extrapolating the baseline and as-built load profiles to an entire year. The kWh savings is then calculated as the difference between the baseline and as-built consumption. The following graph compares the average daily compressor system demand for the as-built and baseline systems for an average weekday:

Baseline vs As-Built Typical Weekday Load Profile



Verified annual savings for installation of the VFD equipped air compressor is 271,040 kWh, resulting in a site-level realization rate of 100%. The 100% realization rate can be attributed to similar methodologies being utilized along with baseline monitoring data.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Compressed Air	271,664	271,040	100%	37.39
Total		271,664	271,040	100%	37.39

Data Collection

The participant received custom incentives from Ameren Missouri.

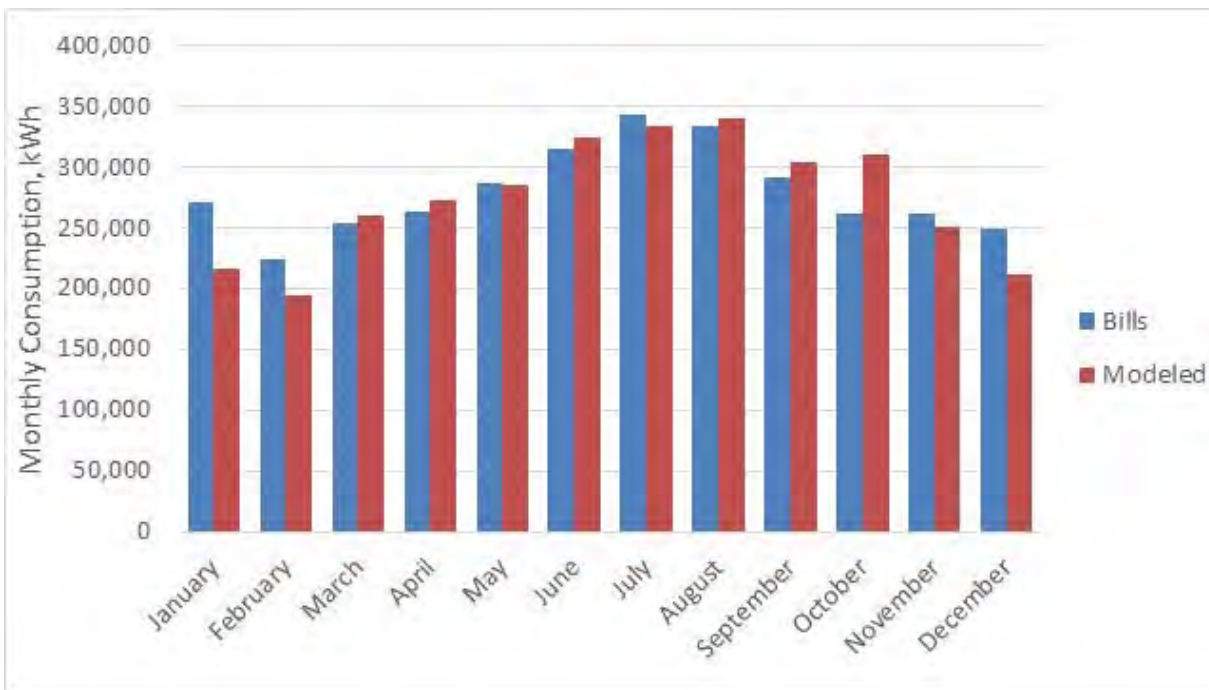
During the M&V visit, ADM staff verified the installation of a new 375 Ton VFD equipped chiller, which is acting as the primary cooling source for the 24 story office building. Field staff also collected specifics about the construction of the facility, occupancy rates, internal loads, HVAC equipment, and HVAC operation.

Analysis Results

VFD Chiller Savings Calculations

Energy savings for the installation of the new VFD equipped chillers was calculated through the use of a Trane Trace 700 energy simulation. As part of the project documentation, ADM was provided the input of the Trane Trace model used to estimate initial energy savings. ADM reviewed the model's inputs and made minor adjustments based on information collected during the on-site visit. The model was then run using 2016 weather data for the St. Louis region to ensure that the model was properly calibrated, and the energy consumption properly reflected the energy consumption of the facility. The results of the calibration effort can be seen in the following graphic:

Trane Trace Model Calibration



Upon verifying the calibration of the initial baseline model, an alternative model run was utilized in Trane Trace to determine the impact on energy consumption that the new VFD chiller would have. The two models were run using TMY3 weather for the region to determine the typical annual savings for the project. The annual savings is the difference between the annual consumption of the baseline and as-built model. The savings results from the model are presented in the following table:

VFD Chiller Energy Savings

Month	TMY3 Savings		
	Baseline	As-Built	Savings
January	212,898	212,898	0
February	191,952	191,952	0
March	217,629	217,629	0
April	251,226	241,849	9,377
May	284,296	263,200	21,096
June	299,202	273,875	25,327
July	322,429	294,791	27,638
August	319,302	293,884	25,418
September	276,241	255,375	20,866
October	263,942	254,681	9,261
November	229,243	228,820	423
December	209,715	209,715	0
Total	3,078,075	2,938,669	139,406

Verified annual savings for installation of the new VFD equipped chiller is 139,406 kWh, resulting in a site-level realization rate of 96%. The small difference in savings can be attributed to small changes being made in the original Trane Trace model, based on information collected during ADM's site visit. These changes were made to increase the accuracy of the model and calibration.

Site-Level Energy Savings

Program	End Use Category	kWh Savings			Gross Ex Post kW Reduction
		Gross Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate	
Custom	Cooling	144,764	139,406	96%	126.95
Total		144,764	139,406	96%	126.95

Data Collection

The participant received custom incentives from Ameren Missouri.

During the M&V visit, ADM staff verified the installation of DrivePak supply fan controllers on (17) 15 Ton rooftop units serving the facility. Each of the DrivePak controllers allows for the speed of the 5 Hp supply fans to be staged based upon the demand of the cooling and heating stages of the unit. NexRev, the manufacturer of DrivePak, also provided fan setpoint tables for how the fans would be operated based on the cooling/heating stages of the units.

Analysis Results

NexRev DrivePak Savings Calculations

Energy savings for the installation of the DrivePak controls on (17) 5 Hp supply fans was calculated using outputs from a prototypical eQuest model to inform a bin style calculation. Using the eQuest prototypical *Large Retail* model as a starting point, changes were made to the model to reflect actual characteristics of the facility. These changes included: hours of operation, number of HVAC zones, and typical temperature setpoints. The model was then run using TMY3 weather for St. Louis, MO area in which the cooling and heating Part Load Ratios (PLR) for each of the (17) HVAC units was outputted at an hourly level. Using the PLRs, the number of hours each unit spent in; Cooling Stage 1, Cooling Stage 2, Heating Stage 1, and Heating Stage 2 was calculated.

The hours of operation for each heating and cooling stage was used to inform the following bin calculation which utilizes the Affinity Laws to determine the resulting as-built fan kW demand at a given speed:

NexRev DrivePak Energy Savings

Variable	Heat		Cool	
	Stage 1	Stage 2	Stage 1	Stage 2
Hours	1,366	96	546	2,353
Fan Speed	60%	81%	60%	80%
Baseline kW	3.95	3.95	3.95	3.95
Affinity Power	2.7	2.7	2.7	2.7
VFD Efficiency	96.5%	96.5%	96.5%	96.5%
As-Built Fan kW	1.03	2.32	1.03	2.24
kW Reduction	2.92	1.63	2.92	1.71
# Fans	17	17	17	17
Total kW Reduction	49.62	27.75	49.62	29.05
kWh Savings	67,797	2,654	27,106	68,361
Total kWh Savings	165,918			

Verified annual savings for installation of the DrivePak controls is 165,918 kWh, resulting in a site-level realization rate of 107%. The difference in savings can be attributed to the assumptions used in the ex-ante calculations. The ex-ante calculations assumed that the fans would operate at 65% speed, 65%

of the time and 83% speed, 35% of the time. The ex-ante also assumed that the fans have a typical annual operation of 3,800 hours compared to the 4,361 hours determined using the eQuest model.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Custom	HVAC	155,346	165,918	107%	73.66
Total		155,346	165,918	107%	73.66

Data Collection

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

During the M&V visit, ADM staff verified equipment installation, post-retrofit connected loads, and determined the lighting operating schedule. Annual lighting operating hours were verified by interviewing facility personnel regarding lighting operating schedules.

Analysis Results

Lighting Retrofit Savings Calculations

<i>Measure Number/Name</i>	<i>TRM Measure Reference Number</i>	<i>End Use Category</i>	<i>Program</i>	<i>Baseline Quantity</i>	<i>Efficient Quantity</i>	<i>Baseline Wattage</i>	<i>Efficient Wattage</i>	<i>Annual Hours of Operation</i>	<i>Heating Cooling Interaction Factor</i>	<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross kWh Realization Rate</i>
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	3005-1	Lighting	Standard	24	24	455	100	4,308	1.00	38,810	36,705	95%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	1169	Misc.	Custom	44	44	295	27	8,760	1.00	103,298	103,298	100%
Total										142,108	140,003	99%

The annual lighting hours of operation for the first line item above with fixtures using photo cells (4,308⁴⁴⁸) are less than the hours of operation used to calculate ex ante savings (4,380). The second line item is consistent with the ex ante hours (8,760).

A heating and cooling interactive factor of 1.00, was applied to the ex post lighting energy savings since the installation location was unconditioned. The ex ante savings estimate did not account for heating and cooling interactive factors for the second line item in the table above but used a factor of 1.04 for the first line item.

The peak coincident demand reduction was determined by applying the corresponding end use kW factor to the kWh savings.⁴⁴⁹

A table showing the energy savings achieved by the measures evaluated for this site is shown below. The overall gross realization rate is 99%. The ex ante energy savings estimate was premised on overestimated annual lighting operating hours for the first line item and overestimated heating and cooling interactive effects.

⁴⁴⁸ Sun or Moon Rise/Set Table for One Year. U.S. Naval Observatory. <http://aa.usno.navy.mil/data/docs/RS_OneYear.php>

⁴⁴⁹ Ameren Missouri (Cycle 2) Missouri Energy Efficiency Investment Act (MEEIA) filing.

Site-Level Energy Savings

<i>Program</i>	<i>End Use Category</i>	<i>kWh Savings</i>			<i>Gross Ex Post kW Reduction</i>
		<i>Gross Ex Ante kWh Savings</i>	<i>Gross Ex Post kWh Savings</i>	<i>Gross Realization Rate</i>	
Standard	Lighting	38,810	36,705	95%	6.97
Custom	Miscellaneous	103,298	103,298	100%	14.25
Total		142,108	140,003	99%	21.22

3. Sampling Plans

This appendix presents detailed technical data regarding the sampling plans that facilitated estimation of energy savings.

Table 3-1 shows the Custom Program project population from which the sample was drawn.¹ These samples fell into five energy savings strata defined by ex ante kWh savings boundaries. Note that in this table, as well as in succeeding tables presenting population statistics used for sample design, the values presented, including coefficients of variation, are calculated based on final program data.

Table 3-1 Population Statistics Used for Custom Program Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Stratum 4</i>	<i>Stratum 5</i>	<i>Totals</i>
Strata boundaries (kWh)	1,534,507 - 1,100,000	1,100,000 - 800,000	800,000 - 300,000	300,000 - 75,000	75,000 - 0	
Population Size	4	5	41	151	742	943
Total kWh savings	5,869,653	4,503,03	19,731,32	22,138,95	13,924,01	66,166,97
Average kWh	1,467,413	900,607	481,252	146,616	18,766	
Standard deviation of kWh	70,619	59,817	159,139	60,439	16,229	
Coefficient of	0.05	0.07	0	0	1	
Final design sample	3	1	15	33	51	103

Table 3-2 shows the Standard non-HIM population from which the sample was drawn. These samples fell into five energy savings strata defined by ex ante kWh savings boundaries.

Table 3-2 Population Statistics Used for Non-HIM Standard Program Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Stratum 4</i>	<i>Stratum 5</i>	<i>Totals</i>
Strata boundaries (kWh)	1,307,602 - 250,000	250,000 - 100,000	100,000 - 50,000	50,000 - 5,000	5,000 - 0	
Population Size	10	46	118	1,052	573	1,799
Total kWh savings	5,991,521	6,808,032	8,036,926	18,732,430	1,443,063	41,011,972
Average kWh Savings	599,152	148,001	68,110	17,806	2,518	
Standard deviation of kWh	416,285	37,486	13,363	11,351	1,325	
Coefficient of variation	0.69	0.25	0	1	1	
Final design sample	2	8	24	116	33	183

Table 3-3 shows the Standard high impact measure 3025 LED linear lamp replacing T8 fluorescent lamp population from which the sample was drawn. These samples fell into three energy savings strata defined by ex ante kWh savings boundaries.

Table 3-3 Statistics Used for Standard Program HIM 3025 Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Totals</i>
Strata boundaries (kWh)	1,475,798 - 300,000	300,000 - 50,000	50,000 - 0	
Population Size	17	151	997	1,165
Total kWh savings	9,562,741	15,494,934	13,373,079	38,430,754
Average kWh Savings	562,514	102,615	13,413	
Standard deviation of kWh	293,828	54,855	13,145	
Coefficient of variation	0.5	0.5	1	
Final design sample	8	36	73	117

Table 3-4 shows the Standard high impact measure 3026 LED linear lamp replacing T12 fluorescent lamp population from which the sample was drawn. These samples fell into three energy savings strata defined by ex ante kWh savings boundaries.

Table 3-4 Population Statistics Used for Standard Program HIM 3026 Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Totals</i>
Strata boundaries (kWh)	409,996 - 100,000	100,000 - 30,000	30,000 - 0	
Population Size	18	140	1,028	1,186
Total kWh savings	2,707,144	6,862,620	7,853,553	17,423,317
Average kWh Savings	150,397	49,019	7,640	
Standard deviation of kWh	76,964	16,394	7,062	
Coefficient of variation	0.5	0.3	0.9	
Final design sample	5	30	74	109

Table 3-5 shows the New Construction project population from which the sample was drawn. These samples fell into four energy savings strata defined by ex ante kWh savings boundaries.

Table 3-5 Population Statistics Used for New Construction Program Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Stratum 4</i>	<i>Totals</i>
Strata boundaries (kWh)	14,987,668 - 5,000,000	5,000,000 - 480,000	480,000 - 100,000	100,000 - 0	
Population Size	1	7	7	13	28
Total kWh savings	15,256,422	8,318,451	1,914,055	422,833	25,911,761
Average kWh Savings	15,256,422	1,188,350	273,436	32,526	
Standard deviation of kWh	-	924,927	96,334	26,716	
Coefficient of variation	-	0.8	0	1	
Final design sample	1	5	4	1	11

Table 3-6 shows the Retro-Commissioning projects with the four sampling strata and the ex ante kWh savings.

Table 3-6 Population Statistics Used for Retro-Commissioning Program Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Stratum 4</i>	<i>Totals</i>
Strata boundaries (kWh)	1,575,980 - 1,000,000	1,000,000 - 500,000	500,000 - 175,000	175,000 - 0	
Population size	1	1	3	4	9
Total kWh savings	1,575,980	507,414	991,660	338,100	3,413,154
Average kWh savings	1,575,980	507,414	330,553	84,525	
Standard deviation of kWh	-	-	54,803	64,958	
Coefficient of variation	-	-	0	1	
Final design sample	1	1	1	2	5

Table 3-7 shows the Small Business Direct Install non-HIM population from which the sample was drawn. These samples fell into three energy savings strata defined by ex ante kWh savings boundaries.

Table 3-7 Population Statistics Used for Non-HIM Small Business Direct Install Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Totals</i>
Strata boundaries (kWh)	51,922 - 20,000	20,000 - 10,000	10,000 - 0	
Population Size	16	58	372	446
Total kWh savings	484,186	771,031	1,221,064	2,476,281
Average kWh Savings	30,262	13,294	3,282	
Standard deviation of kWh	9,784	2,521	2,642	
Coefficient of variation	0.3	0.2	0.8	
Final design sample	4	10	60	74

Table 3-8 shows the Small Business Direct Install high impact measure 3026 LED linear lamp replacing T12 fluorescent lamp population from which the sample was drawn. These samples fell into four energy savings strata defined by ex ante kWh savings boundaries.

Table 3-8 Population Statistics Used for SBDI Program HIM 3026 Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Stratum 4</i>	<i>Totals</i>
Strata boundaries (kWh)	44,648 - 30,000	30,000 - 10,000	10,000 - 4,000	4,000 - 0	
Population Size	5	40	99	146	290
Total kWh savings	199,982	645,577	582,377	258,390	1,686,326
Average kWh Savings	39,996	16,139	5,883	1,770	
Standard deviation of kWh	4,563	5,473	1,472	1,200	
Coefficient of variation	0.1	0.3	0	1	
Final design sample	2	17	16	25	60

Table 3-9 shows the Small Business Direct Install high impact measure, 3084 delamping T8 or T12 linear fluorescent lamp, population from which the sample was drawn. These samples fell into three energy saving strata defined by ex ante kWh savings boundaries.

Table 3-9 Population Statistics Used for SBDI Program HIM 3084 Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Totals</i>
Strata boundaries (kWh)	40,792 - 13,000	13,000 - 4,900	4,900 - 0	
Population Size	15	47	106	168
Total kWh savings	295,024	379,292	241,150	915,466
Average kWh Savings	19,668	8,070	2,275	
Standard deviation of kWh	6,818	2,197	1,457	
Coefficient of variation	0.3	0.3	0.6	
Final design sample	5	10	23	38

Table 3-10 shows the Small Business Direct Install high impact measure, 3007 LED screw in lamp replacing incandescent or halogen reflector lamp, population from which the sample was drawn. These samples fell into three energy savings strata defined by ex ante kWh savings boundaries.

Table 3-10 Population Statistics Used for SBDI Program HIM 3007 Sample Design

<i>Variables</i>	<i>Stratum 1</i>	<i>Stratum 2</i>	<i>Stratum 3</i>	<i>Totals</i>
Strata boundaries (kWh)	32,906 - 8,000	8,000 - 3,000	3,000 - 0	
Population Size	32	54	94	180
Total kWh savings	447,970	271,168	93,835	812,973
Average kWh Savings	13,999	5,022	998	
Standard deviation of kWh	4,734	1,404	765	
Coefficient of variation	0.3	0.3	0.8	
Final design sample	15	11	20	46

The Custom Program stratified sample shown in Table 3-11 resulted in samples that total 28% of the ex ante population kWh savings.

Table 3-11 Ex Ante kWh Savings of Custom Program Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	4,479,545	5,869,653	76%
2	973,543	4,503,035	22%
3	6,995,575	19,731,321	35%
4	5,123,344	22,138,956	23%
5	1,090,611	13,924,011	8%
Total	18,662,618	66,166,976	28%

The standard non-HIM projects' stratified sample shown in Table 3-12 resulted in samples that total 14% of the ex ante population kWh savings.

Table 3-12 Ex Ante kWh Savings of Non-HIM Standard Program Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	564,533	5,991,521	9%
2	1,168,933	6,808,032	17%
3	1,618,324	8,036,926	20%
4	2,487,365	18,732,430	13%
5	78,610	1,443,063	5%
Total	5,917,765	41,011,972	14%

The standard HIM 3025 projects stratified sample shown in Table 3-13 resulted in samples that total 24% of the ex ante population kWh savings.

Table 3-13 Ex Ante kWh Savings of Standard Program HIM 3025 Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	3,973,369	9,562,741	42%
2	3,967,917	15,494,934	26%
3	1,105,376	13,373,079	8%
Total	9,046,662	38,430,754	24%

The standard HIM 3026 projects stratified sample shown in Table 3-14 resulted in samples that total 17% of the ex ante population kWh savings.

Table 3-14 Ex Ante kWh Savings of Standard Program HIM 3026 Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	604,012	2,707,144	22%
2	1,642,120	6,862,620	24%
3	791,715	7,853,553	10%
Total	3,037,847	17,423,317	17%

The new construction projects' stratified sample shown in Table 3-15 resulted in samples that total 87% of the ex ante population kWh savings.

Table 3-15 Ex Ante kWh Savings of New Construction Program Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	15,256,422	15,256,422	100%
2	5,970,449	8,318,451	72%
3	1,111,463	1,914,055	58%
4	82,033	422,833	19%
Total	22,420,367	25,911,761	87%

The retro-commissioning project census shown in Table 3-16 resulted in samples that total 79% of ex ante population kWh savings.

Table 3-16 Ex Ante kWh Savings of Retro-Commissioning Program Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	1,575,980	1,575,980	100%
2	507,414	507,414	100%
3	357,664	991,660	36%
4	267,008	338,100	79%
Total	2,708,066	3,413,154	79%

The small business direct install non-HIM projects stratified sample shown in Table 3-17 resulted in samples that total 17% of the ex ante population kWh savings.

Table 3-17 Ex Ante kWh Savings of Small Business Direct Install Non-HIM Program Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	107,881	484,186	22%
2	123,053	771,031	16%
3	197,912	1,221,064	16%
Total	428,846	2,476,281	17%

The small business direct install HIM 3026 projects stratified sample shown in Table 3-18 resulted in samples that total 31% of the ex ante kWh savings.

Table 3-18 Ex Ante kWh Savings of SBDI HIM 3026 Program Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	86,381	199,982	43%
2	289,288	645,577	45%
3	89,556	582,377	15%
4	52,734	258,390	20%
Total	517,969	1,686,326	31%

The small business direct install HIM 3084 projects stratified sample shown in Table 3-19 resulted in samples that total 22% of the ex ante population kWh savings.

Table 3-19 Ex Ante kWh Savings of SBDI HIM 3084 Program Sampled Projects by Stratum

<i>Stratum</i>	<i>Sample Ex Ante kWh Savings</i>	<i>Total Ex Ante kWh Savings</i>	<i>Percentage of Ex Ante Savings in Sample</i>
1	89,034	295,024	30%
2	74,938	379,292	20%
3	39,801	241,150	17%
Total	203,773	915,466	22%

4. Ex Post Gross Savings Technical Data

This appendix presents detailed technical data regarding the estimation of ex post gross energy savings.

4.1. M&V Sample Site-Level and Measure-Level Gross Savings

Table 4-1 shows the ex ante and ex post gross Custom Program energy savings by sample site.

Table 4-1 Ex Ante and Ex Post Gross Annual kWh Savings for Custom Program by Sampled Site

<i>Custom ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5025	9,120	8,062	88%
5030	9,418	7,704	82%
5032	51,248	41,395	81%
5035	21,024	20,752	99%
5036	13,968	11,557	83%
5037	2,022	1,322	65%
5038	18,287	27,265	149%
5039	10,638	7,675	72%
5040	11,990	18,779	157%
5045	26,981	29,883	111%
5046	33,373	34,302	103%
5048	2,582	1,547	60%
5057	86,593	81,734	94%
5063	83,122	84,172	101%
5064	14,297	12,428	87%
5068	25,646	19,811	77%
5097	3,416	3,736	109%
5124	46,349	19,761	43%
5128	24,458	23,814	97%
5156	9,407	8,746	93%
5160	6,793	8,683	128%
5166	185,438	267,715	144%
5172	1,440	1,388	96%
5176	48,310	47,458	98%
5180	24,118	16,829	70%
5185	12,300	11,058	90%
5191	468,068	38,792	8%
5192	235,951	218,868	93%
5193	315,000	169,606	54%

<i>Custom ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5196	271,664	271,040	100%
5198	1,425,449	2,041,790	143%
5202	95,309	86,463	91%
5204	6,766	3,672	54%
5209	61,756	30,069	49%
5222	8,708	3,666	42%
5223	318,720	447,690	140%
5231	24,695	15,670	63%
5238	30,783	22,127	72%
5245	151,373	156,054	103%
5258	28,910	21,432	74%
5266	329,129	288,472	88%
5267	310,556	306,898	99%
5268	147,406	105,178	71%
5270	28,242	23,991	85%
5271	86,882	62,570	72%
5273	309,348	413,894	134%
5274	723	561	78%
5284	297,651	373,330	125%
5286	17,433	20,911	120%
5288	30,368	32,454	107%
5308	23,851	24,589	103%
5309	15,332	13,297	87%
5313	35,669	32,310	91%
5316	803	213	27%
5330	295,902	366,280	124%
5331	693	232	33%
5337	646,455	658,809	102%
5338	337,627	462,926	137%
5339	173,619	167,437	96%
5349	539,788	535,234	99%
5350	32,400	43,603	135%
5352	156,702	243,667	155%
5369	40,765	46,566	114%
5372	263,158	253,682	96%
5376	413,289	413,302	100%
5377	110,397	116,992	106%
5381	103,298	103,298	100%
5388	25,176	25,762	102%
5390	749,462	739,740	99%
5391	973,543	973,543	100%

<i>Custom ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5392	1,519,589	731,727	48%
5393	761,454	673,305	88%
5394	136,124	241,110	177%
5395	252,244	250,057	99%
5396	37,356	38,932	104%
5397	144,764	139,406	96%
5398	18,501	17,148	93%
5399	3,353	3,194	95%
5401	149,565	191,916	128%
5405	14,183	14,183	100%
5408	83,329	71,689	86%
5409	155,346	165,918	107%
5411	60,832	58,890	97%
5415	80,776	84,994	105%
5418	29,393	22,993	78%
5420	248,157	256,575	103%
5451	536,501	557,127	104%
5452	1,534,507	1,380,831	90%
5464	103,793	101,539	98%
5475	421,788	368,070	87%
5481	89,037	90,282	101%
5483	707,309	633,863	90%
5488	110,026	122,532	111%
5489	192,357	189,198	98%
5495	267,049	262,723	98%
5496	205,536	202,112	98%
5505	78,592	66,251	84%
Sampled Total	18,662,618	18,130,823	97%
All Non-Sample Measures	47,504,358	46,520,434	98%
Total	66,166,976	64,651,256	98%

The ex post gross kWh savings of the sampled Custom Program measures are presented in Table 4-2.

Table 4-2 Ex Ante and Ex Post Gross Annual kWh Savings for Sampled Custom Program Measures

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
100101-Lighting-Linear Tube LED Fixture Replacing T12 Fixture	386,367	394,975	102%

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
100102-Lighting-Linear Tube LED Fixture Replacing T12 HO Fixture	18,501	17,148	93%
100104-Lighting-Linear Tube LED Fixture Replacing T8 Fixture	751,984	665,726	89%
100105-Lighting-Linear Tube LED Fixture Replacing T8 HO Fixture	94,489	90,363	96%
100107-Lighting-Linear Tube LED Fixture Replacing T5 HO Fixture	1,319,004	1,458,595	111%
100111-Lighting-Linear Tube LED Fixture Replacing High Pressure Sodium Fixture	207,752	206,007	99%
100113-Lighting-Linear Tube LED Fixture Replacing CFL Fixture	74,766	72,848	97%
100116-Lighting-Linear Tube LED Fixture Replacing Existing Inefficient Lighting Fixture	126,020	132,757	105%
100201-Lighting-Non Linear LED Fixture Replacing T12 Fixture	918,421	711,917	78%
100202-Lighting-Non Linear LED Fixture Replacing T12 HO Fixture	655,529	599,106	91%
100204-Lighting-Non Linear LED Fixture Replacing T8 Fixture	1,465,676	1,827,729	125%
100205-Lighting-Non Linear LED Fixture Replacing T8 HO Fixture	230,598	239,048	104%
100207-Lighting-Non Linear LED Fixture Replacing T5 HO Fixture	19,040	14,377	76%
100208-Lighting-Non Linear LED Fixture Replacing Metal Halide Fixture	7,229,775	6,352,774	88%
100210-Lighting-Non Linear LED Fixture Replacing Mercury Vapor Fixture	1,135	1,105	97%
100211-Lighting-Non Linear LED Fixture Replacing High Pressure Sodium Fixture	28,776	28,335	98%
100212-Lighting-Non Linear LED Fixture Replacing Incandescent/Halogen Lamp Fixture	273,491	355,464	130%
100213-Lighting-Non Linear LED Fixture Replacing CFL Fixture	537,506	558,231	104%
100214-Lighting-Non Linear LED Fixture Replacing Inefficient Signage Fixture	24,528	24,125	98%
100216-Lighting-Non Linear LED Fixture Replacing Existing Inefficient Lighting Fixture	190,173	228,157	120%
100401-Lighting-T8 32 Watt Fixture Replacing T12 Fixture	1,900	2,684	141%
100402-Lighting-T8 32 Watt Fixture Replacing T12 HO Fixture	2,244	1,761	78%
100408-Lighting-T8 32 Watt Fixture Replacing Metal Halide Fixture	47,104	36,951	78%
100504-Lighting-T8 28 Watt Fixture Replacing T8 Fixture	384,485	406,528	106%
100604-Lighting-T8 25 Watt Fixture Replacing T8 Fixture	1,791	1,688	94%
101108-Lighting-New Efficient Lighting Fixture Replacing Metal Halide Fixture	4,897	4,746	97%
101113-Lighting-New Efficient Lighting Fixture Replacing CFL Fixture	239	33	14%
103621-Lighting-On/Off Occupancy Sensor Replacing No Existing Equipment or Replacing Failed Equipment	370,869	366,315	99%

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
112420-HVAC-Water Cooled Chiller Replacing Existing Inefficient Equipment or Early Replacement	144,764	139,406	96%
112620-HVAC-VFD for Chiller Replacing Existing Inefficient Equipment or Early Replacement	235,951	218,868	93%
112621-HVAC-VFD for Chiller Replacing No Existing Equipment or Replacing Failed Equipment	110,397	116,992	106%
113220-HVAC-HVAC Controls / EMS Replacing Existing Inefficient Equipment or Early Replacement	121,859	121,859	100%
113320-HVAC-VFD for Fan Replacing Existing Inefficient Equipment or Early Replacement	155,346	165,918	107%
115721-HVAC-Chiller Control Optimization Replacing No Existing Equipment or Replacing Failed Equipment	315,000	169,606	54%
115920-HVAC-Cooling Only HVAC Equipment Replacing Existing Inefficient Equipment or Early Replacement	47,060	47,060	100%
125120-Refrigeration-Head Pressure Control Replacing Existing Inefficient Equipment or Early Replacement	1,425,449	2,041,790	143%
154320-Process-Compressor Optimization Replacing Existing Inefficient Equipment or Early Replacement	271,664	271,040	100%
181220-Compressed Air-Compressed Air Optimization Replacing Existing Inefficient Equipment or Early Replacement	468,068	38,792	8%
Total	18,662,618	18,130,823	97%

Table 4-3 shows the ex ante and ex post gross energy savings of the EMS Pilot Program by site. Note that for the EMS Pilot Program, the evaluation team perform an M&V census rather than develop a sample.

Table 4-3 Ex Ante and Ex Post Gross Annual kWh Savings for EMS Pilot Program Sites

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5377	182,165	175,292	96%
5533	225,923	185,220	82%
5638	135,738	111,087	82%
5639	66,399	71,868	108%
5640	241,941	242,786	100%
5641	14,250	14,207	100%
5644	34,725	37,810	109%
Total	901,141	838,270	93%

The ex post gross kWh savings of the EMS Pilot Program are presented by measure in Table 4-4.

Table 4-4 Ex Ante and Ex Post Gross Annual kWh Savings for EMS Pilot Program Measures

<i>EMS Program Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
117920-HVAC-Cooling Replacing Existing System	421,659	372,662	88%
118120-HVAC-Heating Replacing Existing System	244,450	250,197	102%
118220-HVAC-HVAC Replacing Existing System	235,032	215,411	92%
Total	901,141	838,270	93%

Table 4-5 shows the ex ante and ex post gross Standard Program annual energy savings by sample site.

Table 4-5 Ex Ante and Ex Post Gross Annual kWh Savings for Standard Program by Sampled Site

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5001	10,900	15,703	144%
5004	8,387	1,292	15%
5006	41,647	67,909	163%
5007	47,660	32,498	68%
5009	17,934	18,900	105%
5010	3,848	3,505	91%
5011	73,532	72,197	98%
5012	35,531	33,369	94%
5013	3,426	6,639	194%
5015	16,710	14,223	85%
5016	43,689	41,604	95%
5017	94,293	69,710	74%
5018	3,000	2,679	89%
5021	7,171	5,433	76%
5022	3,701	5,532	149%
5026	11,307	16,734	148%
5027	38,877	47,284	122%
5029	6,795	5,379	79%
5031	71,301	59,570	84%
5039	12,287	12,150	99%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5042	57,445	65,261	114%
5045	11,784	13,940	118%
5046	8,440	6,254	74%
5048	5,409	5,544	102%
5049	36,652	38,402	105%
5050	2,048	2,331	114%
5051	17,200	21,346	124%
5053	58,702	58,066	99%
5054	51,469	43,268	84%
5056	6,907	4,381	63%
5058	43,235	40,483	94%
5059	5,480	6,639	121%
5060	1,094	1,242	114%
5061	40,962	31,200	76%
5062	3,244	1,694	52%
5063	4,800	6,647	138%
5064	10,950	11,760	107%
5066	157,454	151,320	96%
5067	12,630	8,324	66%
5069	35,152	54,410	155%
5071	4,129	2,664	65%
5072	11,754	17,413	148%
5073	548,397	536,149	98%
5075	86,109	89,103	103%
5076	42,831	38,865	91%
5077	63,712	39,114	61%
5080	17,190	18,701	109%
5081	60,549	60,549	100%
5086	28,457	51,086	180%
5087	6,443	33,335	517%
5088	11,520	12,412	108%
5089	243,840	243,203	100%
5090	8,112	7,927	98%
5091	44,312	50,710	114%
5092	114,400	63,748	56%
5093	34,500	26,640	77%
5094	45,427	15,112	33%
5095	33,507	34,830	104%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5101	3,987	5,771	145%
5102	6,638	5,452	82%
5103	47,812	37,968	79%
5104	15,928	18,038	113%
5105	8,986	8,068	90%
5106	13,453	17,446	130%
5107	11,153	13,830	124%
5108	11,794	7,546	64%
5115	6,376	5,691	89%
5119	127,296	191,995	151%
5121	4,096	2,706	66%
5122	404	550	136%
5123	6,802	6,357	93%
5130	14,696	14,430	98%
5132	3,569	23,724	665%
5133	9,403	30,478	324%
5134	7,627	7,207	94%
5135	87,186	73,781	85%
5136	7,700	7,517	98%
5140	8,374	9,503	113%
5143	6,447	5,768	89%
5148	18,702	11,525	62%
5149	9,579	8,392	88%
5151	20,539	20,076	98%
5156	659	447	68%
5158	1,477	1,444	98%
5159	11,133	11,170	100%
5160	4,364	918	21%
5161	10,183	10,375	102%
5166	15,728	29,412	187%
5167	61,651	46,803	76%
5168	2,621	5,192	198%
5172	385,713	335,469	87%
5173	681	554	81%
5175	9,734	15,326	157%
5176	162,350	154,285	95%
5177	28,938	23,523	81%
5178	61,617	43,907	71%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5179	42,391	9,657	23%
5180	6,924	661	10%
5181	23,168	29,147	126%
5185	1,265	1,414	112%
5187	12,927	14,884	115%
5199	21,156	6,224	29%
5201	17,482	8,517	49%
5203	44,181	92,440	209%
5204	107,940	59,892	55%
5205	35,618	36,826	103%
5209	38,460	15,897	41%
5211	41,380	53,226	129%
5212	26,742	26,128	98%
5213	69,999	37,181	53%
5214	16,208	16,522	102%
5215	34,004	17,121	50%
5216	54,103	43,931	81%
5217	31,091	35,835	115%
5218	26,919	21,014	78%
5221	22,693	19,428	86%
5222	22,975	15,914	69%
5224	29,761	21,279	71%
5226	70,467	68,838	98%
5227	24,613	13,711	56%
5229	17,013	20,600	121%
5232	51,021	64,855	127%
5234	20,431	17,390	85%
5235	15,368	26,033	169%
5237	24,989	22,257	89%
5238	6,460	5,309	82%
5242	18,217	19,688	108%
5245	18,000	17,268	96%
5246	32,667	35,210	108%
5248	35,571	47,384	133%
5249	42,339	28,884	68%
5251	157,227	148,307	94%
5252	17,463	7,903	45%
5253	33,926	35,284	104%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5254	43,160	22,048	51%
5255	27,998	15,163	54%
5256	89,488	105,363	118%
5257	40,843	51,791	127%
5258	363	90	25%
5259	43,203	29,732	69%
5260	15,604	24,491	157%
5261	22,785	19,762	87%
5262	96,948	115,980	120%
5274	477,375	278,877	58%
5276	54,320	53,095	98%
5278	25,480	22,530	88%
5281	31,064	34,256	110%
5282	92,163	75,184	82%
5285	18,232	24,036	132%
5287	86,084	49,729	58%
5291	15,860	16,230	102%
5292	21,460	16,232	76%
5293	17,036	16,898	99%
5295	21,788	27,462	126%
5296	46,507	38,855	84%
5297	514,427	501,927	98%
5299	50,452	13,173	26%
5300	39,517	41,160	104%
5302	15,279	23,389	153%
5303	22,261	20,805	93%
5304	36,954	28,624	77%
5307	17,221	31,354	182%
5310	41,129	9,074	22%
5312	39,087	55,266	141%
5314	28,892	26,866	93%
5315	26,439	24,218	92%
5316	449,039	514,286	115%
5317	15,142	16,950	112%
5318	28,652	33,348	116%
5320	89,086	98,956	111%
5321	16,585	8,584	52%
5322	92,912	95,786	103%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5323	93,036	74,696	80%
5325	23,402	28,957	124%
5327	16,067	17,589	109%
5328	87,712	75,706	86%
5329	97,256	108,828	112%
5331	625,576	597,233	95%
5332	18,728	8,374	45%
5336	144,685	191,277	132%
5339	64,418	54,960	85%
5340	100,529	80,569	80%
5344	102,277	65,807	64%
5345	69,929	85,517	122%
5346	58,943	39,256	67%
5348	53,846	63,864	119%
5349	383,940	367,447	96%
5350	29,484	25,722	87%
5351	269,640	307,447	114%
5353	76,752	78,906	103%
5354	52,476	64,759	123%
5358	81,774	69,914	85%
5360	56,046	14,660	26%
5365	85,756	67,299	78%
5366	160,129	197,192	123%
5368	198,675	176,125	89%
5369	125,583	122,840	98%
5372	37,110	39,451	106%
5373	236,381	133,020	56%
5374	58,601	46,808	80%
5381	38,810	36,705	95%
5382	128,647	127,829	99%
5384	99,235	85,265	86%
5385	93,397	57,844	62%
5386	90,686	30,402	34%
5387	58,550	85,149	145%
5388	63,479	81,047	128%
5389	125,896	106,812	85%
5396	32,328	33,696	104%
5398	547,184	545,793	100%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5399	196,770	96,226	49%
5401	139,845	22,972	16%
5405	91,373	89,279	98%
5411	1,538	1,506	98%
5412	77,979	80,197	103%
5413	492,974	546,899	111%
5415	9,730	10,238	105%
5417	240,926	197,081	82%
5418	47,859	44,310	93%
5420	102,823	96,360	94%
5424	90,991	61,296	67%
5425	122,319	94,870	78%
5426	54,923	28,249	51%
5427	77,584	60,213	78%
5428	68,964	35,152	51%
5429	59,188	55,386	94%
5433	97,645	103,998	107%
5434	99,083	133,655	135%
5435	54,408	99,045	182%
5436	61,568	78,315	127%
5437	115,975	87,250	75%
5438	97,822	79,226	81%
5439	107,842	129,927	120%
5440	80,685	47,866	59%
5441	53,366	26,876	50%
5442	52,226	65,704	126%
5443	56,624	59,701	105%
5444	55,327	45,321	82%
5445	56,130	65,980	118%
5446	70,554	59,689	85%
5447	50,273	77,316	154%
5449	66,768	72,715	109%
5451	24,589	26,598	108%
5452	24,090	24,090	100%
5462	258,700	181,752	70%
5464	54,965	58,491	106%
5481	231,590	204,568	88%
5482	16,614	23,692	143%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5488	160,712	177,031	110%
5497	277,272	277,272	100%
5506	116,844	121,139	104%
5512	131,225	124,358	95%
5515	165,474	122,088	74%
5516	287,261	184,757	64%
5518	79,387	87,423	110%
5519	101,274	113,902	112%
5520	84,573	37,038	44%
5523	113,276	55,591	49%
5528	71,664	154,945	216%
5532	196,087	187,841	96%
Sampled Total	18,002,274	16,712,816	93%
All Non-Sample Measures	78,863,769	73,785,675	94%
Total	96,866,043	90,498,491	93%

The ex ante and ex post gross kWh savings for the sampled Standard Program measures are presented by measure in Table 4-6.

