Evaluation of Illinois Energy Now Public Sector Custom, Standard, and New Construction Incentives Programs: June 2014 through May 2015

Prepared for:

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Table of Contents

List of Figures

List of Tables

1. Executive Summary

This report presents the results of the impact and process evaluations performed by ADM Associates Inc. (ADM) for three programs administered by the Illinois Department of Commerce & Economic Opportunity (hereinafter referred to as the "Department of Commerce") for public sector entities: Public Sector Custom Incentive Program, Public Sector Standard Incentives Program (grouped together as the Custom and Standard Incentives Programs), and the Public Sector New Construction Program (New Construction Program). This report presents results for electric program year seven and natural gas program year four (EPY7/GPY4), the period from June 2014 through May 2015. The main features of the approach used for the evaluation of the Custom and Standard Incentives Programs and New Construction Program are as follows:

- Data for the study were collected through the following: review of program materials; on-site inspections; end-use metering; and interviews with Department of Commerce staff members, program partner staff members, and participating public sector entities' staff and contractors.
- A sample design was developed for on-site data collection. Separate samples were drawn for electric and natural gas savings that provided savings estimates for programs within ±10% precision at the 90% confidence level. Table 1-1 shows the precision of the sample estimates. Table 1-2 shows the sample sizes for different types of data collection employed for the Custom and Standard Incentives Programs.
- On-site visits were used to collect data for savings impact calculations, to verify measure installation, and to determine measure operating parameters. Facility staff were interviewed to determine operating hours of installed measures, and to explain any additional benefits or shortcomings with the installed measure. For the majority of sites, lighting equipment, HVAC equipment, or motors/VFDs were monitored to obtain accurate information on hours of operation. For electric savings, the 28 projects sampled for the Custom Incentives and New Construction Programs accounted for 55% of the expected kWh savings and the 93 projects sampled for the Standard Incentives Program accounted for 25% of the expected kWh savings. For natural gas savings, the 23 projects sampled for the Custom Incentives and New Construction Programs accounted for 71% of the expected therm savings and the 19 projects sampled for the Standard Incentives Program accounted for 46% of the expected therm savings.
- Surveys of participant decision makers provided information necessary for net-to-gross analysis and process evaluation. For the Custom and Standard Incentives Programs, a total of 159 participant decision makers were surveyed about the influence of the program on their project decision-making. For the New Construction Program, seven decision makers who completed EPY7/GPY4 projects were surveyed.

Table 1-1 Precision of Sample Estimates for Custom and Standard Electric and Natural Gas Savings

Program	*Precision for 90% Confidence Level*
Custom, Standard and New Construction, Electric	± 5.10%
Custom, Standard and New Construction, Natural Gas	± 9.50%

Table 1-2 Sample Sizes for Custom and Standard Incentives Programs Data Collection Efforts

Type of Data Collected	*Sample Size*
Project On-Site Measurement and Verification	74
Participant Decision Maker Survey	159

The Illinois Statewide Technical Reference Manual (TRM) was used to estimate gross savings for measures implemented through the Standard Incentives Program. Measures implemented through the New Construction Program, the Custom Incentives Program and non-TRM savings measures implemented through the Standard Incentives Program were estimated using industry standard engineering calculations and verification of computer simulations.

For standard measures, savings were calculated using one of three different TRM approaches. These approaches are as follows:

- TRM-Calculated: Savings calculated as per Illinois's Statewide TRM Version 3.0.
- TRM-Calculated (Errata Corrected): Savings calculated as per an erratum in Version 4.0 of the TRM.
- ADM-Calculated: Savings calculated using a non-TRM methodology. ADM-Calculated savings were performed when the Standard Incentives Program measure was not in the TRM or when the methodology in the TRM was not applicable because the assumptions provided were not appropriate for that measure.

The realized electric savings for the Custom and Standard Incentives Programs and New Construction Program during the period June 2014 through May 2015 are summarized in Table 1-3, Table 1-4, and Table 1-5.

During this period, gross ex post electric savings total 30,879,936 kWh for the Custom Incentives Program, 67,972,825 kWh for the Standard Incentives Program, and 5,388,509 kWh for the New Construction Program. The gross realization rates for electric savings from the Custom and Standard Incentives Program are 75% and 128%, respectively. For the New Construction Program, the gross realization rate is 100%.

During EPY7/GPY4, net ex post electric savings total 25,343,904 kWh for the Custom Incentives Program, 61,217,664 kWh for the Standard Incentives Program, and 3,241,471 kWh for the New Construction Program. The net-to-gross ratio for the Custom Incentives Program is 82% and the net-to-gross ratio for the Standard Incentives Program is 90%. For the New Construction Program, the net-to-gross ratio is 61%.

Table 1-3 Summary of kWh Savings for Custom Incentives Program

Utility	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	13,485,862	11,073,223	82%	9,252,437	84%
ComEd	27,689,505	19,806,713	72%	16,091,467	81%
Total	41,175,366	30,879,936	75%	25,343,904	82%

Table 1-4 Summary of kWh Savings for Standard Incentives Program

Utility	*Ex Ante kWh Savings*	*TRM-Calculated*		*TRM-Calculated (Errata Corrected)*		*ADM-Calculated*			
		Gross Ex Post kWh Savings	*Net Ex Post kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	11,446,308	13,867,804	12,734,067	13,958,180	12,809,127	14,810,450	129%	13,618,320	92%
ComEd	41,493,314	48,666,149	43,345,164	49,503,120	44,058,373	53,162,374	128%	47,599,344	90%
Total	52,939,622	62,533,953	56,079,231	63,461,300	56,867,501	67,972,825	128%	61,217,664	90%

Table 1-5 Summary of kWh Savings for New Construction Program

Utility	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	4,944,843	4,944,843	100%	2,898,452	59%
ComEd	393,666	393,666	100%	343,019	87%
Total	5,338,509	5,338,509	100%	3,241,471	61%

The gross ex post natural gas savings for the Custom and Standard Incentives Programs and New Construction Program during the period June 2014 through May 2015 are summarized in Table 1-6, Table 1-7, and Table 1-8. For the period, gross ex post natural gas savings total 1,293,082 therms for the Custom Incentives Program, 243,402 therms for the Standard Incentives Program, and 229,161 therms for the New Construction Program. The gross realization rates for the Custom and Standard Incentives Programs are 75% and 115%, respectively. The gross realization rate for the New Construction Program is 115%.

The total net ex post natural gas savings is 1,090,456 therms for the Custom Incentives Program, 127,513 therms for the Standard Incentives Program, and 152,612 therms for the New Construction Program. The net-to-gross ratio for the Custom Incentives Program is 84% while the net to gross ratio for the Standard Incentives Program is 52%. For the New Construction Program, the net to gross ratio is 67%.

Table 1-6 Summary of Therm Savings for Custom Incentives Program

Utility	*Ex Ante Therm Savings*	*Gross Ex Post Therm Savings*	*Gross Realization Rate*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Ameren	239,768	180,621	75%	151,788	84%
Nicor	625,166	480,991	77%	377,312	78%
North Shore	173,611	134,264	77%	104,182	78%
Peoples	676,240	497,205	74%	457,174	92%
Total	1,714,785	1,293,082	75%	1,090,456	84%

Table 1-7 Summary of Therm Savings for Standard Incentives Program

Utility	*Ex Ante Therm Savings*	*TRM-Calculated*		*TRM-Calculated (Errata Corrected)*		*ADM-Calculated*			
		Gross Ex Post Therm Savings	*Net Ex Post Therm Savings*	*Gross Ex Post Therm Savings*	*Net Ex Post Therm Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Ameren	30,455	29,678	19,066	30,810	19,787	30,810	101%	19,787	64%
Nicor	119,821	137,952	66,850	139,431	68,113	139,431	116%	68,113	49%
North Shore	5,756	6,656	3,214	6,769	3,291	6,769	118%	3,291	49%
Peoples	56,019	65,796	35,842	66,392	36,322	66,392	119%	36,322	55%
Total	212,051	240,082	124,972	243,402	127,513	243,402	115%	127,513	52%

Table 1-8 Summary of Therm Savings for New Construction Program

Utility	*Ex Ante Therm Savings*	*Gross Ex Post Therm Savings*	*Gross Realization Rate*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Ameren	27,252	31,328	115%	5,803	19%
Nicor	172,091	197,832	115%	146,810	74%
Total	199,343	229,161	115%	152,612	67%

The gross ex post peak demand reductions for the Custom and Standard Incentives Programs and New Construction Program during the period June 2014 through May 2015 are summarized in Table 1-9 and Table 1-10. For the period, gross peak demand reductions total 2,071.20 kW for the Custom Incentives Program, and 5,512.24 kW for the Standard Incentives Program. The gross realization rate for the Standard Incentives Program is 72%.

The net peak demand reductions total 1,943.57 kW for the Custom Incentives Program, 5,161.78 kW for the Standard Incentives Program. There were no peak kW reductions for the New Construction Program.

Table 1-9 Summary of Peak kW Reductions for Custom Incentives Program

Utility	*Ex Ante kW Savings*	*Gross Ex Post kW Savings*	*Gross Realization Rate*	*Net Ex Post kW Savings*	*Net-to-Gross Ratio*
Ameren	N/A	724.50		700.45	97%
ComEd	N/A	1,346.70		1,243.12	92%
Total	N/A	2,071.20		1,943.57	94%

Table 1-10 Summary of Peak kW Reductions for Standard Incentives Program

Utility	*Ex Ante kW Savings*	*TRM-Calculated*		*TRM-Calculated (Errata Corrected)*		*ADM-Calculated*			
		Gross Ex Post kW Savings	*Net Ex Post kW Savings*	*Gross Ex Post kW Savings*	*Net Ex Post kW Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*	*Net Ex Post kW Savings*	*Net-to-Gross Ratio*
Ameren	1,641.00	949.88	888.63	951.40	890.03	1,193.12	73%	1,120.96	94%
ComEd	6,051.95	3,410.45	3,182.77	3,421.28	3,192.76	4,319.12	71%	4,040.82	94%
Total	7,692.95	4,360.33	4,071.40	4,372.68	4,082.79	5,512.24	72%	5,161.78	94%

The following presents a selection of key findings from EPY7/GPY4:

- For the Custom Incentives, Standard Incentives, and New Construction Programs, combined, gross and net electric savings declined slightly from the prior year. For all three programs, gross ex post kWh savings declined by 9% and net ex post kWh savings declined by 4%. The gross and net ex post kWh savings of the Custom and New Construction Incentive Program increased, while Standard Incentives kWh savings decreased.
- For all three programs, natural gas savings declined to a greater extent than electric savings. Across the three incentive programs, gross ex post therm savings declined by 69% and net ex post therm savings declined by 73%. The decline was largely due to decreased custom incentive projects. Gross and net ex post therm savings increased for the Standard Incentives and New Construction Programs.
- Survey respondents indicate that participants are learning about the program through a variety of sources. Trade allies or other contractors, equipment vendors, or energy consultants were a source of awareness for 26% of participants in the Custom and Standard Incentives Programs. Other common sources of awareness mentioned were friends or

colleagues (18%), presentation at a conference or workshop (14%), and through a professional group or association (13%).

- Most program participants that worked on application materials rated the materials as clear and few (<5%) gave ratings that indicated there were significant clarity issues. Additionally, most respondents, 92% indicated that they knew whom to go to for additional assistance with the application.
- Participant satisfaction was high. Ninety-six percent of respondents indicated that they were satisfied with the program overall and nearly all respondents were satisfied with their interactions with program staff. The time to get the rebate was the aspect of the program that the largest share of respondents reported dissatisfaction with.
- A significant share of New Construction Program respondents (43%) reported that they received new construction design assistance from the Smart Design and Assistance Center (SEDAC). These respondents also rated this assistance as having a high impact on the decision to incorporate the energy efficient design features or equipment into the project.
- All New Construction Program participants were satisfied with the program overall. None of the respondents reported dissatisfaction with any aspect of the program.

2. Introduction

This section presents a description of the three programs that Illinois Department of Commerce & Economic Opportunity (hereinafter referred to as the "Department of Commerce") offers to public sector entities. These programs are the Public Sector Custom and Standard Incentives Programs (Custom and Standard Incentives Program) and the Public Sector New Construction Program (New Construction Program). This section also includes an overview of the evaluation approach and report contents for the evaluation of electric program year seven and natural gas program year four (EPY7/GPY4), the period from June 2014 through May 2015.

2.1 Description of Programs

The Custom and Standard Incentives Programs and the New Construction Program offered by the Department of Commerce were designed to help the public sector identify and implement energy saving projects. The three programs evaluated in this report are described below.

2.1.1 Custom and Standard Incentives Programs

2.1.1.1 Incentive Structure

The following summarizes both the Custom and Standard Incentives Programs offered by the Department:

- The Custom Incentives Program generates electric and natural gas savings by helping public sector entities identify and implement energy savings projects and provide incentives on a per kilowatt hour (kWh) or per therm basis. During EPY7/GPY4, the program provided incentives of $0.12 per kWh saved and $3.00 per therm saved. A payback period of one to seven years is required for custom incentive projects.
- The Standard Incentives Program generates electric and natural gas savings by helping public sector entities identify and implement energy saving projects. The program offers incentives on a prescriptive basis for qualifying equipment purchased and installed by the participant.
- Higher incentives were offered for break-through equipment and devices that generate electric savings through both programs. For example, through the Custom Incentives Program some types of exterior LED and induction lighting projects were provided a higher custom incentive of $0.30 per kWh saved. Through the Standard Incentives Program additional incentives were provided for geothermal heat pumps.

Incentives provided by the program could not exceed 100% of the incremental measure cost or 75% of the total project cost.

In addition to the incentive structures outline above, there were two bonus incentive opportunities offered during the program year under both programs. The Sweet Deal Bonus and the Partner Bonus Coupons. The Sweet Deal Bonus offered a 10% bonus for projects completed by October 31st, 2014 and a 5% bonus for projects completed by February 14th, 2015. For projects receiving the 10% bonus, the incentive cap was increased to 83% of the total project cost. For projects, receiving the 5% bonus, the incentive cap was increased to 79% of the total project cost.

The programs also offered Partner Bonus Coupon incentives of 15% to public entities that implement standard and custom projects. The bonus incentive could only be applied to one project per participant. With the Partner Bonus Coupon, the total incentive payment cannot cover more than 86% of the total project cost and projects could not receive both the Sweet Deal and Partner Bonus Coupon incentives.