Table 4-6 Ex Ante and Ex Post Gross Annual kWh Savings for Sampled Standard Measures

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
200102-Lighting-Linear LED Lamp <=22 Watt Lamp Replacing T8 32 Watt Lamp	172,446	168,725	98%
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	34,612	36,519	106%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	259,465	220,578	85%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	789,934	734,137	93%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	401,171	398,091	99%
201212-Lighting-LED 12-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	8,050	5,688	71%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	73,217	78,576	107%
201518-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >50 and <=120 Watts	13,875	7,229	52%
201618-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >120 Watts	50,140	35,450	71%
201718-Lighting-Dual Technology Occupancy Sensor Controlling Lighting Circuit >150 Watts	238,260	91,436	38%

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
272020-Water Heating-Heat Pump Water Heater Replacing Water Heater w/ 98% Efficiency 2.9-14.6 kW (10 to 50 MBH)	21,156	6,224	29%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	1,339,886	1,206,605	90%
301818-Lighting-Fixture Mounted Occupancy Sensor Controlling >50 and <=200 Watts Replacing No Controls	72,300	30,231	42%
305005-Lighting-<=80 Watt Lamp or Fixture Replacing Interior HID 100-175 Watt Lamp or Fixture	54,683	62,537	114%
305013-Lighting-<=80 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 100-175 Watt Lamp or Fixture	386,658	387,550	100%
305106-Lighting-62-130 Watt Lamp or Fixture Replacing Interior HID 176-300 Watt Lamp or Fixture	82,939	84,666	102%
305114-Lighting-62-130 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 176-300 Watt Lamp or Fixture	14,050	11,958	85%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	1,322,496	1,224,275	93%
305234-Lighting-85-225 Watt Lamp or Fixture Replacing Garage or Exterior 24/7 HID 301-500 Watt Lamp or Fixture	22,338	4,332	19%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	3,037,847	2,630,173	87%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	8,874,216	8,527,732	96%
305502-Lighting-Linear ft T8 25 Watt (<=7 Watts/ft) Replacing T8 32 Watt Linear ft	58,694	62,276	106%
305801-Lighting-Delamping Replacing T12 <=40 Watt	381,284	397,703	104%
305802-Lighting-Delamping Replacing T8 32 Watt	292,557	300,126	103%
Total	18,002,274	16,712,816	93%

Table 4-7 shows the ex ante and ex post gross New Construction Program annual energy savings by sample site.

Table 4-7 Ex Ante and Ex Post Gross Annual kWh Savings for New Construction Program by Sampled Site

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5109	499,680	368,517	74%
5110	82,033	79,648	97%
5111	947,494	947,405	100%
5112	3,116,954	3,106,748	100%
5370	382,499	496,459	130%
5371	894,761	928,207	104%
5378	189,963	314,693	166%
5404	261,066	222,119	85%
5451	15,256,422	14,987,668	98%
5635	277,935	208,214	75%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5647	511,560	480,132	94%
Sampled Total	22,420,367	22,139,809	99%
All Non-Sample Measures	3,491,394	3,520,537	101%
Total	25,911,761	25,660,346	99%

The ex ante and ex post gross kWh savings for the sampled New Construction Program measures are presented by measure in Table 4-8.

Table 4-8 Ex Ante and Ex Post Gross Annual kWh Savings for Sampled New Construction Measures

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
103521-Lighting-Dimming Occupancy Sensor Replacing No Existing Equipment or Replacing Failed Equipment	277,935	208,214	75%
112721-HVAC-Packaged / Rooftop Unit Replacing No Existing Equipment or Replacing Failed Equipment	32,419	0	0%
125121-Refrigeration-Head Pressure Control Replacing No Existing Equipment or Replacing Failed Equipment	187,017	92,026	49%
166021-Motors-VFD for Process Motor Replacing No Existing Equipment or Replacing Failed Equipment	10,185,525	9,783,187	96%
181221-Compressed Air-Compressed Air Optimization Replacing No Existing Equipment or Replacing Failed Equipment	1,523,755	1,376,480	90%
185521-Compressed Air-Efficient Air Compressor Replacing No Existing Equipment or Replacing Failed Equipment	287,193	241,200	84%
301918-Lighting-Fixture Mounted Occupancy Sensor Controlling >=201 and <=500 Watts Replacing No Controls	417,000	423,650	102%
406123-Lighting-New Construction Lighting Power Density (LPD)	9,509,523	10,015,052	105%
	22,420,367	22,139,809	99%

Table 4-9 shows the ex ante and ex post gross Retro-Commissioning Program annual energy savings by sample site.

Table 4-9 Ex Ante and Ex Post Gross kWh Savings for Retro-Commissioning Program by Sampled Site

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5113	94,554	104,116	110%
5645	507,414	465,686	92%
5646	1,575,980	1,715,132	109%
5659	357,664	347,421	97%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5660	172,454	172,454	100%
Sampled Total	2,708,066	2,804,809	104%
All Non-Sample Measures	705,088	689,477	98%
Total	3,413,154	3,494,286	102%

The ex ante and ex post gross kWh savings for the sampled Retro-Commissioning Program measures are presented by measure in Table 4-10.

Table 4-10 Ex Ante and Ex Post Gross Annual kWh Savings for Sampled Retro-Commissioning Program Measures

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
112420-HVAC-Water Cooled Chiller Replacing Existing Inefficient Equipment or Early Replacement	910,567	990,966	109%
113220-HVAC-HVAC Controls / EMS Replacing Existing Inefficient Equipment or Early Replacement	357,664	347,421	97%
116620-HVAC-HVAC Optimization - Airside	665,413	724,166	109%
187320-Compressed Air-Compressed Air System Leak Repair	774,422	742,256	96%
Total	2,708,066	2,804,809	104%

Table 4-11 shows the ex ante and ex post gross SBDI Program annual energy savings by sample site.

Table 4-11 Ex Ante and Ex Post Gross Annual kWh Savings for SBDI Non-HIM by Sampled Site

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5002	6,512	10,612	163%
5003	2,450	1,999	82%
5005	3,384	6,765	200%
5014	4,494	5,409	120%
5019	3,033	3,992	132%
5020	1,159	4,491	387%
5023	2,876	3,663	127%
5024	3,972	4,991	126%
5028	6,586	3,926	60%
5033	3,675	3,017	82%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5044	17,994	25,526	142%
5070	4,536	2,645	58%
5078	21,549	20,668	96%
5082	8,972	7,477	83%
5084	26,184	26,134	100%
5085	14,027	10,603	76%
5099	10,064	12,943	129%
5118	11,755	4,237	36%
5164	8,186	10,056	123%
5184	19,480	18,975	97%
5186	11,574	11,429	99%
5189	3,900	2,701	69%
5275	35,901	51,063	142%
5319	21,915	29,056	133%
5326	21,985	13,931	63%
5457	38,330	45,086	118%
5458	54,568	74,815	137%
5461	43,051	31,108	72%
5471	10,969	10,780	98%
5474	15,135	14,203	94%
5476	35,786	42,600	119%
5479	28,044	20,730	74%
5480	15,601	15,755	101%
5482	16,003	22,183	139%
5485	15,388	16,983	110%
5487	26,013	32,450	125%
5490	16,783	16,679	99%
5492	19,517	16,953	87%
5499	13,587	14,415	106%
5500	16,728	16,358	98%
5501	12,904	12,880	100%
5502	12,082	10,365	86%
5503	27,867	20,234	73%
5504	17,686	18,487	105%
5509	19,409	21,936	113%
5510	19,118	20,309	106%
5513	32,535	42,098	129%
5517	20,611	25,010	121%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5525	17,560	16,921	96%
5526	18,245	24,323	133%
5527	17,502	22,218	127%
5530	29,525	24,562	83%
5531	50,981	47,663	93%
5534	32,411	38,024	117%
5535	13,961	14,392	103%
5536	7,094	8,721	123%
5539	20,478	12,454	61%
5540	1,760	3,688	210%
5541	17,315	13,303	77%
5545	8,429	12,465	148%
5546	12,270	12,003	98%
5547	8,125	6,675	82%
5549	15,118	18,077	120%
5551	16,628	14,607	88%
5553	14,587	17,859	122%
5554	35,205	20,817	59%
5556	17,934	13,496	75%
5563	12,281	18,603	151%
5565	18,530	24,064	130%
5566	6,570	3,148	48%
5567	7,487	9,362	125%
5568	31,970	33,294	104%
5570	7,120	9,097	128%
5571	10,235	9,819	96%
5576	16,013	18,713	117%
5579	31,695	37,508	118%
5588	7,266	9,732	134%
5590	8,984	6,445	72%
5591	4,532	4,076	90%
5600	29,259	25,132	86%
5609	7,756	7,101	92%
5613	15,497	13,384	86%
5615	6,540	9,624	147%
5620	39,472	44,253	112%
5626	4,497	5,192	115%
5629	14,490	16,994	117%

<i>ID</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
5631	9,643	10,244	106%
5633	18,890	19,051	101%
Sampled Total	1,467,733	1,535,830	105%
All Non-Sample Measures	4,423,313	4,619,365	104%
Total	5,891,046	6,155,195	104%

The ex ante and ex post gross kWh savings for the sampled SBDI measures are presented by measure in Table 4-12.

Table 4-12 Ex Ante and Ex Post Gross Annual kWh Savings for Sampled SBDI Measures

<i>Measure Name</i>	<i>Ex Ante kWh Savings</i>	<i>Ex Post Gross kWh Savings</i>	<i>Gross kWh Savings Realization Rate</i>
200808-Lighting-LED <=13 Watt Lamp Replacing Halogen MR-16 35-50 Watt Lamp or Fixture	15,481	19,618	127%
200909-Lighting-LED <=14 Watt Lamp Replacing Halogen BR/R 45-66 Watt Lamp or Fixture	317,145	323,863	102%
201010-Lighting-LED <=20 Watt Lamp Replacing Halogen PAR 48-90 Watt Lamp or Fixture	73,488	80,314	109%
201111-Lighting-LED <=11 Watt Lamp Replacing Halogen A 28-52 Watt Lamp	62,939	62,282	99%
201316-Lighting-LED or Electroluminescent Replacing Incandescent Exit Sign	11,619	14,403	124%
201317-Lighting-LED or Electroluminescent Replacing CFL Exit Sign	1,542	5,231	339%
201518-Lighting-Single Technology Occupancy Sensor Controlling Lighting Circuit >50 and <=120 Watts	125	2	2%
301132-Lighting-LED 7-20 Watt Lamp Replacing Halogen A 53-70 Watt Lamp	57,153	47,192	83%
305233-Lighting-85-225 Watt Lamp or Fixture Replacing Interior HID 301-500 Watt Lamp or Fixture	50,123	52,127	104%
305401-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T12 <=40 Watt Linear ft	517,969	545,503	105%
305402-Lighting-Linear ft LED (<=5.5 Watts/ft) Replacing T8 32 Watt Linear ft	156,376	163,503	105%
305801-Lighting-Delamping Replacing T12 <=40 Watt	194,195	210,536	108%
305802-Lighting-Delamping Replacing T8 32 Watt	9,578	11,255	118%
Total	1,467,733	1,535,830	105%

4.2. High Impact Measures

BizSavers measures may or may not be characterized in the Ameren Missouri Technical Reference Manual (TRM). High Impact Measures (HIM) are defined at the program-level

as those measures with the greatest program-level ex ante energy savings that, in the aggregate, account for at least 50% of the total program-level ex ante savings associated with all program TRM measures. Measures were implemented under the Standard Program and SBDI Program that are characterized in the Ameren Missouri TRM. The top contributing remained consistent during the program year which are all lighting measures. The Standard Program HIMs are LED linear tube measures for replacing T8 linear tubes and replacing T12 linear tubes. One of the three SBDI Program HIM measures is also for LED linear tubes replacing T12 linear tubes. The second HIM measure for SBDI is new this program year, for delamping existing T12 lamps while replacing the remaining lamps with LED linear tubes. The “delamping” incentive allows the applicant to select less new efficient lamps, taking advantage of improved lumen output at lower power. The third SBDI Program HIM measure is for replacing screw in reflector lamps with LED reflector lamps. The results are presented to identify the variance of the parameters for the lighting measure savings algorithm, between the ex ante values and the ex post values:

$$kWh\ Savings = Hours \times (Q_{Base} \times W_{Base} - Q_{Post} \times W_{Post}) \times HCIF / 1000$$

Where,

Hours = Annual hours of use

Q_{base} = Baseline quantity

W_{base} = Baseline watts

Q_{post} = Installed quantity

W_{post} = Installed watts

HCIF = Heating Cooling Interactive Factor

1000 = W/kW conversion

4.2.1. Standard HIM Measure Number 3025 LED linear tube replacing T8 fluorescent tube

This Standard measure applies to the replacement of T8 fluorescent linear lamps and replacing with LED linear lamps or fixtures.

4.2.1.1. Sampling

Summary data regarding the sampling plan is presented in report Volume I. This HIM measure included 117 measure samples. The ex ante savings of 38,430,754 kWh from this HIM measure is 40% of the total Standard program ex ante savings. The sample group of 9,046,622 kWh achieved a precision of 9.8% at 90% confidence level.

4.2.1.2. Results

The results are presented to review the inputs of the savings algorithm for lighting measures. The quantity figures illustrate the relationship between the ex ante lamp quantity and the verified quantity from the ex post project level site visit evaluations.

The power figures illustrate the relationship between the ex ante power of the lamp or fixture compared to the ex post project level site visit verification.

The HOU (annual hours of use) figures illustrate the relationship between the ex ante hours and the metered or verified hours from the usage areas from project level site visits. The hours for each project-measure may be aggregated depending on the size or complexity of the usage areas for metering the lighting operation.

The HCIF (heating cooling interactive factor) compares the ex ante and ex post stated factor used in the savings algorithm. The ex post factor is determined based on climate zone, building type, HVAC equipment type and usage area.

Figure 4-1 Standard Measure 3025: Quantity

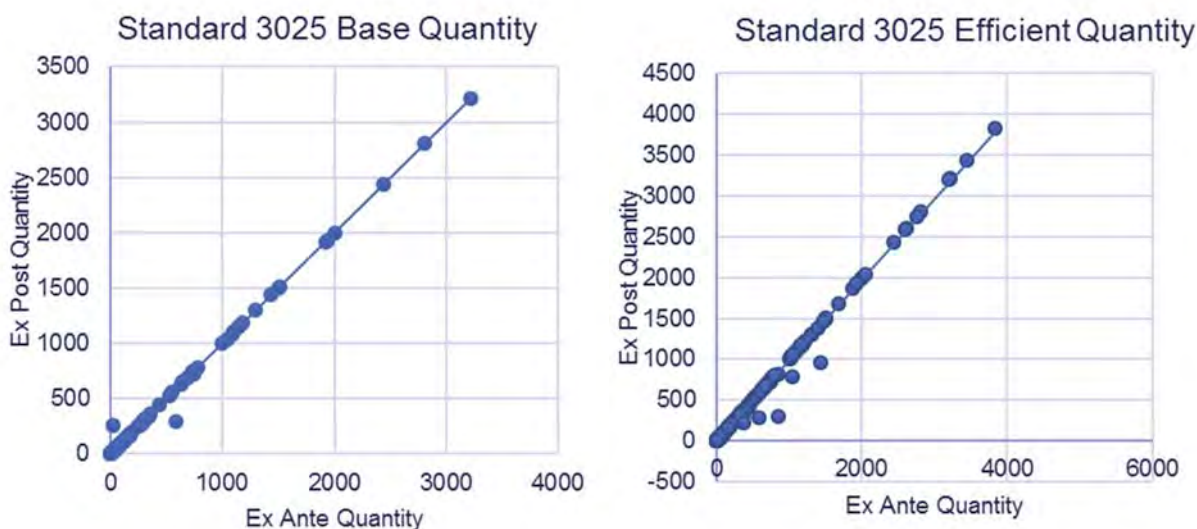


Table 4-13 Standard Measure 3025: Quantity

	Ex Ante Base Quantity		Ex Post Base Quantity		Ex Ante Efficient Quantity		Ex Post Efficient Quantity	
Mean	379		374		380		372	
Min/Max	1	3,829	1	3,829	1	3,829	1	3,829
Observations*	250		250		250		250	
Pearson Correlation	0.99780				0.99678			
t Stat	2.068				2.282			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project.

Figure 4-2 Standard Measure 3025: Power

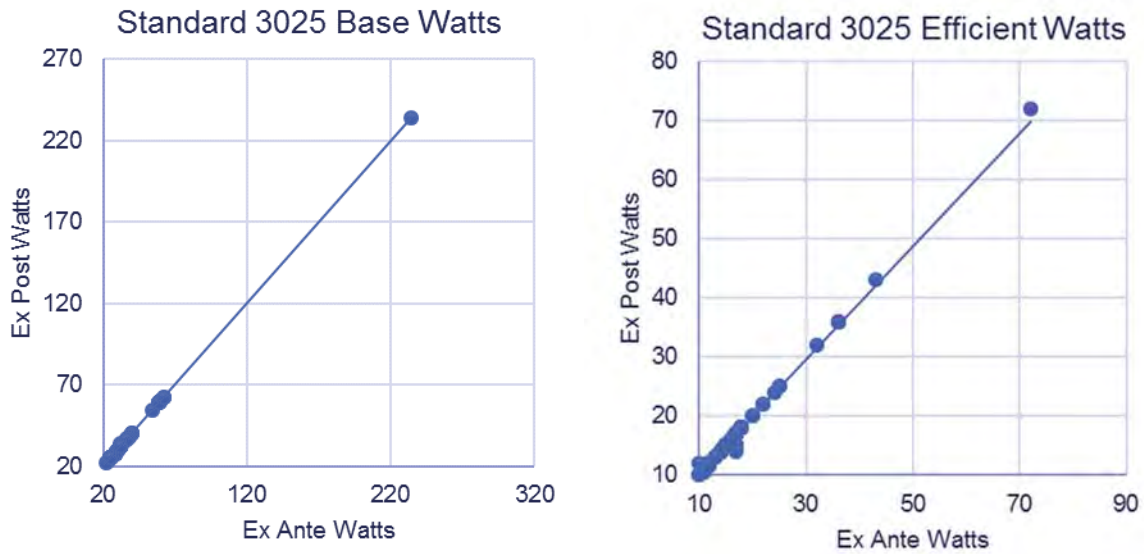


Table 4-14 Standard Measure 3025: Power

	<i>Ex Ante Base Watts</i>		<i>Ex Post Base Watts</i>		<i>Ex Ante Efficient Watts</i>		<i>Ex Post Efficient Watts</i>	
Mean	33.3		33.4		16.1		16.1	
Min/Max	17	234	17	234	8.5	72	8.5	72
Observations*	250		250		250		250	
Pearson Correlation	0.99996				0.97678			
t Stat	-1.000				-0.210			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

Figure 4-3 Standard Measure 3025: HOU, HCIF

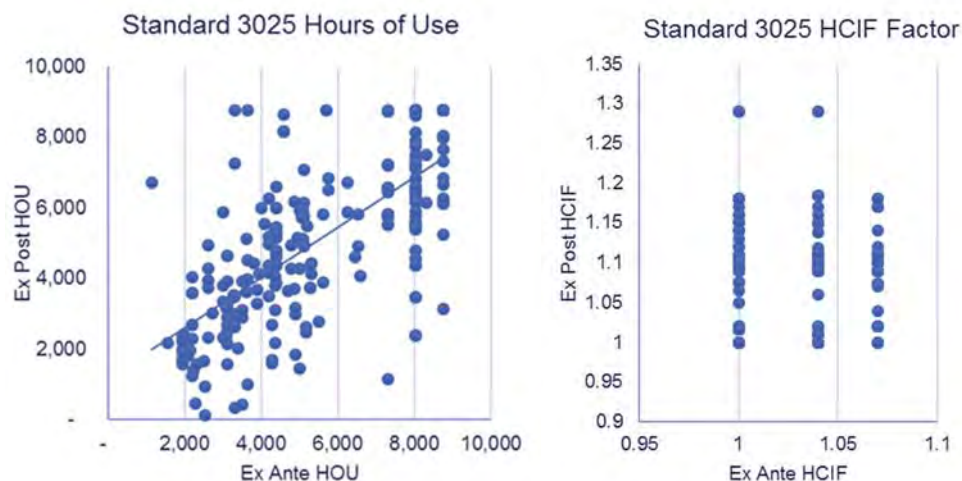


Table 4-15 Standard Measure 3025: HOU, HCIF

	Ex Ante HOU		Ex Post HOU		Ex Ante HCIF		Ex Post HCIF	
Mean	5,489		5,073		1.03		1.09	
Min/Max	1,145	8,760	135	8,760	1.00	1.07	1.00	1.29
Observations*	250		250		250		250	
Pearson Correlation	0.71235				-0.04084			
t Stat	3.804				-12.893			

4.2.1.3. Observations

The two-sample t-test and Pearson correlation for this high impact measure identified inputs to the lighting savings algorithm which may produce ex post savings different than the ex ante kWh savings. The difference of the means of the ex ante and ex post observations are not significant for the base lighting watts, base lighting quantity, efficient watts and efficient quantity. The verified quantities are similar across low and high installed quantities, verified linear tube fixture watts are similar across single lamp to six lamp fixtures. But, the inputs for annual hours of use and heating-cooling interactive factor show a difference between the ex ante and ex post groups. Hours of use may be higher or lower than expected. The ex ante HCIF indicates a trimodal population, not due to facility specific HVAC equipment, but due to default value updates within the application.

4.2.2. Standard HIM Measure Number 3026 LED linear lamp replacing T12 fluorescent lamp

This Standard measure applies to the removal of T12 fluorescent linear lamp or fixtures and replacing with LED linear lamp or fixtures.

4.2.2.1. Sampling Plan

Summary data regarding the sampling plan is presented in report Volume I. This HIM measure included 109 measure samples. The ex ante savings of 17,43,317 kWh from this HIM measure is 18% of the total Standard program ex ante savings. The sample group of 3,037,847 kWh achieved a precision of 9.8% at 90% confidence level.

4.2.2.2. Results

The results are presented to review the inputs of the savings algorithm for lighting measures.

Figure 4-4 Standard Measure 3026: Quantity

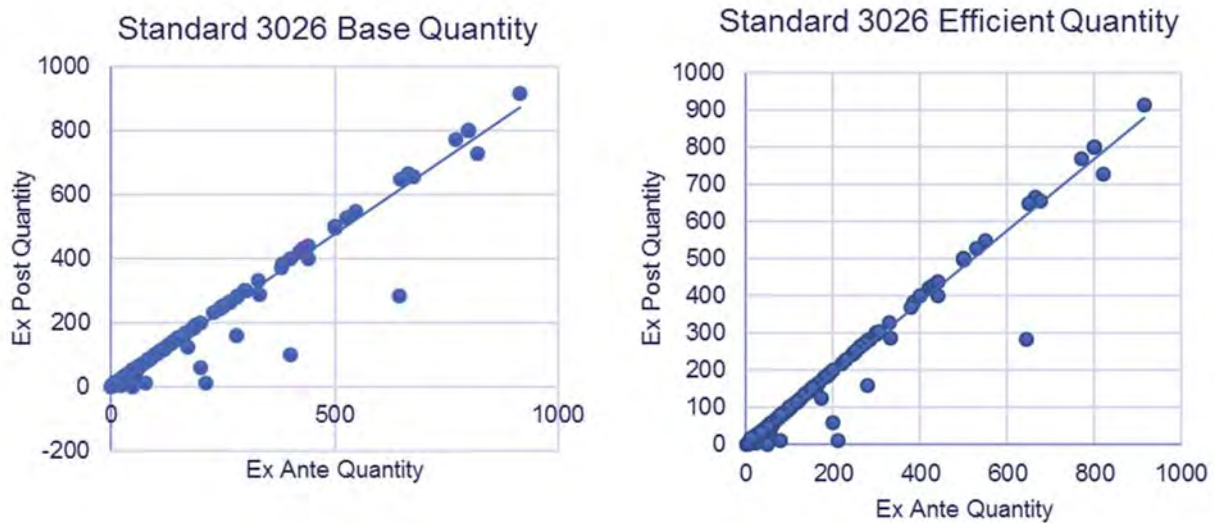


Table 4-16 Standard Measure 3026: Quantity

	Ex Ante Base Quantity		Ex Post Base Quantity		Ex Ante Efficient Quantity		Ex Post Efficient Quantity	
Mean	153.2		144.9		156.2		149.6	
Min/Max	1	914	0	914	1	914	0	914

Observations*	188	188	188	188
Pearson Correlation	0.98026		0.98569	
t Stat	2.813		2.656	

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

Figure 4-5 Standard Measure 3026: Power

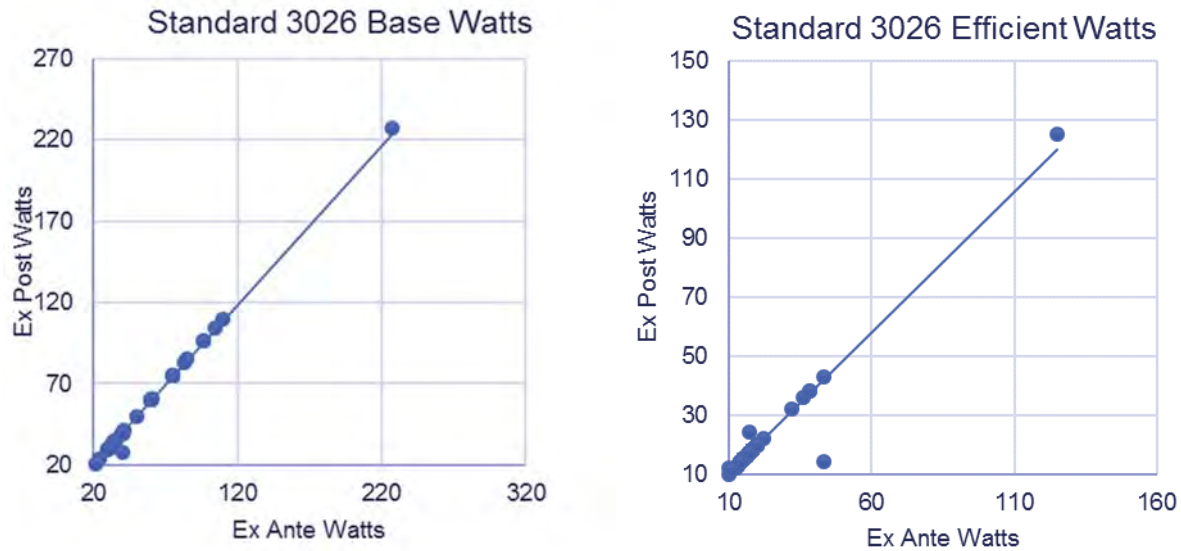


Table 4-17 Standard Measure 3026: Power

	Ex Ante Base Watts		Ex Post Base Watts		Ex Ante Efficient Watts		Ex Post Efficient Watts	
Mean	44.1		44.2		17.5		17.4	
Min/Max	17	227	17	227	9	125	9	125
Observations*	188		188		188		188	
Pearson Correlation	0.99098				0.97110			
t Stat	-0.609				0.634			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

Figure 4-6 Standard Measure 3026: HOU, HCIF

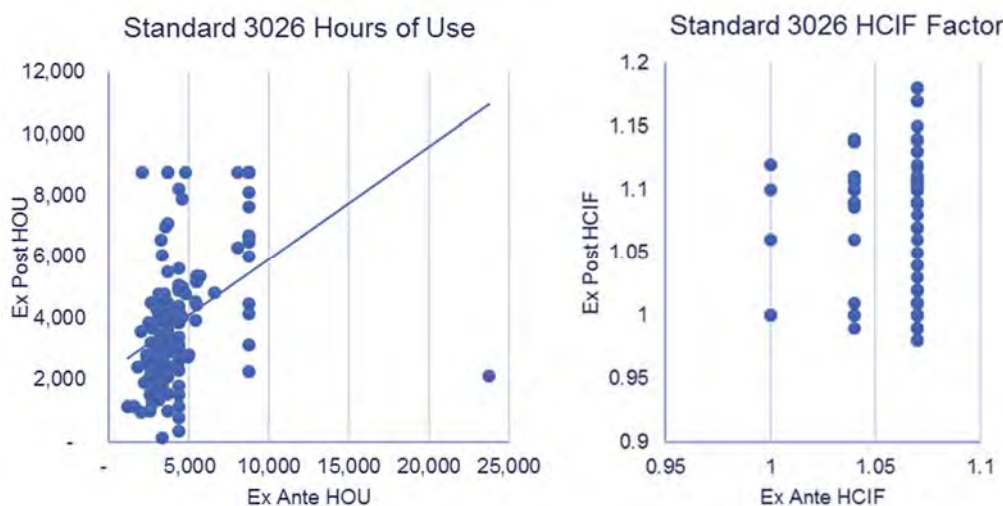


Table 4-18 Standard Measure 3026: HOU, HCIF

	<i>Ex Ante HOU</i>		<i>Ex Post HOU</i>		<i>Ex Ante HCIF</i>		<i>Ex Post HCIF</i>	
Mean	4,152		3,916		1.05		1.08	
Min/Max	469	8,760	141	8,760	1.00	1.07	0.98	1.18
Observations*	188		188		188		188	
Pearson Correlation	0.64819				0.25683			
t Stat	1.813				-8.597			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

4.2.2.3. Observations

The two-sample t-test and Pearson correlation for this high impact measure identified inputs to the lighting savings algorithm which may produce ex post savings different than the ex ante kWh savings. The difference of the means of the ex ante and ex post observations are not significant for the base lighting watts, and efficient watts. There was some variance in the quantities when accompanied by the delamping measure. The verified linear tube fixture watts are similar across single lamp to six lamp fixtures. But, the inputs for annual hours of use and heating-cooling interactive factor show a difference between the ex ante and ex post groups. Hours of use may be higher or lower than expected. The ex ante HCIF indicates a trimodal population, not due to facility specific HVAC equipment, but due to default value updates within the application

4.2.3. SBDI HIM Measure Number 3026 LED linear lamp replacing T12 fluorescent lamp

This SBDI measure applies to the removal to T12 linear lamps and replacing with LED linear lamps.

4.2.3.1. Sampling Plan

Summary data regarding the sampling plan is presented in report Volume I. This HIM measure included 60 measure samples. The 1,686,326 kWh from this HIM measure is 29% of the total SBDI Program ex ante savings. The sample group of 465,235 kWh achieved a precision of 6.1% at 90% confidence level.