If incentives were provided from other public sources, those incentives in combination with the program incentives, could not exceed 100% of the total project cost. Additionally, incentive awards could not exceed $300,000 unless multiple project locations were included

2.1.1.2 Project Summary

Expected electric savings are shown in Table 2-1 by utility for the Custom and Standard Incentives Programs. There were 174 Custom Incentives Program projects during the period from June 2014 through May 2015 that were expected to provide savings of 41,175,366 kWh. Additionally, there were 1,193 Standard Incentives Program projects during the period June 2014 through May 2015 that were expected to provide savings of 52,939,622 kWh.

Table 2-1 Ex Ante kWh Savings for Custom and Standard Incentives Programs

Utility	*Ex Ante kWh Savings*	
	Custom Incentives Program	*Standard Incentives Program*
Ameren	13,485,862	11,446,308
ComEd	27,689,505	41,493,314
Total	41,175,366	52,939,622

Expected natural gas savings are shown in Table 2-2 by utility for the Custom and Standard Incentives Programs. There were 106 Custom Incentives Program projects during the period June 2014 through May 2015, which were expected to provide a total savings of 1,714,785 therms. The 84 Standard Incentives Program projects during the same period were expected to provide a total savings of 212,051 therms.

Table 2-2 Ex Ante Therm Savings for Custom and Standard Incentives Programs

Utility	*Ex Ante Therm Savings*	
	Custom Incentives Program	*Standard Incentives Program*
Ameren	239,768	30,455
Nicor	625,166	119,821
North Shore	173,611	5,756
Peoples	676,240	56,019
Total	1,714,785	212,051

Figure 2-1 shows the Custom Incentives Program's realized kWh savings by the date of application submission.

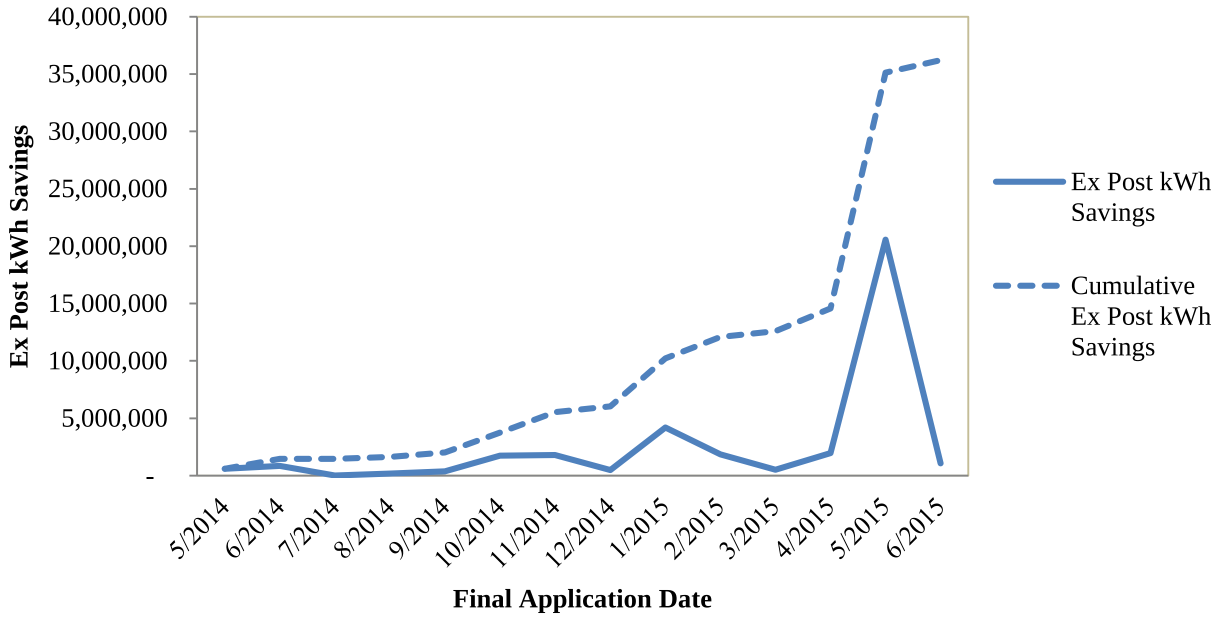


Figure 2-1 Custom Incentives Program Cumulative Ex Post kWh Savings by Date of Application Submission

Figure 2-2 shows the Standard Incentives Program's realized kWh savings by the date of application submission.

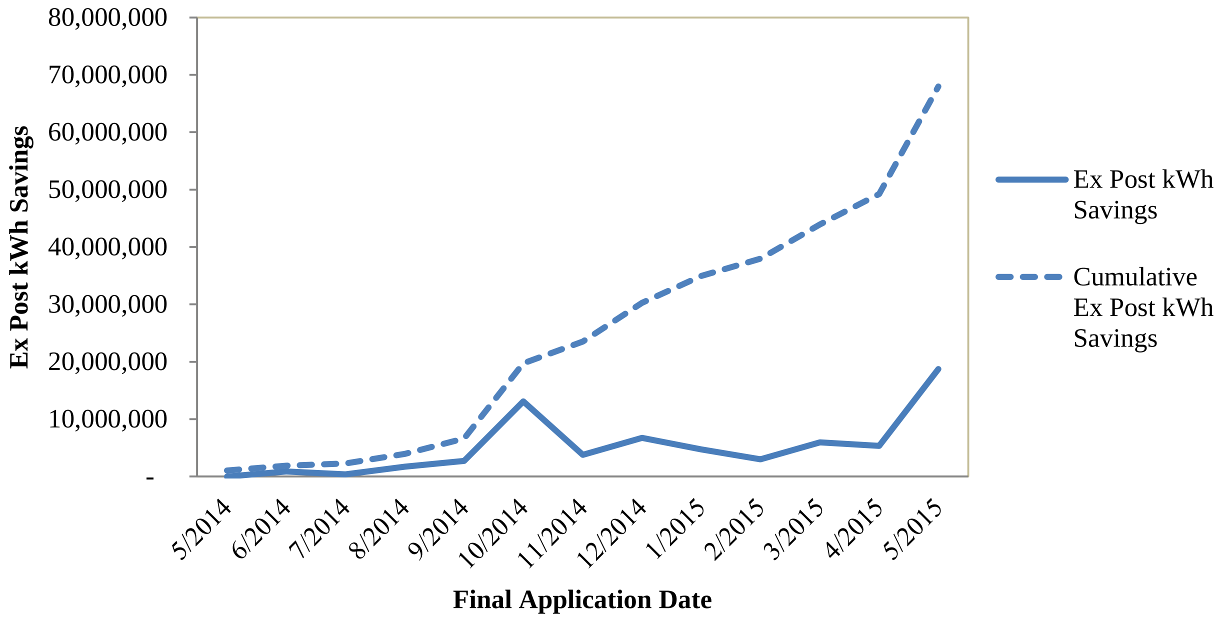


Figure 2-2 Standard Incentives Program Cumulative Ex Post kWh Savings by Date of Application Submission

Figure 2-3 shows the Custom Incentives Program's realized therm savings by the date of application submission.

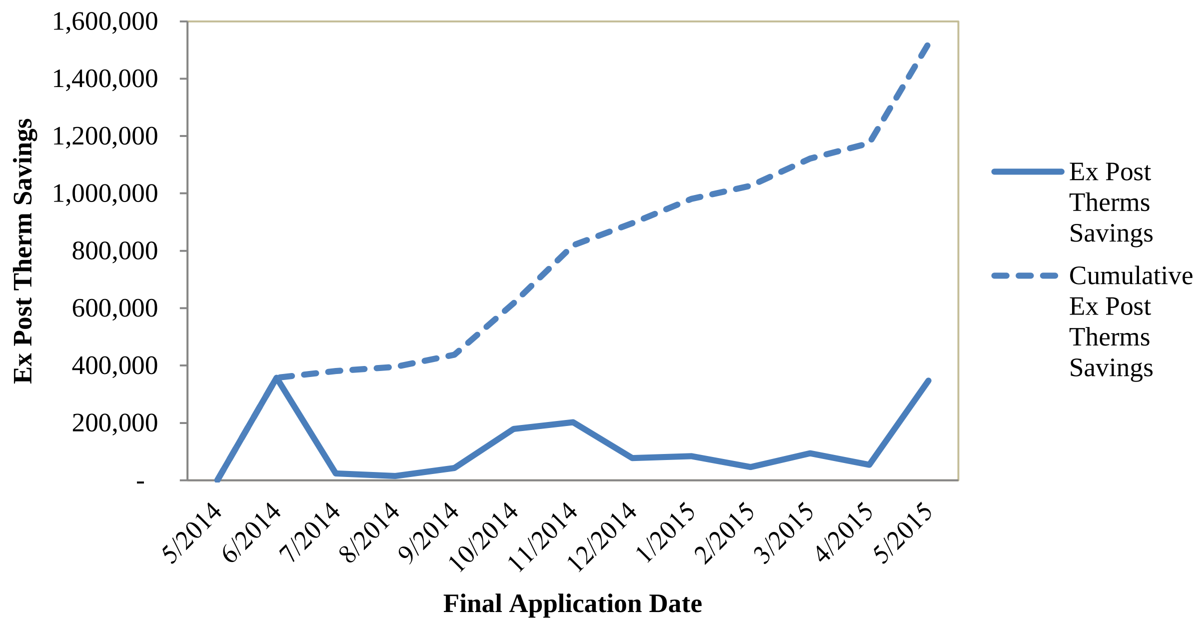


Figure 2-3 Custom Incentives Program Cumulative Ex Post Therm Savings by Date of Application Submission

Figure 2-4 shows the Standard Incentives Program's realized therm savings by the date of application submission.

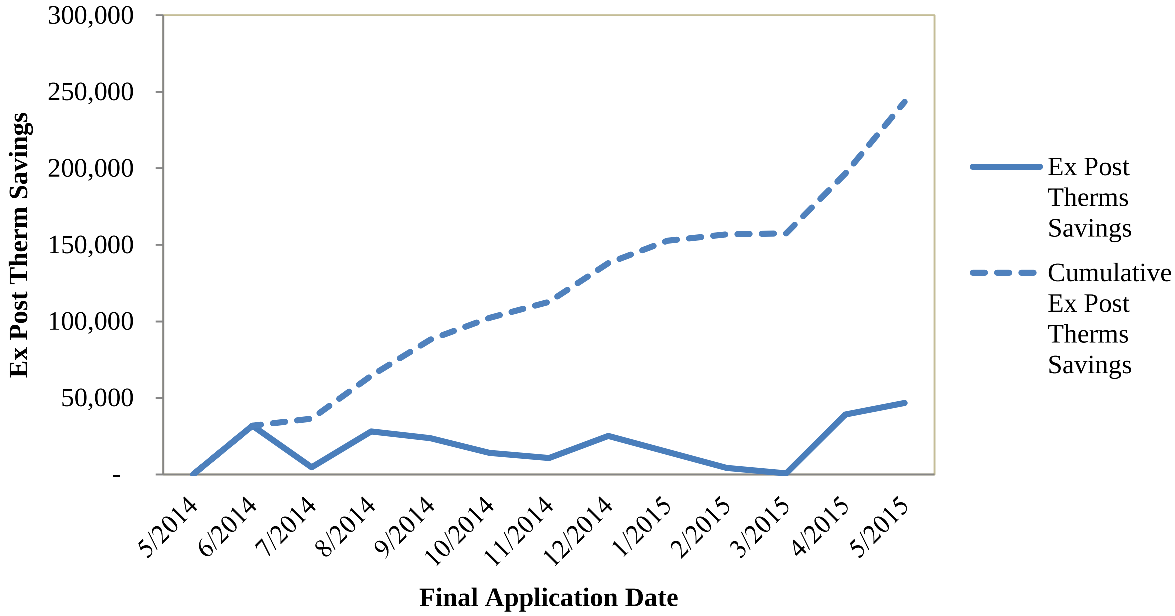


Figure 2-4 Standard Incentives Program Cumulative Ex Post Therm Savings by Date of Application Submission

2.1.2 New Construction Program

The New Construction Program generates electric and natural gas savings through new construction and major renovation of public sector buildings that exceed the requirements of the current Illinois Energy Conservation Code for Commercial Buildings. Applicants receive incentives for incorporating energy saving technologies and designing features that exceed the building code requirements that are in effect at the time of application.

To receive program incentives for electric savings, project sites must be serviced by the utilities Ameren Illinois or ComEd. Incentives are available for gas efficiency measures for sites serviced by utilities Ameren Illinois, Nicor, Peoples, or North Shore.

The New Construction Program incentives encourage construction and major renovation projects to build or renovate buildings to use less energy than buildings constructed only to code requirements. Applicants can receive custom incentives for energy savings, or receive prescriptive incentives with fixed dollar amounts for equipment installed. There are two components of the custom incentives: a base incentive rate and a bonus rate for applicants seeking LEED Silver, Gold, or Platinum designation. The base rate incentives are $0.08 per kWh and $2.00 per therm saved by exceeding building energy code requirements. The bonus incentive rates for each applicable building code are shown in Table 2-3.

Table 2-3 EPY7/GPY4 Bonus Incentive Rates

IECC 2009/ ASHRAE 90.1 2007 required	*Incentive per square foot*	*IECC 2012/ ASHRAE 90.1 2010 required*	*Incentive per square foot*
5% beyond code	$0.00	5% beyond code	$0.40
10% beyond code	$0.20	10% beyond code	$0.60
15% beyond code	$0.40	15% beyond code	$0.80
20% beyond code	$0.60	20% beyond code	$1.00
25% beyond code	$0.80	25% beyond code	$1.20
30% beyond code	$1.00	30% beyond code	$1.40

Incentives for prescriptive measures are available for lighting equipment, envelope measures, mechanical measures, water heating measures, and kitchen measures. The incentives for these measures are based on the following:

- Lighting incentives on lighting density (i.e., watts per square foot);
- Envelope measures on R-values per square foot;
- Mechanical measures on equipment efficiency, type, and size;
- Water heating measures on equipment type; and
- Kitchen measures are set on a per unit basis that varies by measure.