4.2.3.2. Results

Figure 4-7 Measure SBDI 3026: Quantity

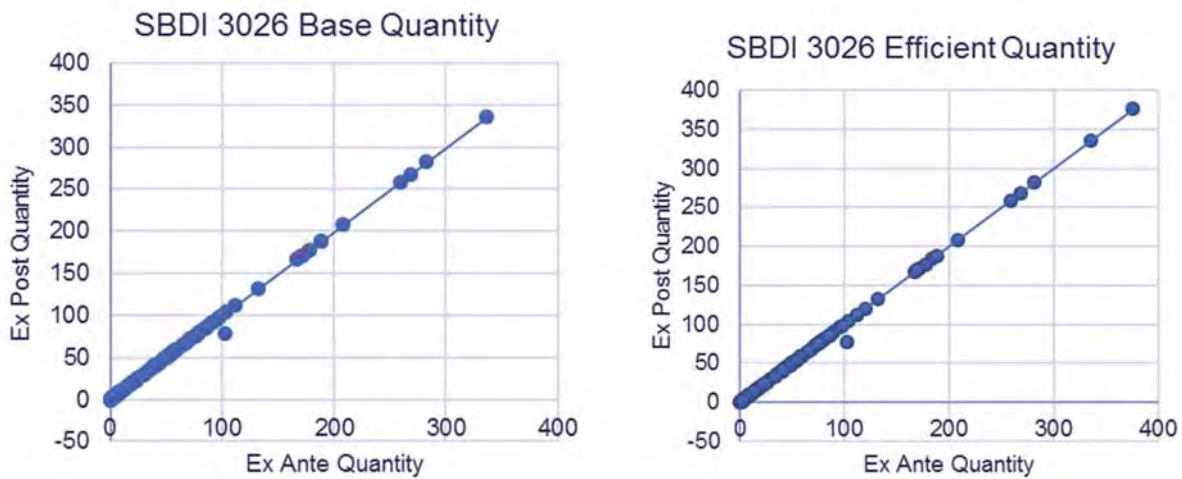


Table 4-19 Measure SBDI 3026: Quantity

	<i>Ex Ante Base Quantity</i>		<i>Ex Post Base Quantity</i>		<i>Ex Ante Efficient Quantity</i>		<i>Ex Post Efficient Quantity</i>	
Mean	48.0		47.8		52.4		52.2	
Min/Max	1	336	1	336	1	376	1	376
Observations*	136		136		136		136	
Pearson Correlation	0.99939							

Figure 4-8 Measure SBDI 3026: Power

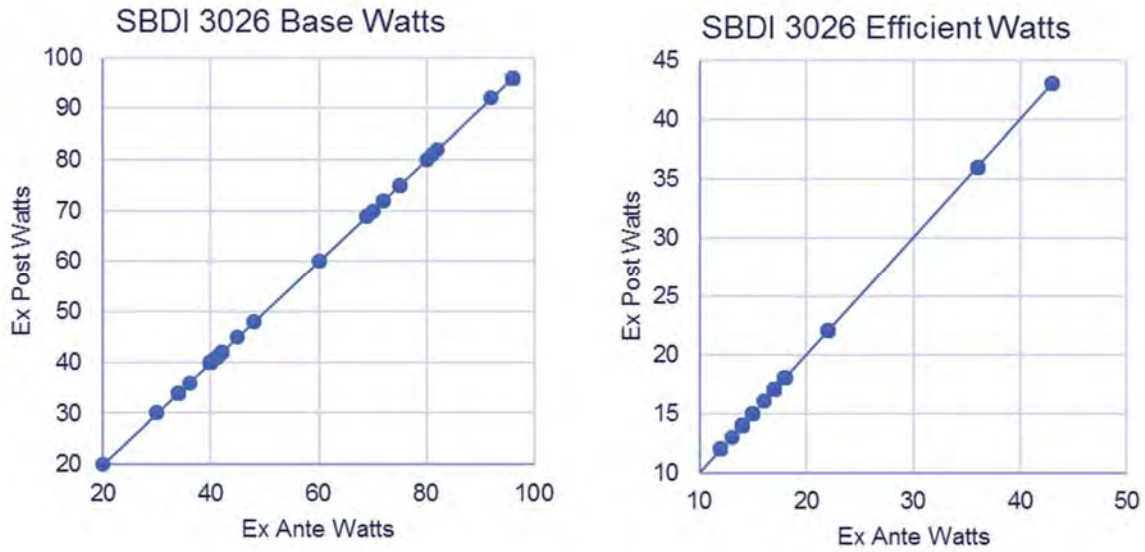


Table 4-20 Measure SBDI 3026: Power

	Ex Ante Base Watts		Ex Post Base Watts		Ex Ante Efficient Watts		Ex Post Efficient Watts	
Mean	48		48		18		18	
Min/Max	20	96	20	96	9	43	09	43
Observations*	136		136		136		136	
Pearson Correlation	1.00000				1.00000			
t Stat	NA				NA			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

Figure 4-9 Measure SBDI 3026: HOU, HCIF

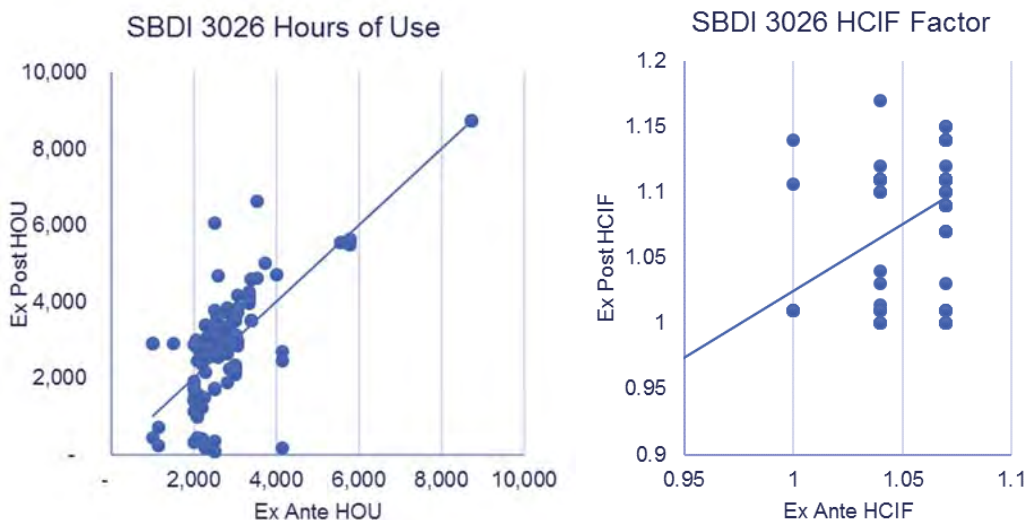


Table 4-21 Measure SBDI 3026: HOU, HCIF

	Ex Ante HOU		Ex Post HOU		Ex Ante HCIF		Ex Post HCIF	
Mean	2,817		2,852		1.04		1.07	
Min/Max	1,000	8,736	80	8,760	0.00	1.07	0.00	1.17
Observations*	136		136		136		136	
Pearson Correlation	0.75884				0.94281			
t Stat	-0.392				-5.603			

4.2.3.3. Observations

The two-sample t-test and Pearson correlation for this high impact measure identified inputs to the lighting savings algorithm which may produce ex post savings different than the ex ante kWh savings. The difference of the means of the ex ante and ex post observations are not significant for the base lighting watts, base lighting quantity, efficient watts and efficient quantity. The verified quantities are similar across low and high installed quantities, verified linear tube fixture watts are similar across single lamp to six lamp fixtures. But, the inputs for annual hours of use and heating-cooling interactive factor show a difference between the ex ante and ex post groups. Hours of use may be higher or lower than expected. The ex ante HCIF indicates a trimodal population, not due to facility specific HVAC equipment, but due to default value updates within the application.

4.2.4. SBDI HIM Measure Number 3084 Delamp when retrofitting with LED linear lamp

This SBDI measure applies to the removal of T8 or T12 linear fluorescent lamps along with a retrofit of the remaining lamps to LED linear lamps.

4.2.4.1. *Sampling Plan*

Summary data regarding the sampling plan is presented in report Volume I. This HIM measure included 38 measure samples. The 915,466 kWh from this HIM measure is 16% of the total SBDI Program ex ante savings. The sample group of 203,773 kWh achieved a precision of 9.9 at 90% confidence level.

4.2.4.2. *Results*

Figure 4-10 Measure SBDI 3084 Delamp Quantity

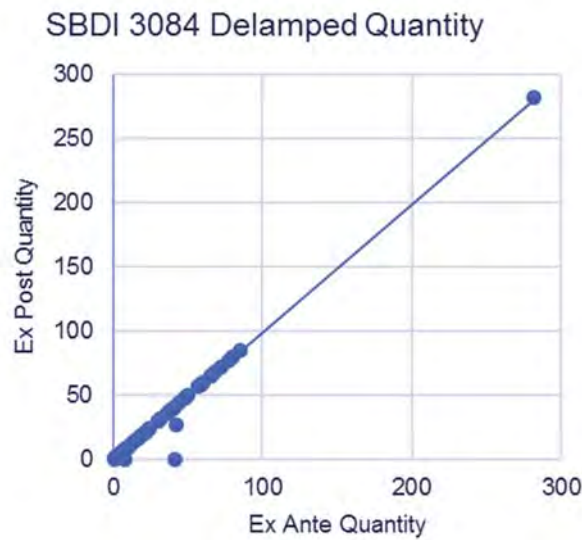


Table 4-22 Measure SBDI 3084: Delamp Quantity

	<i>Ex Ante Base Quantity</i>		<i>Ex Post Base Quantity</i>	
Mean	31.3		30.6	
Min/Max	1	282	0	282
Observations*	59		59	
Pearson Correlation	0.98713			
t Stat	0.755			

Figure 4-11 Measure SBDI 3084: Delamped Power

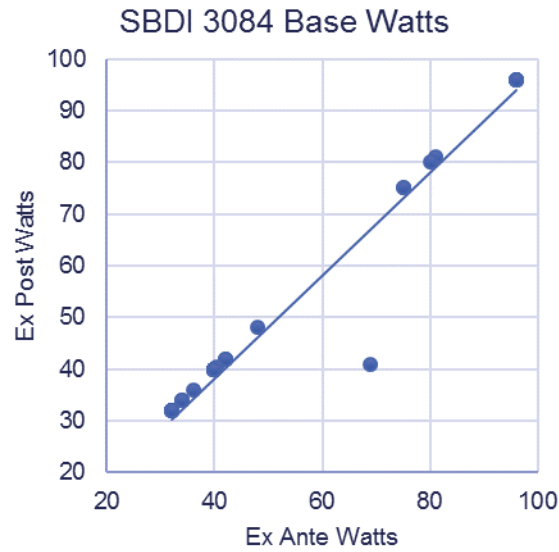


Table 4-23 Measure SBDI 3084: Delamped Power

	Ex Ante Base Watts		Ex Post Base Watts	
Mean	46.4		44.6	
Min/Max	32	96	32	96
Observations*	59		59	
Pearson Correlation	0.91821			
t Stat	1.740			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

Figure 4-12 Measure SBDI 3084: HOU, HCIF

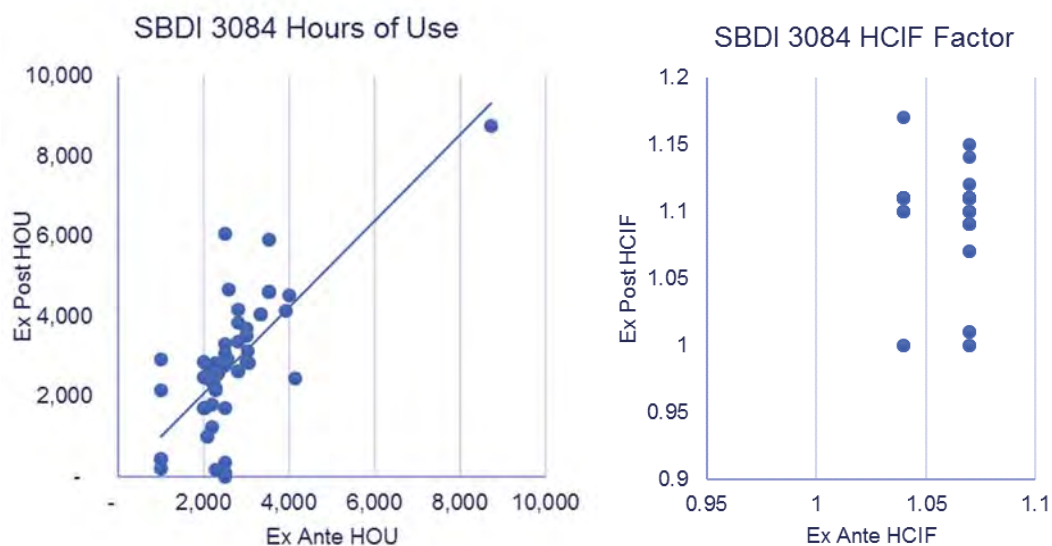


Table 4-24 Measure SBDI 3084: HOU, HCIF

	Ex Ante HOU		Ex Post HOU		Ex Ante HCIF		Ex Post HCIF	
Mean	2,628		2,760		1.06		1.10	
Min/Max	1,000	8,736	103	8,760	1.04	1.07	1.00	1.17
Observations*	59		59		59		59	
Pearson Correlation	0.71155				-0.00577			
t Stat	-0.888				-7.339			

4.2.4.3. Observations

The two-sample t-test and Pearson correlation for this high impact measure identified inputs to the lighting savings algorithm which may produce ex post savings different than the ex ante kWh savings. The difference of the means of the ex ante and ex post observations for the quantity delamped and the existing base wattage are overall not significant, less two observations where the site contact confirmed some usage areas not delamped. The inputs for annual hours of use and heating-cooling interactive factor show a difference between the ex ante and ex post groups. Hours of use may be higher or lower than expected. The ex ante HCIF indicates a bimodal population, not due to facility specific HVAC equipment, but due to default value updates within the application.

4.2.5. SBDI HIM Measure Number 3007 LED screw in reflector lamp replacing incandescent or halogen reflector lamp.

4.2.5.1. Sampling Plan

Summary data regarding the sampling plan is presented in report Volume I. This HIM measure included 46 measure samples. The 812,973 kWh from this HIM measure is 14% of the total SBDI Program ex ante savings. The sample group of 317,145 kWh achieved a precision of 7.6% at 90% confidence level.

4.2.5.2. Results

Figure 4-13 Measure SBDI 3007: Quantity

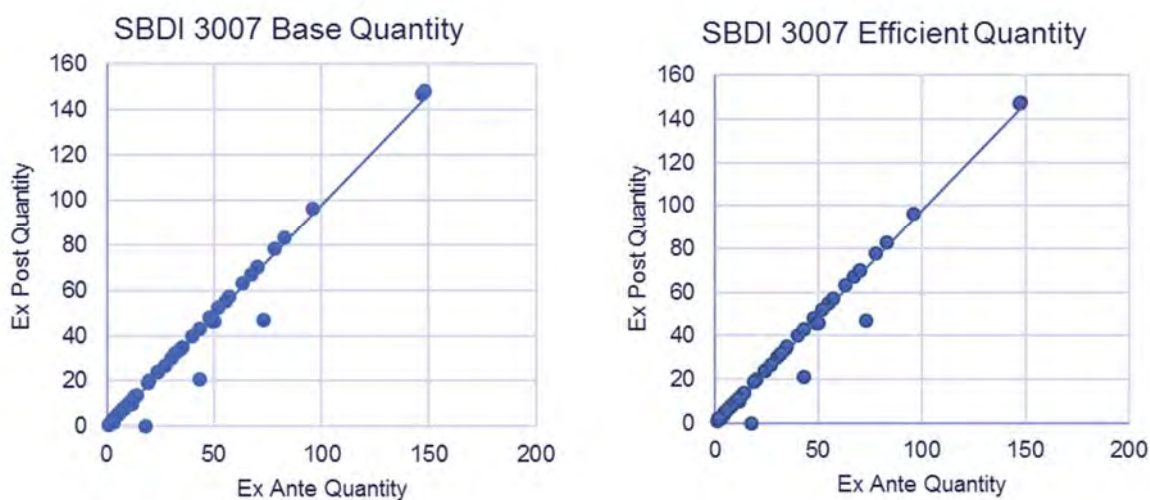


Table 4-25 Measure SBDI 3007: Quantity

	<i>Ex Ante Base Quantity</i>		<i>Ex Post Base Quantity</i>		<i>Ex Ante Efficient Quantity</i>		<i>Ex Post Efficient Quantity</i>	
Mean	33.4		31.9		33.4		31.9	
Min/Max	1	148	1	148	1	148	1	148
Observations*	52		52		52		52	
Pearson Correlation	0.98852				0.98852			
t Stat	2.009				2.009			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

Figure 4-14 Measure SBDI 3007: Power

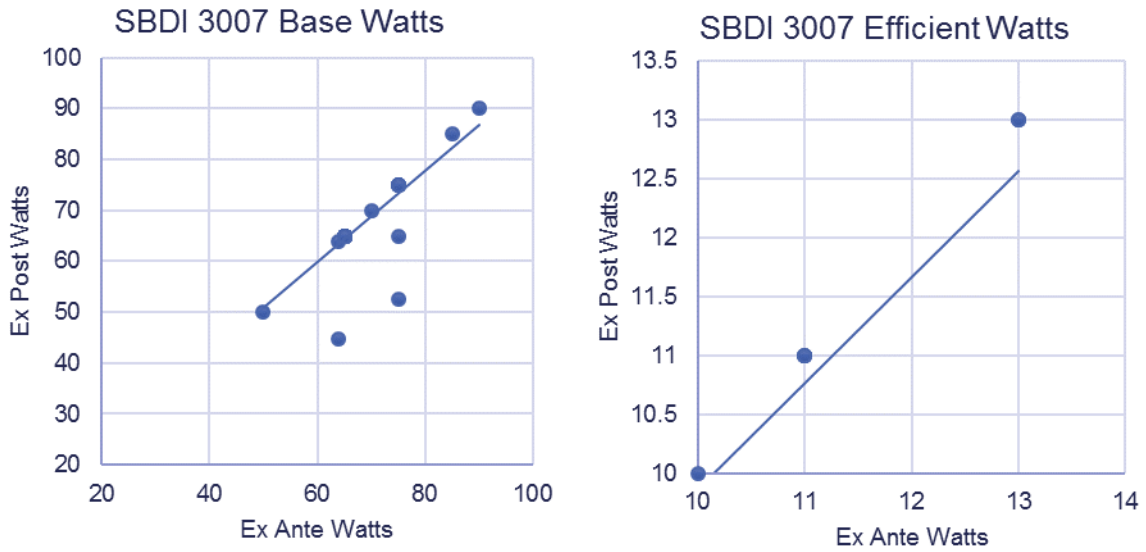


Table 4-26 Measure SBDI 3007: Power

	Ex Ante Base Watts		Ex Post Base Watts		Ex Ante Efficient Watts		Ex Post Efficient Watts	
Mean	67.4		66.4		8.5		8.5	
Min/Max	50	90	44.8	90	7	13	7	13
Observations*	52		52		52		52	
Pearson Correlation	0.79324				0.89790			
t Stat	1.685				-0.227			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

Figure 4-15 Measure SBDI 3007: HOU, HCIF

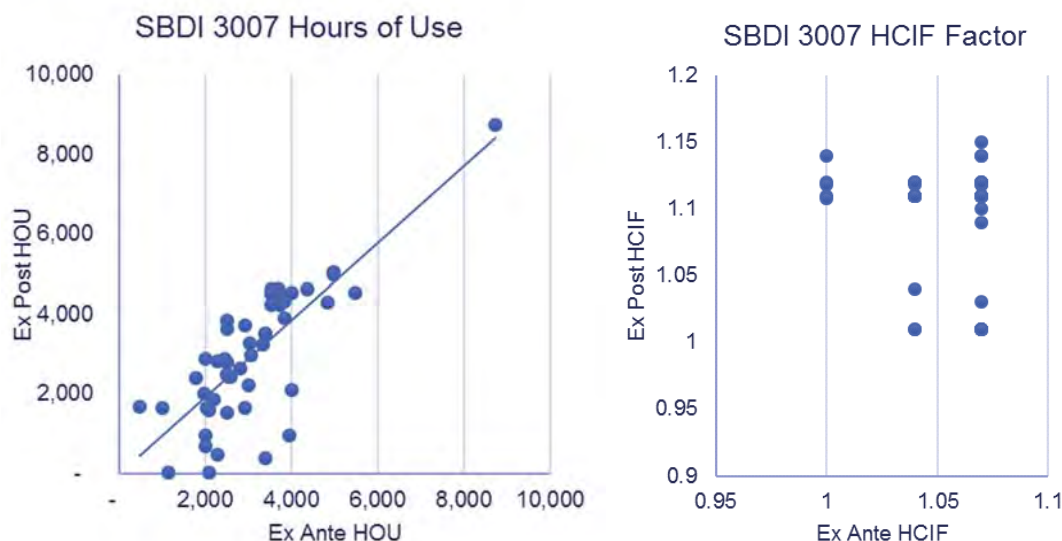


Table 4-27 Measure SBDI 3007: HOU, HCIF

	Ex Ante HOU		Ex Post HOU		Ex Ante HCIF		Ex Post HCIF	
Mean	3,075		2,951		1.05		1.10	
Min/Max	468	8,736	14	8,736	1.00	1.07	1.01	1.15
Observations*	52		52		52		52	
Pearson Correlation	0.78536				-0.18001			
t Stat	0.905				-6.061			

*Observation quantity varies from sample, as the sample quantity aggregates all the measures installed within a single project

4.2.5.3. Observations

The two-sample t-test and Pearson correlation for this high impact measure identified inputs to the lighting savings algorithm which may produce ex post savings different than the ex ante kWh savings. The difference of the means of the ex ante and ex post observations show difference in the base watts. The ex post evaluation surveyed the site contact during the project level site visit for removed lamps, and recorded wattages of used lamps that had not yet been disposed. The inputs for annual hours of use and heating-cooling interactive factor show a difference between the ex ante and ex post groups. Hours of use may be higher or lower than expected. The ex ante HCIF indicates a trimodal population, not due to facility specific HVAC equipment, but due to default value updates within the application

5. Staff and Implementer Interview Guides

Ameren Program Manager

Roles & Responsibilities

Now, I'd like to hear about invoice review and auditing.

[In all questions, probe as appropriate about the EMS and SBDI]

First, please briefly describe your activities relating to the BizSavers program. *[Probe about reports received]*

Who do you interact with, both at Ameren and Lockheed, in your invoice review and auditing function?

Those are all my questions. Thank you very much for your time.

Roles & Responsibilities

- Q1. Let's start with a bit about you. You are currently the BizSavers Program Manager, correct?
- Q2. About how much of your time is devoted to the Ameren Missouri BizSavers program?
- Q3. How is that going so far? Any unexpected challenges?
- Q4. And can you give me an update on staffing, responsibilities, or the reporting structure for BizSavers at Ameren Missouri? *[If needed: Who do you report to? Who reports to you?]*
- Q5. Who replaced *[employee name redacted]* in invoice review and auditing? How is that working out?
- Q6. Are there any other planned changes in staffing, responsibilities, or reporting structure? If so, what are they?
- Q7. Are the current staffing levels sufficient for supporting the administration and oversight needs of the program?

Program Progress

Let's talk about how the BizSavers programs are progressing.

- Q8. Overall, how well are the various programs progressing relative to goals and expectations?
- Q9. There were 48 RCx projects started in the 2016/17 program year but as of July 1, none started in 2017/18. Do you know why that might be? Have you spoken with Lockheed Martin about that?

- Q10. It looks like EMS has picked up, with 10 2016/17 program year projects started as of July 1. What do you think at this point of the potential for that pilot?
- Q11. What needs to be done achieve success with the EMS pilot?
- Q12. Is EMS still getting support from other Ameren staff? What additional support, if any, might be needed?
- Q13. SBDI participation declined from December 2016 through February of this year, but it began increasing again in March. Is participation meeting your expectations?
If not: What needs to be done to achieve success with SBDI?
Have you discussed this with Lockheed? If so, what did you discuss and how did that go?
- Q14. Is SBDI still getting support from other Ameren staff? What additional support, if any, might be needed?
- Q15. So far, how are the other program elements – standard, custom, and new construction – doing relative to goals? *[Probe about savings goals, project completions, pipeline, achievement of non-lighting savings.]*
If not doing well: What might the program do to improve progress toward goals?

Program Measures

- Q16. I understand that the program started providing incentives again for exterior lighting. Is this having the desired effect?
If not: Why do you think that is? What else might be done?
[Note that lighting and controls kWh in PY 2016/17 was 73% of PY 2015, while HVAC was 154% of PY 2015. Over the first four months of PY 2017/18, lighting and controls kWh is 136% of same period in 2016/17, and HVAC is about the same.]
- Q17. What other measures been added or modified in the past year, if any? *[Probe about reasons and uptake. Were these new prescriptive measures?]*

Marketing and Outreach

[For all questions, probe about EMS and SBDI]

Now, just a couple of questions about the status of marketing and outreach activities for the program.

- Q18. Can you give me an update on program marketing, including Ameren marketing activities, Lockheed activities, and coordination between them? *[Probe: Does Ameren conduct any program marketing independent of Lockheed? If so, what?]*

- Q19. How have Lockheed Martin's program marketing and outreach efforts in the current program year fit with your expectations? *[Probe: What are they doing well? In what ways, if any, do they fall short of expectations?]*
- Q20. Are program marketing and outreach targeting the right business subsectors?
If not: Have you spoken with Lockheed about that? What do they plan to do? Will that be sufficient?
- Q21. From your perspective, how well is Lockheed Martin recruiting and managing trade allies or other program partners?

Communication

Next, I'd like to hear briefly about how communication processes are working both within Ameren and between Ameren and Lockheed.

- Q22. How has communication been between Ameren and Lockheed staff? *[Probe about: Frequency and type of reports and meetings, monthly meetings/webinars with KAEs and CSAs, LM reports to CSAs about projects in their territory, Ameren keeping LM informed on key accounts, LM presentations to Ameren.]*
- Q23. And how has communication been among Ameren staff regarding the BizSavers program? *[Probe about any changes in frequency or type of meeting.]*

[If issues identified, ask Q24]

- Q24. What do you think should be done to improve communication?

Tracking, Reporting, QA/QC

Next, I'd also like to hear about tracking, reporting, and QA/QC.

- Q25. How well is the current tracking and reporting process working to meet your needs? *[Probe about additional reports or information that would be useful.]*
- Q26. What tracking and reporting changes were made, if any, this program year? How have those worked out?
- Q27. From your perspective, how is Lockheed doing with program QA/QC? *[Probe about any problems or challenges identified] [If problems or challenges identified, ask:]*
- Q28. What has been done to address those issues? What else needs to be done?

Conclusion

- Q29. Is there anything that you would like to see changed in how Lockheed is implementing the program?
- Q30. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Q31. What would you like to learn from the program evaluation?

Those are all of my questions. Thank you very much for your time.

Lockheed Martin Program Manager

Roles & Responsibilities

- Q1. Let's start with a bit about you. You are still the current BizSavers Program Manager for Lockheed Martin, correct?
- Q2. The last time you were interviewed for the evaluation, this past December, you said that your job was focusing more on the outreach and business development aspects of the program rather than on engineering and operations. Is that still the case? If not, what has changed?
- Q3. Have your job title or responsibilities regarding the BizSavers program changed in any other way since the last time you were interviewed? If so, how?
- Q4. About how much of your time is devoted to the Ameren Missouri BizSavers program?
- Q5. Since we last spoke last December, have there been any changes to staffing, responsibilities, or the reporting structure for BizSavers at Lockheed? If so, please describe.
- Q6. Are there any other planned changes in staffing, responsibilities, or reporting structure? If so, what are they?
- Q7. Do you think the current level of staff support is sufficient for supporting the program implementation needs?

Program Progress

Let's talk about how the BizSavers programs are progressing, including any recent program changes. For any of these questions, just let me know if Justin or Kristen would have more direct knowledge.

- Q8. Overall, how well are the various programs progressing relative to goals and expectations?
- Q9. There were 48 RCx projects started in the 2016/17 program year but as of July 1, none started in 2017/18. Do you know why that might be?
- Q10. What is being done or planned, if anything, to increase RCx project uptake? What else might be done?
- Q11. It looks like EMS has picked up. What do you think at this point of the potential for that pilot? *[If needed: as of July 1, there were 10 new 2016/17 program year project starts.]*

- Q12. What needs to be done, if anything, to achieve success with the EMS pilot?
- Q13. SBDI participation declined from December 2016 through February of this year, but it began increasing again in March. Is participation meeting your expectations?
If not: What needs to be done, if anything, to achieve success with SBDI?
- Q14. New construction project starts were much higher in 2016 than in previous program years, and they continue at a high rate in 2017. What do you think has driven that increase?
- Q15. So far, how are the standard and custom programs doing relative to goals? *[Probe about savings goals, project completions, pipeline, achievement of non-lighting savings.]*
If not doing well: What might the program do to improve progress toward goals?

Program Measures

- Q16. I understand that the program started providing incentives again for exterior lighting. Is this having the desired effect?
If not: Why do you think that is? What else might be done?
[Note that lighting and controls kWh in PY 2016/17 was 73% of PY 2015, while HVAC was 154% of PY 2015. Over the first four months of PY 2017/18, lighting and controls kWh is 136% of same period in 2016/17, and HVAC is about the same.]
- Q17. What other measures been added or modified in the past year, if any? *[Probe about reasons and uptake. Were these new prescriptive measures?]*
- Q18. Do any other measures need to be added or modified?
- Q19. Have you discussed those possible additions or modifications with anyone else?
If so, who? What is the outcome of those discussions?

Marketing and Outreach

[For all questions, probe about EMS and SBDI]

Now, just a couple of questions about the status of marketing and outreach activities for the program.

- Q20. Overall, how well have the program marketing and outreach efforts in the current program year worked?
[Probe: Are they sufficient to deliver the program participation and savings goals?]
- Q21. Are program marketing and outreach targeting the right business subsectors?
[If concerns are noted about marketing and outreach, ask Q24]

Q22. What is being done about those concerns? What else should be done?

Communication

Next, I'd like to hear briefly about how communication processes are working between and within staff at Ameren Missouri and Lockheed.

Q23. How has communication been between Ameren and Lockheed staff? *[Probe about: Frequency and type of reports and meetings, monthly meetings/webinars with KAEs and CSAs, LM reports to CSAs about projects in their territory, Ameren keeping LM informed on key accounts, LM presentations to Ameren.]*

Q24. And how has communication been within the Lockheed BizSavers staff about the program? *[Probe about any changes in frequency or type of meeting.]*

[If issues identified, ask Q27]

Q25. What do you think should be done to improve communication?

Tracking, Reporting, QA/QC

Next, I'd also like to hear about tracking, reporting, and QA/QC.

Q26. How well is the current tracking and reporting process working to meet your needs? *[Probe about additional reports or information that would be useful.]*

Q27. What tracking and reporting changes were made, if any, this program year? How have those worked out?

Q28. What changes have been made, if any, to QA/QC procedures?

Q29. I know you are aware that ADM has continued to find discrepancies between the quantities of applied-for and installed lighting. Can you tell me what Lockheed is doing to address this? What else might you do?

Q30. What other issues, if any, have arisen with program QA/QC, including anything that Ameren identified and brought to your attention through its review and audit of invoices?

Q31. What kinds of corrective measures have been taken? Have those measures been effective?

Conclusion

Q32. Is there anything that you would like to see changed in how Ameren Missouri is managing Lockheed's implementation of the program?

Q33. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Q34. What would you like to learn from the program evaluation this year?

Those are all of my questions. Thank you very much for your time.

Marketing Manager

Roles & Responsibilities

- Q1. Let's start with a bit about you. Is your title still Marketing Manager?
- Q2. Have any of your responsibilities changed since this past December, when you were last interviewed? If so, how?
- Q3. You previously reported that about 75% of your time is devoted to the BizSavers program. Is that still about right? If not, how has it changed?
- Q4. This past December, you noted that Lockheed has hired two new marketing coordinators supporting BizSavers programs. How is that working out?
Are they still supporting other utilities in addition to Ameren Missouri?

Marketing

- Q5. You previously reported that Lockheed had worked with Ameren to change the look of marketing materials to make new materials distinct from old ones. How is that working out?
What feedback, if any, have you gotten from trade allies on that or Ameren account staff on that?
- Q6. You mentioned before that Lockheed was moving away from distributing hard copy case studies and fact sheets toward online distribution. The goal was to use email campaigns to drive customers and TAs to the website. How is that working out?
How do you know that? *[Probe about metrics used to assess new strategy]*
- Q7. Can you give me an update on any new marketing activities started since last December? *[Probe about anything listed in monthly summaries]*
What are the goals?
How are you assessing success?
How are they working so far?
- Q8. What, if anything, is being done to raise awareness of the new construction and retro-commissioning programs, among customers or trade allies? In particular, what is being done, if anything, to raise awareness of the need to involve program staff early in the design phase for new construction projects? *[Probe about cross-program promotion]*

- Q9. Back in December, you mentioned there had been some changes to the look and navigation of the website. What metrics do you have on how that has improved its usability?
- Q10. Can you give me any updates on the program's efforts to reach specific market segments? *[Probe about specific segments identified, what has been done, and what the metrics for success are]*
- Q11. Also, can you give me an update on coordination of marketing with Ameren Missouri? *[Review prior interview notes and probe on comments made previously]*
- Q12. What other changes are planned, if any, for BizSavers marketing and outreach?

Communication

Next I'd like to hear briefly about how communication processes are working between and within staff at Ameren Missouri and Lockheed.

- Q13. How has communication been between Lockheed and Ameren staff? *[Probe about: Frequency and type of reports and meetings, monthly meetings/webinars with KAEs and CSAs, LM reports to CSAs about projects in their territory, Ameren keeping LM informed on key accounts, LM presentations to Ameren.]*
- Q14. And how has communication been within the Lockheed BizSavers staff about the program? *[Probe about any changes in frequency or type of meeting.]*

[If issues identified, ask Q15]

- Q15. What do you think should be done to improve program communication?

Tracking & Reporting

Next, I'd also like to hear about tracking and reporting.

- Q16. From your perspective, how well is the current process of tracking and reporting program data?

Are you getting the information you need? Would any other reports or information be useful?

Any differences by program?

Conclusion

- Q17. Is there anything that you would like to see changed in program offerings in the future?
- Q18. Is there anything else about the program that we have not discussed that you feel should be mentioned?
- Q19. What would you like to learn from the program evaluation?

Those are all of my questions. Thank you very much for your time.

Lockheed Martin Operations Lead

Roles & Responsibilities

- Q1. Let's start with a bit about you. I have your job title as Operations Lead – is that correct? If not, what is your current job title?
- Q2. Please let me know if any of your responsibilities changed since we last spoke?
- Q3. In the latest organization chart, we have, you oversee four project coordinators, a finance lead, and a data analyst. Do you still oversee these staff? If not, what has changed?
- Q4. What are the key responsibilities of the four project coordinators (Laurie, Mackenzie, Taylor, and Jordan)?

Program Processes

- Q5. In last year's evaluation, we got feedback from trade allies and participants that suggested the application process was challenging, particularly for custom projects. What, if anything, has been done to make the process smoother? *[For example, one-quarter of surveyed participants had to resubmit custom applications, largely to correct errors in calculating incentives, or had to provide additional supporting documentation].*
- Q6. One of the recommendations the evaluation team made was to add information about documentation requirements to the "welcome" tab of the incentive application. Has Lockheed considered this or implemented it? If not, why not? .
- Q7. Another recommendation was to record the incentive calculation errors made, as part of the project record, so that either Lockheed or the evaluation team can identify the most common types of errors. Has Lockheed considered this or implemented it? If not, why not?
- Q8. Has Lockheed made any changes to how the New Construction or SBDI programs under your purview are implemented? If so, what are they?
If changes made:
- Q9. Why were those changes made? What effect have they had?
- Q10. This past December, you mentioned that business development representatives had become more involved in the new construction program. How has the involvement of business development representatives affected the new construction projects you see coming into the program? *[Probe about: number of projects, type of projects, completeness of applications, concerns or questions that applicants have had.]*

- Q11. It seems like a main limitation to getting more savings from the new construction program has been in getting involved early in project planning. Do you agree with that and, if so, what do you think are the reasons for that?
- Q12. Are there any specific actors – building owners, architects, designers, and so forth – that the program has had difficulty engaging? What can be done about that?
- Q13. We are planning to interview architects and designers this year to get their sense of what's needed to get the new construction program involved earlier in the planning of projects. What would you most like to learn from this group about that would help the program engage them more in the new construction program?
- Q14. What do you see as the biggest challenge to the new construction program? What is being done to address that challenge?
- Q15. What changes, if any, would you like to see made to the new construction program? Why?
- Q16. Has Lockheed made any other changes to any program processes? If so, what are they?
- If changes made:
- Q17. Why were those changes made? What effect have they had?

Communication

Next I'd like to hear briefly about how communication processes are working between and within staff at Ameren Missouri and Lockheed.

- Q18. How has communication been between Lockheed and Ameren staff? *[Probe about: Frequency and type of reports and meetings, monthly meetings/webinars with KARs and CSAs, LM reports to CSAs about projects in their territory, Ameren keeping LM informed on key accounts, LM presentations to Ameren.]*
- Q19. And how has communication been within the Lockheed BizSavers staff about the program? *[Probe about any changes in frequency or type of meeting.]*

[If issues identified, ask Q12]

- Q20. What do you think should be done to improve program communication?

Trade Allies & Other Service Providers

I'd also like to get an update on how the program is working with trade allies and other program partners.

- Q21. When Lockheed staff were last interviewed this past December, we learned that the program has focused on recruiting only the TAs that had been active prior to the program lapse. But the Monthly Marketing Summaries show that the program

has continued recruiting TAs and is up to 276. Does this reflect a change in strategy? If so, why? *[Probe about: Effect on program savings.]*

<i>Month</i>	<i>Cum. TAs</i>	<i># Co. Approved this Month</i>	<i># Pending Training</i>
<i>March</i>	<i>258</i>	<i>5</i>	<i>2</i>
<i>April</i>	<i>265</i>	<i>7</i>	<i>1</i>
<i>May</i>	<i>272</i>	<i>7</i>	<i>1</i>
<i>June</i>	<i>276</i>	<i>3</i>	<i>3</i>

- Q22. In the previous end of year report, the evaluation team recommended that Lockheed increase re-introduce distributing printed collateral to TAs to help improve program awareness. Has Lockheed considered or done this? If not, why not?
- Q23. I counted seven SBDI SPs who started projects in the current program year but didn't start any before this program year. Six of them were in the list from last program year, but one – *[company name removed]* – was not in last year's list. Does that sound accurate to you? Have you recruited any new SPs other than Lighting Solutions? Do you plan to recruit any more SPs? Why or why not?
- Q24. It looks like most of the SPs have started more projects than they did last year. What do you think accounts for the increased activity?
- Q25. And can you give me an update on efforts to keep TAs informed of program offerings and changes? *[Probe about training, events, and newsletters, and things mentioned in Monthly Summary: Trade Ally Awards program, including the videos (March), TAN Awards Winners page and home page banner on website.]*
- Q26. Have there been any new special campaigns to increase TA activity, like the money-savings deals and “4 simple steps” campaigns Lockheed did last year? Or do you plan any? If so, please describe them. *[Probe about purpose and goals; how they track success (e.g., could they tell that campaigns increased number of applications?)]*
- Q27. Last December, you indicated you were working on moving away from basing TAN tiers on cumulative project completions. Can you update me on the progress there?
- Q28. In last evaluation, we found some evidence that contractors' incomplete understanding of the new construction incentive process may have resulted in some customers' getting less incentives than they might otherwise. What, if anything, is being done, to ensure that trade allies fully understand the rules for the new construction program? *[If needed: One customer did not receive incentives for HVAC and water heater because contractor thought they could apply for incentives after purchasing equipment. Probe about recommendations made in*

the prior report to provide specific training on new construction program rules and processes and provide some special recognition to contractors who attend such training—for example, identifying such contractors as “new construction program specialists” on the trade ally website and providing special new construction program co-branding]

Q29. What other changes, if any, are planned for outreach to, and interaction with, trade allies and other service providers? *[Probe about types of TA, including RSPs and NC.]*

Tracking & Reporting

Next, I'd also like to hear about tracking and reporting.

Q30. From your perspective, how well is the current tracking and reporting process working? *[Probe about additional reports or information that would be useful. Probe about differences by program]*

Q31. What tracking and reporting changes were made, if any, this program year? How have those worked out?

Q32. What changes have been made, if any, to QA/QC procedures?