Total incentives cannot exceed 100% of the incremental measure cost or 75% of the project cost. If additional incentives are provided from other public sources, those incentives in combination with the program incentives cannot exceed 100% of the total project cost. The maximum bonus incentive is $100,000 and the total base and bonus incentive cannot exceed $2.50 per square foot or $300,000 (unless the project includes multiple project locations).

Preapproval of projects is strongly encouraged and incentives for certain measures may not be allowed if pre-retrofit equipment is not identifiable.

Expected kWh and therm savings by utility are shown in Table 2-4 and in Table 2-5. There were eight projects completed through the New Construction Program that received incentives for reductions in electricity usage during the period June 2014 through May 2015. These projects were expected to provide savings of 5,338,509 kWh.

Table 2-4 Ex Ante kWh Savings for New Construction Program

Utility	*Ex Ante kWh Savings*
Ameren	4,944,843
ComEd	393,666
Total	5,338,509

There were seven projects completed through the New Construction program that received natural gas incentives during the period June 2014 through May 2015. These projects were expected to provide savings of 199,343 therms.

Table 2-5 Ex Ante Therm Savings for New Construction Program

Utility	*Ex Ante Therm Savings*
Ameren	27,252
Nicor	172,091
Total	199,343

2.2 Overview of Evaluation Approach

The objective of the impact evaluation performed for the Custom and Standard Incentives Programs, and the New Construction Program was to determine the gross and net electric and natural gas savings and peak demand (kW) reductions resulting from projects completed during the June 2014 through May 2015 period.

The evaluation approach had the following main features:

- Available documentation (e.g., audit reports, savings calculation work papers, etc.) was reviewed for a sample of projects, with particular attention to the calculation procedures and documentation for savings estimates.
- On-site data collection was conducted for a sample of projects to provide the information needed for estimating savings and demand reductions. Monitoring was also conducted at some sites to obtain more accurate information on the hours of operation for lighting, HVAC equipment, and motors/VFDs.
- The Illinois Statewide Technical Reference Manual (TRM) Version 3.0 was used to estimate gross savings for measures implemented through the Standard Incentives Program. Measures implemented through the New Construction Program, the Custom Incentives Program and non-TRM savings for measures implemented through the Standard Incentives Program were estimated using proven techniques, including industry standard engineering calculations and verification of computer simulations developed by program contractors to determine energy savings.
  - Analysis of lighting savings was conducted using ADM's custom-designed lighting evaluation model with system parameters (fixture wattage, operating characteristics, etc.) based on operating parameter information collected on-site and, if appropriate, industry standards.
  - For HVAC measures, the original analyses used to calculate the expected savings were reviewed and the operating and structural parameters of the analysis were

verified. For custom measures or relatively more complex measures, simulations with the DOE-2 energy analysis model were used to develop estimates of energy use and savings from the installed measures.

- A participant survey was conducted from a sample of program participants to gather information on participant decision-making, and factors that affected net-to-gross savings ratios for the program.

2.3 Organization of Report

This report on the impact and process evaluation of the Custom and Standard Incentives Programs and the New Construction Program for the period June 2014 through May 2015 is organized as follows:

- Chapter 3 presents the methods used for and the results obtained from estimating gross savings for measures installed under the Custom and Standard Incentives Programs and the New Construction Program.
- Chapter 4 presents the methods used for and results obtained from estimating net savings for the Custom and Standard Incentives Programs and the New Construction Program.
- Chapter 5 presents and discusses the methods used for and results obtained from the process evaluation of the Custom and Standard Incentives Programs and the New Construction Program.
- Appendix A: Site-Level Reports presents the methods and results for the individual sample site analyses.
- Appendix B: Custom and Standard Incentives Participant Survey provides a copy of the questionnaire used for the survey of decision makers for participants in the Custom and Standard Incentives Programs.
- Appendix C: Custom and Standard Participant Survey Responses presents the results from a survey of decision makers for participants that received incentives under the Custom and Standard Incentives Programs.
- Appendix D: New Construction Participant Survey provides a copy of the questionnaire used for the survey of decision makers for participants in the New Construction Program.
- Appendix E: New Construction Participant Survey Responses presents the results from a survey of decision makers for participants that received incentives under the New Construction Program.
- Appendix F: Free Ridership Analysis presents the results of the analysis of alternative scoring options allowed for under the Illinois Statewide Technical Reference Manual (TRM) Version 5.0, Vol. 4, Core Non-Residential Free Ridership Protocol (p.28).

3. Estimation of Gross Savings

This chapter addresses the estimation of gross kWh, gross therm savings, and peak kW reductions resulting from measures installed in facilities of participants that obtained incentives under the Custom and Standard Incentives Programs, and the New Construction Program during the period June 2014 through May 2015. Section 3.1 describes the methodology used for estimating gross savings. Section 3.2 presents the electric and natural gas gross savings results for the three programs.

3.1 Methodology for Estimating Gross Savings

This section describes the methodology used for estimating gross savings for the Custom and Standard Incentives Programs and the New Construction Program.

3.1.1 Sampling Plan

Data used to estimate the gross savings achieved through the Custom and Standard Incentives Programs were collected for samples of projects completed during the June 2014 through May 2015 period. Samples were drawn for both electric and natural gas savings achieved through the programs.[1]

3.1.1.1 Samples for Electric Projects

Data obtained from the Department of Commerce showed that during the period June 2014 through May 2015, there were 182 Custom Incentives and New Construction Programs projects that were expected to provide total electric savings of 46,513,875 kWh annually. During the same period there were 1,192 Standard Incentives Program projects, which were expected to provide total electric savings of 52,939,622 kWh annually.

Inspection of data on kWh savings for individual projects obtained from the Department of Commerce indicated that the distribution of electric savings was generally positively skewed, with a small number of projects accounting for a high percentage of the estimated energy savings for the Custom and Standard Incentives and New Construction Programs. Estimation of electric savings for Custom and Standard Incentives and New Construction Programs is based on a ratio estimation, which allows a smaller sample size to be used while still meeting requirements for precision. The actual precision of the Custom Incentives and New Construction Programs sample is ±7.70% at 90% confidence, while the actual precision of the Standard Incentives Program sample is ±6.77% at 90% confidence.

[1] New construction projects were included in the custom project sample.

Table 3-1 shows the number of projects and expected kWh savings for the Custom Incentives Program sample by stratum.

Table 3-1 Population Statistics Used for Sample Design for Custom Incentives and New Construction Programs kWh Savings

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*Totals*
Strata boundaries (kWh)	30,000 <	30,001 – 160,000	160,001 – 560,000	560,001 - 1,880,000	1,880,001 – 5,055,927	
Number of projects	79	52	32	14	5	182
Total kWh savings	700,046	4,282,856	9,288,124	15,209,533	17,033,317	46,513,875
Average kWh Savings	8,861	82,363	290,254	1,086,395	3,406,663	255,571
Standard deviation of kWh savings	8,159	37,059	108,904	338,555	1,179,459	636,006
Coefficient of variation	0.92	0.45	0.38	0.31	0.35	2.49
Final design sample	3	8	7	5	5	28

Table 3-2 shows the number of projects and expected kWh savings of the Standard Incentives Program sample by stratum.

Table 3-2 Population Statistics Used for Sample Design for Standard Incentives Program kWh Savings

	Stratum 1	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*Totals*
Strata boundaries (kWh)	25,000 <	25,001 – 80,000	80,001 – 280,000	280,001 - 720,000	720,001 – 978,693	
Number of projects	776	246	134	31	5	1,192
Total kWh savings	5,892,430	11,123,518	19,370,064	12,361,949	4,191,661	52,939,622
Average kWh Savings	7,593	45,218	144,553	398,773	838,332	44,412
Standard deviation of kWh savings	6,698	14,568	51,035	97,437	95,806	92,520
Coefficient of variation	0.88	0.32	0.35	0.24	0.11	2.08
Final design sample	48	12	15	12	5	92

As shown in Table 3-3, the sample projects account for approximately 55% of the Custom Incentives and New Construction Programs' expected kWh savings, and, as shown in Table 3-4, the Standard Incentives Program's sample projects account for approximately 25% of expected kWh savings.

Table 3-3 Ex Ante kWh Savings for Custom Incentives and New Construction Sampled Projects by Stratum

Stratum	*Sample Ex Ante kWh Savings*	*Total Ex Ante kWh Savings*	*Percent of Ex Ante kWh Savings in Sample*
5	17,033,317	17,033,317	100%
4	5,412,879	15,209,533	36%
3	2,421,069	9,288,124	26%
2	600,888	4,282,856	14%
1	11,252	700,046	2%
Total	25,479,405	46,513,875	55%

Table 3-4 Ex Ante kWh Savings for Standard Incentives Sampled Projects by Stratum

Stratum	*Sample Ex Ante kWh Savings*	*Total Ex Ante kWh Savings*	*Percent of Ex Ante kWh Savings in Sample*
5	4,191,661	4,191,661	100%
4	4,984,914	12,361,949	40%
3	2,858,827	19,370,064	15%
2	528,564	11,123,518	5%
1	450,986	5,892,430	8%
Total	13,014,953	52,939,622	25%

3.1.1.2 Samples for Natural Gas Projects

Data obtained from the Department of Commerce showed that during the period June 2014 through May 2015, there were 112 Custom Incentives and New Construction Programs projects that were expected to provide natural gas savings of 1,914,127 therms. During the same period, there were 84 Standard Incentives Program projects that were expected to provide natural gas savings of 212,051 therms.

Inspection of data on therm savings for individual projects obtained from the Department of Commerce indicated that the distribution of savings was generally positively skewed, with a relatively small number of projects accounting for a high percentage of the estimated savings. Estimation of natural gas savings for Custom and Standard Incentives and New Construction Programs is based on a ratio estimation procedure, which allows a smaller sample size to be used while still meeting requirements for precision. The actual precision of the Custom Incentives and New Construction Programs sample is ±10.50% at 90% confidence, while the actual precision of the Standard Incentives Program sample is ±7.70% at 90% confidence.

Table 3-5 shows the number of projects and expected therm savings of the Custom Incentives Program sample by stratum.

Table 3-5 Population Statistics Used for Sample Design for Custom Incentives and New Construction Programs Therm Savings

	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Totals
Strata boundaries (therm)	6,000 <	6,001 – 19,250	19,251 – 120,000	120,001 – 308,918	
Number of projects	40	45	25	2	112
Total therm savings	110,770	493,298	853,206	456,853	1,914,127
Average therm savings	2,769	10,962	34,128	228,427	17,090
Standard deviation of therm savings	1,605	3,320	16,230	113,818	33,737
Coefficient of variation	0.58	0.30	0.48	0.50	1.97
Final design sample	3	9	9	2	23

Table 3-6 shows the number of projects and expected therm savings of the Standard Incentives Program sample by stratum.

Table 3-6 Population Statistics Used for Sample Design for Standard Incentives Program Therm Savings

	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Totals
Strata boundaries (therm)	980 <	981 – 3,080	3,081 – 8,000	8,001 - 25,619	
Number of projects	34	26	20	4	84
Total therm savings	13,751	52,466	87,494	58,340	212,051
Average therm savings	404	2,018	4,375	14,585	2,524
Standard deviation of therm savings	272	582	1,129	7,577	3,501
Coefficient of variation	0.67	0.29	0.26	0.52	1.39
Final design sample	6	3	6	4	19

As shown in Table 3-7 the sample projects account for approximately 71% of the Custom Incentives and New Construction Programs' expected therm savings, and as shown in Table 3-8, the sample projects account for approximately 46% of the Standard Incentives Program's expected therm savings.

Table 3-7 Ex Ante Therm Savings for Custom Incentives and New Construction Sampled Projects by Stratum

Stratum	*Sample Ex Ante Savings*	*Total Ex Ante Savings*	*Percent of Ex Ante Therm Savings in Sample*
4	456,853	456,853	100%
3	315,717	853,206	37%
2	101,934	493,298	21%
1	6,895	110,770	6%
Total	881,399	1,914,127	71%

Table 3-8 Ex Ante Therm Savings for Standard Incentives Sampled Projects by Stratum

Stratum	*Sample Ex Ante Savings*	*Total Ex Ante Savings*	*Percent of Ex Ante Therm Savings in Sample*
4	58,340	58,340	100%
3	29,548	87,494	34%
2	6,633	52,466	13%
1	2,823	13,751	21%
Total	97,344	212,051	46%

3.1.2 Review of Documentation

For each project selected in the sample, ADM reviewed the available documentation for each incented measure including audit reports, savings calculation work papers, program forms, databases, billing data, and weather data, with particular attention given to documentation supporting calculation procedures and savings estimates. Each application was reviewed to verify inclusion of the following information:

- Documentation of the equipment replaced, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information;
- Documentation of the newly-installed equipment, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information; and for custom measures
- Information about ex ante savings calculation methodology, and assumptions that were employed.

In the event of uncertainty regarding project characteristics, or apparently incomplete project documentation, ADM staff contacted the Department of Commerce to obtain further project information from program staff, participants, or contractors that facilitated the project implementation. This will facilitate the development of an appropriate project-specific M&V plan.

3.1.3 On-Site Data Collection Procedures

Data collected through on-site visits included information on the facilities participating in the program and data used in calculating savings impacts. Documentation ADM collected from the Department of Commerce about projects selected in the M&V sample included company names, project ID, site address, and contact information.

During an on-site visit, ADM field staff performed the following tasks:

- Verified the implementation of all measures the participants received incentives for, by confirming that energy efficiency measures were installed correctly, and were functional.
- Collected physical data needed to analyze realized energy savings from installed measures.
- Interviewed personnel at the facility to obtain additional information about installed measures.
- At sites requiring higher accuracy of savings calculations, staff monitored operating hours of the installed measures. Monitoring was not conducted at sites where project documentation allowed for sufficiently detailed calculations.

3.1.4 Procedures for Estimating Savings from Measures Installed

This section presents procedures used to estimate savings for projects implemented through the Custom and Standard Incentives Programs and the New Construction Program.

3.1.4.1 Procedures for Estimating Savings from Custom Incentives Program Projects

The method ADM employed for measures implemented through the Custom Incentives Program was dependent on the measure type. Categories of measures may include the following:

- Lighting;
- HVAC;
- Motors;
- VFDs;
- Compressed-Air;
- Refrigeration; and
- Process Improvements.