Q33. I know you are aware that ADM has continued to find discrepancies between the quantities of applied-for and installed lighting. Can you tell me what Lockheed is doing to address this? What else might you do?

Q34. Can you help clarify when savings are and are not associated with the “study” measure in new construction projects?

1. We noticed that sometimes there are savings associated with a study and another measure variable, sometimes there are savings shown only for a study, and sometimes there are savings shown only for other measures.
2. Also, projects that show savings only for the study measure never have a status beyond “committed.” Why is that?

Conclusion

Q35. Is there anything that you would like to see changed in program offerings in the future?

Q36. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Q37. What would you like to learn from the program evaluation?

Those are all of my questions. Thank you very much for your time.

Lockheed Martin Specialty Programs Lead

Roles & Responsibilities

- Q1. Let's start with a bit about you. I understand you are the Special Programs Lead for the Ameren Missouri programs and you are managing the New Construction and SBDI programs as well as the Trade Ally Network. Is that accurate?
- Q2. Have any of your responsibilities changed since this past December? If so, how?
- Q3. Are you still full time on Ameren or do you have responsibilities for other programs?

Program Processes

- Q4. Has Lockheed made any changes to how the New Construction or SBDI programs under your purview are implemented? If so, what are they?
- If changes made:
- Q5. Why were those changes made? What effect have they had?
- Q6. This past December, you mentioned that business development representatives had become more involved in the new construction program. How has the involvement of business development representatives affected the new construction projects you see coming into the program? *[Probe about: number of projects, type of projects, completeness of applications, concerns or questions that applicants have had.]*
- Q7. It seems like a main limitation to getting more savings from the new construction program has been in getting involved early in project planning. Do you agree with that and, if so, what do you think are the reasons for that?
- Q8. Are there any specific actors – building owners, architects, designers, and so forth – that the program has had difficulty engaging? What can be done about that?
- Q9. We are planning to interview architects and designers this year to get their sense of what's needed to get the new construction program involved earlier in the planning of projects. What would you most like to learn from this group about that would help the program engage them more in the new construction program?
- Q10. What do you see as the biggest challenge to the new construction program? What is being done to address that challenge?
- Q11. What changes, if any, would you like to see made to the new construction program? Why?

Trade Allies & Other Service Providers

I'd also like to get an update on how the program is working with trade allies and other program partners.

Q12. When you were last interviewed this past December, you mentioned that the program has focused on recruiting only the TAs that had been active prior to the program lapse. But the Monthly Marketing Summaries show that the program has continued recruiting TAs and is up to 276. Does this reflect a change in strategy? If so, why? *[Probe about: Effect on program savings.]*

<i>Month</i>	<i>Cum. TAs</i>	<i># Co. Approved this Month</i>	<i># Pending Training</i>
<i>March</i>	<i>258</i>	<i>5</i>	<i>2</i>
<i>April</i>	<i>265</i>	<i>7</i>	<i>1</i>
<i>May</i>	<i>272</i>	<i>7</i>	<i>1</i>
<i>June</i>	<i>276</i>	<i>3</i>	<i>3</i>

Q13. In the previous end of year report, the evaluation team recommended that Lockheed increase re-introduce distributing printed collateral to TAs to help improve program awareness. Has Lockheed considered or done this? If not, why not?

Q14. I counted seven SBDI SPs who started projects in the current program year but didn't start any before this program year. Six of them were in the list from last program year, but one – *[company name removed]* – was not in last year's list. Does that sound accurate to you? Have you recruited any new SPs other than Lighting Solutions? Do you plan to recruit anymore? Why or why not?

Q15. It looks like most of the SPs have started more projects than they did last year. What do you think accounts for the increased activity?

Q16. And can you give me an update on efforts to keep TAs informed of program offerings and changes? *[Probe about training, events, and newsletters, and things mentioned in Monthly Summary: Trade Ally Awards program, including the videos (March), TAN Awards Winners page and home page banner on website.]*

Q17. Have there been any new special campaigns to increase TA activity, like the money-savings deals and “4 simple steps” campaigns Lockheed did last year? Or do you plan any? If so, please describe them. *[Probe about purpose and goals; how they track success (e.g., could they tell that campaigns increased number of applications?)]*

Q18. Last December, you indicated you were working on moving away from basing TAN tiers on cumulative project completions. Can you update me on the progress there?

Q19. In last evaluation, we found some evidence that contractors' incomplete understanding of the new construction incentive process may have resulted in some customers' getting less incentives than they might otherwise. What, if anything, is being done, to ensure that trade allies fully understand the rules for

the new construction program? *[If needed: One customer did not receive incentives for HVAC and water heater because contractor thought they could apply for incentives after purchasing equipment. Probe about recommendations made in the prior report to provide specific training on new construction program rules and processes and provide some special recognition to contractors who attend such training—for example, identifying such contractors as “new construction program specialists” on the trade ally website and providing special new construction program co-branding]*

- Q20. What other changes, if any, are planned for outreach to, and interaction with, trade allies and other service providers? *[Probe about types of TA, including RSPs and NC.]*

Communication

Next I'd like to hear briefly about how communication processes are working between and within staff at Ameren Missouri and Lockheed.

- Q21. How has communication been between Lockheed and Ameren staff? *[Probe about: Frequency and type of reports and meetings, monthly meetings/webinars with KARs and CSAs, LM reports to CSAs about projects in their territory, Ameren keeping LM informed on key accounts, LM presentations to Ameren.]*

- Q22. And how has communication been within the Lockheed BizSavers staff about the program? *[Probe about any changes in frequency or type of meeting.]*

[If issues identified, ask Q18]

- Q23. What do you think should be done to improve program communication?

Tracking & Reporting

Next, I'd also like to hear about tracking and reporting.

- Q24. From your perspective, how well is the current process of tracking and reporting projects working? Any differences by program? *[Probe about additional reports or information that would be useful.]*

Conclusion

- Q25. Is there anything that you would like to see changed in program offerings in the future?

- Q26. Is there anything else about the program that we have not discussed that you feel should be mentioned?

- Q27. What would you like to learn from the program evaluation?

Those are all of my questions. Thank you very much for your time.

6. Online Participant Survey

GROUP: Participants across five programs: Standard, Custom, Retro-commissioning, New Construction, SBDI, and EMS Program Participants

1. Our records indicate you were the main contact for the energy efficient project(s) completed at [FR_LOC1] in [YEAR].

Many of the following questions are about your organization's financial decision making and the project planning process.

Were you involved in the decision to complete this project(s)?

1. Yes, I was involved in the decision to complete the project(s)
2. No, I was involved in the project(s) but not the decision to complete the project(s)
3. No, I was not involved in the project(s)
4. No, I do not work for [ORGANIZATION] but provided services for the project(s)
88. Don't know

[DISPLAY Q2 IF Q1 = 2-4; THEN Q3, THEN SKIP TO END]

2. Could you please provide the name and contact information of the person most knowledgeable about the decision to install the energy efficient equipment at the [LOCATION]?

1. [OPEN ENDED] Name and Email

3. What is your job title or role?

1. Facilities Manager
2. Energy Manager
3. Other facilities management/maintenance position
4. Chief Financial Officer
5. Other financial/administrative position
6. Proprietor/Owner
7. President/CEO
8. Manager
9. Other (Specify) _____

4. Which of the following, if any, does your company have in place at [FR_LOC1]?
[Select all that apply]

1. A person or persons responsible for monitoring or managing energy usage
2. Defined energy savings goals
3. A specific policy requiring that energy efficiency be considered when purchasing equipment

4. Carbon reduction goals
5. Other – please describe: _____
6. None of the above
88. Don't know

Awareness

5. Had you applied for or received Ameren Missouri incentives for any equipment replacements or building upgrades before the one(s) you did in [YEAR]?
 1. Yes
 2. No
 88. Don't know

[DISPLAY Q6 IF Q5 = 2 OR 88]

6. How did you learn about Ameren Missouri's incentives for efficient equipment or upgrades? (Select all that apply)
 1. From the contractor, equipment vendor, or energy consultant who did the energy efficient project(s) completed at [FR_LOC1] in [YEAR]
 2. From some other contractor, equipment vendor, or energy consultant
 3. From an Ameren Missouri Account Representative
 4. From a BizSavers representative
 5. From a search engine (Google, Yahoo, Bing)
 6. At an event/trade show
 7. Received an email blast or electronic newsletter
 8. Received an informational brochure
 9. From a program sponsored webinar
 10. From mobile advertising
 11. From Ameren Missouri's website
 12. TV / radio ad's sponsored by Ameren Missouri
 13. Friends or colleagues
 14. Through past experience with the program
 15. Other (please explain)
 88. Don't know

[DISPLAY Q7 IF Q5 = 1]

7. When you first applied for Ameren Missouri incentives for efficient equipment or upgrades, how did you learn about those incentives? (Select all that apply)
 1. From the contractor, equipment vendor, or energy consultant who did the energy efficient project(s) completed at [FR_LOC1] in [YEAR].
 2. From some other contractor, equipment vendor, or energy consultant.
 3. From an Ameren Missouri Account Representative

4. From a BizSavers representative (not the person who actually did the project)
5. From a search engine (Google, Yahoo, Bing)
6. At an event/trade show
7. Received an email blast or electronic newsletter
8. Received an informational brochure
9. From a program sponsored webinar
10. From mobile advertising
11. From Ameren Missouri's website
12. TV / radio ad's sponsored by Ameren Missouri
13. Friends or colleagues
14. Other (please explain)
88. Don't know

[DISPLAY Q8 ONLY IF STANDARD = 1 AND CUSTOM = 0]

8. In addition to the incentives for specific standard equipment upgrades you received, did you know you could qualify for incentives by proposing a custom energy-upgrade project that fits your specific facility needs?
 1. Yes
 2. No
 88. Don't know

[DISPLAY Q9 ONLY IF SBDI = 1 (AND ALL OTHER INCENTIVE TYPES = 0)]

9. In addition to the discounted lighting equipment you received, did you know you could qualify for incentives for other types of energy efficient equipment, such as heating, cooling, hot water, and refrigeration?
 1. Yes
 2. No
 88. Don't know

[DISPLAY Q10 ONLY IF SBDI = 1 (AND ALL OTHER INCENTIVE TYPES = 0)]

10. If the space heating, cooling, or refrigeration equipment at [FR_LOC1] needed repair or replacement, who would be financially responsible for the repair or replacement?
 1. Our firm/organization
 2. The building owner (not our firm/organization)
 3. A property management or energy management firm
 4. Other (please explain)
 88. Don't know

[DISPLAY Q11 ONLY IF Q10 = 1 (OUR FIRM/ORGANIZATION)]

[FOR Q11, INSERT 5-POINT SCALE, WITH 1 LABELED AS “NOT AT ALL INTERESTED” AND 5 LABELED AS “EXTREMELY INTERESTED” BUT 2, 3, AND 4 NOT LABELED. INCLUDE “DON’T KNOW” OPTION.]

11. If the space heating, cooling, or refrigeration equipment at [FR_LOC1] needed repair or replacement, how interested would you be in using Ameren Missouri incentives to replace your equipment with new, energy efficient equipment.

Please answer using a scale of 1-5 where one means “not at all interested” and 5 means “extremely interested.”

[DISPLAY Q12 IF NEW CONSTRUCTION = 1]

12. You recently received incentives through Ameren Missouri’s New Construction program. At what point did you learn about the availability of those incentives?
1. Before we even started discussing any new construction project
 2. After we had started discussing a project but before selecting the major energy-using equipment
 3. After we had started the design but before selecting the major energy-using equipment
 4. After we had selected the major energy-using equipment
 88. Don’t know

[DISPLAY Q13 IF NEW CONSTRUCTION = 1]

13. At the time you applied for Ameren Missouri incentives for your new construction projects, did you understand that you could not receive incentives for any energy efficient equipment that was already part of your design before you talked to program representatives?
1. Yes
 2. No
 88. Don’t know

[DISPLAY Q14 IF NEW CONSTRUCTION = 1]

[FOR Q14, INSERT 5-POINT SCALE, WITH 1 LABELED AS “NOT AT ALL” AND 5 LABELED AS “COMPLETELY” BUT 2, 3, AND 4 NOT LABELED. INCLUDE “DON’T KNOW” OPTION.]

14. How well did the New Construction program’s range of incentive options fit your needs?

[DISPLAY Q15 ONLY IF Q14 < 4]

15. What caused the range of incentive options offered to fail to meet your needs completely? [OPEN-ENDED RESPONSE]

[DISPLAY Q16 AND Q17 ONLY IF RCX = 1]

16. You recently received incentives for a retro-commissioning project. Which of these other Ameren Missouri program incentives are you aware of?
1. New Construction and major building renovation incentives
 2. Standard incentives for specific measures such as lighting, HVAC, refrigeration, and water heating equipment
 3. Custom incentives for non-standard measures
 4. None of the above

[FOR Q17, INSERT 5-POINT SCALE, WITH 1 LABELED AS “NOT AT ALL” AND 5 LABELED AS “COMPLETELY” BUT 2, 3, AND 4 NOT LABELED. INCLUDE “DON’T KNOW” OPTION.]

17. How well did the Retro-commissioning program’s range of incentive options fit your needs?

[DISPLAY Q18 ONLY IF Q17 < 4]

18. In what way did the range of incentive options offered fail to meet your needs completely? [OPEN-ENDED RESPONSE]

[DISPLAY Q19 ONLY IF CUSTOM = 1 OR Q8 = 1]

19. Were you aware that the custom incentives for cooling equipment increased from \$.07/kWh to \$.15/kWh, starting in 2016?
1. Yes
 2. No
 88. Don’t know

Program Delivery Efficiency

Application Process [do not display]

20. Which of the following people worked on completing your application for program incentives (including gathering required documentation)? (Select all that apply)
1. Yourself
 2. Another member of your company
 3. A contractor
 4. An equipment vendor
 5. A designer or architect
 6. Someone else – please define: _____
 88. Don’t know

[DISPLAY Q21 IF Q20 = 1 AND SBDI = 0]

[FOR Q21, INSERT 5-POINT SCALE, WITH 1 LABELED AS “NOT AT ALL CLEAR” AND 5 LABELED AS “COMPLETELY CLEAR” BUT 2, 3, AND 4 NOT LABELED. INCLUDE “DON’T KNOW” OPTION.]

21. Thinking back to the application process, please rate the clarity of information on how to complete the application...

[DISPLAY Q22 ONLY IF Q21 < 4]

22. What information, including instructions on forms, needs to be further clarified?

[DISPLAY Q23 ONLY IF FAST TRACK = 1 AND SBDI = 0 AND NC = 0]

23. At the time you submitted your application, which of the following best describes what your understanding of the application rules was?

1. I had to purchase and install all of the equipment before applying for incentives
2. I had to purchase all equipment before applying for incentives but I could install equipment after applying
3. I could purchase equipment after applying for incentives
4. Other
88. Don't know

[DISPLAY Q23 ONLY IF FAST TRACK = 1 AND SBDI = 0 AND NC = 0]

24. At the time you submitted your application, which of the following best describes what your understanding of the application rules was?

1. After Ameren Missouri approved my planned equipment replacement, I had to purchase and install all of the equipment before completing the incentive application
2. After Ameren Missouri approved my planned equipment replacement, I had to purchase all equipment before completing the incentive application but I could install equipment after completing the application
3. After Ameren Missouri approved my planned equipment replacement, I could purchase equipment after completing the application
4. Other
88. Don't know

[DISPLAY Q25 ONLY IF Q20 = 1 (YOURSELF) AND SBDI = 0]

[FOR Q25, INSERT 5-POINT SCALE, WITH 1 LABELED AS “COMPLETELY UNACCEPTABLE” AND 5 LABELED AS “COMPLETELY ACCEPTABLE” BUT 2, 3, AND 4 NOT LABELED.

FOR ALL ITEMS, INCLUDE “DON’T KNOW” OPTION.

FOR ITEM 25A, INCLUDE OPTION “NOT APPLICABLE - DID NOT GET FORMS FROM THE WEBSITE”.

FOR ITEM 25D, INCLUDE OPTION “NOT APPLICABLE - NO DOCUMENTATION REQUIRED]

25. Using a 5-point scale, where 1 = “completely unacceptable” and 5 = “completely acceptable,” how would you rate. . .
- a. ...the ease of finding forms on Ameren Missouri’s website
 - b. ...the ease of using the electronic application worksheets
 - c. ...the time it took to approve the application
 - d. ...the effort required to provide required invoices or other supporting documentation
 - e. ...the overall application process

[DISPLAY Q26 ONLY IF SBDI = 0]

26. Did you have a clear sense of whom you could go to for assistance with the application process?
1. Yes
 2. No
 88. Don’t know

[DISPLAY Q27 ONLY IF CUSTOM = 1 OR RCX = 1 OR NC = 1 OR EMS = 1]

27. After initial submission, were you (or anyone acting on your behalf) required to resubmit or provide additional documentation before your application was approved?
1. Yes
 2. No
 88. Don’t know

[DISPLAY Q28 ONLY IF Q27= 1 (YES)]

28. Which of the following were reasons that you had to resubmit your application? (Please select all that apply)
1. Issues related to how energy savings were calculated
 2. [DISPLAY IF RCx = 1] Other issues related to the Audit
 3. [DISPLAY IF NC = 1] Other issues related to the Technical Analysis study
 4. Issues related to additional supporting documentation such as invoices
 5. Other issues – please specify: _____
 88. Don’t know

[DISPLAY Q29 ONLY IF SBDI = 0]

29. How did the incentive amount compare to what you expected?
1. It was much less
 2. It was somewhat less

3. It was about the amount expected
4. It was somewhat more
5. It was much more
88. Don't know

[DISPLAY Q30 ONLY IF SBDI = 1 AND STANDARD = 0 AND CUSTOM = 0 AND RCX = 0 AND NC = 0 AND EMS = 0]

30. How did the project cost compare to what you expected?

1. It was much less
2. It was somewhat less
3. It was about the amount expected
4. It was somewhat more
5. It was much more
88. Don't know

[DISPLAY Q31 IF DELAMP = 1]

31. According to our records you received an incentive for permanently removing [DELAMP_QUANT] linear fluorescent lamps. Were all of these lamps installed and operating at the time the removal work began?

1. Yes
2. No
88. Don't know

[DISPLAY Q32 ONLY IF Q31=2]

32. Approximately what share of the lamps that you received an incentive for permanently removing were NOT installed and operating at the time they were removed?

1. _____ Percent of lamps not installed and operating
88. Don't know

[DISPLAY Q33 ONLY IF Q31=2]

33. Thinking about the lamps that were NOT installed and operating when the removal work began, when were those lamps last installed and operating? Was it...

1. Less than one month before the removal work
2. One month to less than six months before the removal work
3. Six to 12 months before the removal work
4. More than one year before the removal work
88. Don't know

Equipment Selection

[FOR EACH PART OF Q34, INSERT FOLLOWING RESPONSE OPTIONS:

1 = No interaction with this type of person or they provided no input

2 = Input had no effect on decision

3 = Small effect on decision

4 = Moderate to large effect on decision

5 = Critical effect – could not have made decision without it

88 = I don't know how the interactions affected the decision

34. How did each of the following affect your decision to install the efficient equipment?

- a. [IF STANDARD = 1 OR CUSTOM = 1 OR EMS = 1] Vendor (retailer)
- b. [IF STANDARD = 1 OR CUSTOM = 1 OR RCX = 1 OR EMS = 1] Contractor (installer)
- c. [IF STANDARD = 1 OR CUSTOM = 1 OR NC = 1] Designer or architect
- d. [IF SBDI = 1] SBDI Service Provider (contractor)
- e. Ameren Missouri staff member, such as an account representative
- f. BizSavers program representative
- g. [IF RCX = 1] Audit Results
- h. [IF RCX = 1] Your RCx service provider
- i. [IF NC = 1] The "design team" process
- j. [IF NC = 1] General Contractor
- k. [IF NC = 1] The technical analysis study (energy modeling study)
- l. Someone else, please specify

[DISPLAY Q35 ONLY IF Q34L = 3 -5]

35. Who was the someone else that affected your decision to install the efficient equipment?

[DISPLAY Q36 ONLY IF STANDARD = 1]

36. You were required to submit a completed application, along with invoices and other documentation within 180 days after installing your project. Does this time frame limit the types of projects, like HVAC, water heating or other standard upgrades that you might propose to do through the program?

1. No
2. Yes
88. Don't know

Measurement and Verification

37. After your project was completed, did a program representative other than the contractor inspect the work done through the program?
1. Yes
 2. No
 88. Don't know

[DISPLAY Q38 IF Q37=1]

[FOR Q38, INSERT 5-POINT SCALE, WITH 1 LABELED AS "NOT AT ALL AGREE" AND 5 LABELED AS "COMPLETELY AGREE" BUT 2, 3, AND 4 NOT LABELED.]

FOR ALL ITEMS, INCLUDE "DON'T KNOW" OPTION]

38. Using a scale of 1-5 where one means Not at all agree and 5 means Completely agree, please rate your agreement with the following statements:
- a. The inspector was courteous
 - b. The inspector was efficient

Customer Satisfaction

39. In the course of doing this project did you have any interactions with program staff? Program staff DO NOT include anyone hired by you to install the equipment, conduct an audit or design your system.
1. Yes
 2. No
 88. Not sure

[DISPLAY Q40 IF Q39 = 1]

[FOR Q40, INSERT 5-POINT SCALE, WITH 1 LABELED AS "NOT AT ALL KNOWLEDGEABLE" AND 5 LABELED AS "VERY KNOWLEDGEABLE" BUT 2, 3, AND 4 NOT LABELED. INCLUDE "NOT SURE" OPTION]

40. On the scale provided, please indicate how knowledgeable were program staff about the issues you discussed with them?

[DISPLAY Q41 IF Q39 = 1]

[FOR Q41, INSERT 5-POINT SCALE, WITH 1 LABELED AS "NOT AT ALL SATISFIED" AND 5 LABELED AS "VERY SATISFIED" BUT 2, 3, AND 4 NOT LABELED. INCLUDE "NOT SURE" AND "NOT APPLICABLE – HAD NO QUESTIONS OR CONCERNS" OPTIONS]

41. On the scale of 1-5 where 1 means not at all satisfied and 5 means very satisfied, please indicate how satisfied you are with the following:

- a. how long it took program staff to address your questions or concerns
- b. how thoroughly they addressed your question or concern

[FOR Q42, INSERT 5-POINT SCALE, WITH 1 LABELED AS “NOT AT ALL SATISFIED” AND 5 LABELED AS “VERY SATISFIED” BUT 2, 3, AND 4 NOT LABELED. INCLUDE “NOT SURE” OPTION]

42. On the scale of 1-5 where 1 means not at all satisfied and 5 means very satisfied, please indicate how satisfied you are with the following:
- a. the steps you had to take to get through the program
 - b. [IF RCx=0] the equipment that was installed
 - c. [IF RCx=0] the quality of the installation
 - d. [IF RCx=0] the amount of time it took to deliver and install the equipment
 - e. [IF SBDI=0] the amount of time it took to get your rebate or incentive
 - f. [IF SBDI=0 and RCx=0] the range of equipment that qualifies for incentives
 - g. [IF SBDI=1] the types of equipment that you were able to get through the program
 - h. [IF SBDI=1] how well the contractor explained the program rules and processes
 - i. [IF SBDI=1] how well the contractor explained the equipment recommendations
 - j. [IF SBDI=1] how well the contractor explained how much the incentives would cover
 - k. [IF SBDI=1] the walk-through assessment you received
 - l. [IF SBDI=1] the cost of the new lighting or other equipment
 - m. [IF SBDI=1] the time it took to get your new lighting or other equipment
 - n. the program, overall

[DISPLAY Q43 IF Q42 A-N < 4]

43. Please describe the ways in which you were not satisfied with the aspects of the program mentioned above? _____

Net-To-Gross Section

Free-Ridership [Do Not Display]

44. Before you knew about the BizSavers Program had you purchased and installed any energy efficient equipment at the [FR_LOC1] location?
1. Yes
 2. No
 88. Don't know
45. Has your organization purchased any significant energy efficient equipment in the last three years for which you did not apply for a financial incentive through an energy efficiency program at the [FR_LOC1] location?

1. Yes. Our organization purchased energy efficient equipment but did not apply for incentive.
 2. No. Our organization purchased significant energy efficient equipment and applied for an incentive.
 3. No significant energy efficient equipment was purchased by our organization.
 88. Don't know
46. Before participating in the BizSavers Program had you implemented any equipment or measure similar to [FR_MEAS 1] at the [FR_LOC1] location?
1. Yes
 2. No
 88. Don't know
47. Did you have plans to [INSTALL] the [FR_MEAS 1] at the [FR_LOC1] location before participating in the BizSavers Program?
1. Yes
 2. No
 88. Don't know
48. Would you have completed the [FR_MEAS 1] project even if you had not participated in the program?
1. Yes
 2. No
 88. Don't know

[DISPLAY Q49 IF Q5= 1]

49. How important was previous experience with the BizSavers Program in making your decision to [INSTALL] the [FR_MEAS 1] at the [FR_LOC1] location?
1. Very important
 2. Somewhat important
 3. Only slightly important
 4. Not at all important
 5. Did not have previous experience with the program.
 88. Don't know

[DISPLAY Q50 IF SBDI = 1]

50. If the Service Provider that completed the onsite energy assessment had nor not recommended [INSTALLING] the [FR_MEAS 1], how likely is it that you would have [INSTALLED] it anyway?
1. Definitely would have installed
 2. Probably would have installed

3. Probably would not have installed
4. Definitely would not have installed
88. Don't know

51. Did a BizSavers Program or other Ameren Missouri representative recommend that you [INSTALL] the [FR_MEAS 1] at the [FR_LOC1] location?

1. Yes
2. No
88. Don't know

[DISPLAY Q52 IF Q51 = 1]

52. If the BizSavers Program representative had not recommended [INSTALLING] the [FR_MEAS 1], how likely is it that you would have [INSTALLED] it anyway?

1. Definitely would have installed
2. Probably would have installed
3. Probably would not have installed
4. Definitely would not have installed
88. Don't know

53. Would you have been financially able to [INSTALL] the [FR_MEAS 1] at the [FR_LOC1] location without the financial incentive from the BizSavers Program?

1. Yes
2. No
88. Don't know

[DISPLAY Q54 IF Q53 = 2]

54. To confirm, your organization would NOT have allocated the funds to complete a similar energy saving project if the program incentive was not available. Is that correct?

1. Yes, that is correct.
2. No, that is not correct.
88. Don't know

[DISPLAY Q55 IF Q54 = 2]

55. In your own words, can you tell me what your organization would have likely done if the financial incentive was not available from the program?

56. If the financial incentive from the BizSavers Program had not been available, how likely is it that you would have [INSTALLED] the [FR_MEAS 1] at the [FR_LOC1] location anyway?

1. Definitely would have installed

2. Probably would have installed
3. Probably would not have installed
4. Definitely would not have installed
88. Don't know

[DISPLAY Q57 IF QUANT > 1]

57. We would like to know whether the availability of information and financial incentives through the [PROGRAM] affected the quantity (or number of units) of [FR_MEAS1] that you purchased and [INSTALLED] at the [FR_LOC1] location.

Did you purchase and [INSTALL] more [FR_MEAS 1] than you otherwise would have without the program?

1. Yes
2. No, program did not affect quantity purchased and [INSTALLED].
88. Don't know

[DISPLAY Q58 IF ENERGY_USING = 1]

58. We would like to know whether the availability of information and financial incentives through the BizSavers Program affected the level of energy efficiency you chose for [FR_MEAS 1] at the [FR LOC1] location.

Did you choose equipment that was more energy efficient than you would have chosen because of the program?

1. Yes
2. No, program did not affect level of efficiency chosen for equipment.
88. Don't know

[DISPLAY 59 IF Q58 = 1]

59. What type of equipment, if any, would you have installed if the program was not available?

[DISPLAY Q60 IF NC = 0]

60. We would like to know whether the availability of information and financial incentives through the BizSavers Program affected the timing of your purchase and installation of the [FR_MEAS1] at the [FR_LOC1] location.

Did you purchase and [INSTALL] the [FR_MEAS1] earlier than you otherwise would have without the program?

1. Yes
2. No, program did not affect did not affect timing of purchase and [INSTALLATION].
88. Don't know

[DISPLAY Q61 IF Q60 = 1]

61. When would you otherwise have [INSTALLED] the equipment?
1. Less than 6 months later
 2. 6-12 months later
 3. 1-2 years later
 4. 3-5 years later
 5. More than 5 years later
 88. Don't know

[DISPLAY Q62 IF NUMBER OF MEASURE TYPES > 1]

62. Our records indicate you [INSTALLED_FR2] [FR_MEAS2] at the [FR_LOC2] location in addition to [FR_MEAS1] at the [FR__LOC1] location. Did both of these projects go through the same decision making process or was a separate decision made for each?
1. The same decision making process applies to both projects.
 2. A different decision making process applies to each project.
 3. We did not [INSTALL_FR2] [FR_MEAS2] at the [FR_LOC2] location.
 88. Don't know

[IF Q62 = 1, CYCLE THROUGH Q46- Q61 FOR FR_MEAS2]

Spillover

[DISPLAY IF SPILLOVER = 1]

63. According to our records, you also installed some [SPILL_MEASURES] at the [SPILL_LOC] that you did not receive an incentive for. Is that correct?
1. Yes
 2. No, did not install that equipment
 3. No, we received an incentive for the equipment we installed
 88. Don't know

[DISPLAY Q64 IF Q63 = 1]

64. How important was your experience with the BizSavers Program in your decision to install this [SPILL_MEASURES], using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"

[SCALE: 0 "NOT AT ALL IMPORTANT" - 10 "VERY IMPORTANT", 88 = DON'T KNOW]

65. If you had not participated in the BizSavers Program, how likely is it that your organization would still have installed this [SPILL_MEASURES], using a 0 to 10 scale, where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

[SCALE: 0 “DEFINITELY WOULD NOT HAVE INSTALLED” - 10 “DEFINITELY WOULD HAVE INSTALLED”, 88 = DON’T KNOW]

[DISPLAY Q66 IF Q64=0,1,2,3 AND Q65=0,1,2,3 OR IF Q64=8,9,10 AND Q65=8,9,10]

66. You scored the importance of your program experience to your decision to implement the [SPILL_MEASURES], [SPILL_MEASURES], with [Q53 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing the [SPILL_MEASURES], if your organization had not participated in the program with [Q54 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

[OPEN ENDED]

[DISPLAY Q67 IF SPILLOVER = 1]

67. Because of your experience with the program, has your organization installed any other energy efficiency measures at this facility or at your other facilities within Ameren Missouri’s service territory that did NOT receive incentives through Ameren Missouri’s BizSavers Program?

1. Yes
2. No
88. Don’t know

General Spillover Questions

[DISPLAY IF SPILLOVER = 0]

68. We would like to know if you have installed any additional energy efficient equipment because of your experience with the program that you DID NOT receive an incentive for.

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

1. Yes
2. No
88. Don’t know

[DISPLAY Q69 IF Q68 = 1]

69. What additional equipment have you installed? [MULTI SELECT]

1. Lighting
2. Lighting controls or occupancy sensors
3. Unitary or split air conditioning system or chiller

4. Refrigeration equipment
5. Kitchen equipment
6. Something else
96. Didn't implement any measures [SKIP TO FIRMOGRAPHICS]
88. Don't know [SKIP TO FIRMOGRAPHICS]

[DISPLAY Q70 IF Q68 = 1]

70. Why didn't you apply for or receive incentives for those items? [MULTI SELECT
RANDOMIZE ORDER, BUT FIX OTHER AND DON'T KNOW]
 1. Didn't know whether equipment qualified for financial incentives
 2. Equipment did not qualify for financial incentives
 3. Too much paperwork for the financial incentive application
 4. Financial incentive was insufficient
 5. Didn't have time to complete paperwork for financial incentive application
 6. Didn't know about financial incentives until after equipment was purchased
 7. Other reason (please describe): _____
 8. We did receive an incentive from Ameren Missouri for that equipment [SKIP
TO FIRMOGRAPHICS]
 88. Don't know

Lighting

[DISPLAY Q71 IF Q69 = 1]

71. What type of lighting did you install? [MULTI-SELECT]
 1. T8 lamps or fixtures
 2. T5 lamps or fixtures
 3. Highbay Fixtures
 4. Metal Halides
 5. LED lamps
 6. High Intensity Discharge Lamps (HID)
 7. Another type [OPEN ENDED]
 88. Don't know

[DISPLAY Q73 IF Q71 = 1]

72. What type of T8 lamps or fixtures did you install?
 1. 4' lamps
 2. 2 lamp fixtures
 3. 4 lamp fixtures
 4. 6 lamp fixtures
 5. Another type
 88. Don't know

[DISPLAY Q74 IF Q73 = 5]

73. What other type of T8 lamp or fixtures did you install?

[OPEN ENDED]

[DISPLAY Q75 IF Q71 = 2]

74. What type of T5 lamps or fixtures did you install?

1. 4' lamps
2. 2 lamp fixtures
3. 4 lamp fixtures
4. 6 lamp fixtures
5. Another type
88. Don't know

[DISPLAY Q76 IF Q75 = 5]

75. What other type of T5 lamp or fixtures did you install?

[OPEN ENDED]

[DISPLAY Q77 IF Q71 = 3]

76. What type of highbay lighting did you install?

1. T5
2. T8
3. Another type
88. Don't know

[DISPLAY Q78 IF Q77 = 3]

77. What other type of highbay lighting did you install?

[OPEN ENDED]

[DISPLAY Q79 IF Q71 = 3]

78. How many lamps per fixture are there in the High Bay Fixtures?

[OPEN ENDED] lamps per fixture

[DISPLAY Q80 IF Q71 = 4]

79. What type of metal halide lighting fixture did you install?

1. Ceramic
2. Pulse start
3. Other
88. Don't know

[DISPLAY Q81 IF Q71 = 5]

80. What type of LED lamps did you install?

1. BAR/R
2. PAR
3. A-line
4. MR16
5. Exit Sign
6. Linear
7. Another type
88. Don't know

[DISPLAY Q82 IF Q81 = 6]

81. How long are the linear LED lamps that you installed?

1. 2 foot
2. 4 foot
3. 8 foot
4. Other (Please specify)
88. Don't know

[DISPLAY Q83 IF Q82 = 4]

82. What other type of LED did you install?

1. [OPEN ENDED]

[LOOP Q84-Q89 FOR EACH TYPE SELECTED IN Q71]

83. How many [Q71 RESPONSE] did you install?

1. [OPEN ENDED, NUMERIC]

84. What was the average wattage of the [Q71 RESPONSE]?

1. [OPEN ENDED, NUMERIC]

85. Were they installed inside or outside?

1. Inside
2. Outside
88. Don't know

86. What type of building did you install the [Q71 RESPONSE] lighting in?

1. College/University
2. Elementary School
3. Exterior
4. Garage (24/7 lighting)
5. Garage

6. Grocery
7. Heavy Industry
8. High School/Middle School
9. Hospital
10. Hotel/Motel – Common
11. Hotel/Motel – Guest Rooms
12. Light Industry
13. Miscellaneous
14. Multifamily Common Area
15. Office
16. Religious Worship/Church
17. Restaurant
18. Retail/Service
19. Warehouse
20. Other (Please specify)
88. Don't know

87. What type of lighting did the [Q71 RESPONSE] replace?

1. T12s (LINEAR FLOURESCENTS)
2. T8s (LINEAR FLOURESCENTS)
3. Metal halide
4. High Intensity Discharge Lamps (HID)
5. Something else (VERBATIM)
88. Don't know

88. How many of the old lamps or bulbs did you remove?

1. [OPEN ENDED, NUMERIC]

[DISPLAY Q90 IF Q71 = 1-7]

89. How important was your experience with the BizSavers Program in your decision to install this lighting equipment, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"

[SCALE: 0 "NOT AT ALL IMPORTANT" - 10 "VERY IMPORTANT", 88 = DON'T KNOW]

[DISPLAY Q91 IF Q71 = 1-7]

90. If you had not participated in the BizSavers Program, how likely is it that your organization would still have installed this lighting equipment, using a 0 to 10 scale, where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

[SCALE: 0 "DEFINITELY WOULD NOT HAVE INSTALLED" - 10 "DEFINITELY WOULD HAVE INSTALLED", 88 = DON'T KNOW]

[DISPLAY Q92 IF Q90=0,1,2,3 AND Q91=0,1,2,3
OR IF Q90=8,9,10 AND Q91=8,9,10]

91. You scored the importance of your program experience to your decision to implement additional lighting measures with [Q90 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing additional lighting measures if your organization had not participated in the program with [Q91 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

1. [OPEN ENDED]

Lighting Controls

[DISPLAY Q93 IF Q69 = 2]

92. What type of lighting controls did you install?

1. Centralized lighting control system
2. Occupancy sensors
3. Something else (Please explain)
88. Don't know

[DISPLAY Q94 IF Q69 = 2]

93. How many square feet is the area being controlled?

1. [NUMERIC] sq. ft.

[DISPLAY Q95 IF Q93 = 2]

94. How many fixtures are being controlled by the lighting controls?

1. [OPEN ENDED, NUMERIC]

[DISPLAY Q96 IF Q93 = 2]

95. On average, how many lamps or bulbs does each fixture contain?

1. [OPEN ENDED, NUMERIC]

[DISPLAY Q97 IF Q93 = 2]

96. What is the average wattage of these lamps?

1. [OPEN ENDED, NUMERIC]

[DISPLAY Q98 IF Q69 = 2]

97. What type of building did you install the controls in?

1. College/University
2. Elementary School

3. Exterior
4. Garage (24/7 lighting)
5. Garage
6. Grocery
7. Heavy Industry
8. High School/Middle School
9. Hospital
10. Hotel/Motel – Common
11. Hotel/Motel – Guest Rooms
12. Light Industry
13. Miscellaneous
14. Multifamily Common Area
15. Office
16. Religious Worship/Church
17. Restaurant
18. Retail/Service
19. Warehouse
20. Other (Please specify)
88. Don't know

[DISPLAY Q99 IF Q69 =2]

98. How important was your experience with the [PROGRAM_NAME] Program in your decision to install lighting controls, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"

[SCALE: 0 "NOT AT ALL IMPORTANT" - 10 "VERY IMPORTANT", 88 = DON'T KNOW]

[DISPLAY Q100 IF Q69= 2]

99. If you had not participated in the [PROGRAM_NAME] Program, how likely is it that your organization would still have installed lighting controls, using a 0 to 10 scale, where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

[SCALE: 0 "DEFINITELY WOULD NOT HAVE INSTALLED" - 10 "DEFINITELY WOULD HAVE INSTALLED", 88 = DON'T KNOW]

[DISPLAY Q101 IF Q99=0,1,2,3 AND Q100=0,1,2,3

OR IF Q99=8,9,10 AND Q100=8,9,10]

100. You scored the importance of your program experience to your decision to implement lighting controls with [Q99 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing lighting controls if your organization had not participated in the program with [Q100 RESPONSE] out of 10 possible

points. Can you please explain the role the program made in your decision to implement this measure?

1. [OPEN ENDED]

HVAC Measures

[DISPLAY Q102 IF Q69 = 3]

101. What types of energy efficient equipment did you install as part of the HVAC project? [MULTI SELECT]

1. Air conditioning system
2. Heat pump (A heating and cooling system that transfers heat energy from a source to a destination)
3. Ground Source Heat pump (A heating and cooling system that transfers heat to or from the ground)
4. Air cooled chiller (A system that produces cold liquid sent around to individual spaces used for cooling air usually found in larger facilities)
5. Water cooled chiller (A system that produces cold liquid sent around to individual spaces used for cooling air usually found in larger facilities)
6. HVAC Occupancy Controls
7. Another type
88. Don't know

[DISPLAY Q103 IF Q102 = 7]

102. What other type of HVAC equipment did you install?

1. [OPEN ENDED]

[DISPLAY Q104 IF Q102 = 1]

103. What is the size (tons) of the air conditioning system installed?

1. [NUMERIC] tons

[DISPLAY Q105 IF Q102 = 2]

104. What is the size (tons) of the heat pump installed?

1. [NUMERIC] tons

[DISPLAY Q106 IF Q102 = 3]

105. What is the size (tons) of the ground source heat pump installed?

1. [NUMERIC] tons

[DISPLAY Q107 IF Q102 = 4]

106. What type of air cooled chiller was installed?

1. Reciprocating
2. Screw

[DISPLAY Q108 IF Q102=4]

107. What is the coefficient of performance (COP) and the integrated part load value (IPLV) of the installed air cooled chiller?

1. [NUMERIC] COP
2. [NUMERIC] IPLV

[DISPLAY Q109 IF Q102 = 4]

108. What is the size (tons) of the air cooled chiller installed?

1. [NUMERIC] tons

[DISPLAY Q110 IF Q102=5]

109. What type of water cooled chiller was installed?

1. Centrifugal
2. Screw
88. Don't know

[DISPLAY Q111 IF Q102=5]

110. What is the integrated part load value (IPLV) of the installed water cooled chiller?

1. [NUMERIC] IPLV

[DISPLAY Q112 IF Q102 = 5]

111. What is the size (tons) of the water cooled chiller installed?

1. [NUMERIC] tons

[DISPLAY Q113 IF Q102=6]

112. How many buildings have HVAC occupancy controls installed?

1. [OPEN ENDED, NUMERIC]

[DISPLAY Q114 IF Q69=3]

113. How important was your experience with the BizSavers Program in your decision to install this HVAC equipment, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"

[SCALE: 0 "NOT AT ALL IMPORTANT" - 10 "VERY IMPORTANT", 88 = DON'T KNOW]

[DISPLAY Q115 IF Q Q69= 3]

114. If you had not participated in the BizSavers Program, how likely is it that your organization would still have installed this HVAC equipment, using a 0 to 10 scale,

where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

[SCALE: 0 “DEFINITELY WOULD NOT HAVE INSTALLED” - 10 “DEFINITELY WOULD HAVE INSTALLED”, 88 = DON'T KNOW]

[DISPLAY Q116 IF Q114=0,1,2,3 AND Q115=0,1,2,3

OR IF Q114=8,9,10 AND Q115=8,9,10]

115. You scored the importance of your program experience to your decision to implement HVAC measures with [Q114 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing HVAC measures if your organization had not participated in the program with [Q115 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

1. [OPEN ENDED]

Commercial Refrigeration Equipment

[DISPLAY Q117 IF Q69 = 4]

116. What types of energy efficient refrigeration equipment did you install?

1. ENERGY STAR Commercial freezer
2. ENERGY STAR Commercial refrigerator
3. Anti-sweat heater controls
4. Strip Curtain
5. Some other type of refrigeration equipment
88. Don't know

[DISPLAY Q118 IF Q117= 5]

117. What other type of energy efficient refrigeration equipment did you install?

1. [OPEN ENDED]

[DISPLAY Q119 IF Q117 = 1]

118. How many ENERGY STAR commercial freezers did you install?

1. [NUMERIC]

[DISPLAY Q120 IF Q117 = 1, LOOP FOR EACH UP TO THREE TIMES]

119. What is the volume in cubic feet of the first freezer?

1. [NUMERIC] cubic feet

[DISPLAY Q121 IF Q117 = 1, LOOP FOR EACH UP TO THREE TIMES]

120. Does this freezer have a solid door or a glass door?

1. Solid door
2. Glass door
88. Don't know

[DISPLAY Q122 IF Q117 = 2]

121. How many ENERGY STAR commercial refrigerators did you install?

1. [NUMERIC]

[DISPLAY Q123 IF Q117 = 2, REPEAT FOR EACH UP TO THREE TIMES]

122. What is the volume in cubic feet of the first refrigerator?

1. [NUMERIC] cubic feet

[DISPLAY Q124 IF Q117 = 2, REPEAT FOR EACH UP TO THREE TIMES]

123. Does this refrigerator have a solid door or a glass door?

1. Solid door
2. Glass door
88. Don't know

[DISPLAY Q125 IF Q117 = 3]

124. How many anti-sweat heater controls did you install?

1. [NUMERIC]

[DISPLAY Q126 IF Q117 = 4]

125. How many strip curtains were installed?

1. [NUMERIC]

[DISPLAY Q127 IF Q117 = 4]

126. Where were the strip curtains installed?

1. Walk-in freezer
2. Walk-in cooler
88. Don't know

[DISPLAY Q128 IF AND Q117= 1-5]

127. How important was your experience with the BizSavers Program in your decision to install the energy efficient refrigeration equipment, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"

[SCALE: 0 "NOT AT ALL IMPORTANT" - 10 "VERY IMPORTANT", 88 = DON'T KNOW]

[DISPLAY Q129IF AND Q117= 1-5]

128. If you had not participated in the BizSavers Program, how likely is it that your organization would still have installed this energy efficient refrigeration equipment, using a 0 to 10 scale, where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

[SCALE: 0 “DEFINITELY WOULD NOT HAVE INSTALLED” - 10 “DEFINITELY WOULD HAVE INSTALLED”, 88 = DON’T KNOW]

[DISPLAY Q130 IF Q128=0,1,2,3 AND Q129=0,1,2,3 AND Q117 = 1-5

OR IF Q128=8,9,10 AND Q129=8,9,10 AND Q117 = 1-5]

129. You scored the importance of your program experience to your decision to implement energy efficient refrigeration equipment with [Q128 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing energy efficient refrigeration equipment if your organization had not participated in the program with [Q129 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

1. [OPEN ENDED]

Commercial Kitchen Equipment

[DISPLAY Q131IF Q69 = 5]

130. What type of kitchen equipment did you install?

1. ENERGY STAR Commercial steam cookers
2. ENERGY STAR hot food holding cabinets
3. ENERGY STAR ice machines
4. Low-flow pre-rinse sprayer
5. Some other type of kitchen equipment
88. Don't know

[DISPLAY Q132 IF Q131 = 5]

131. What other type of kitchen equipment did you install?

1. [OPEN ENDED]

[DISPLAY Q133 IF Q131 = 1]

132. How many ENERGY STAR commercial steam cookers did you install?

1. 3 pan steam cookers [NUMERIC]
2. 4 pan steam cookers [NUMERIC]
3. 5 pan steam cookers [NUMERIC]

4. 6 pan steam cookers [NUMERIC]

[DISPLAY Q134 IF Q131 = 2]

133. How many ENERGY STAR hot food holding cabinets did you install?

1. [NUMERIC]

[DISPLAY Q135 IF Q131 = 3]

134. How many ENERGY STAR ice machines did you install?

1. [NUMERIC]

[DISPLAY Q136 IF Q131 = 3]

135. What is the average production (lbs ice/day) of the ice machine(s) installed?

1. [NUMERIC] lbs ice/day

[DISPLAY Q137 IF Q131 = 4]

136. Do any of the low-flow pre-rinse sprayers reduce the use of electrically heated water?

1. Yes
2. No
88. Don't know

[DISPLAY Q138 IF Q137= 1]

137. How many low-flow pre-rinse sprayers that reduce the use of electrically heated water did you install?

1. [NUMERIC] pre-rinse sprayers

[DISPLAY Q139 IF AND Q131=1-5]

138. How important was your experience with the BizSavers Program in your decision to install this kitchen equipment, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"

[SCALE: 0 "NOT AT ALL IMPORTANT" - 10 "VERY IMPORTANT", 88 = DON'T KNOW]

[DISPLAY Q140 IF AND Q131=1-5]

139. If you had not participated in the BizSavers Program, how likely is it that your organization would still have installed this kitchen equipment, using a 0 to 10 scale, where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

[SCALE: 0 "DEFINITELY WOULD NOT HAVE INSTALLED" - 10 "DEFINITELY WOULD HAVE INSTALLED", 88 = DON'T KNOW]

[DISPLAY Q141 IF Q139=0,1,2,3 AND Q140=0,1,2,3

OR IF Q139=8,9,10 AND Q140=8,9,10 AND Q131=1-5]

140. You scored the importance of your program experience to your decision to implement energy efficient kitchen equipment with [Q139 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing energy efficient kitchen equipment if your organization had not participated in the program with [Q140 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

1. [OPEN ENDED]

Commercial Misc. Equipment [DO NOT DISPLAY]

[DISPLAY Q142 IF Q69 = 6]

141. What type of equipment did you install?

1. Heat pump water heater
2. ENERGY STAR vending machine
3. Low flow faucet aerator
4. Low flow showerhead
5. Efficient pump
6. VFD controls
7. Other equipment
88. Don't know

[DISPLAY Q143 IF Q142 =7]

142. What other type of equipment did you install?

1. [OPEN ENDED]

[DISPLAY Q144 IF Q142=1]

143. How many heat pump water heaters did you install?

1. [NUMERIC]

[DISPLAY Q145 IF Q142=2]

144. How many ENERGY STAR vending machines did you install?

1. [NUMERIC]

[DISPLAY Q146 IF Q142=1]

145. What is the average size (MBH) of the heat pump water heaters?

1. [NUMERIC] MBH

[DISPLAY Q147 IF Q142=3]

146. Do any of the buildings in which you installed the low-flow faucet aerators have electric water heating?

1. Yes
2. No
88. Don't know

[DISPLAY Q148 IF Q147=1]

147. How many buildings with electric water heating had low flow faucet aerators installed?

1. [NUMERIC]

[DISPLAY Q149 IF Q142= 5]

148. How many pump motors did you install?

1. [NUMERIC]

[DISPLAY Q150 IF Q142=5]

149. What is the average horsepower of the newly installed pump motors?

1. [NUMERIC]

[DISPLAY Q151 IF Q142=5]

150. What is the average efficiency of the new pump motors?

1. [OPEN ENDED]

[DISPLAY Q152 IF Q142=6]

151. How many motors had VFDs installed?

1. [OPEN ENDED, NUMERIC]

[DISPLAY Q153 IF Q142=6]

152. What is the application of the motor?

1. [OPEN ENDED]

[DISPLAY Q154 IF Q142=6]

153. What is the average horse power of the motors controlled by the VFDs?

1. [OPEN ENDED]

[DISPLAY Q155 IF AND Q142=1-7]

154. How important was your experience with the BizSavers Program in your decision to install this additional equipment, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?"

[SCALE: 0 "NOT AT ALL IMPORTANT" - 10 "VERY IMPORTANT", 88 = DON'T KNOW]

88. Don't know

[DISPLAY Q156 IF AND Q142 = 1-7]

155. If you had not participated in the BizSavers Program, how likely is it that your organization would still have installed this additional equipment, using a 0 to 10 scale, where 0 means you definitely WOULD NOT have installed this equipment and 10 means you definitely WOULD have installed this equipment?

[SCALE: 0 "DEFINITELY WOULD NOT HAVE INSTALLED" - 10 "DEFINITELY WOULD HAVE INSTALLED", 88 = DON'T KNOW]

[DISPLAY Q157 IF Q155=0,1,2,3 AND Q156=0,1,2,3

OR IF Q155=8,9,10 AND Q156=8,9,10]

156. You scored the importance of your program experience to your decision to implement energy efficient additional equipment with [Q155 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing energy efficient additional equipment if your organization had not participated in the program with [Q156 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

1. [OPEN ENDED]

Firmographic

[Note to reviewer: The customer database has many fields indicating much of the "firmographic" data we will want to capture. However, we have not yet established how much of it is populated. Therefore, we propose the following questions. If the database provides sufficient firmographic data, we will be able to eliminate some or all of these questions.]

157. Which of the following best describes the type of work that your firm or organization does at [FR_LOC1]?

1. Industrial
2. Restaurant (not fast food)
3. Fast food restaurant
4. Retail
5. Office
6. Grocery and convenience
7. School
8. Lodging
9. Warehouse

10. Other – specify: _____
88. Not sure
158. Does your organization rent, own and occupy, or own and rent the facility to someone else at this location?
1. Own
 2. Own and occupy
 3. Own and rent to someone else
 88. Don't know
159. Including all the properties, how many separate work locations does your organization own or lease space in, in Ameren Missouri territory? (A work location may consist of multiple buildings in close proximity to each other, such as a university campus – please indicate the number of locations) _____
160. Please list any other properties that could benefit from energy efficient electric or gas equipment upgrades which may qualify for an incentive. Please provide company name, contact person, and phone number and/or email address. _____
[OPEN-ENDED RESPONSE]
161. How many square feet (indoor space) is the part of the property at [LOCATION] that your firm or organization occupies? (If your firm or organization occupies the entire property, indicate the total size of that property.)
1. Less than 5,000
 2. 5,001 to 10,000
 3. 10,001 to 20,000
 4. 20,001 to 50,000
 5. 50,001 to 75,000
 6. 75,001 to 100,000
 7. 100,001 to 250,000
 8. 250,001 to 500,000
 9. 500,001 to 1,000,000
 10. More than 1,000,000
 88. Not sure
162. How can the BizSavers Program implementation team provide you with better service? _____ [OPEN-ENDED RESPONSE]

7. New Construction Architect and Designer Interview Guide

Respondent Information

First, I'd like a little information about you and your company.

[ASK ALL]

Q1. How long has your firm been in business in the Ameren Missouri service territory?

Q2. What is your title and overall role in the firm?

Q3. And beyond that overall role, have you had any more specific role in the new building projects that received Ameren Missouri incentives? If so, what?

Have you received any information about the Ameren Missouri BizSavers New Construction incentive program?

[If no:] What type of information would be useful to you?

[If yes:] What information did you receive?

Did it cover the Whole Building Performance Program?

Who did you receive it from?

Did you find the information to be useful?

If not useful, what type of information would be useful?

Informing clients of available Ameren Missouri incentives early in the design process is one way to insure project incentive amounts are maximized. What role could architect and designers have in informing clients of BizSavers commercial new construction incentives and program rules? *[Probe: Are general or electrical engineering contractors more effective in informing clients about available incentives?]*

What assistance would you need from the BizSavers program to be most effective in providing that information to your clients?

What factors might limit your ability to provide that kind of information to your clients?

As you may or may not know, Ameren's New Construction program runs on a three-year cycle with the current program cycle ending January 31, 2019. To your knowledge, is it your clients' understanding that projects must be completed within a given program cycle in order to receive incentives? Do you know of any cases where that might have prevented a client from applying for incentives?

- Q4. Please tell me a little about your firm, like what types of buildings it specializes in, if any. *[Probe about market sector, business segments, etc.]*
- Q5. Are there any types of customers that do not take as much advantage of the program as they could? If so, what types?
- Q6. What keeps them taking advantage of the program?
- Q7. What could the program do, if anything, to better reach and serve the range of customer types you deal with?

Project Information

Now, I'd like to confirm that I have correct information about the new construction project(s) that you have done that received or is expected to receive Ameren Missouri incentives since 2016.

[ASK ALL]

- Q5. Please let me know if the following information is correct and, if it's not correct, please give me the correct information.

[Fill in info from project data. All but six respondents were associated with only one project in the committed, installed, or completed phase. One was associated with five, one with four, two with three, and two with two.]

Prj	Phase	Address	Lighting Only or Nonlighting	Start Date	Date Completed, Installed, or Committed
1					
2					
3					
4					
5					

[ASK ALL]

- Q9. Ameren Missouri provides incentives for several types of new construction projects: completely new footprints, additions or expansions, major renovations or redesigns of existing space, and build-outs of warm shells.

Which of those best describes the kind of project(s) you did?

Awareness and Application

[ASK ALL]

- Q10. Did you know about Ameren Missouri incentives for new construction projects before you started working on the project(s) we are talking about today?

[IF KNEW ABOUT INCENTIVES BEFORE STARTED PROJECT]

Q11. For how long have you known about Ameren Missouri new construction incentives?

Q12. How did you originally learn about the incentives?

[ASK ALL]

Q13. Were you at all involved in discussions or decisions about applying for Ameren Missouri incentives for the project we are talking about today? If so, in what way were you involved? And who else was involved in those discussions?

Q14. At what point in the new construction design and planning was the subject of applying for Ameren Missouri incentives brought up? *[Probe: For example, was this before you started planning the project, after initial plans but before equipment selection was being discussed, after equipment selection discussions started but before final decisions were made, or after equipment selection decisions were made?]*

[IF NOT INVOLVED IN DISCUSSION/DECISIONS, SKIP TO **PROJECT DECISION MAKING** SECTION]

[IF DID NOT GET NONLIGHTING INCENTIVES]

Q15. Records show only lighting savings for the project(s) you did. Do you know if your client applied for incentives for non-lighting equipment?

[IF APPLIED FOR NON-LIGHTING INCENTIVES]

Q16. For what non-lighting equipment did your client apply for incentives?

Q17. Why wasn't your client able to get the incentives for non-lighting equipment? *[Probe about whether equipment qualified or not, whether the equipment was already part of the project design.]*

[IF DID NOT APPLY FOR NON-LIGHTING INCENTIVES]

Q18. Why didn't your client apply for incentives for non-lighting equipment? *[Probe about whether equipment qualified or not, whether the equipment was already part of the project design, or whether it would have been too costly or difficult to change the design to incorporate incentive-qualifying equipment.]*

[IF DISCONTINUED PROJECT]

Q19. Thinking about the project you worked on that was discontinued, what were the reasons for discontinuing that project?

Project Decision Making

[ASK ALL]

Q20. Did you have any discussions with Ameren Missouri new construction program staff [including the program implementation contractor, Lockheed Martin] about how to build more energy efficiency into your project designs? If so, at what point in the design process did those discussions take place? How, if at all, did those discussions affect what you did?

Probe:

- *What did the discussions lead you to do that you wouldn't have done if you hadn't learned about them?*
- *How did the suggestions of program reps affect the design?*
- *How, if at all, was this affected by client characteristics?*

Q21. Did the Ameren Missouri new construction incentives affect the design of the new construction project(s)? *[If needed: That is, beyond any effect of discussing plans with the program staff]*

Probe:

- *What did the incentives lead you to do that you wouldn't have done if you hadn't learned about them?*

Q22. Who else, such as building contractors, were involved with you in discussions about the new construction project? What role did they have?

Q23. Other than any discussions with program staff or the incentives themselves, what factors influence the selection of energy efficient equipment or features that you included in your designs? *[Probe about influence of: Vendor/retailer, contractor, long-term cost savings, etc.]*

Q24. Were there any program-recommended energy efficiency equipment or construction practices that you decided **not** to include in the project design? If so, what were they and why did you decide not to include them?

Q25. What, if anything, could the program have done to increase the energy efficiency of the equipment or design of your new construction project(s)? *[Probe: Could the program have increased the energy efficiency of the equipment or design if it had gotten involved earlier in the planning process?]*

Q26. What, if anything, could the program do to make sure it gets involved earlier in the planning process in future projects?

Experience with Processes, Requirements, and Staff

[ASK ALL]

Q27. Were you involved in completing the application for New Construction incentives? If so, what was your involvement?

[IF INVOLVED IN APPLICATION]

Q28. And how was your experience with the application paperwork? *[Probe about: Clarity of instructions on how to complete the application. Information that needs to be clarified. Ease of finding application]*

[ASK ALL]

Q29. Did you contact program staff at any time to get clarification about program or application process or requirements? If so, how was your experience getting the information you needed? *[Probe about: Knowing who to contact, staff knowledgeability, speed of, thoroughness of]*

General Program Feedback

I'd like to finish by getting some more general feedback from you about the program.

Q30. What suggestions do you have, if any, for improving the program's process and requirements? *[If needed: That is, the program's approval of planned upgrades, the documentation requirements, the program's review of paperwork, and so forth.]*

Q31. What changes would you suggest, if any, to the range of equipment types or construction practices that qualify for program incentives?

End

[ASK ALL]

Q32. That is all the questions I have. Do you have any additional comments?

Thank you for your time

8. Retro-Commissioning Interview Guides

Retro-Commissioning Service Providers

Introduction and Background

Let's start with a few questions about your company.

[ASK ALL]

Q1. What services does your firm provide? [*Probes: audits, installation of retrofits, commissioning, retro-commissioning, energy management, ...*]

[ASK ALL]

Q2. What type of retro-commissioning services do you specialize in?

- a. Building optimization
- b. Compressed air
- c. Refrigeration
- d. Other, specify: _____

[ASK ALL]

Q3. How long has your firm provided retro-commissioning services?

Customer Firmographics

I have a few questions about your retro-commissioning customers.

[ASK ALL]

Q4. First, what are the main business or building types that you work with on retro-commissioning projects?

[ASK ALL]

Q5. Are your customers typically the building owner, a property management firm, or a tenant leasing space in a building?

[ASK ALL]

Q6. Have you done a retro-commissioning project for anyone who was a tenant leasing their building space? If so, how does the process for completing projects differ and what role does the building owner have?

[ASK ALL]

Q7. What size, in square feet, are the properties you serve with retro-commissioning?

Customer Awareness of RCx

[ASK ALL]

Q8. Which customers do you typically market the retro-commissioning incentives to? Are there certain types of customers that are better candidates for retro-commissioning than others? How are they better candidates? [*If industrial/manufacturing customers: Are there certain types of customers that are better candidates for retro-commissioning? For example, food preparation, equipment manufacturing, etc.*]

[ASK ALL]

Q9. What challenges do you encounter in finding customers who qualify for retro-commissioning services?

[ASK ALL]

Q10. How do you explain retro-commissioning to customers?

Identifying Equipment Upgrades and Installations

[ASK ALL]

Q11. When doing retro-commissioning projects, how often do you identify equipment upgrades or installations in addition to equipment tuning or maintenance actions?

[ASK EVER IDENTIFIES UPGRADES OR INSTALLATIONS]

Q12. What types of equipment upgrades or installations have you identified? [*Probe about **low or no-cost upgrades** vs. more capital-intensive ones.*]

Q13. Do any of those upgrades or installations require applying for other BizSavers incentives, outside the retro-commissioning program? If so, how well does that work? [*Probe about any challenges or obstacles in applying for BizSavers non-retro-commissioning incentives.*]

[ASK ALL]

Q14. What, if anything, prevents your customers from participating in Ameren Missouri's retro-commissioning program? [*If needed: Are there upgrades that are currently not offered by Ameren Missouri that your customers would be interested in? Are there upgrades that are offered by Ameren Missouri that your customers are less likely to take advantage of? If so, what prevents them from completing those upgrades?*]

[ASK ALL]

Q15. What follow up, if any, do you typically do with your retro-commissioning customers after work has been completed? [*If needed: Do you offer routine inspections? If so, is that included in the total project cost?*]

[ASK ALL]

Q16. Do you provide any information or training to your customers about how to keep their equipment and systems operating efficiently? If so, what type of information or training? What information or training do your customers find most useful?

Retro-commissioning Program Comparisons

[ASK ALL]

Q17. Do you provide retro-commissioning services in locations other than Ameren Missouri territory? If so, how do the services you provide differ, if at all, between those in Ameren Missouri territory and other utility territories?

Training

I'd like to hear a bit about any information or training you've received from Ameren Missouri or BizSavers about the retro-commissioning program and any information or training you provide to your customers.

[ASK ALL]

Q18. What information or training did you get from Ameren Missouri or Lockheed Martin to prepare you to deliver the retro-commissioning program to your customers?

[ASK ALL]

Q19. How well did that information or training prepare you?

[ASK ALL]

Q20. What additional information or training about the retro-commissioning program, if any, would you like? [*Probe about specific program processes, technologies, rules, etc.*]

Conclusion

[ASK ALL]

Q21. What have you heard from your retro-commissioning customers about the retro-commissioning program through Ameren? Do you see any barriers to participation? If so what are the barriers?

[ASK ALL]

Q22. What affect, if any, did the interruption of the Ameren program in early 2016 have on your participation in the retro-commissioning program?

[ASK ALL]

Q23. What are the strengths of the retro-commissioning program offered by Ameren Missouri?

[ASK ALL]

Q24. What are the challenges of the retro-commissioning program offered by Ameren Missouri?

[ASK ALL]

Q25. Do you have any other comments or thoughts about the program that you think would be useful for Ameren Missouri to hear?

Thank you for taking the time to talk. Would it be alright for me to contact you via phone or email for any needed clarifications?

Retro-Commissioning Participant

Background

Q1. Can you please tell me your title or role?

Q2. Do you own, lease, or rent the facility at [LOCATION]?

Q3. What type of work does your firm or organization do at [LOCATION]?

Awareness of RCx and Initiative

Q4. Did you already know about the Ameren Missouri Retro-commissioning incentives before you talked with your Retro-commissioning Service Provider, or RSP? If so, how did you know about them?

Q5. And had you already decided to apply for the Ameren Missouri Retro-commissioning incentives before you talked with your Retro-commissioning Service Provider, or RSP?

Decision Making

Q6. Were you already thinking about doing a retro-commissioning project before you spoke with your RSP?

Q7. And what all was done in your retro-commissioning project? [*Probe about: Equipment that was replaced. Anything done to make existing equipment and systems operate more efficiently (optimization work), by equipment type.*]

Q8. How did you decide what to do for your retro-commissioning project once you decided to do it? What role did the RSP have in that process? For example, what information did the RSP provide that shaped the decision?

[IF DID OTHER CYCLE 3 PROJECTS BEFORE RCx PROJECT(S)]

Q9. Program records show that your company did some other projects in the past year or so before you started the retro-commissioning project. [*Review project history*] In what way, if any, did your experience with those projects influence your decisions about doing the retro-commissioning project?

[IF DID OTHER CYCLE 3 PROJECTS AFTER RCx PROJECT(S)]

Q10. Program records show that your company has done some other projects since starting the retro-commissioning project. [*Review project history*] In what way, if any, did your experience with your retro-commissioning project influence your decisions about doing those other projects?

Application

Q11. How was your experience with completing the application for retro-commissioning incentives?

Q12. Who else helped you complete the application? What did they do? *Probe about role of RSP, other program staff?*

[IF RCX AGENT OR SOMEONE ELSE FROM PROGRAM HELPED WITH APPLICATION]

Q13. Would you have been able to complete the application without assistance from the RSP/program staff?

Audit and Equipment Recommendations

Q14. And how was your experience with the audit?

Q15. Did your RSP recommend energy efficiency opportunities that your firm decide not to pursue? If so, what were they and why did you decide not to include them?

Q16. Did the program disqualify any equipment types or optimization measures that you think would have saved energy? If so, what were they?

Q17. Did the RSP provide your company with any information or training on how to keep your equipment and systems operating efficiently? If so, please describe that information or training? Was that information or training useful? If so, what was most useful? If not, why not?

[IF COMPLETED RCx PROJECT(S)]

Q18. And how was your experience with the on-site inspections after completion of the retro-commissioning project?

Assistance Received

Q19. Did you have any questions about any program requirements other than how to complete the application?

[IF HAD QUESTIONS ABOUT REQUIREMENTS]

Q20. Did you know who you could go to if you had questions about program requirements? [*Probe about: knowing how to contact Retro-commissioning*]

Service Provider (RSP) and other program representatives, or ability to get needed info from Ameren MO website]?

- Q21. What could the program or its representatives do, if anything, to keep you better informed about the process or requirements?

Satisfaction

- Q22. How was the quality of the work done through your retro-commissioning project? *[Probe about any equipment delivery issues, equipment performance, and quality of installation.]*

- Q23. How did the incentive amount compare to what you expected?

- Q24. On a scale of 1 to 5, where 1 means “not at all satisfied” and 5 means “very satisfied,” how satisfied were you with your experience with the retro-commissioning program?

- Q25. Was there anything you were at all dissatisfied with? *[The steps you had to take to get through program, the range of equipment that qualified for incentives, interactions with staff, the audit...]*

- Q26. In what ways could the program be improved?

Awareness of / Interest in Other BizSavers Incentives

- Q27. In addition to the support you received for retro-commissioning, what other Ameren Missouri incentives for new or existing commercial buildings are you aware of? *[Review list of project types done to inform wording of this question.]*

- Q28. Will your firm consider applying for Ameren Missouri incentives in the future? If so, which ones? If not, why not?

Firmographics

I'd like to learn a little more about your firm so we can know can better understand the market that the Retro-commissioning program serves.

- Q29. How many separate locations does your organization own or lease for its own use in Ameren Missouri territory?

- Q30. In how many of these locations would retro-commissioning, or compressed air or refrigeration optimization be applicable?

- Q31. How many square feet of indoor space is the property at [LOCATION] that we have been talking about?

Spillover

- Q32. Since participating in the BizSavers Program, has your organization installed any ADDITIONAL energy efficiency measures at this facility or at your other facilities

within Ameren Missouri's service territory that did NOT receive incentives through Ameren Missouri's BizSavers Program?

1. Yes
2. No
88. Don't know

[ASK IF Q32 = 1]

Q33. What additional equipment have you installed?

1. *[RECORD RESPONSES IN SPILLOVER MATRIX]*

That is all the questions I have. Thank you for your time.

As I review and analyze your responses, would it be alright if I contacted you again if needed to clarify a response?

Thanks again. Good bye.

Retro-Commissioning Near-Participant

Background

- Q1. Can you please tell me your title or role?
- Q2. Do you own, lease, or rent the facility at [LOCATION]?
- Q3. What type of work does your firm or organization do at [LOCATION]?

Awareness of RCx and Initiative

- Q4. Did you already know about the Ameren Missouri Retro-commissioning incentives before you talked with your Retro-commissioning Service Provider, or RSP? If so, how did you know about them?
- Q5. And had you already decided to apply for the Ameren Missouri Retro-commissioning incentives before you talked with your Retro-commissioning Service Provider, or RSP?

Decision Making

- Q6. Were you already thinking about doing a retro-commissioning project before you spoke with your RSP?
- Q7. And what all were you looking at doing in your retro-commissioning project? *[Probe about: Equipment that was replaced. Anything done to make existing equipment and systems operate more efficiently (optimization work), by equipment type.]*
- Q8. How did you decide on those measures? What role did the RSP have in that process? For example, what information did the RSP provide that shaped the initial decision?

- Q9. Program records show that your company did complete an equipment retrofit project after discontinuing the retro-commissioning project. In what way, if any, did your experience with the retro-commissioning application process influence the decision to do the retrofit project? *[IF NEEDED: The project was custom/standard, started on 8/18/17, about one year after starting the discontinued RCx project, and completed on 9/19/17.]*

Application

- Q10. How was your experience with starting the application paperwork for retro-commissioning incentives?
- Q11. Who else helped you with the application? What did they do? *Probe about role of RSP, other program staff?*

[IF RCX AGENT OR SOMEONE ELSE FROM PROGRAM HELPED WITH APPLICATION]

- Q12. Would you have been able to do the initial application paperwork without assistance from the RSP/program staff?

Audit and Equipment Recommendations

- Q13. Did you go as far as having an audit done? If so, how was your experience with the audit?
- Q14. Did the program disqualify any equipment types or optimization measures that you think would have saved energy? If so, what were they?
- Q15. And why did your firm decide not to complete the application process?

Assistance Received

- Q16. Did you have any questions about any program requirements other than how to complete the application?

[IF HAD QUESTIONS ABOUT REQUIREMENTS]

- Q17. Did you know who you could go to if you had questions about program requirements? *[Probe about: knowing how to contact Retro-commissioning Service Provider (RSP) and other program representatives, or ability to get needed info from Ameren MO website?]*
- Q18. What could the program or its representatives do, if anything, to keep you better informed about the process or requirements?

Satisfaction

- Q19. Was there anything in particular about the process you were at all dissatisfied with? [The steps you had to take to get through program, the range of equipment that qualified for incentives, interactions with staff, the audit...]
- Q20. Do you think your firm will submit another application for retro-commissioning in the future? If not, why not?

Awareness of / Interest in Other BizSavers Incentives

- Q21. In addition to the support you received for retro-commissioning, what other Ameren Missouri incentives for new or existing commercial buildings are you aware of?
- Q22. Will your firm consider applying for Ameren Missouri incentives other than for retro-commissioning in the future? If so, which ones? If not, why not?

Firmographics

I'd like to learn a little more about your firm so we can know can better understand the market that the Retro-commissioning program serves.

- Q23. How many separate locations does your organization own or lease for its own use in Ameren Missouri territory?
- Q24. In how many of these locations would retro-commissioning, or compressed air or refrigeration optimization be applicable
- Q25. How many square feet of indoor space is the property at [LOCATION] that we have been talking about?

Spillover

- Q26. Since your experience with the BizSavers Program, has your organization installed any ADDITIONAL energy efficiency measures at this facility or at your other facilities within Ameren Missouri's service territory that did NOT receive incentives through Ameren Missouri's BizSavers Program?

1. Yes
2. No
88. Don't know

[ASK IF Q34 = 1]

- Q27. What additional equipment have you installed?

1. *[RECORD RESPONSES IN SPILLOVER MATRIX]*

That is all the questions I have. Thank you for your time.

As I review and analyze your responses, would it be alright if I contacted you again if needed to clarify a response?

Thanks again. Good bye.

9. Non-Participant Survey

Phone

Screening [ALL]

Hello, this is [Interviewer] calling from Research into Action on behalf of Ameren Missouri with a few brief questions about energy usage. I was hoping to speak with someone who knows how decisions are made in your organization about facility upgrades and major equipment purchases.

[If appropriate respondent]

Ameren Missouri is trying to learn how companies make decisions about energy use, particularly about replacing or upgrading energy-using equipment and facilities. Your organization was selected at random for a brief telephone survey. The survey will take about 10 or 12 minutes of your time. Would you like to do the survey now?

[If respondent agrees to take survey]

First, I need to ask a couple of questions to see if you are eligible for this survey.

[ALL]

S1. When it comes to purchasing energy-using equipment for your facilities/sites, do you...?

[SINGLE RESPONSE]

1. Make those decisions
2. Provide input to others who make those decisions
3. Have no involvement with those decisions

[IF S1=3]

S2. Could you please let us know the name and contact information (phone and/or email) of someone who is involved in those decisions?

1. [OPEN-END RESPONSE]

[IF S1 = 3, DISPLAY FOLLOWING AND TERMINATE:

WE HAVE NO FURTHER QUESTIONS FOR YOU. THANK YOU FOR YOUR TIME.]

[IF S1= 1 OR 2]

S3. To the best of your knowledge, has your organization replaced or upgraded electricity-using equipment in the past three years for which it received or is expecting to receive a cash incentive from Ameren Missouri?

[Interviewer: “electricity-using equipment” means equipment that requires electricity to operate, such as lighting, motors, computers, etc.]

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF S3 = 1, DISPLAY FOLLOWING AND TERMINATE:

THANK YOU. WE ARE LOOKING FOR COMPANIES THAT HAVE NOT RECEIVED AND ARE NOT EXPECTING TO RECEIVE AMEREN MISSOURI EQUIPMENT INCENTIVES. THEREFORE, WE HAVE NO FURTHER QUESTIONS FOR YOU. THANK YOU FOR YOUR TIME.]