ADM used specific methods to determine gross savings for projects, depending on the type of measure analyzed. These typical methods are summarized in Table 3-9.

Table 3-9 Typical Methods to Determine Savings for Measures

Type of Measure	*Method to Determine Savings*
Compressed Air Systems	Engineering analysis, with monitoring data on load factor and schedule of operation
Lighting	Analysis based on data regarding wattages before and after installation of measures and lighting hours-of-use data
HVAC (including packaged units, chillers, cooling towers, and controls/EMS)	eQUEST model using DOE-2 as its analytical engine for estimating HVAC loads and calibrated with site-level billing data to establish a benchmark
Motors and VFDs	Measurements of power and run-time obtained through monitoring
Refrigeration	Simulations with eQUEST engineering analysis model, with monitoring data
Process Improvements	Engineering analysis, with monitoring data on load factor and schedule of operation

The activities specified in Table 3-9 generated calculations of project ex post gross energy savings. This allowed for calculation of a realization rate (the ratio of verified gross savings to expected gross savings) for each sampled project. ADM developed estimates of program level gross savings by applying the realization rates of sampled projects to non-sampled projects.

Sampled sites with relatively high or low realization rates were further analyzed to determine the reasons for the discrepancy between expected and realized energy savings.

The following discussion describes the basic procedures used for estimating savings from various measure types.

Plan for Analyzing Savings from Lighting Measures: Lighting measures examined include retrofits of existing fixtures, lamps and/or ballasts with energy efficient fixtures, lamps and/or ballasts. These measures reduce demand, while not affecting operating hours. Any proposed lighting control strategies that might include the addition of efficient control technologies such as motion sensors or daylighting controls are examined. These measures typically involve a reduction in hours of operation and/or lower current passing through the fixtures.

Analyzing the savings from such lighting measures requires data for retrofitted fixtures on (1) wattages before and after retrofit and (2) hours of operation before and after the retrofit. Fixture wattages are taken from a table of standard wattages, with corrections made for non-operating fixtures. Hours of operation are determined from metered data collected after measure installation for a sample of fixtures.

To determine baseline and post-retrofit demand values for the lighting efficiency measures, ADM uses in-house data on standard wattages of lighting fixtures and ballasts to determine demand values for lighting fixtures. These data provide information on wattages for common lamp and ballast combinations.

As noted, ADM collects data with which to determine average operating hours for retrofitted fixtures by using time-of-use data loggers to monitor a sample of "last points of control" for unique usage areas in the sites where lighting efficiency measures have been installed. Usage areas are defined to be those areas within a facility that are expected to have comparable average operating hours. Typical usage areas are designated in the forms used for data collection.

ADM uses per-fixture baseline demand, retrofit demand, and appropriate post-retrofit operating hours to calculate peak capacity savings and annual energy savings for sampled fixtures of each usage type.

Peak demand reductions (kW) calculated for projects that are part of the sample for measurement and verification. To calculate total peak demand reductions, the total realized peak kW reductions for the sampled projects of a stratum were factored by the ratio of total expected kWh savings to sample expected kWh savings.

Peak demand reductions are calculated as the difference between peak period baseline demand and post-installation peak period demand of the affected lighting equipment, per the following formula:

$$\text{Peak Demand Reductions} = kW_{before} - kW_{after}$$

The baseline and post-installation average demands are calculated by dividing the total kWh usage during the peak period by the number of hours in the peak period.

ADM calculates annual energy savings for each sampled fixture per the following formula:

$$\text{Annual Energy Savings} = kWh_{before} - kWh_{after}$$

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

- Results from the monitored sample are used to calculate the average operating hours of the metered lights in each costing period for every unique building type/usage area.
- These average operating hours are then applied to the baseline and post-installation average demand for each usage area to calculate the respective energy usage and peak period demand for each usage area.
- The annual baseline energy usage is the sum of the baseline kWh for each costing period for all of the usage areas. The post-retrofit energy usage is calculated similarly. The energy savings are calculated as the difference between baseline and post-installation energy usage.
- Savings from lighting measures in conditioned spaces are factored by the region-specific, building type-specific heating cooling interaction factors in order to calculate total savings attributable to lighting measures, inclusive of impacts on HVAC operation.

Plan for Analyzing Savings from HVAC Measures: Savings estimates for HVAC measures installed at a facility are derived by using the energy use estimates developed through DOE-2 simulations and engineering calculations. The HVAC simulations also allow calculation of the primary and secondary effects of lighting measures on energy use. Each simulation produces estimates of HVAC energy and demand usage to be expected under different assumptions about equipment and/or construction conditions. There may be cases in which DOE-2 simulation is inappropriate because data are not available to properly calibrate a simulation model, and engineering analysis provides more accurate M&V results.

For the analysis of HVAC measures, the data collected through on-site visits and monitoring are utilized. Using this data, ADM prepares estimates of the energy savings for the energy efficient equipment and measures installed in each of the participant facilities. Engineering staff develop independent estimates of the savings through engineering calculations or through simulations with energy analysis models. By using energy simulations for the analysis, the energy use associated with the end-use affected by the measure(s) being analyzed can be quantified. With these quantities in hand, it is a simple matter to determine what the energy use would have been without the measure(s).

Before making the analytical runs for each site with sampled project HVAC measures, engineering staff prepare a model calibration run. This is a base case simulation to ensure that the energy use estimates from the simulations have been reconciled against actual data on the building's energy use. This run is based on the information collected in an on-site visit pertaining to types of equipment, their efficiencies and capacities, and their operating profiles. Current operating schedules are used for this simulation, as are local (TMY) weather data covering the study period. The model calibration run is made using actual weather data for a time period corresponding to the available billing data for the site.

The goal of the model calibration effort is to have the results of the DOE-2 simulation come within approximately 10% of the patterns and magnitude of the energy use observed in the billing data history. In some cases, it may not be possible to achieve this calibration goal because of idiosyncrasies of particular facilities (e.g., multiple buildings, discontinuous occupancy patterns, etc.).

Once the analysis model has been calibrated for a particular facility, ADM performs three steps in calculating estimates of energy savings for HVAC measures installed or to be installed at the facility.

- First, an analysis of energy use at a facility under the assumption that the energy efficiency measures are not installed is performed.
- Second, energy use at the facility with all conditions the same but with the energy efficiency measures now installed is analyzed.
- Third, the results of the analyses from the preceding steps are compared to determine the energy savings attributable to the energy efficiency measure.

Plan for Analyzing Savings from Motors: Estimates of the energy savings from use of high efficiency motors on HVAC and non-HVAC applications are derived through an "after-only" analysis. With this method, energy use is measured only for the high efficiency motor and only after it has been installed. The data thus collected are then used in estimating what energy use would have been for the motor application *if the high efficiency motor had not been installed*. In effect, the after-only analysis is a reversal of the usual design calculation used to estimate the savings that would result from installing a high efficiency motor. That is, at the design stage, the question addressed is how would energy use change for an application if a high efficiency motor is installed, whereas the after-only analysis addresses what the level of energy use would have been had the high efficiency motor not been installed.