Program Awareness and Sources of Awareness

[ALL]

Q1. Which types of equipment does your organization make equipment maintenance or replacement decisions about?

[Do not read; after each response, say: anything else? Until respondent indicates no other equipment.]

[MULTIPLE BINARY RESPONSE, EXCEPT 98 AND 99 PRECLUDE OTHER RESPONSES]

1. Lighting
2. Heating
3. Cooling
4. Computers
5. Refrigeration
6. Motors
7. Other: [OPEN-ENDED RESPONSE]
98. Don't know

[ALL]

Q2. Before we contacted you, were you aware that Ameren Missouri provides cash incentives for energy efficient equipment purchases and upgrades for existing and new buildings?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF Q2 = YES]

Q3. In the past year, from what sources have you gotten information about the energy efficiency incentives from Ameren Missouri? Please try to name all the sources you have gotten information from.

[Do not read; after each response, say: what else? Until respondent indicates no other sources.]

1. A bill insert, mailing, or flyer from Ameren
2. An email or online newsletter from Ameren
3. An Ameren advertisement in the newspaper
4. An Ameren advertisement on TV or radio
5. An Ameren representative
6. Ameren's website
7. Social media
8. Searching the internet (online)
9. Word of mouth (friend, neighbor, family, co-worker, colleague)
10. Trade (contractors, distributors, manufacturers, retailers, installers, etc)
11. None
12. Other, specify: _____
98. Don't know
99. Refused

Upgrades to Energy-using Equipment

Now we'd like to know about any recent or planned equipment purchases.

[ALL]

Q4. What equipment or building features, if any, has your organization replaced or upgraded in the past two years?

[MULTIPLE BINARY RESPONSE; HOWEVER, OPTIONS 11, 98, AND 99 CANNOT BE SELECTED IF ANY OTHER RESPONSES ARE SELECTED]

1. Windows
2. Insulation (ceiling, attic or wall)
3. Heating, cooling, HVAC
4. Water heating
5. Motors or motor controls
6. Cooking (ovens)
7. Refrigeration or freezing
8. Lighting
9. Lighting controls, including occupancy sensors or dimmers
10. Data center or IT equipment

- 11. Other - specify: _____
- 12. None
- 98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED]

Q5. What type of lighting was installed?

- 1. LED
- 2. Fluorescent tube
- 3. Other – specify: _____
- 98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND USAGE >= 4000]

Q6. Who did your organization purchase the lighting from? Please select all that apply.

- 1. Distributor
- 2. Retailer
- 3. Contractor/installer
- 4. Other – specify: _____
- 98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND Q6.1 (DISTRIBUTOR) IS SELECTED AND USAGE >= 4000]

Q7A. Did the distributor your organization bought lighting from mention the energy-efficiency incentives available from Ameren Missouri?

- 1. Yes
- 2. No
- 98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND Q6.2 (RETAILER) IS SELECTED AND USAGE >= 4000]

Q7B. Did the retailer your organization bought lighting from mention the energy-efficiency incentives available from Ameren Missouri?

- 1. Yes
- 2. No
- 98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND Q6.3 (CONTRACTOR/INSTALLER) IS SELECTED AND USAGE >= 4000]

Q7C. Did the contractor or installer who provided the lighting mention the energy-efficiency incentives available from Ameren Missouri?

- 1. Yes

2. No
98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND USAGE < 4000]

Q7D. Did anyone your organization bought lighting from mention the energy-efficiency incentives available from Ameren Missouri? If yes, who?

1. [OPEN-END RESPONSE]
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) IS SELECTED]

Q8. You said your organization installed some non-lighting equipment. Who did your organization purchase that equipment from?

1. Distributor
2. Retailer
3. Contractor/installer
4. Other – specify: _____
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) AND Q8.1 (DISTRIBUTOR) IS SELECTED]

Q9A. Did the distributor your organization bought non-lighting equipment from mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) AND Q8.2 (RETAILER) IS SELECTED]

Q9B. Did the retailer your organization bought non-lighting equipment from mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) AND Q8.3 (CONTRACTOR/INSTALLER) IS SELECTED]

Q9C. Did the contractor or installer who provided the non-lighting equipment mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes

- 2. No
- 98. Don't know

[IF (Q4.11 NOT SELECTED AND Q4.98 NOT SELECTED AND Q4.99 NOT SELECTED (HAS REPLACED EQUIPMENT)) AND USAGE >=4000]

Q10. In general, how much does input from each of the following types of people influence your organization's decisions about equipment replacements and upgrades? Please answer on a scale from 1 to 7, where 1 means "no influence" and 7 means "very great influence".

[Read each item. Repeat response options as needed. If someone indicates they received no input from a type of person, record as 1 "no influence".]

- 1. Equipment distributors
- 2. Equipment retailers
- 3. Contractor or installers
- 4. Someone else, please specify: _____

[IF (Q4.11 NOT SELECTED AND Q4.98 NOT SELECTED AND Q4.99 NOT SELECTED) (HAS REPLACED EQUIPMENT) AND USAGE <4000]

Q11. In general, how much do equipment vendors influence your organization's decisions about equipment replacements and upgrades? Please answer on a scale from 1 to 7, where 1 means "no influence" and 7 means "very great influence".

[INSERT 1-7 SCALE WITH 98 = DK, 99 = REF]

[ALL]

Q12. How likely is it that you will use Ameren Missouri incentives to increase the energy efficiency level of any equipment replacements or upgrades you will make in the next two years? This could include replacements that might result from unexpected equipment failures as well as planned replacements. Please answer on a scale from 1 to 7, where 1 means "not at all likely" and 7 means "extremely likely".

[INSERT 1-7 SCALE WITH 98 = DK, 99 = REF]

Interest in New Construction

[IF USAGE >=4000]

Q13. Is your organization considering undertaking any new construction or major building renovation projects within the next five years?

[If needed: this could include adding a new wing, gutting an existing building, or building an entirely new building.]

- 1. Yes

2. No
98. Don't know

[IF Q13= 1 (YES)]

Q14. Has your organization begun discussing the project design with an architect, design engineer, or other type of contractor?

1. Yes
2. No
98. Don't know

[IF Q14= 1 (YES)]

Q15. In those discussions, has anyone brought up the possibility of using energy-efficiency incentives from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q14= 1 (YES)]

Q16. In general, how much does input from the design professionals you have dealt with influence your organization's decisions about the equipment you will use in the new construction or major building renovation project? Please answer on a scale from 1 to 7, where 1 means "no influence" and 7 means "very great influence".

[INSERT SCALE FROM 1 (NO INFLUENCE) TO 7 (VERY GREAT INFLUENCE) WITH 98=DK]

Interest in SBDI

[IF RATE CLASS = 2M]

Q17. Is your organization responsible for purchasing the lighting at your location?

1. Yes
2. No
98. Don't know
99. Refused

[IF RATE CLASS= 2M AND Q17= 1 (YES)]

Q18. Thinking about all of the lighting at your work location, about what proportion does LED lighting make up? Would you say...

1. None or very little
2. More than very little, but less than half
3. About half

4. More than half, but not nearly all
5. All or nearly all
98. Don't know

[IF RATE CLASS = 2M AND Q17= 1]

Q19. About what percentage of your organization's total monthly operating costs do your electricity bills make up?

1. OPEN END: _____
98. Don't know

[Q20 AND Q21 ARE PRESENTED IN RANDOM ORDER]

[IF RATE CLASS = 2M AND Q17 = 1 (YES)]

Q20. Would you replace your organization's lighting if you could reduce monthly electric bills by 10% to 20%?

1. Yes
2. Maybe
3. No

[IF RATE CLASS = 2M AND Q17= 1 (YES)]

Q21. Would you replace your organization's lighting if you could reduce monthly electric bills by more than 20%?

1. Yes
2. Maybe
3. No

[IF RATE CLASS = 2M AND Q17= 1 (YES) AND USAGE>=4000]

Q22. The Ameren Missouri Small Business Direct Install, or SBDI, program provides free walk-through energy assessments and cash incentives that typically cover at least half the cost of new, efficient lighting equipment. Several designated Service Providers provide the walk-through assessments and completely handle the application process.

If an SBDI Service Provider contacted your organization, how likely is it that your organization would schedule a free walk-through energy assessment? Please use a 1 to 7 scale where 1 means "not at all likely" and 7 means "extremely likely".

[INSERT SCALE FROM 1 (NOT AT ALL) TO 7 (EXTREMELY) WITH 98 = DK]

[IF RATE CLASS = 2M AND Q17= 1 AND Q22 <> 7 AND USAGE>=4000]

Q23. What might keep your organization from scheduling a free walk-through energy assessment with an Ameren Missouri Small Business Direct Install Service Provider?

[Follow initial response with “what else”?]

1. [OPEN-END RESPONSE]
98. Don't know

Interest in EMS Pilot

[IF TAX EXEMPT = YES]

Q24. The next questions are about Energy Management Systems, or EMSs, which control, monitor, and log energy consumption of a building or of specific equipment such as lighting, air conditioning, or security systems. To your knowledge, does your organization have an EMS installed at your facility?

1. Yes
2. No
98. Don't know

[IF TAX EXEMPT = YES]

Q25. Before reading the above description, how familiar were you with Energy Management Systems?

1. I knew a lot about them
2. I knew a moderate amount about them
3. I knew little or nothing about them
99. Refused

[IF TAX EXEMPT = YES]

Q26. Ameren Missouri is now offering incentives to tax-exempt organizations to install an EMS. The incentive covers up to \$35,000 or 50% of the cost of equipment and software, whichever is less. Based on that information, how interested would your organization be in learning more about Ameren Missouri incentives for an EMS? Please use a 1 to 7 scale where 1 means “not at all” and 7 means “extremely”.

[INSERT SCALE FROM 1 (NOT AT ALL) TO 7 (EXTREMELY) WITH 98 = DK]

[IF TAX EXEMPT = YES AND Q26 <> 7]

Q27. What might keep your company from applying for these new incentives for an EMS?

[Follow initial response with “what else”?]

1. [OPEN-END RESPONSE]

98. Don't know

Organization Description

We are almost finished. I'd like to ask you just a few final questions about you and your organization.

[ALL]

Q28. What is your job title?

[Do not read list. Record one response. If necessary, ask: is that most like {and read list}]

1. Accounting/Finance (accountant, treasurer, bookkeeper)
2. Administrative (secretary, receptionist, office specialist)
3. President or Vice President
4. CEO/CFO/Officer Position
5. Director
6. Proprietor/Owner/Partner
7. Manager
8. Controller
9. Maintenance/Facilities Management
10. Pastor
11. Other (Specify) _____
98. Don't know
99. Refused

[IF TYPE = NULL]

Q29. What is your organization's primary business or activity?

[Do not read list. Record one response. Probe to code. List is ordered from most to least common.]

"Professional services" covers a wide range of generally office-based services, including banking/financial, consulting, advertising, real estate management & sales, telecommunications, but excludes government offices, which is a separate category.]

1. Professional services (office)
2. Transportation (trucking, boating, air)
3. Construction and related trades (e.g., contractors)
4. Retail
5. Restaurant
6. Grocery/convenience store
7. Government

8. Warehouse
9. Healthcare
10. Auto Service (garage, gas, towing, rental)
11. Industrial/manufacturing
12. State-certified K-12 school (public or private)
13. Other school type
14. Entertainment
15. Lodging
16. Agriculture
17. Religious
18. Not applicable
19. Service or non-profit
20. Related to real estate/property management
21. Other, please describe _____
98. Don't know
99. Refused

[IF USAGE >= 4000]

Q30. Including all the properties, how many separate work locations does your organization own or lease space in, in Ameren Missouri territory?

[If needed: a work location may consist of multiple buildings in close proximity to each other, such as a university campus.]

1. [OPEN-END RESPONSE]
98. Don't know

[IF USAGE >= 4000]

Q31. What is the approximate total square footage of the facility or facilities that your organization owns or leases in Ameren Missouri territory? Your best guess is fine.

1. [OPEN-END RESPONSE]
98. Don't know

[IF USAGE < 4000]

Q32. What is the approximate total square footage of your workplace? Your best guess is fine.

1. [OPEN-END RESPONSE]
98. Don't know

[ALL]

Q33. Thinking about your work location, does your organization...

1. Own and occupy the entire building

2. Own the building and occupy part of it while leasing parts to others
3. Lease the space
4. Other – specify: _____
98. Don't know

Implementer Contact

[ALL]

Q34. Would you be interested in having someone contact you to provide more information on Ameren Missouri's cash incentives for energy-efficiency upgrades?

1. Yes – respondent is correct contact
2. Yes – respondent provides different contact: _____
3. No
98. Don't know
99. Refused

Web

Screening [ALL]

Thank you for agreeing to help Ameren Missouri with this important activity.

This should take no more than 15 minutes, and we encourage you to complete it in one session. However, if you do need to take a break at any time, just exit the browser. Later, you can click on the survey link again and it will take you back to where you started.

First, please answer a couple of questions to see if you are eligible for this survey.

[ALL]

S1. When it comes to purchasing energy-using equipment for your facilities/sites, which of the following best describes your role?

[SINGLE RESPONSE]

1. I make those decisions
2. I provide input to others who make those decisions
3. I have no involvement with those decisions

[IF S1=3]

S2. Please let us know the name and contact information (phone and/or email) of someone who is involved in those decisions:

1. [OPEN-END RESPONSE]

[IF S1 = 3, DISPLAY FOLLOWING AND TERMINATE:

WE HAVE NO FURTHER QUESTIONS FOR YOU. THANK YOU FOR YOUR TIME.]

[ALL]

S3. To the best of your knowledge, has your organization replaced or upgraded electricity-using equipment in the past three years for which it received or is expecting to receive a cash incentive from Ameren Missouri?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[IF S3 = 1, DISPLAY FOLLOWING AND TERMINATE:

THANK YOU. WE ARE LOOKING FOR COMPANIES THAT HAVE NOT RECEIVED AND ARE NOT EXPECTING TO RECEIVE AMEREN MISSOURI EQUIPMENT INCENTIVES. THEREFORE, WE HAVE NO FURTHER QUESTIONS FOR YOU. THANK YOU FOR YOUR TIME.]

Program Awareness and Sources of Awareness

[ALL]

Q1. Please select all of the types of equipment for which your company or organization makes maintenance or replacement decisions at its work locations.

[MULTIPLE BINARY RESPONSE, EXCEPT 98 AND 99 PRECLUDE OTHER RESPONSES]

1. Lighting
2. Heating
3. Cooling
4. Computers
5. Refrigeration
6. Motors
7. Other: [OPEN-ENDED RESPONSE]
98. Don't know

[ALL]

Q2. Before we contacted you, were you aware that Ameren Missouri provides cash incentives for energy efficient equipment purchases and upgrades for existing and new buildings?

[SINGLE RESPONSE]

1. Yes
2. No

98. Don't know

[IF Q2 = YES]

Q3. In the past year, from what sources have you gotten information about the energy efficiency incentives from Ameren Missouri? Please try to name all the sources you have gotten information from.

1. [OPEN-END RESPONSE]

98. Don't know

Upgrades to Energy-using Equipment

Now we'd like to know about any recent or planned equipment purchases.

[ALL]

Q4. What equipment or building features, if any, has your organization replaced or upgraded in the past two years?

[MULTIPLE BINARY RESPONSE; HOWEVER, OPTIONS 11, 98, AND 99 CANNOT BE SELECTED IF ANY OTHER RESPONSES ARE SELECTED]

1. Windows
2. Insulation (ceiling, attic or wall)
3. Heating, cooling, HVAC
4. Water heating
5. Motors or motor controls
6. Cooking (ovens)
7. Refrigeration or freezing
8. Lighting
9. Lighting controls, including occupancy sensors or dimmers
10. Data center or IT equipment
11. Other - specify: _____
12. None
98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED]

Q5. What type of lighting was installed?

1. LED
2. Fluorescent tube
3. Other – specify: _____
98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND USAGE >= 4000]

Q6. Who did your organization purchase the lighting from? Please select all that apply.

1. Distributor
2. Retailer
3. Contractor/installer
4. Other – specify: _____
98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND Q6.1 (DISTRIBUTOR) IS SELECTED AND USAGE >= 4000]

Q7. Did the distributor your organization bought lighting from mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND Q6.2 (RETAILER) IS SELECTED AND USAGE >= 4000]

Q8. Did the retailer your organization bought lighting from mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND Q6.3 (CONTRACTOR/INSTALLER) IS SELECTED AND USAGE >= 4000]

Q9. Did the contractor or installer who provided the lighting mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q4.8 (LIGHTING) IS SELECTED AND USAGE < 4000]

Q10. Did anyone your organization bought lighting from mention the energy-efficiency incentives available from Ameren Missouri? If yes, who?

1. [OPEN-END RESPONSE]
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) IS SELECTED]

Q11. You said your organization installed some non-lighting equipment. Who did your organization purchase that equipment from? Please select all that apply.

1. Distributor
2. Retailer
3. Contractor/installer
4. Other – specify: _____
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) AND Q11.1 (DISTRIBUTOR) IS SELECTED]

Q12. Did the distributor your organization bought non-lighting equipment from mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) AND Q11.2 (RETAILER) IS SELECTED]

Q13. Did the retailer your organization bought non-lighting equipment from mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q4.1 OR Q4.2 OR Q4.3 OR Q4.4 OR Q4.5 OR Q4.6 OR Q4.7 OR Q4.9 OR Q4.10 (ANYTHING BUT LIGHTING) AND Q11.3 (CONTRACTOR/INSTALLER) IS SELECTED]

Q14. Did the contractor or installer who provided the non-lighting equipment mention the energy-efficiency incentives available from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF (Q4.11 NOT SELECTED AND Q4.98 NOT SELECTED AND Q4.99 NOT SELECTED (HAS REPLACED EQUIPMENT))] AND USAGE >=4000]

Q15. In general, how much does input from each of the following types of people influence your organization's decisions about equipment replacements and upgrades?

[INSERT SCALE FROM 1 (NO INFLUENCE) TO 7 (VERY GREAT INFLUENCE) WITH 98=DK. RANDOMIZE ORDER OF ITEMS 1-4]

1. Equipment distributors
2. Equipment retailers

3. Contractor or installers
4. Someone else, please specify: _____

[IF (Q4.11 NOT SELECTED AND Q4.98 NOT SELECTED AND Q4.99 NOT SELECTED) (HAS REPLACED EQUIPMENT) AND USAGE <4000]

Q16. In general, how much do equipment vendors influence your organization's decisions about equipment replacements and upgrades?

[INSERT SCALE FROM 1 (NO INFLUENCE) TO 7 (VERY GREAT INFLUENCE) WITH 98=DK]

[ALL]

Q17. How likely is it that you will use Ameren Missouri incentives to increase the energy efficiency level of any equipment replacements or upgrades you will make in the next two years? Please answer on a scale from 1 to 7, where 1 means "not at all likely" and 7 means "extremely likely".

[INSERT 1-7 SCALE WITH 98 = DK, 99 = REF]

Interest in New Construction

[IF USAGE >=4000]

Q18. Is your organization considering undertaking any new construction or major building renovation projects within the next five years? This could include adding a new wing, gutting an existing building, or building an entirely new building.

1. Yes
2. No
98. Don't know

[IF Q18 = 1 (YES)]

Q19. Has your organization begun discussing the project design with an architect, design engineer, or other type of contractor?

1. Yes
2. No
98. Don't know

[IF Q19 = 1 (YES)]

Q20. In those discussions, has anyone brought up the possibility of using energy-efficiency incentives from Ameren Missouri?

1. Yes
2. No
98. Don't know

[IF Q19 = 1 (YES)]

Q21. In general, how much does input from the design professionals you have dealt with influence your organization's decisions about the equipment you will use in the new construction or major building renovation project?

[INSERT SCALE FROM 1 (NO INFLUENCE) TO 7 (VERY GREAT INFLUENCE) WITH 98=DK]

Interest in SBDI

[IF 2M = YES]

Q22. Is your organization responsible for purchasing the lighting at your location?

1. Yes
2. No
98. Don't know
99. Refused

[IF 2M = YES AND Q22 = 1 (YES)]

Q23. Thinking about all of the lighting at your work location, about what proportion does LED lighting make up? Would you say...

1. None or very little
2. More than very little, but less than half
3. About half
4. More than half, but not nearly all
5. All or nearly all
98. Don't know

[IF 2M = YES AND Q22 = 1]

Q24. About what percentage of your organization's total monthly operating costs do your electricity bills make up?

1. OPEN END: _____
98. Don't know

[Q25 AND Q26 ARE PRESENTED IN RANDOM ORDER]

[IF 2M=YES AND Q22 = 1 (YES)]

Q25. Would you replace your organization's lighting if you could reduce monthly electric bills by 10% to 20%?

1. Yes
2. Maybe
3. No

[IF 2M=YES AND Q22 = 1 (YES)]

Q26. Would you replace your organization's lighting if you could reduce monthly electric bills by more than 20%?

1. Yes
2. Maybe
3. No

[IF 2M=YES AND Q22 = 1 (YES) AND USAGE>=4000]

Q27. The Ameren Missouri Small Business Direct Install, or SBDI, program provides free walk-through energy assessments and cash incentives that typically cover at least half the cost of new, efficient lighting equipment. Several designated Service Providers provide the walk-through assessments and completely handle the application process.

If an SBDI Service Provider contacted your organization, how likely is it that your organization would schedule a free walk-through energy assessment?

[INSERT SCALE FROM 1 (NOT AT ALL) TO 7 (EXTREMELY) WITH 98 = DK]

[IF 2M=YES AND Q22 = 1 AND Q27 <> 7 AND USAGE>=4000]

Q28. What might keep your organization from scheduling a free walk-through energy assessment with an Ameren Missouri Small Business Direct Install Service Provider?

1. [OPEN-END RESPONSE]
98. Don't know

Interest in EMS Pilot

[IF TAX_EXEMPT = YES]

Q29. The next questions are about Energy Management Systems, or EMSs, which control, monitor, and log energy consumption of a building or of specific equipment such as lighting, air conditioning, or security systems. To your knowledge, does your organization have an EMS?

1. Yes
2. No
98. Don't know

[IF TAX_EXEMPT = YES]

Q30. Before reading the above description, how familiar were you with Energy Management Systems?

1. I knew a lot about them

2. I knew a moderate amount about them
3. I knew little or nothing about them
99. Refused

[IF TAX_EXEMPT = YES]

Q31. Ameren Missouri is now offering incentives to tax-exempt organizations to install an EMS. The incentive covers up to \$35,000 or 50% of the cost of equipment and software, whichever is less. Based on that information, how interested would your organization be in learning more about Ameren Missouri incentives for an EMS?

[INSERT SCALE FROM 1 (NOT AT ALL) TO 7 (EXTREMELY) WITH 98 = DK]

[IF TAX_EXEMPT = YES AND Q31 <> 7]

Q32. What might keep your company from applying for these new incentives for an EMS?

1. [OPEN-END RESPONSE]
98. Don't know

Organization Description

We are almost finished. I'd like to ask you just a few final questions about you and your organization.

[ALL]

Q33. What is your job title?

1. [OPEN-END RESPONSE]
98. Don't know

[IF TYPE = NULL]

Q34. What is your organization's primary business or activity?

1. [OPEN-END RESPONSE]
98. Don't know

[IF USAGE >= 4000]

Q35. Including all the properties, how many separate work locations does your organization own or lease space in, in Ameren Missouri territory?

1. [OPEN-END RESPONSE]
98. Don't know

[IF USAGE >= 4000]

Q36. What is the approximate total square footage of the facility or facilities that your organization owns or leases in Ameren Missouri territory?

1. [OPEN-END RESPONSE]
98. Don't know

[IF USAGE < 4000]

Q37. What is the approximate total square footage of your workplace?

1. [OPEN-END RESPONSE]
98. Don't know

[ALL]

Q38. Thinking about your work location, does your organization...

1. Own and occupy the entire building
2. Own the building and occupy part of it while leasing parts to others
3. Lease the space
4. Other – specify: _____
98. Don't know

Implementer Contact

[ALL]

Q39. Would you be interested in having someone contact you to provide more information on Ameren Missouri's cash incentives for energy-efficiency upgrades?

1. Yes – respondent is correct contact
2. Yes – respondent provides different contact: _____
3. No
98. Don't know
99. Refused

10. Lighting Trade Ally Interview Guide

Screening Questions

[ASK ALL]

S1. [Labelled as S2 in the Qualtrics survey] Which of the following types of equipment do you deal in?

1. Cooling
2. Heating
3. Cooking
4. Building shell
5. Lighting
6. Water heating
7. Motors
8. Air compression
9. Industrial process
10. Refrigeration
11. Energy management systems (EMS)
12. Building management or automation systems (BMS or BAS)
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK IF S1=5(lighting) or LIGHTING=1]

S2. When describing the high-efficient lighting you have sold and/or installed in the past year in Ameren Missouri's service territory, will you be answering only for yourself, for a specific company location, or for the entire company's work in Ameren Missouri service territory?

1. I will be answering only for myself
2. I will be answering for everyone at a specific company location
3. I will be answering for my entire company's work at multiple locations in Ameren Missouri service territory

[ASK ALL]

S3. Which of the following describe the kind of work your company does? Please select all that apply.

[MULTIPLE SELECTION]

1. Sells equipment to contractors who install the equipment. [will go to Vendor block (Q1), then process evaluation block]

2. Sells equipment directly to businesses and other end-users. [If selected, and 1 is not selected: Go to contractor block (Q9), then process evaluation block]
3. Installs equipment at end-user sites. [If selected, and 1 is not selected: Go to contractor block (Q9), then process evaluation block]
4. Neither sells nor installs equipment. [UNIQUE RESPONSE] [will go to process evaluation block]
98. Don't know [UNIQUE RESPONSE] [will go to process evaluation block]

[IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED, GO TO CONTRACTOR BLOCK, Q9]

[ASK IF S3 = 4 (NEITHER SELLS NOR INSTALLS EQUIPMENT)]

S4. Please briefly describe what your company does:

1. [OPEN-END RESPONSE] [then go to Process Evaluation Block, Q19]

Vendor Questions

[ASK IF S3.1 IS SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED]

Q1. Which of the following types of lighting did your company sell within the Ameren Missouri service territory from March 2017 through February 2018?

Please select all that apply. If your company sold none of the types listed, please select the last option.

1. LED screw-in lamps, LED linear tubes, LED strip kits
2. LED luminaires/fixtures
3. T5/T8 Fluorescent tubes
4. T5/T8 Fluorescent fixtures
5. Lighting controls
6. None of the above types of equipment [UNIQUE RESPONSE]

[ASK IF Q1 = 6]

Q2. Please briefly describe the types of lighting equipment your company sold within Ameren Missouri service territory from March 2017 through February 2018:

1. [OPEN-END RESPONSE] [Go to Process Evaluation Block]

[ASK IF S3.1 IS SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q1 ≠ 6]

Q3. How many of the following specific types of lighting did you sell within the Ameren Missouri service territory from March 2017 through February 2018?

[PROGRAMMER: Display only the specific lighting measures that are associated with lighting types selected in Q1, as shown in column 1 of the table.]

DISPLAY IF SELECTED IN Q1	SPECIFIC LIGHTING MEASURE	# Sold or installed
ASK IF Q1_1 (LED Lamps, etc.) is selected	1. LED A-Lamp, 11W or less	
	2. LED A-Lamp, more than 11W	
	3. LED directional or flood, 15W or less	
	4. LED directional or flood, more than 15W	
	5. LED mogul base, 80W or less	
	6. LED mogul base, more than 80W	
	7. LED 4' linear tube	
	8. LED 2' linear tubes, 3' linear tubes, or U-tube (total across all three)	
	9. LED strip kits replacing 4' tubes	
	10. LED strip kits replacing 2' or 3' tubes, or U-tube (total across all three)	
ASK IF Q1_2 (LED Luminaires) is selected	11. LED linear troffer fixtures, 4'	
	12. LED linear troffer fixtures, 2' or 3' or U-tube (total across all three)	
	13. LED high bay fixtures	
	14. LED low bay fixtures and garage fixtures	
	15. LED pole fixtures	
	16. LED exterior wall wash fixtures	
	17. LED exit signs	
	18. LED ceiling downlight fixtures	
ASK IF Q1_3 (Other Lamps) is selected	19. T8 linear fluorescent tubes (any length)	
	20. T5 linear fluorescent tubes (any length)	
ASK IF Q1_4 (Other Luminaires) is selected	21. T8 linear fluorescent fixtures (per lamp)	
	22. T5 linear fluorescent fixtures (per lamp)	
ASK IF Q1_5 (Lighting controls) is selected	23. Daylighting controls	
	24. Ceiling-mounted occupancy sensors	
	25. Wall-mounted occupancy sensors	

[ASK IF S3.1 IS SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q1 ≠ 6]

Q4. For each of the following equipment types, about what percentage of your sales in Ameren Missouri service territory were **directly to the end-users, NOT to contractors or other equipment dealers?**

[PROGRAMMER: Display only the types of lighting selected in Q1.]

Display Logic	Lighting Type	Percentage sold to contractors
ASK IF Q1_1 IS SELECTED	1. LED screw-in lamps, LED linear tubes, LED strip kits	FOR EACH ITEM, INSERT

ASK IF Q1_2 IS SELECTED	2. LED luminaires/fixtures	OPTIONS: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, DON'T KNOW
ASK IF Q1_3 IS SELECTED	3. T5/T8 Fluorescent tubes	
ASK IF Q1_4 IS SELECTED	4. T5/T8 Fluorescent fixtures	
ASK IF Q1_5 IS SELECTED	5. Lighting controls	

[DISPLAY STATEMENT IF S3.1 IS SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q1 ≠ 6 AND ANY OF Q4_1, Q4_2, Q4_3, Q4_4, Q4_5 > 0% - I.E., ANY SALES DIRECTLY TO END-USERS]

The next questions are about your sales of lighting equipment to **businesses or other end-users**. They **do not** apply to your sales to contractors.

[ASK IF S3.1 IS SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q1 ≠ 6 AND ANY OF Q4_1, Q4_2, Q4_3, Q4_4, Q4_5 > 0% - I.E., ANY SALES DIRECTLY TO END-USERS]

Q5. Of your sales of each of the following equipment types to businesses or other end-users in Ameren Missouri service territory, about what percentage of the time did the customer indicate that they would apply for BizSavers incentives?

[PROGRAMMER NOTE: Display only the types of lighting selected in Q1 .]

Display Logic	Lighting Type	Percentage of customers that indicated they would apply for BizSavers incentives
ASK IF Q1_1 IS SELECTED AND Q4_1 IS <100%	1. LED screw-in lamps, LED linear tubes, LED strip kits	FOR EACH ITEM, INSERT OPTIONS: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, DON'T KNOW
ASK IF Q1_2 IS SELECTED AND Q4_2 IS <100%	2. LED luminaires/fixtures	
ASK IF Q1_3 IS SELECTED AND Q4_3 IS <100%	3. T5/T8 Fluorescent tubes	
ASK IF Q1_4 IS SELECTED AND Q4_4 IS <100%	4. T5/T8 Fluorescent fixtures	
ASK IF Q1_5 IS SELECTED AND Q4_5 IS <100%	5. Lighting controls	

[ASK IF S3.1 IS SELECTED]

Q6. And when you make a sale of lighting equipment **directly to businesses or other end-users**, about what percentage of the time do you recommend equipment for their job? (As opposed to times when the customer did not request a recommendation and you did not offer one.)

1. [OPEN-END RESPONSE] percent

[ASK IF S3.1 IS SELECTED]

Q7. And when you recommend equipment to an **end-user customer** for a lighting job, about what percentage of your recommendations do your customers accept, on average?

1. [OPEN-END RESPONSE] percent

[ASK IF S3.1 IS SELECTED]

Q8. Please use a number from 0 to 100 to indicate how much influence the BizSavers program had on the equipment recommendations you have made to **end-user customers**. A “0” means that the program had no influence on your recommendations, and a “100” means that the program totally influenced your recommendations – that is, you would not have made the recommendations without the program’s influence.

(You may consider any way in which the program may have influenced your recommendations, such as by making you aware of the incentives for equipment or by providing you information on the advantages of specific types of equipment.)

[PROGRAMMER NOTE: Insert 0-100 sliding(?) scale with “Not sure” option]

Contractor Questions

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED]

Q9. Which of the following types of lighting did your company sell within the Ameren Missouri service territory from March 2017 through February 2018? [FORCE RESPONSE]

Please select all that apply. If your company sold none of the types listed, please select the last option.

1. LED screw-in lamps, LED linear tubes, or LED strip kits
2. LED Luminaires/fixtures
3. T5/T8 fluorescent tubes
4. T5/T8 fluorescent fixtures
5. Lighting controls
6. None of the above types of equipment [UNIQUE RESPONSE]

[ASK IF Q9= 6]

Q10. Please briefly describe the types of equipment your company sold within Ameren Missouri service territory from March 2017 through February 2018:

1. [OPEN-END RESPONSE] [Go to Process Evaluation Block]

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q9 ≠ 6]

Q11. How many of the following specific types of lighting did you sell within the Ameren Missouri service territory from March 2017 through February 2018?

[PROGRAMMER: Display only the specific lighting measures that are associated with lighting types selected in Q1, as shown in column 1 of the table.]

DISPLAY IF SELECTED IN Q9	SPECIFIC LIGHTING MEASURE	# Sold or installed
ASK IF Q9_1 (LED Lamps, etc.) is selected	1. LED A-Lamp, 11W or less	
	2. LED A-Lamp, more than 11W	
	3. LED directional or flood, 15W or less	
	4. LED directional or flood, more than 15W	
	5. LED mogul base, 80W or less	
	6. LED mogul base, more than 80W	
	7. LED 4' linear tube	
	8. LED 2' linear tubes, 3' linear tubes, or U-tube (total across all three)	
	9. LED strip kits replacing 4' tubes	
	10. LED strip kits replacing 2' or 3' tubes, or U-tube (total across all three)	
ASK IF Q9_2 (LED Luminaires) is selected	11. LED linear troffer fixtures, 4'	
	12. LED linear troffer fixtures, 2' or 3' or U-tube (total across all three)	
	13. LED high bay fixtures	
	14. LED low bay fixtures and garage fixtures	
	15. LED pole fixtures	
	16. LED exterior wall wash fixtures	
	17. LED exit signs	
	18. LED ceiling downlight fixtures	
ASK IF Q9_3 (Other Lamps) is selected	19. T8 linear fluorescent tubes (any length)	
	20. T5 linear fluorescent tubes (any length)	
ASK IF Q9_4 (Other Luminaires) is selected	21. T8 linear fluorescent fixtures (per lamp)	
	22. T5 linear fluorescent fixtures (per lamp)	
ASK IF Q9_5 (Lighting controls) is selected	23. Daylighting controls	
	24. Ceiling-mounted occupancy sensors	
	25. Wall-mounted occupancy sensors	

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q9 ≠ 6]

Q12. Thinking about the lighting jobs you have done, about what percent of the time did the vendor that sold you the equipment make an equipment recommendation? (As opposed to times when you did not request a recommendation and the vendor did not offer one.)

1. OPEN-END RESPONSE percent

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q9 ≠ 6]

Q13. And when you do a lighting job, about what percentage of the time do you recommend equipment to your customer? (As opposed to times when your customer does not request a recommendation and you do not offer one.)

1. OPEN-END RESPONSE percent

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q9 ≠ 6]

Q14. And when you recommend equipment for a lighting job, about what percentage of your recommendations do your customers accept, on average?

1. OPEN-END RESPONSE percent

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q9 ≠ 6]

Q15. Of your sales of each of the following equipment types to businesses or other end-users in Ameren Missouri service territory, about what percentage of the time did your customer apply for BizSavers incentives?

[PROGRAMMER NOTE: Display only the types of lighting selected in Q9.]

Display Logic	Lighting Type	Percentage of customers that indicated they would apply for BizSavers incentives
ASK IF Q9_1 IS SELECTED	1. LED screw-in lamps, LED linear tubes, LED strip kits	FOR EACH ITEM, INSERT OPTIONS: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%, DON'T KNOW
ASK IF Q9_2 IS SELECTED	2. LED luminaires/fixtures	
ASK IF Q9_3 IS SELECTED	3. T5/T8 Fluorescent tubes	
ASK IF Q9_4 IS SELECTED	4. T5/T8 Fluorescent fixtures	
ASK IF Q9_5 IS SELECTED	5. Lighting controls	

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q9 ≠ 6]

Q16. Please use a number from 0 to 100 to indicate how much influence **vendor** recommendations, when given, had on the equipment recommendations you have made to customers. A “0” means that the vendor recommendations had no influence on your recommendations, and a “100” means that the vendor recommendations totally influenced your recommendations – that is, you would not have made the recommendations without the influence of the vendor recommendations.

[PROGRAMMER NOTE: Insert 0-100 sliding(?) scale with “Not sure” option]

[ASK IF S3.1 IS NOT SELECTED AND S3.4 IS NOT SELECTED AND S3.98 IS NOT SELECTED AND EITHER LIGHTING=YES OR S2.5 IS SELECTED AND Q9 ≠ 6]

Q17. Please use a number from 0 to 100 to indicate how much influence the **BizSavers program** had on the equipment recommendations you have made to customers. A “0” means that the program had no influence on your recommendations, and a “100” means that the program totally influenced your recommendations – that is, you would not have made the recommendations without the program’s influence.

(You may consider any way in which the program may have influenced your recommendations, such as by making you aware of the incentives for equipment or by providing you information on the advantages of specific types of equipment.)

[PROGRAMMER NOTE: Insert 0-100 sliding(?) scale with “Not sure” option]

Process Questions

We have few remaining questions to get your thoughts and feedback about Ameren Missouri’s nonresidential energy efficiency programs.

[ASK ALL]

Q18. Please rate your agreement or disagreement with the following statements about Ameren Missouri and the BizSavers Program.

[INSERT SCALE FROM 1 (STRONGLY DISAGREE) TO 7 (STRONGLY AGREE) WITH 98=DK]

1. The BizSavers Program motivates businesses to invest in energy efficiency more than they would otherwise do
2. [IF STANDARD = YES] The application process for Standard incentives is reasonable
3. [IF CUSTOM = YES] The application process for Custom incentives is reasonable
4. [IF NC = YES] The application process for new construction incentives is reasonable

5. [IF RCX = YES] The application process for retro-commissioning incentives is reasonable
6. [IF SBDISP = YES] The application process for SBDI incentives is reasonable
7. The BizSavers Program communicates well with me
8. The BizSavers Program helps me get work

[ASK ALL]

Q19. About what proportion of your customers already knew about the Ameren Missouri BizSavers incentives before you mentioned the incentives to them?

1. None or very few
2. More than very few but less than half
3. About half
4. More than half but not nearly all
5. All or nearly all
98. Don't know

[ASK ALL]

Q20. The BizSavers program eliminated incentives for exterior lighting during the 2016 program year. What effect, if any, did this have on your company's business?

1. An extremely adverse effect
2. A somewhat adverse effect
3. No effect
4. A somewhat positive effect
5. An extremely positive effect
98. Don't know

[ASK IF Q20 = 4 OR 5]

Q21. You said the elimination of incentives for exterior lighting had a positive effect on your business. In what way did it have a positive effect?

1. [OPEN-END RESPONSE]
98. Don't know

[ASK ALL]

Q22. The BizSavers program restored incentives for exterior lighting during the 2017 program year. What effect, if any, did this have on your company's business?

1. An extremely adverse effect
2. A somewhat adverse effect
3. No effect
4. A somewhat positive effect
5. An extremely positive effect

98. Don't know

[ASK ALL]

Q23. Before 2016, the Custom Program provided incentives at \$.06 per kWh for lighting measures and \$.07 per kWh for non-lighting measures. Starting in 2016, the Custom program provides higher incentive levels for cooling, HVAC, cooking, building shell, lighting, and water heating, and lower incentives for refrigeration equipment. The incentive levels for motors, air compression, and process-related measures remained the same.

Before reading the above, were you aware of this change?

1. Yes
2. No
3. Not sure

[ASK IF S1.1 OR S1.2 OR ... S1.10 (ANY EQUIPMENT TYPE) IS SELECTED]

Q24. To what extent, if any, have you experienced each of the following since the above change in incentives?

[INSERT SCALE OF 1 (NOT AT ALL) TO 7 (TO A GREAT DEGREE), WITH 98=DK, FOR EACH ITEM]

1. [IF S1.1 IS SELECTED] An increase in the number or size of cooling projects.
2. [IF S1.2 IS SELECTED] An increase in the number or size of heating projects.
3. [IF S1.3 IS SELECTED] An increase in the number or size of projects with cooking equipment.
4. [IF S1.4 IS SELECTED] An increase in the number or size of building shell projects.
5. [IF S1.5 IS SELECTED OR LIGHTING =1] An increase in the number or size of lighting projects.
6. [IF S1.6 IS SELECTED] An increase in the number or size of water heating projects.
7. [IF S1.7 IS SELECTED] An increase in the number or size of projects with motors.
8. [IF S1.8 IS SELECTED] An increase in the number or size of air compression projects.
9. [IF S1.9 IS SELECTED] An increase in the number or size of process-related projects.
10. [IF S1.10 IS SELECTED] An increase in the number or size of refrigeration projects.
11. [IF S1.10 IS SELECTED] A decrease in the number or size of refrigeration projects.

[ASK IF S1.11 OR S1.12 (EMS OR BMS) IS SELECTED OR IF EMS = YES]

Q25. We would like to know how clear the distinction is between a building management system (BMS), which controls mechanical and electrical equipment, and an energy management system (EMS), which allows users to monitor energy usage in those systems. Would you say that, to most of your clients, the distinction between BMS and EMS is...

1. Completely clear
2. Mostly clear
3. Somewhat clear
4. Not very clear
5. Not at all clear

[ASK IF S1.11 OR S1.12 (EMS OR BMS) IS SELECTED OR IF EMS = YES]

Q26. How much of a challenge is it to explain the difference between a BMS and EMS to your clients?

[INSERT SCALE FROM 1 (NO CHALLENGE AT ALL) TO 7 (GREAT CHALLENGE) WITH 98=DK]

[ASK IF S1.11 OR S1.12 (EMS OR BMS) IS SELECTED OR IF EMS = YES]

Q27. In 2016, Ameren Missouri began a new pilot offering enhanced incentives to nonprofits and tax-exempt entities to install an EMS. The incentive covers up to 50% of the cost of equipment and software.

Before reading the above, had you heard of this new pilot offering?

1. Yes
2. No
98. Don't know

[ASK IF (S1.5 (LIGHTING) IS SELECTED OR LIGHTING =1) AND SBDISP = NO]

Q28. In 2016, Ameren Missouri began a new program called the Small Business Direct Install (SBDI) program, offering enhanced incentives for lighting equipment to businesses in Ameren Missouri 2M Small General Service Electric Rate. In this program, an approved SBDI Service Provider conducts a free walk-through assessment. After invoicing customers for agreed-upon lighting measures, the Service Provider submits an application for incentives, which are paid per-unit to the Service Provider and are designed to cover half or more of the project cost.

Before reading the above, had you heard of this new program?

1. Yes
2. No
98. Don't know

[ASK IF (\$1.5 (LIGHTING) IS SELECTED OR LIGHTING =1) AND SBDISP = NO]

Q29. Would you be interested in becoming an SBDI Service Provider?

1. Yes
2. No
98. Don't know

[ASK IF (\$1.5 (LIGHTING) IS SELECTED OR LIGHTING =1) AND SBDISP = NO AND Q29 = 2 (NO)]

Q30. Why are you not interested in being an SBDI Service Provider?

1. [OPEN-END RESPONSE]
98. Don't know

[ASK ALL]

Q31. Please let us know of any ways in which you think the Ameren Missouri BizSavers Program could be improved or anything that Ameren Missouri could do to more effectively promote energy efficiency among its nonresidential customers:

1. [OPEN-END RESPONSE]
98. Don't know

Additional questions added:

- About what percentage of your lighting-related sales (\$) are done through the SBDI program? [list 0% 10% 20% ... 100%]
- Of all the attempts you have made in the past year to sell lighting through the SBDI program, about what percentage resulted in a walk-through assessment? [list 0% 10% 20% ... 100%]
- Of the SBDI walk-through assessments you have made in the past year, about what percentage resulted in SBDI projects? [list 0% 10% 20% ... 100%]
- Is there a business size (square feet) below which it would not be worth the effort to try to schedule a SBDI walk-through assessment? [1. Yes (specify size) 2. No]
- What factors prevent you from being able to do more SBDI projects? [OE]
- How could Ameren Missouri help you do more SBDI projects? [OE]

End Script for Those Who Completed

Thank you again for taking the time to complete the survey. As mentioned, we would like to thank you with a \$50 gift card. We will send it to \${m://FirstName} \${m://LastName} at \${m://Email1}. You will receive your gift card within the next 3 business days.

End Script for Screen-outs

[ASK IF S3=3 OR 4]

We are looking for companies that either sell or install equipment. Thank you for your time.

11. Non-Participant Spillover Methodology

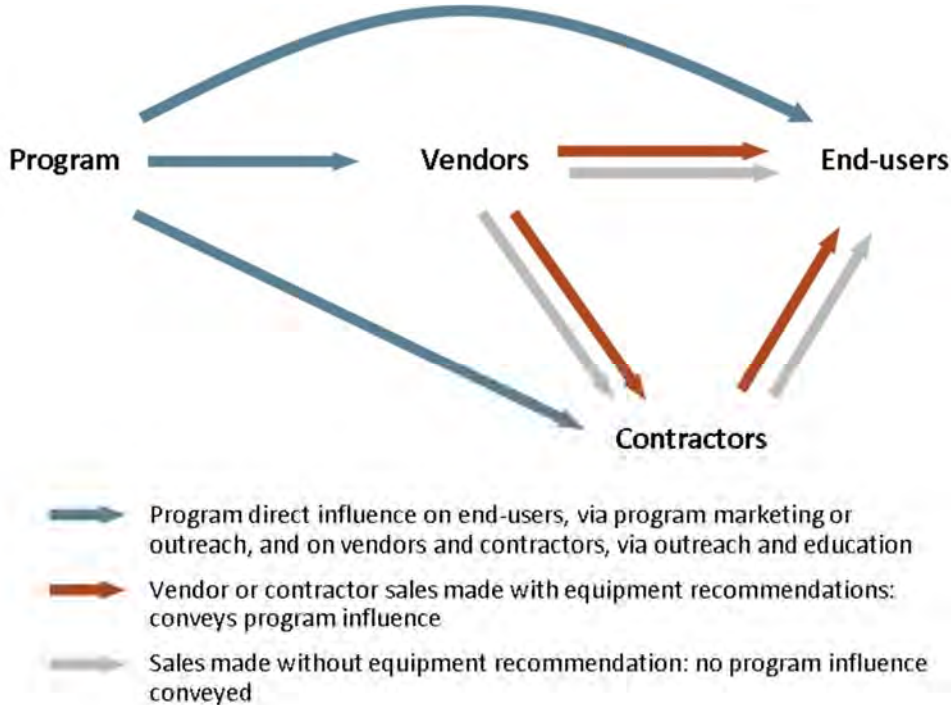
The evaluation team estimated lighting-related spillover by estimating the number of program-attributable lighting measures that surveyed vendors (distributors and manufacturer representatives) and installation contractors sold during program year 2017 (PY2017).

The method is based on the observation that a program may influence end-users' unincented equipment sales directly, via the program experience itself (in the case of participants) or program marketing (in the case of nonparticipants), or indirectly, via its influence on vendors and contractors who then convey that influence through their equipment recommendations. The method further takes the following considerations into account:

- Distributors may sell to contractors or directly to end-users.
- In each transaction, the seller may recommend equipment to the buyer or may not recommend equipment (if the buyer specifies equipment).

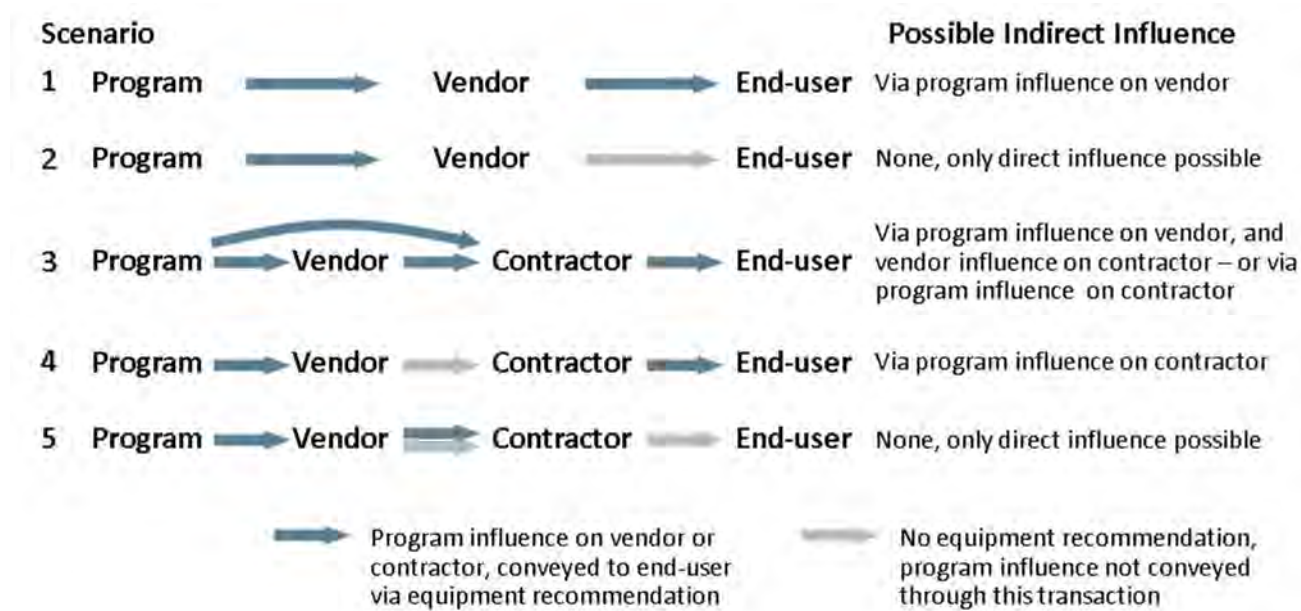
Figure 11-1 illustrates the above considerations.

Figure 11-1 Program Influence and Equipment Sales Channels



The above shows that there are multiple possible scenarios in which program influence may or may not be indirectly conveyed via equipment recommendations (Figure 11-2).

Figure 11-2 Sales Scenarios and Program Influence



This figure illustrates two important facts. First, while program direct influence may be possible in any scenario, it is the only possible influence in those scenarios where no vendor or contractor makes an equipment recommendation to the end-user. Second, if the vendor recommends equipment to the contractor and the contractor recommends equipment to the end-user, there are two possible channels of program indirect influence: 1) via the program influence on the vendor and the vendor influence on the contractor; and 2) via the program influence on the contractor.

The evaluation team surveyed vendors and contractors to estimate number of units of program-eligible un-incented lighting measures sold with and without recommendations, and to assess the program’s influence on each vendor and contractor’s recommendations as well as the influence those recommendations had on their buyers. This allowed the team to allocate each survey respondent’s sales to one of the above channels and to estimate the strength of program influence operating on those sales. Details of the approach follow.

Description of Survey

The evaluation team designed an online survey instruments for vendors and installation contractors. The survey asked respondents to identify which of five types of high-efficiency lighting they sold within Ameren Missouri service territory within the 2017

program year (PY2017) and, for each lighting type they sold, the number of units of each specific measure they sold (Table 11-1).

Table 11-1 Lighting Types and Measures Assessed

<i>Lighting Type</i>	<i>Specific Lighting Measure</i>
LED screw-in lamps, LED linear tubes, LED strip kits	LED A-Lamp, 11W or less
	LED A-Lamp, more than 11W
	LED directional or flood, 15W or less
	LED directional or flood, more than 15W
	LED mogul base, 80W or less
	LED mogul base, more than 80W
	LED 4' linear tube
	LED 2' linear tubes, 3' linear tubes, or U-tube (total across all three)
	LED strip kits replacing 4' tubes
	LED strip kits replacing 2' or 3' tubes, or U-tube (total across all three)
LED luminaires/fixtures	LED linear troffer fixtures, 4'
	LED linear troffer fixtures, 2' or 3' or U-tube (total across all three)
	LED high bay fixtures
	LED low bay fixtures and garage fixtures
	LED pole fixtures
	LED exterior wall wash fixtures
	LED exit signs
	LED ceiling downlight fixtures
T5/T8 Fluorescent tubes	T8 linear fluorescent tubes (any length)
	T5 linear fluorescent tubes (any length)
T5/T8 Fluorescent fixtures	T8 linear fluorescent fixtures (per lamp)
	T5 linear fluorescent fixtures (per lamp)
Lighting controls	Daylighting controls
	Ceiling-mounted occupancy sensors
	Wall-mounted occupancy sensors

The evaluation team identified the above 25 lighting measures by aggregating the program-eligible lighting types into typical categories of efficient lighting that varied by wattage.

The survey then asked questions designed to allocate the total reported sales to the five channels identified above. The survey asked vendors what percentage of total sales (by measure type) went to contractors versus to end-users. The survey asked both vendors and contractors about the percentages of sales in which the respondent made equipment recommendations to end-users. The also asked contractors to report the percentage of their sales in which the vendor had made an equipment recommendation to them.

The survey asked respondents to report the percentage of end-user sales, within each lighting type, for which the customers reported they would apply for BizSavers incentives.

The survey asked all respondents to rate the program's influence on their recommendations with the following question:

Please use a number from 0 to 100 to indicate how much influence the BizSavers program had on the equipment recommendations you have made to **end-user customers**. A "0" means that the program had no influence on your recommendations, and a "100" means that the program totally influenced your recommendations – that is, you would not have made the recommendations without the program's influence.

(You may consider any way in which the program may have influenced your recommendations, such as by making you aware of the incentives for equipment or by providing you information on the advantages of specific types of equipment.)

The survey also used a similar question with contractors to assess the influence of vendor recommendations on the contractors' own recommendations to end-user customers.

Finally, the survey assessed the respondents' influence on their end-user customers by asking what percentage of their recommendations the customers accepted.

In anticipation that more than one respondent from the same company might answer the survey, the survey included a question asking whether the respondent was reporting sales just for him/herself, for the respondent's company location (in the case of companies with multiple locations), or for the company as a whole.

Sampling and Data Collection Methodology

The target population for the spillover survey was any lighting vendors and contractors doing business in the Ameren Missouri service territory. On the assumption that most of the vendors and contractors with significant lighting work in the Ameren Missouri service territory had done at least one *BizSavers* project, we defined the survey frame as any firm that had done any *BizSavers* projects during the current program cycle.

The evaluation team conducted the lighting spillover survey as part of a general online survey of trade allies who were active in Ameren Missouri's service territory. The team sent up to three email invitations to take the survey to 447 individual trade allies, representing 276 companies, who had completed at least one *BizSavers* project in the 2017 program year. Of those 447 trade allies, 349 individuals, representing 208 companies, were associated with lighting projects in the program tracking database.

The email invitation to complete the online survey explained the purpose of the survey and offered a \$50 gift card for completing the survey. The invitation provided contact

information for key evaluation team and Ameren Missouri staff. The team sent up to three weekly follow-up emails to all recipients of the email survey invitation.

The above efforts resulted in the completion of the lighting spillover survey by 93 lighting vendors (n = 42) and contractors (n = 51). In some cases, multiple respondents from the same company answered the survey. In those cases, the team followed these procedures to prevent double-counting:

- If at least one individual indicated he/she was responding for the entire company, across locations, the team counted that respondent.
- If no one was responding for the entire company but two or more were responding for a given company location, the team counted the respondent reporting the highest total lighting sales.
- If two or more were responding for the same company but different locations, all responses were counted.
- If all respondents for a company were reporting only for themselves, then all responses were counted.

Applying those rules brought the counted total to 63 vendors (n = 28) and contractors (n = 35). Together, those 63 respondents represented 13% of the PY2017 *BizSavers* lighting ex ante savings.

Estimation of Un-Incented Units Sold

For each surveyed lighting vendor or contractor, the evaluation team used two methods to estimate the number of un-incented units of each lighting type sold. First, as noted above, the survey asked each respondent to estimate the percentage of sales of each lighting type for which customers applied for BizSavers incentives, which produced the first estimate of un-incented sales. Second, for each survey respondent and for each lighting measure, the team identified the program-tracked incented lighting sales and subtracted the incented count from the total sales reported in the survey. Then, for each respondent and each lighting measure, the team took the *lower* of the two estimates of the number of un-incented measures sold.⁴⁵⁰ This produces the most conservative estimate of spillover.

The program implementer had already identified participant spillover savings associated with completed *BizSavers* projects (“project-level spillover”) and recorded those savings in the program database. The evaluation team subtracted any such measures from the

⁴⁵⁰ In the case of respondents who did not report sales of a given lighting measure but for whom the program database showed incented savings for that measure, the evaluation team assigned zero un-incented savings, rather than a negative number, to that measure.

totals produced by the above method to produce a net number of un-incented measures sold for each survey respondent.

The team then used the survey responses to allocate the savings from the net un-incented sales of each lighting measure to the five scenarios described above, specifically:

- Scenario 1 (vendor sales to end-users with recommendations): percentage of vendor sales to end-users x percentage of vendor sales with recommendations.
- Scenario 2 (vendor sales to end-users without recommendations): percentage of vendor sales to end-users x (1 - percentage of vendor sales with recommendations).
- Scenario 3 (contractor sales to end-users with both vendor and contractor recommendations): percentage of sales to end-users x percentage of sales with recommendations from vendors x percentage of sales with recommendations to end-users.
- Scenario 4 (contractor sales to end-users with only contractor recommendations): percentage of sales to end-users x (1 - percentage of sales with recommendations from vendors) x percentage of sales with recommendations to end-users.
- Scenario 5 (contractor sales to end-users with no contractor recommendations⁴⁵¹): percentage of sales to end-users x (1 - percentage of sales with recommendations to end-users).

None of the scenarios includes the vendors' reported sales to contractors. That is because all vendor sales to contractors also represent contractor sales to end-users. Since this approach already counts the contractors' reported sales to end-users, adding vendor sales to contractors would double-count those sales.

Calculation of Program Indirect Influence on End-Users

The team used survey respondent data to calculate the program *indirect* influence on each respondent's sales in Scenarios 1, 3, and 4, in which indirect influence is possible. In all cases, the indirect influence was calculated as the product of the influence values occurring in each transaction, where each influence value may range from 0% to 100%.⁴⁵² Thus, the final indirect influence value must be equal to or less than the greatest influence of any individual transaction.

⁴⁵¹ In this case, it does not matter whether or not the vendor made an equipment recommendation, as no such recommendation would be passed on to the end-user.

⁴⁵² For program influence on vendors and contractors and vendor influence on contractors, the 0-100 rating was divided by 100 to produce a percentage. The influence of vendors and contractors on end-users was already a percentage – the reported percentage of recommendations that were accepted.

For all but one influence value, the team used the survey respondent's own survey response (that is, the respondent's rating of others' influence on the respondent or the respondent's reported percentage of recommendations accepted). The exception is for Scenario 3, for which program indirect influence – calculated as the product of program influence on the vendor, vendor influence on the contractor, and contractor influence on end-users – is applied to contractor-reported sales. Since the contractors could not provide a rating of the program influence on vendors, the evaluation team used the mean vendor rating in this case.

The above methods produced mean indirect influence values of 60% for Scenario 1, 37% for Scenario 3, and 65% for Scenario 4.

Calculation of Program Direct Influence on End-Users

The nonparticipant survey for PY2017 did not assess program influence on un-incented energy efficiency equipment purchases. The PY2014 and PY2016 evaluations included nonparticipant surveys in which respondents rated the program's influence on efficiency upgrades. In the PY2014 survey, responses from 27 respondents provided a mean program influence of 14.8% on efficiency upgrades.⁴⁵³ Of 52 respondents who reported equipment upgrades in the PY2016 survey, none reported that the program influenced their upgrade decisions. For the current evaluation, the team used the weighted mean influence of 5% from those two evaluations as the mean program direct influence on un-incented equipment sales.

Application of Maximum Influence Channel in Each Scenario

Direct program influence is possible in all five scenarios, which indirect influence is also possible in Scenarios 1, 3, and 4. For Scenarios 2 and 5, only program direct influence is possible, and so the evaluation team calculated program-attributable sales in those scenarios as the estimated number of un-incented measures sold in those scenarios times the estimated program direct influence, or 5%.

For Scenarios 1, 3, and 4, the evaluation team calculated program-attributable sales as the estimated number of un-incented measures sold in those scenarios times the greater of: 1) the estimated program *indirect* influence in each scenario; and 2) the estimated mean program direct influence. In most cases, the program indirect influence was greater than the direct influence.

Application of Savings Values to Program-Attributable Measures

The evaluation team used the Ameren Missouri TRM to assign a kWh savings value for each of the evaluated lighting measure categories. This allowed the evaluation team to

⁴⁵³ Respondents rated program influence from 1 (none) to 5 (great). The evaluation team converted the 1-5 ratings to percentages, as 0%, 25%, 50%, 75%, and 100%.

estimate the total energy savings that resulted from each survey respondent's program-attributable un-incented sales of high-efficiency lighting.

12. Heating and Cooling Interactive Factors

Building Type	Cooling Type	Heating Type	Cape Girardeau			Jefferson City			Kirksville			St. Louis		
			kWh HIF	kWh CIF	Peak Demand HCIF	kWh HIF	kWh CIF	Peak Demand HCIF	kWh HIF	kWh CIF	Peak Demand HCIF	kWh HIF	kWh CIF	Peak Demand HCIF
Assembly	Packaged Single Zone	Gas	0.00	0.14	1.12	0.00	0.15	1.34	0.00	0.13	1.26	0.00	0.14	1.33
Assembly	Packaged Single Zone	Heat Pump	-0.11	0.14	1.12	-0.11	0.15	1.34	-0.10	0.12	1.23	-0.11	0.14	1.31
Bio Manufacturer	Packaged Single Zone	Gas	0.00	0.10	1.54	0.00	0.11	1.57	0.00	0.10	1.49	0.00	0.11	1.59
Bio Manufacturer	Packaged Single Zone	Heat Pump	-0.05	0.11	1.54	-0.06	0.11	1.58	-0.08	0.10	1.49	-0.06	0.11	1.60
Conditioned Storage	Packaged Single Zone	Gas	0.00	0.09	2.30	0.00	0.10	2.15	0.00	0.08	2.30	0.00	0.10	1.92
Conditioned Storage	Packaged Single Zone	Heat Pump	-0.09	0.10	2.31	-0.10	0.10	2.17	-0.09	0.08	2.30	-0.09	0.10	1.94
Education (Community College)	VAV+Packaged Single Zone	Heat Pump	0.00	0.07	1.48	0.00	0.08	1.43	0.00	0.07	1.43	0.00	0.09	1.42
Education (Community College)	VAV+Packaged Single Zone	Gas	0.00	0.07	1.48	0.00	0.08	1.43	0.00	0.07	1.43	0.00	0.09	1.42
Education (High School)	Fan Coil+Packaged Single Zone	Gas	0.00	0.10	1.18	0.00	0.10	1.14	0.00	0.08	1.16	0.00	0.09	1.23
Education (High School)	Fan Coil+Packaged Single Zone	Heat Pump	-0.03	0.10	1.18	-0.03	0.10	1.14	-0.03	0.08	1.16	-0.03	0.09	1.23
Education (High School)	VAV	Gas	0.00	0.08	1.18	0.00	0.09	1.09	0.00	0.06	1.18	0.00	0.08	1.07
Education (Primary School)	Packaged Single Zone	Gas	0.00	0.09	1.11	0.00	0.09	1.14	0.00	0.08	1.17	0.00	0.09	1.17
Education (Primary School)	Packaged Single Zone	Heat Pump	-0.10	0.09	1.11	-0.11	0.09	1.14	-0.11	0.08	1.16	-0.11	0.09	1.16
Education (Relocatable Classroom)	Packaged Single Zone	Electric Resistance	-0.28	0.11	1.11	-0.30	0.11	1.12	-0.34	0.09	1.13	-0.30	0.11	1.12
Education (Relocatable Classroom)	Packaged Single Zone	Heat Pump	-0.08	0.06	1.09	-0.09	0.06	1.09	-0.09	0.05	1.11	-0.09	0.06	1.10
Education (Relocatable Classroom)	Packaged Single Zone	Gas	0.00	0.09	1.09	0.00	0.09	1.09	0.00	0.07	1.11	0.00	0.08	1.10
Education (University)	VAV	Gas	0.00	0.08	1.41	0.00	0.09	1.38	0.00	0.09	1.61	0.00	0.09	1.36
Hospital	VAV+Packaged Single Zone	Heat Pump	0.00	0.07	1.18	0.00	0.07	1.21	0.00	0.06	1.18	0.00	0.07	1.17
Hospital	VAV+Packaged Single Zone	Gas	0.00	0.07	1.18	0.00	0.07	1.21	0.00	0.06	1.18	0.00	0.07	1.17
Hotel	PVAV+PTHP+PSZ	Heat Pump	-0.01	0.20	1.29	-0.01	0.20	1.38	-0.01	0.16	1.37	-0.01	0.18	1.31
Hotel	VAV+FPFC+PHP	Heat Pump	0.00	0.11	1.23	0.00	0.11	1.21	0.00	0.10	1.36	0.00	0.11	1.43
Hotel	VAV+PTAC+PSZ	Electric Resistance	-0.16	0.20	1.30	-0.19	0.20	1.39	-0.26	0.16	1.38	-0.20	0.19	1.35
Hotel	VAV+PTHP+PSZ	Heat Pump	-0.01	0.20	1.29	-0.01	0.19	1.37	-0.01	0.16	1.36	-0.01	0.18	1.37
Light Manufacturing	Packaged Single Zone	Gas	0.00	0.09	1.52	0.00	0.10	1.49	0.00	0.08	1.48	0.00	0.09	1.46
Light Manufacturing	Packaged Single Zone	Heat Pump	-0.09	0.09	1.53	-0.09	0.10	1.50	-0.08	0.08	1.48	-0.09	0.10	1.46
Motel	Packaged Terminal AC	Electric Resistance	-0.22	0.17	1.43	-0.24	0.16	1.40	-0.29	0.15	1.38	-0.24	0.16	1.44
Motel	Packaged Terminal HP	Heat Pump	-0.04	0.16	1.41	-0.04	0.16	1.39	-0.03	0.14	1.36	-0.04	0.15	1.43
Nursing Home	Fan Coil+Packaged Single Zone	Heat Pump	0.00	0.14	1.52	0.00	0.14	1.34	0.00	0.12	1.38	0.00	0.14	1.35
Nursing Home	VAV	Gas	0.00	0.09	1.54	0.00	0.10	1.47	0.00	0.08	1.53	0.00	0.09	1.44
Nursing Home	Fan Coil+Packaged Single Zone	Gas	0.00	0.14	1.52	0.00	0.14	1.34	0.00	0.12	1.38	0.00	0.14	1.34
Office (Large)	Water Loop Heat Pump	Heat Pump	-0.06	0.24	1.39	-0.07	0.23	1.41	-0.08	0.19	1.40	-0.07	0.22	1.41
Office (Large)	VAV	Gas	0.00	0.10	1.32	0.00	0.09	1.30	0.00	0.08	1.30	0.00	0.09	1.41
Office (Small)	Packaged Single Zone	Gas	0.00	0.10	1.39	0.00	0.11	1.38	0.00	0.09	1.37	0.00	0.11	1.36
Office (Small)	Packaged Single Zone	Heat Pump	-0.09	0.11	1.39	-0.10	0.11	1.38	-0.09	0.09	1.38	-0.09	0.11	1.37
Restaurant (Fast Food)	Packaged Single Zone	Gas	0.00	0.10	1.24	0.00	0.11	1.33	0.00	0.09	1.37	0.00	0.10	1.33
Restaurant (Fast Food)	Packaged Single Zone	Heat Pump	-0.08	0.10	1.25	-0.08	0.11	1.33	-0.08	0.09	1.37	-0.08	0.10	1.34
Restaurant (Full-Service)	Packaged Single Zone	Gas	0.00	0.12	1.21	0.00	0.13	1.36	0.00	0.11	1.40	0.00	0.12	1.35
Restaurant (Full-Service)	Packaged Single Zone	Heat Pump	0.00	0.03	1.29	0.00	0.04	1.28	0.00	0.02	1.36	0.00	0.03	1.09
Retail (Large 3-Story)	VAV	Gas	0.00	0.08	1.35	0.00	0.10	1.36	0.00	0.10	1.33	0.00	0.11	1.34
Retail (Large Single-Story)	Packaged Single Zone	Gas	0.00	0.10	1.26	0.00	0.11	1.28	0.00	0.09	1.32	0.00	0.10	1.29
Retail (Large Single-Story)	Packaged Single Zone	Heat Pump	-0.09	0.10	1.28	-0.10	0.11	1.29	-0.08	0.09	1.31	-0.09	0.10	1.28
Retail (Small)	Packaged Single Zone	Gas	0.00	0.11	1.26	0.00	0.11	1.25	0.00	0.10	1.30	0.00	0.11	1.28
Retail (Small)	Packaged Single Zone	Heat Pump	-0.10	0.11	1.27	-0.10	0.12	1.26	-0.09	0.10	1.30	-0.10	0.11	1.28
Freezer Space (Low Temp)	N/A	N/A	0.00	1.50	1.50	0.00	1.50	1.50	0.00	1.50	1.50	0.00	1.50	1.50
Med. Temp Refrig Space	N/A	N/A	0.00	1.29	1.29	0.00	1.29	1.29	0.00	1.29	1.29	0.00	1.29	1.29
High Temp Refrig. Space	N/A	N/A	0.00	1.18	1.18	0.00	1.18	1.18	0.00	1.18	1.18	0.00	1.18	1.18
Walk-in/In Store Refrigerator	N/A	N/A	0.00	1.40	1.40	0.00	1.40	1.40	0.00	1.40	1.40	0.00	1.40	1.40

13. Cost Effectiveness Technical Data

The following appendix presents the critical technical data used to develop the cost effectiveness test results, at the portfolio and program level. ADM provided the inputs for the cost effectiveness testing by measure end use and effective useful life. The analysis was performed by Ameren Missouri using DSMore.

One of the key objectives of the economic modeling was to assure that the analysis was comparable to the Ameren Missouri's planning analysis. This allows Ameren Missouri to compare evaluated results with the expected numbers within the plan. First, the same analysis tool was used (DSMore). Second, Ameren Missouri provided economic and financial assumptions used to develop the model. Some of those assumptions include:

- Discount Rate = 6.46% for Utility Cost Test (UCT), Total Resource Cost (TRC) test, Ratepayer Impact Measure (RIM) test, and Participant Cost Test (PCT); 3.00% for Societal Cost Test (SCT).
- Line losses = 4.84%
- Summer Peak would occur during the 16th hour of a July day on average
- Avoided Electric costs from the 2014 Integrated Resource Plan filing were used for measures delivered between March 1, 2017 and September 28, 2017. Avoided costs from the 2017 Integrated Resource Plan that was filed October 1, 2017 were used for all measures delivered on or after October 1, 2017.
- Escalation rates for different costs occur at the component level with separate escalation rates for fuel, capacity, generation, T&D and customer rates carried out over 25 years.
- Cost Escalation Rate = 2%

The model assumptions are driven by measure loadshapes, which tells the model when to apply the savings during the day. This assures that the loadshape for that end use matches the system peak impacts of that end use and provides the correct summer coincident savings.

A number of business portfolio-level costs are reflected in the program-level cost effectiveness analysis. These business portfolio-level costs include those for EM&V, education and outreach, portfolio administration, and data tracking. Business portfolio costs were allocated by the program's share of the net present value (NPV) of the utility cost test (UCT) benefits of the business portfolio. The NPV of the UCT benefits and the apportionment factor are shown in Table 13-2.

Table 13-1 Business Portfolio Cost Apportionment Factors

<i>Program</i>	<i>NPV of UCT Benefits (2016 Dollars)</i>	<i>Apportionment Factor</i>
Custom	\$44,477,760	36.75%
Standard	\$52,574,160	43.44%
New Construction	\$16,992,849	14.04%
Retro-Commissioning	\$2,740,284	2.26%
Small Business Direct Install	\$3,478,011	2.87%
EMS	\$762,890	0.63%
Total	\$121,025,955	100.00%

Table 13-2 presents summarizes program UCT costs by cost category. The values presented below are inclusive of the allocated portfolio costs and are shown in 2016 dollars.

Table 13-2 Ameren Missouri PY2017 Cost Data

<i>C&I EE PROGRAM COSTS (PY2017)</i>	<i>Administrative Costs (2016 Dollars)</i>	<i>Incentive Costs (2016 Dollars)</i>	<i>Total Costs (2016 Dollars)</i>
Custom	\$3,556,163	\$4,944,462	\$8,500,625
EMS	\$61,897	\$202,960	\$264,857
Standard	\$3,923,881	\$7,225,572	\$11,149,453
New Construction	\$1,031,097	\$1,734,648	\$2,765,745
Retro-Commissioning	\$322,309	\$381,396	\$703,705
Small Business Direct Install	\$234,981	\$839,314	\$1,074,296
Total C&I Program Costs	\$9,130,329	\$15,328,351	\$24,458,680

Each cost test provides a benefit-cost ratio that reflects the net benefit or cost to a specific stakeholder. For example, the Utility Cost Test (UCT) takes into account all program costs and benefits from the utility (or program administrator) perspective, to demonstrate how the program impacts the utility relative to other program stakeholders. If the ratio is less than one, the costs outweigh the benefits; if the ratio is greater than one, the benefits outweigh the costs. Table 13-3 below is a summary of benefit and cost inputs for each cost test performed.

Table 13-3 Summary of Benefits and Costs Included in Each Cost Effectiveness Test⁴⁵⁴

Test	Benefits	Costs
UCT	Perspective of utility, government agency, or third party implementing the program	
	<ul style="list-style-type: none"> ▪ Energy-related costs avoided by the utility, ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution 	<ul style="list-style-type: none"> ▪ Program overhead costs ▪ Utility/program administrator incentive costs, ▪ Utility/program administrator installation costs
TRC	Benefits and costs from the perspective of all utility customers (participants and non-participants) in the utility service territory	
	<ul style="list-style-type: none"> ▪ Energy-related costs avoided by the utility, ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution, ▪ Additional resource savings ▪ Applicable tax credits 	<ul style="list-style-type: none"> ▪ Program overhead costs, ▪ Program installation costs, ▪ Incremental measure costs (Whether paid by the customer of utility)
RIM	Impact of efficiency measure on non-participating ratepayers overall	
	<ul style="list-style-type: none"> ▪ Energy-related costs avoided by the utility, ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution 	<ul style="list-style-type: none"> ▪ Program overhead costs, ▪ Utility/program administrator incentive costs, ▪ Utility/program administrator installation costs, ▪ Lost revenue due to reduced energy bills
PCT	Benefits and costs from the perspective of the customer installing the measure	
	<ul style="list-style-type: none"> ▪ Bill savings, ▪ Incremental installation costs ▪ Applicable tax credits or incentives 	<ul style="list-style-type: none"> ▪ Incentive payments, ▪ Incremental equipment costs
SCT	Benefits and costs from the perspective of society	
	<ul style="list-style-type: none"> ▪ Energy-related costs avoided by the utility, ▪ Capacity-related costs avoided by the utility, including generation, transmission, and distribution, ▪ Additional resource savings ▪ Non-monetized benefits (and costs) such as cleaner air or health impacts (not quantified in this analysis) 	<ul style="list-style-type: none"> ▪ Program overhead costs, ▪ Program installation costs, ▪ Incremental measure costs (Whether paid by the customer of utility)

*Incentives are considered incremental measure costs

The following sections provide a detailed review of the cost test results at the portfolio and program levels. The evaluation team presents the majority of costs and savings on a net basis, meaning that the net-to-gross ratio was applied to account for the impact of free ridership and spillovers. However, the evaluation team presents the participant borne costs, as applied to the Participant Cost Test (PCT), on a gross basis. For the PCT, the participant cost is based on what a single customer sees as the value times the number of participants.

BizSavers Portfolio Level Cost Test Inputs and Results

Table 13-4 summarizes the key financial benefit and cost inputs for the portfolio level Utility Costs Test (UCT). Ameren Missouri's avoided cost of energy is \$121 million. Incentives and overhead totaled \$24.5 million, which yields a benefit-cost ratio of 4.95.

Table 13-4 Utility Cost Test (UCT) Inputs and Results - Portfolio Level

<i>UCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$77,763,542	
Avoided Electric Capacity	\$33,608,179	
Avoided T&D Electric	\$9,654,233	
Incentives		\$15,328,351
EM&V, Admin, Data Tracking		\$9,130,329
Total	\$121,025,955	\$24,458,680
UCT Benefit - Cost Ratio	4.95	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The TRC test results, shown in Table 13-5, reflect the BizSavers Program impacts on all customers in the Ameren Missouri service territory, participants and non-participants. The participant measure costs and overhead make up the total portfolio costs of \$63.2 million. The benefits consist of the utility's total avoided costs of \$121 million, which yields a benefit-cost ratio of 1.91.

⁴⁵⁴ EPA, Understanding Cost-Effectiveness of energy efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers, 2008. <http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf>, pg. 3-2

Table 13-5 Total Resource Cost Test (TRC) Inputs and Results - Portfolio Level

<i>TRC Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$77,763,542	
Avoided Electric Capacity	\$33,608,179	
Avoided T&D Electric	\$9,654,233	
Participation Costs (net)		\$54,101,352
EM&V, Admin, Data Tracking		\$9,114,183
Total	\$121,025,955	\$63,215,535
TRC Benefit - Cost Ratio	1.91	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The portfolio level RIM test reflects the program impacts on utility rates. Table 13-6 summarizes key inputs for the RIM test. The net benefits include the avoided utility costs of \$121 million, and the costs of \$194.1 million. The same costs are included in the RIM, as they are in the UCT; however, lost revenues from reduced energy bills are also included. The financial data for the RIM test yields a benefit-cost ratio of 0.62. The ratio suggests that rates have potential to increase over time. However, a RIM < 1 does not always mean that rates will increase, in the long term. Energy efficiency programs are designed to reduce the capacity needs of the system, which may increase or decrease rates depending on the level of capital costs saved.⁴⁵⁵

⁴⁵⁵ EPA, Understanding Cost-Effectiveness of energy efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers, 2008. <http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf>, pg. 3-6

Table 13-6 Ratepayer Impact Measure Test (RIM) Inputs and Results - Portfolio Level

<i>RIM Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$77,763,542	
Avoided Electric Capacity	\$33,608,179	
Avoided T&D Electric	\$9,654,233	
Incentives		\$15,328,351
EM&V, Admin, Data Tracking		\$9,130,329
Lost Revenues		\$169,691,301
Total	\$121,025,955	\$194,149,981
RIM Benefit - Cost Ratio	0.62	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

Table 13-7 summarizes the key financial inputs to the portfolio level PCT, which reflects the program impacts on the participants. The portfolio level benefits include the program incentives and energy bill savings, which total \$188.4 million. The costs include gross participant costs, totaling \$55.1 million and yielding a benefit-cost ratio of 3.42.

Table 13-7 Participant Cost Test (PCT) Inputs and Results – Portfolio Level

<i>PCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Bill Savings (Gross)	\$173,099,118	
Incentives	\$15,328,351	
Participant Cost (Gross)		\$55,144,909
Total	\$188,427,469	\$55,144,909
PCT Benefit - Cost Ratio	3.42	

The portfolio level SCT reflects the program impacts on society; the key financial inputs are displayed in Table 13-8. The net benefits include the avoided utility costs of \$160.6 million and the costs of \$65.4 million. The financial data for the SCT test yields a benefit-cost ratio of 2.46.

Table 13-8 Societal Cost Test (SCT) Inputs and Results - Portfolio Level

<i>SCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$102,365,316	
Avoided Electric Capacity	\$45,736,719	
Avoided T&D Electric	\$12,475,892	
Participation Costs (net)		\$55,918,737
EM&V, Admin, Data Tracking		\$9,437,037
Total	\$160,577,927	\$65,355,774
SCT Benefit - Cost Ratio	2.46	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

BizSavers Custom Program Cost Test Inputs and Results

The evaluation team performed cost tests for each of the four BizSavers Programs, those results were rolled into the portfolio level analysis that was presented above. The following sections provide a more in-depth look at how each individual program performed from a cost effectiveness perspective.

Table 13-9 summarizes the key financial benefit and cost inputs for the Custom Program UCT. The Custom Program attained \$44.5 million in avoided utility costs. Incentives, overhead and other program costs totaled \$8.5 million, which yields a benefit-cost ratio of 5.23.

Table 13-9 Utility Cost Test (UCT) Inputs and Results – Custom Program

<i>UCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$25,810,475	
Avoided Electric Capacity	\$14,531,312	
Avoided T&D Electric	\$4,135,972	
Incentives		\$4,944,462
EM&V, Admin, Data Tracking		\$3,556,163
Total	\$44,477,760	\$8,500,625
UCT Benefit - Cost Ratio	5.23	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The TRC test results, shown in Table 13-10, reflect the Custom Program impacts on all customers in the Ameren Missouri service territory, participants and non-participants. The participant measure costs, overhead, and other program costs total \$25.1 million. The benefits consist of the utility's total avoided costs of \$44.5 million, which yields a benefit-cost ratio of 1.78.

Table 13-10 Total Resource Cost Test (TRC) Inputs and Results - Custom Program

<i>TRC Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$25,810,475	
Avoided Electric Capacity	\$14,531,312	
Avoided T&D Electric	\$4,135,972	
Participation Costs (net)		\$21,495,029
EM&V, Admin, Data Tracking		\$3,556,163
Total	\$44,477,760	\$25,051,192
TRC Benefit - Cost Ratio	1.78	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The Custom Program RIM test reflects the program impacts on utility rates. Table 13-11 summarizes key inputs for the RIM test. The net benefits include the avoided utility costs of \$44.5 million. The same costs are included in the RIM, as they are in the UCT; however lost revenues from reduced energy bills are also included totaling \$62.3 million. The financial data for the RIM test yields a benefit-cost ratio of 0.71.

Table 13-11 Ratepayer Impact Measure Test (RIM) Inputs and Results - Custom Program

<i>RIM Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$25,810,475	
Avoided Electric Capacity	\$14,531,312	
Avoided T&D Electric	\$4,135,972	
Incentives		\$4,944,462
EM&V, Admin, Data Tracking		\$3,556,163
Lost Revenues		\$53,774,547
Total	\$44,477,760	\$62,275,173
RIM Benefit - Cost Ratio	0.71	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The Custom Program PCT reflects the program impacts on the participants; Table 13-12 summarizes the key financial inputs. The portfolio level benefits include the program incentives and energy bill savings, which total \$60.2 million. The costs include measure incentives and gross participant costs; totaling \$22.1 million and yielding a benefit-cost ratio of 2.73.

Table 13-12 Participant Cost Test (PCT) Inputs and Results – Custom Program

<i>PCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Bill Savings (Gross)	\$55,276,625	
Incentives	\$4,944,462	
Participant Cost (Gross)		\$22,092,378
Total	\$60,221,087	\$22,092,378
PCT Benefit - Cost Ratio	2.73	

The portfolio level SCT reflects the program impacts on society; Table 13-13 summarizes the key financial inputs. The net benefits include the avoided utility costs of \$59.1 million and the costs of \$25.9 million. The financial data for the SCT test yields a benefit-cost ratio of 2.28.

Table 13-13 Societal Cost Test (SCT) Inputs and Results – Custom Program

<i>SCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$33,914,987	
Avoided Electric Capacity	\$19,839,113	
Avoided T&D Electric	\$5,364,567	
Participation Costs (net)		\$22,217,095
EM&V, Admin, Data Tracking		\$3,675,623
Total	\$59,118,667	\$25,892,718
SCT Benefit - Cost Ratio	2.28	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

BizSavers Standard Cost Test Inputs and Results

Table 13-14 provides the key financial benefit and cost inputs for the Standard Program UCT. The Custom Program attained \$52.6 million in avoided utility costs. Incentives and overhead totaled \$11.1 million, which yields a benefit-cost ratio of 4.72.

Table 13-14 Utility Cost Test (UCT) Inputs and Results – Standard Program

<i>UCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$36,523,564	
Avoided Electric Capacity	\$12,447,514	
Avoided T&D Electric	\$3,603,083	
Incentives		\$7,225,572
EM&V, Admin, Data Tracking		\$3,923,881
Total	\$52,574,160	\$11,149,453
UCT Benefit - Cost Ratio	4.72	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The TRC test results, shown in Table 13-15, reflect the Standard Program impacts on all customers in the Ameren Missouri service territory, participants and non-participants. The participant measure costs, overhead, and other program costs total \$22.9 million. The benefits consist of the utility's total avoided costs of \$52.6 million, which yields a benefit-cost ratio of 2.30.

Table 13-15 Total Resource Cost Test (TRC) Inputs and Results - Standard Program

<i>TRC Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$36,523,564	
Avoided Electric Capacity	\$12,447,514	
Avoided T&D Electric	\$3,603,083	
Participation Costs (net)		\$18,963,897
EM&V, Admin, Data Tracking		\$3,923,881
Total	\$52,574,160	\$22,887,778
TRC Benefit - Cost Ratio	2.30	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The Standard Program RIM test reflects the program impacts on utility rates. Table 13-16 summarizes the key inputs for the RIM test. The net benefits include the avoided utility costs of \$52.6 million. The same costs are included in the RIM, as they are in the UCT; however lost revenues from reduced energy bills are also included totaling \$94.4 million. The financial data for the RIM test yields a benefit-cost ratio of 0.56.

Table 13-16 Ratepayer Impact Measure Test (RIM) Inputs and Results - Standard Program

<i>RIM Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$36,523,564	
Avoided Electric Capacity	\$12,447,514	
Avoided T&D Electric	\$3,603,083	
Incentives		\$7,225,572
EM&V, Admin, Data Tracking		\$3,923,881
Lost Revenues		\$83,220,122
Total	\$52,574,160	\$94,369,575
RIM Benefit - Cost Ratio	0.56	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The Standard Program PCT reflects the program impacts on the participants; Table 13-17 displays the key financial inputs. The Standard Program benefits include the program incentives and energy bill savings, which total \$92.4 million. The costs include gross participant costs; totaling \$19.4 million and yielding a benefit-cost ratio of 4.76.

Table 13-17 Participant Cost Test (PCT) Inputs and Results – Standard Program

<i>PCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Bill Savings (Gross)	\$85,210,819	
Incentives	\$7,225,572	
Participant Cost (Gross)		\$19,433,344
Total	\$92,436,391	\$19,433,344
PCT Benefit - Cost Ratio	4.76	

Table 13-18 summarizes the Standard Program SCT test results. The net benefits include the avoided utility costs of \$69.9 million and the costs of \$23.7 million. The financial data for the SCT test yields a benefit-cost ratio of 2.95.

Table 13-18 Societal Cost Test (SCT) Inputs and Results – Standard Program

<i>SCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$48,302,224	
Avoided Electric Capacity	\$16,933,099	
Avoided T&D Electric	\$4,647,249	
Participation Costs (net)		\$19,600,937
EM&V, Admin, Data Tracking		\$4,055,692
Total	\$69,882,573	\$23,656,629
SCT Benefit - Cost Ratio	2.95	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

BizSavers New Construction Cost Test Inputs and Results

Table 13-19 provides the key financial benefit and cost inputs for the New Construction Program UCT. The New Construction Program attained \$17.0 million in avoided utility costs. Incentives and overhead totaled \$2.8 million, which yields a benefit-cost ratio of 6.14.

Table 13-19 Utility Cost Test (UCT) Inputs and Results– New Construction Program

<i>UCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$11,570,497	
Avoided Electric Capacity	\$4,336,541	
Avoided T&D Electric	\$1,085,811	
Incentives		\$1,734,648
EM&V, Admin, Data Tracking		\$1,031,097
Total	\$16,992,849	\$2,765,745
UCT Benefit - Cost Ratio	6.14	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The TRC test results, shown Table 13-20 reflect the New Construction Program impacts on all customers in the Ameren Missouri service territory, participants and non-participants. The participant measure costs, overhead, and other program costs total \$12.5 million. The benefits consist of the utility’s total avoided costs of \$17.0 million, which yields a benefit-cost ratio of 1.36.

Table 13-20 Total Resource Cost Test (TRC) Inputs and Results - New Construction Program

<i>TRC Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$11,570,497	
Avoided Electric Capacity	\$4,336,541	
Avoided T&D Electric	\$1,085,811	
Participation Costs (net)		\$11,461,646
EM&V, Admin, Data Tracking		\$1,031,097
Total	\$16,992,849	\$12,492,743
TRC Benefit - Cost Ratio	1.36	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The New Construction Program RIM test reflects the program impacts on utility rates. Table 13-21 summarizes the key inputs for the RIM test. The net benefits include the avoided utility costs of \$17.0 million. The same costs are included in the RIM, as they are in the UCT; however lost revenues from reduced energy bills are also included totaling \$27.2 million. The financial data for the RIM test yields a benefit-cost ratio of 0.63.

Table 13-21 Ratepayer Impact Measure Test (RIM) Inputs and Results - New Construction Program

<i>RIM Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$11,570,497	
Avoided Electric Capacity	\$4,336,541	
Avoided T&D Electric	\$1,085,811	
Incentives		\$1,734,648
EM&V, Admin, Data Tracking		\$1,031,097
Lost Revenues		\$24,398,019
Total	\$16,992,849	\$27,163,764
RIM Benefit - Cost Ratio	0.63	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The New Construction Program PCT reflects the program impacts on the participants; Table 13-22 summarizes the key financial inputs. The New Construction Program benefits include the program incentives and energy bill savings, which total \$26.1 million. The costs include measure incentives and gross participant costs, totaling \$11.5 million and yielding a benefit-cost ratio of 2.28.

Table 13-22 Participant Cost Test (PCT) Inputs and Results – New Construction Program

<i>PCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Bill Savings (Gross)	\$24,392,036	
Incentives	\$1,734,648	
Participant Cost (Gross)		\$11,459,030
Total	\$26,126,684	\$11,459,030
PCT Benefit - Cost Ratio	2.28	

Table 13-23 summarizes the New Construction Program SCT test results. The net benefits include the avoided utility costs of \$22.3 million and the costs of \$12.9 million. The financial data for the SCT test yields a benefit-cost ratio of 1.73.

Table 13-23 Societal Cost Test (SCT) Inputs and Results – New Construction Program

<i>SCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$15,134,737	
Avoided Electric Capacity	\$5,809,057	
Avoided T&D Electric	\$1,391,498	
Participation Costs (net)		\$11,846,668
EM&V, Admin, Data Tracking		\$1,065,734
Total	\$22,335,291	\$12,912,402
SCT Benefit - Cost Ratio	1.73	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

BizSavers Retro-Commissioning Cost Test Inputs and Results

Table 13-24 summarizes key financial benefit and cost inputs for the Retro-Commissioning Program UCT. The Retro-Commissioning Program attained \$2.7 million in avoided utility costs. Incentives and overhead totaled \$705,705, which yields a benefit-cost ratio of 3.89.

Table 13-24 Utility Cost Test (UCT) Inputs and Results – Retro-Commissioning Program

<i>UCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$1,131,024	
Avoided Electric Capacity	\$1,127,917	
Avoided T&D Electric	\$481,343	
Incentives		\$381,396
EM&V, Admin, Data Tracking		\$322,309
Total	\$2,740,284	\$703,705
UCT Benefit - Cost Ratio	3.89	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The TRC test results, shown Table 13-25 reflect the Retro-Commissioning Program impacts on all customers in the Ameren Missouri service territory, participants and non-participants. The participant measure costs, overhead, and other program costs total \$820,941. The benefits consist of the utility's total avoided costs of \$2.7 million, which yields a benefit-cost ratio of 3.34.

Table 13-25 Total Resource Cost Test (TRC) Inputs and Results – Retro-Commissioning Program

<i>TRC Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$1,131,024	
Avoided Electric Capacity	\$1,127,917	
Avoided T&D Electric	\$481,343	
Participation Costs (net)		\$498,631
EM&V, Admin, Data Tracking		\$322,309
Total	\$2,740,284	\$820,941
TRC Benefit - Cost Ratio	3.34	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The Retro-Commissioning Program RIM test reflects the program impacts on utility rates. Table 13-26 summarizes key inputs for the RIM test. The net benefits include the avoided utility costs of \$2.7 million. The same costs are included in the RIM, as they are in the UCT; however lost revenues from reduced energy bills are also included totaling \$3.0 million. The financial data for the RIM test yields a benefit-cost ratio of 0.91.

Table 13-26 Ratepayer Impact Measure Test (RIM) Inputs and Results – Retro-Commissioning Program

<i>RIM Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$1,131,024	
Avoided Electric Capacity	\$1,127,917	
Avoided T&D Electric	\$481,343	
Incentives		\$381,396
EM&V, Admin, Data Tracking		\$322,309
Lost Revenues		\$2,314,501
Total	\$2,740,284	\$3,018,205
RIM Benefit - Cost Ratio	0.91	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The Retro-Commissioning Program PCT reflects the program impacts on the participants; Table 13-27 displays the key financial inputs. The New Construction Program benefits include the program incentives and energy bill savings, which total \$2.7 million. The costs include gross participant costs totaling \$498,631 and yielding a benefit-cost ratio of 5.41.

Table 13-27 Participant Cost Test (PCT) Inputs and Results – Retro-Commissioning Program

<i>PCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Bill Savings (Gross)	\$2,314,501	
Incentives	\$381,396	
Participant Cost (Gross)		\$498,631
Total	\$2,695,896	\$498,631
PCT Benefit - Cost Ratio	5.41	

Table 13-28 summarizes the Retro-Commissioning Program SCT test. The net benefits include the avoided utility costs, totaling \$3.7 million. The costs total \$848,518. The financial data for the SCT test yields a benefit-cost ratio of 4.35.

Table 13-28 Societal Cost Test (SCT) Inputs and Results – Retro-Commissioning Program

<i>SCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$1,467,405	
Avoided Electric Capacity	\$1,594,289	
Avoided T&D Electric	\$629,455	
Participation Costs (net)		\$515,382
EM&V, Admin, Data Tracking		\$333,136
Total	\$3,691,150	\$848,518
SCT Benefit - Cost Ratio	4.35	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

BizSavers SBDI Cost Test Inputs and Results

Table 13-29 summarizes key financial benefit and cost inputs for the SBDI Program UCT. The SBDI Program attained \$3.5 million in avoided utility costs. Incentives and overhead totaled \$1.1 million which yields a benefit-cost ratio of 3.24.

Table 13-29 Utility Cost Test (UCT) Inputs and Results – SBDI Program

<i>UCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$2,403,594	
Avoided Electric Capacity	\$836,438	
Avoided T&D Electric	\$237,979	
Incentives		\$839,314
EM&V, Admin, Data Tracking		\$234,981
Total	\$3,478,011	\$1,074,296
UCT Benefit - Cost Ratio	3.24	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The TRC test results, shown Table 13-30 reflect the SBDI Program impacts on all customers in the Ameren Missouri service territory, participants and non-participants. The participant measure costs, overhead, and other program costs total \$1.5 million. The benefits consist of the utility’s total avoided costs of \$3.5, which yields a benefit-cost ratio of 2.28.

Table 13-30 Total Resource Cost Test (TRC) Inputs and Results – SBDI Program

<i>TRC Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$2,403,594	
Avoided Electric Capacity	\$836,438	
Avoided T&D Electric	\$237,979	
Participation Costs (net)		\$1,309,105
EM&V, Admin, Data Tracking		\$218,836
Total	\$3,478,011	\$1,527,941
TRC Benefit - Cost Ratio	2.28	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The SBDI Program RIM test reflects the program impacts on utility rates. Table 13-31 summarizes key inputs for the RIM test. The net benefits include the avoided utility costs of \$3.5 million. The financial data for the RIM test yields a benefit-cost ratio of 0.53.

Table 13-31 Ratepayer Impact Measure Test (RIM) Inputs and Results – SBDI Program

<i>RIM Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$2,403,594	
Avoided Electric Capacity	\$836,438	
Avoided T&D Electric	\$237,979	
Incentives		\$839,314
EM&V, Admin, Data Tracking		\$234,981
Lost Revenues		\$5,429,287
Total	\$3,478,011	\$6,503,582
RIM Benefit - Cost Ratio	0.53	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The SBDI Program PCT reflects the program impacts on the participants; Table 13-32 displays the key financial inputs. The New Construction Program benefits include the program incentives and energy bill savings, which total \$6.2 million. The costs include gross participant costs totaling \$1.3 million and yielding a benefit-cost ratio of 4.80. The results indicate that participants' energy bill savings is more than four and a half times the costs.

Table 13-32 Participant Cost Test (PCT) Inputs and Results – SBDI Program

<i>PCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Bill Savings (Gross)	\$5,350,312	
Incentives	\$839,314	
Participant Cost (Gross)		\$1,288,482
Total	\$6,189,626	\$1,288,482
PCT Benefit - Cost Ratio	4.80	

Table 13-33 summarizes the SBDI Program SCT test. The net benefits include the avoided utility costs of \$4.5 million and the costs of \$1.6 million. The financial data for the SCT test yields a benefit-cost ratio of 2.85.

Table 13-33 Societal Cost Test (SCT) Inputs and Results – SBDI Program

<i>SCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$3,122,817	
Avoided Electric Capacity	\$1,115,795	
Avoided T&D Electric	\$302,193	
Participation Costs (net)		\$1,353,081
EM&V, Admin, Data Tracking		\$242,875
Total	\$4,540,805	\$1,595,956
SCT Benefit - Cost Ratio	2.85	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

BizSavers EMS Cost Test Inputs and Results

Table 13-34 summarizes key financial benefit and cost inputs for the SBDI Program UCT. The EMS Program attained \$762,890 in avoided utility costs. Incentives and overhead totaled \$264,857 which yields a benefit-cost ratio of 2.88.

Table 13-34 Utility Cost Test (UCT) Inputs and Results – EMS Program

<i>UCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$324,388	
Avoided Electric Capacity	\$328,457	
Avoided T&D Electric	\$110,045	
Incentives		\$202,960
EM&V, Admin, Data Tracking		\$61,897
Total	\$762,890	\$264,857
UCT Benefit - Cost Ratio	2.88	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The TRC test results, shown Table 13-35 reflect the EMS Program impacts on all customers in the Ameren Missouri service territory, participants and non-participants. The participant measure costs, overhead, and other program costs total \$434,941. The benefits consist of the utility’s total avoided costs of \$762,890, which yields a benefit-cost ratio of 1.75.

Table 13-35 Total Resource Cost Test (TRC) Inputs and Results – EMS Program

<i>TRC Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$324,388	
Avoided Electric Capacity	\$328,457	
Avoided T&D Electric	\$110,045	
Participation Costs (net)		\$373,043
EM&V, Admin, Data Tracking		\$61,897
Total	\$762,890	\$434,941
TRC Benefit - Cost Ratio	1.75	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The EMS Program RIM test reflects the program impacts on utility rates. Table 13-36 summarizes key inputs for the RIM test. The net benefits include the avoided utility costs of \$762,890. The same costs are included in the RIM, as they are in the UCT; however lost revenues from reduced energy bills are also included totaling \$819,682. The financial data for the RIM test yields a benefit-cost ratio of 0.93.

Table 13-36 Ratepayer Impact Measure Test (RIM) Inputs and Results – EMS Program

<i>RIM Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$324,388	
Avoided Electric Capacity	\$328,457	
Avoided T&D Electric	\$110,045	
Incentives		\$202,960
EM&V, Admin, Data Tracking		\$61,897
Lost Revenues		\$554,825
Total	\$762,890	\$819,682
RIM Benefit - Cost Ratio	0.93	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

The EMS Program PCT reflects the program impacts on the participants; Table 13-37 displays the key financial inputs. The New Construction Program benefits include the program incentives and energy bill savings, which total \$757,785. The costs include gross participant costs totaling \$373,043 and yielding a benefit-cost ratio of 2.03.

Table 13-37 Participant Cost Test (PCT) Inputs and Results – EMS Program

<i>PCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Bill Savings (Gross)	\$554,825	
Incentives	\$202,960	
Participant Cost (Gross)		\$373,043
Total	\$757,785	\$373,043
PCT Benefit - Cost Ratio	2.03	

Table 13-38 summarizes the EMS Program SCT test. The net benefits include the avoided utility costs of \$1.0 million, against the costs of \$449,551. The financial data for the SCT test yields a benefit-cost ratio of 2.01.

Table 13-38 Societal Cost Test (SCT) Inputs and Results – EMS Program

<i>SCT Calculations</i>		
<i>Category</i>	<i>Benefits (2016 Dollars)</i>	<i>Costs (2016 Dollars)</i>
Avoided Electric Production	\$423,145	
Avoided Electric Capacity	\$445,365	
Avoided T&D Electric	\$140,931	
Participation Costs (net)		\$385,575
EM&V, Admin, Data Tracking		\$63,977
Total	\$1,009,441	\$449,551
SCT Benefit - Cost Ratio	2.25	
Note: Incentive costs in excess of measure incremental costs are allocated to other/miscellaneous costs.		

14. Glossary of Terms

Adjustments: Modifications on ex ante analysis conditions (e.g. hours of lighting operation) because of observations made by ADM field technicians during the measurement and verification (M&V) on-site visit, which change baseline energy or energy demand values.

Baseline: The projected scenario where the subject project or program was not implemented. Baseline conditions are sometimes referred to as “business-as-usual” conditions. Baselines are defined as either project-specific baselines or performance standard baselines.

Confidence (level): A confidence level is a value that indicates the reliability of a calculated estimate from a sample. A higher confidence level indicates a stronger estimate that is more likely to lie within the population parameter. It is an indication of how close an estimated value derived from a sample is to the true population value of the quantity in question. The confidence level is the likelihood that the evaluation has captured the true impacts of the program within a certain range of values (i.e., precision).

Cost-effectiveness: The present value of the estimated benefits produced by an energy efficiency program compared to the estimated total costs to determine if the proposed investment or measure is desirable (e.g., whether the estimated benefits exceed the estimated costs from a societal perspective). It is an indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice.

Deemed Savings: An estimate of the gross energy savings or gross energy demand savings for a single unit of an installed energy efficiency measure. This estimate (a) comes from data sources and analytical methods that are widely accepted for the particular measure and purpose, and (b) is applicable to the situation being evaluated.

Demand: The time rate of energy flow. Demand usually refers to electric power measured in kW (equals kWh/h) but can also refer to natural gas, usually as Btu/hr., kBtu/hr., therms/day, etc.

Effective Useful Life: An estimate of the median number of years that the efficiency measures installed under a program are still in place and operable.

Energy Efficiency: The use of less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way, or using less energy to perform the same function. “Energy conservation” is a term that has also been used, but it has the connotation of doing without a service in order to save energy rather than using less energy to perform the same function.

Energy Efficiency Measure: Installation of equipment, subsystems or systems, or modification of equipment, subsystems, systems, or operations on the customer side of

the meter, for the purpose of reducing energy and/or demand (and, hence, energy and/or demand costs) at a comparable level of service.

Engineering Model: Engineering equations used to calculate energy usage and savings. These models are usually based on a quantitative description of physical processes that transform delivered energy into useful work such as heat, lighting, or motor drive. In practice, these models may be reduced to simple equations in spreadsheets that calculate energy usage or savings as a function of measurable attributes of customers, facilities, or equipment (e.g., lighting use = watts × hours of use).

Evaluation: The performance of studies and activities aimed at determining the effects of a program. This includes any of a wide range of assessment activities associated with understanding or documenting program performance, assessing program or program-related markets and market operations; any of a wide range of evaluative efforts including assessing program-induced changes in energy efficiency markets, levels of demand or energy savings, and program cost-effectiveness.

Ex Ante: The saving calculated by the implementation contractor, Lockheed Martin, per the TRM. These numbers are developed prior to ADM's analysis.

Ex Post: The savings that have been verified by the EM&V contractor. This includes adjustments for equipment that may not have been installed, calculation errors, and differences in assumptions.

Free Rider: A program participant who would have implemented the program measure or practice in the absence of the program incentive. Free riders can be total (who would have implemented all of the same measures without the incentives), partial (who would have implemented some of the same measures without the incentives), or deferred (who would have implemented the measures, but at some time in the future).

Ex Ante kWh Savings: The estimation of electrical energy (kWh) expected to be saved by implementing energy efficiency measures, calculated by the implementation contractor before measures are enacted and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Ex Ante Peak kW Savings: The estimation of electrical energy demand (kW) expected to be saved by implementing energy efficiency measures, calculated by the implementation contractor before measures are enacted and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Ex Post Gross kWh Savings: The estimation of electrical energy (kWh) saved by implementing energy efficiency measures, calculated by ADM, after measures were enacted, and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Ex Post Gross Peak kW Savings: The estimation of electrical energy demand (kW) saved by implementing energy efficiency measures, calculated by ADM, after measures were enacted, and without considering externalities like free ridership and spillovers. Savings are typically reported as annual savings.

Gross kWh Savings Realization Rate: The ratio of ex post (or “realized”) gross kWh savings over ex ante gross kWh savings.

Gross Peak kW Savings Realization Rate: The ratio of ex post (or “realized”) gross kW savings over ex ante gross kW savings.

Gross Realization Rate: The ratio of ex post gross energy savings over ex ante gross energy savings

Gross Savings: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated.

Impact Evaluation: An evaluation of the program-specific, directly induced changes (e.g., energy and/or demand usage) attributable to an energy efficiency program.

Interaction Factors: Changes in energy use or demand occurring beyond the measurement boundary of the M&V analysis.

kWh Savings Target: The goal of energy savings for programs and their components set by utility companies before the programs began.

Measure: Energy efficient equipment or service that is implemented to conserve energy.

Measurement: A procedure for assigning a number to an observed object or event.

Measurement and Verification (M&V): The data collection, monitoring, observations, and analysis by field technicians used for the calculation of ex post gross energy and demand savings for individual sites or projects. M&V can be a subset of program impact evaluation.

Metering: The collection of energy-consumption data over time through the use of meters. These meters may collect information with respect to an end-use, a circuit, a piece of equipment, or a whole building (or facility). Short-term metering generally refers to data collection for no more than a few weeks. End-use metering refers specifically to separate data collection for one or more end-uses in a facility, such as lighting, air conditioning or refrigeration. Spot metering is an instantaneous measurement (rather than over time) to determine an energy-consumption rate.

Monitoring: Gathering of relevant measurement data, including but not limited to energy-consumption data, over time to evaluate equipment or system performance. Examples include chiller electric demand, inlet evaporator temperature and flow, outlet evaporator temperature, condenser inlet temperature, and ambient dry-bulb temperature and relative

humidity or wet-bulb temperature, for use in developing a chiller performance map (e.g., kW/ton vs. cooling load and vs. condenser inlet temperature).

Net Ex Post kWh Savings: The estimation of electrical energy (kWh) savings from programs or measures after the measures have been installed and after adjusting for possible externalities, such as free ridership and spillovers.

Net Ex Post Peak kW Savings: The estimation of electrical energy demand (kW) savings from programs or measures after the measures have been installed and after adjusting for possible externalities, such as free ridership and spillovers.

Net Savings: The amount of energy reduced based on the particular project after subtracting the negative free ridership effects and adding the positive spillover effects. Therefore, net savings equal gross savings, minus free ridership, plus the summation of participant spillovers, and non-participant spillovers. It is a better estimate of how much energy reductions occurred particularly because of the program incentive(s).

Net-to-Gross-Ratio (NTGR): A factor representing net program savings divided by gross program savings. It is applied to gross program impacts to convert gross program impacts into net program load impacts that are adjusted for free ridership and spillover. Net-to-Gross-Ratio (NTGR) = $(1 - \text{Free-Ridership \%} + \text{Spillover \%})$, also defined as Net Savings / Gross Savings.

Non-participant: A consumer who was eligible but did not participate in the subject efficiency program in a given program year. Each evaluation plan should provide a definition of a non-participant as it applies to a specific evaluation.

Participant: A consumer who received a service offered through the subject efficiency program in a given program year. The term “service” is used in this definition to suggest that the service can be a wide variety of services, including financial rebates, technical assistance, product installations, training, energy efficiency information or other services, items, or conditions. Each evaluation plan should define “participant” as it applies to the specific evaluation.

Peak Demand: The maximum level of metered demand during a specified period, such as a billing month or a peak demand period.

Peak kW Savings Target: The goal of energy demand savings set by the utility company for their program or program component before the program time frame begins.

Portfolio: Either (a) a collection of similar programs addressing the same market (e.g., a portfolio of residential programs), technology (e.g., motor-efficiency programs), or mechanisms (e.g., loan programs) or (b) the set of all programs conducted by one organization, such as a utility (and which could include programs that cover multiple markets, technologies, etc.).

Primary Effects: Effects that the project or program are intended to achieve. For efficiency programs, this is primarily a reduction in energy use per unit of output.

Process Evaluation: A systematic assessment of an energy efficiency program's process. The assessment includes documenting program operations at the time of the examination, and identifying and recommending improvements to increase the program's efficiency or effectiveness for acquiring energy resources while maintaining high levels of participant satisfaction.

Program: A group of projects, with similar characteristics and installed in similar applications. Examples could include a utility program to install energy-efficient lighting in commercial buildings, a developer's program to build a subdivision of homes that have photovoltaic systems, or a state residential energy efficiency code program.

Project: An activity or course of action involving one or multiple energy efficiency measures, at a single facility or site.

Ratepayer Impact Test (RIM): RIM tests measure the distributional impacts of conservation programs from the viewpoint of all of the utility's customers. The test measures what happens to average price levels due to changes in utility revenues and operating costs caused by a program. A benefit/cost ratio less than 1.0 indicates the program will influence prices upward for all customers. For a program passing the TRC but failing the RIM, average prices will increase, resulting in higher energy service costs for customers not participating in the program.

Regression Analysis: A statistical analysis of the relationship between a dependent variable (response variable) to specified independent variables (explanatory variables). The mathematical model of their relationship is the regression equation.

Reporting Period: The time following implementation of an energy efficiency activity during which savings are to be determined.

Secondary Effects: Unintended impacts of the project or program such as rebound effect (e.g., increasing energy use as it becomes more efficient and less costly to use), activity shifting (e.g., movement of generation resources to another location), and market leakage (e.g., emission changes due to changes in supply or demand of commercial markets). These secondary effects can be positive or negative.

Spillover: A positive externality related to a participant or non-participant enacting additional energy efficiency measures without an incentive because of a participant's experience in the program. There can be participant and/or non-participant spillover rates depending on the rate at which participants (and non-participants) adopt energy efficiency measures or take other types of efficiency actions on their own (i.e., without an incentive being offered).

Stipulated Values: See "deemed savings."

Total Resource Cost Test (TRC): This test compares the program benefits of avoided supply costs against the costs for administering a program and the cost of upgrading equipment. This test examines efficiency from the viewpoint of an entire service territory. When a program passes the TRC, this indicates total resource costs will drop, and the total cost of energy services for an average customer will fall.

Uncertainty: The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall with some degree of confidence.

Utility Cost Test (UCT): Also known as the Program Administrator Test (PACT), this test measures cost-effectiveness from the viewpoint of the sponsoring utility or program administrator. If avoided supply costs exceed program administrator costs, then average costs will decrease.