For the “after only” analysis, it is not possible to use a comparison of direct measurements to determine savings, since measured data are collected only for the high efficiency motor. However, savings attributable to installation of the high efficiency motor can be estimated using information on the efficiencies of the high efficiency motor and on the motor it replaced. In particular, demand and energy savings can be calculated as follows:

$$\text{Demand Savings} = \text{kW}\textit{peak} \text{ x } (1/\text{Eff}_{old} - 1/\text{Eff}_{new})$$

kWpeak = Volts x Ampspeak x Power Factor, and Ampspeak is the interval with the maximum recorded Amps during the monitoring period.

$$\text{Energy Savings} = \text{kW}_{ave} \text{ x } (1/\text{Eff}_{old} - 1/\text{Eff}_{new}) \text{ x Hours of use}$$

kWave = Volts x Ampsave x Power Factor and Ampsave is the average measured Amps for the duration of the monitored period.

$$\text{Annual Energy Savings} = \text{kW}_{ave} \text{ x } (1/\text{Eff}_{old} - 1/\text{Eff}_{new}) \text{ x (days of operation per year/ days metered) x Annual Adjustment Factor}$$

kW_{ave} = Volts x $Amps_{ave}$ x Power Factor is for the monitoring period, $Amps_{ave}$ is the average measured Amps for the duration of the monitored period, and use factor is determined from interviews with site personnel. The Annual Adjustment Factor is 1 if the monitoring period is typical for the yearly operation, less than 1 if the monitoring period is expected to be higher use than typical for the rest of the year, and more than 1 if the monitoring period is expected to be lower than typical for the rest of the year.[2]

The information on motor efficiencies needed for the calculation of savings is obtained from different sources. The data on the efficiencies of high efficiency motors installed under the

[2] Current year weather data were compared with the *Typical Meteorological Year* from the National Oceanic & Atmospheric Administration (NOAA)

program should be available from program records. In some cases, the efficiencies of the replaced motors may also be noted in the Department of Commerce's program records. If the motor replacement is for normal replacement, the baseline efficiency is established as the efficiency of new, standard efficiency motor. However, in cases of early replacement, the efficiency of the old motor is used for the length of the remaining life. [3]

Because most motors monitored run only under full load conditions, some adjustments must be made from the "industry averages" of full load efficiencies. Motor efficiency curves of typical real motors that have the same full load efficiencies are used for determining part load efficiencies.

As is seen with motor efficiency, the power factor varies with motor loading. Motor power factor curves of typical real motors that have the same full load power factor are used for determining part load power factor.

Another factor to consider in demand and energy savings comparisons of motor change out programs is the rotor slip. Full load RPM ratings of motors vary. For centrifugal loads such as fans and pumps, the power supplied is dependent on the speed of the driven equipment. The power is theoretically proportional to the cube of the speed, but in practice more closely approximates the square of the speed. In general, high efficiency motors have slightly higher full load RPM ratings (lower slip) than standard motors. Where nameplate ratings of full load RPM are available for replaced motors, a derating factor can be applied.[4]

The data needed to carry out these plans for determining savings are collected from several sources.

- The first source of data is the information from each project's documentation. This information is expected to include aggregate energy used at a site, disaggregated energy usage data for certain targeted processes (if available), before (actual) and after (projected) data on production, scrap, and other key performance indicators, and final reports (which include process improvement recommendations, analyses, conclusions, performance targets, etc.).
- The second source of data is energy use obtained from utilities.
- The third source is information collected through on-site inspections of the facilities. ADM staff collect the data during on-site visits using a form that is comprehensive in addressing a

[3] Assumptions regarding measure expected useful life were taken from the most recent Database for Energy Efficiency Resources (DEER). See http://www.deeresources.com/.

[4] As an example, take the case where a new motor has a full load RPM rating of 1770 and the old motor had a full load RPM rating of 1760. The derating factor would be:

Derating factor = $(RPM_{old})^2 / (RPM_{new})^2 = 1760^2 / 1770^2 = 0.989$

facility's characteristics, its modes and schedules of operation, and its electrical and mechanical systems. The form also addresses various energy efficiency measures, including high efficiency lighting (both lamps and ballasts), lighting occupancy sensors, lighting dimmers and controls, air conditioning, high efficiency motors, etc.

- As a fourth source of data, selected end-use equipment are monitored to develop information on operating schedules and power draws.

Plan for Analyzing Savings from VFDs: A variable-frequency drive (VFD) is an electronic device that controls the speed of a motor by varying the magnitude of the voltage, current, or frequency of the electric power supplied to the motor. The two factors that make a motor load a suitable application for a VFD are variable speed requirements and high annual operating hours. The interplay of these two factors can be summarized by information on the motor's duty cycle, which essentially shows the percentage of time during the year that the motor operates at different speeds. The duty cycle should show good variability in speed requirements, with the motor operating at reduced speed a high percentage of the time.

Potential energy savings from the use of VFDs are usually most significant with variable-torque loads, which have been estimated to account for 50% to 60% of total motor energy use in the non-residential sectors. Energy saving VFDs may be found on fans, centrifugal pumps, centrifugal blowers, and other centrifugal loads, most usually where the duty cycle of the process provided a wide range of speeds of operation.

ADM’s dual approach to determining savings from installation of VFDs involves making one-time measurements of voltage, current, and power factor of the VFD/motor and conducting continuous measurements of amperage over a period of time in order to obtain the data needed to develop VFD load profiles and calculate demand and energy savings. VFDs are generally used in applications where motor loading changes when motor speed changes. Consequently, the true power drawn by a VFD is recorded to develop VFD load shapes. One-time measurements of power are made for different percent speed settings. Power and percent speed or frequency (depending on VFD display options) are recorded for as wide a range of speeds as the participant allows the process to be controlled, so field staff attempt to obtain readings from 40 to 100% speed in 10 to 15% increments.

Plan for Analyzing Savings from Compressed Air Measures: Measures to improve the efficiency of a compressed air system include the reduction of air leaks, resizing of compressors, installing more efficient compressors, improved controls, or a complete system redesign. Savings from such measures are evaluated through engineering analysis of compressor performance curves, supported by data collected through short-term metering.

ADM field staff obtain nameplate information for the pre-retrofit equipment either from the project file or during the on-site survey. Performance curve data are obtained from manufacturers. Engineering staff then conduct an engineering analysis of the performance characteristics of the pre-retrofit equipment. During the on-site survey, field staff inspect the as-built system equipment, take pressure and load readings, and interview the system operator to identify seasonal variations in load. Potential interactions with other compressors are assessed and it is verified that the rebated compressor is being operated as intended.

When appropriate, short-term measurements are performed to reduce the uncertainty in defining the load on the as-built system. These measurements may be taken either with a multi-channel logger, which can record true power for several compressors, with current loggers, which can provide average amperage values, or with motor loggers to record operating hours. The appropriate metering equipment is selected by taking into account variability in load and the cost of conducting the monitoring.

ADM used AirMaster+ to calculate the savings attributed to the energy efficiency measures installed within each compressed air system. The as-built and baseline compressor types were inputted into the model using data points collected during on-site verification. The as-built model was then calibrated to a typical daily schedule, derived from at least two weeks of trending data. Project energy savings were calculated by subtracting the as-built from the baseline energy consumption.

Plan for Analyzing Savings from Refrigeration and Process Improvements: Analysis of savings from refrigeration and process improvements is inherently project-specific. Because of the specificity of processes, analyzing the processes through simulations is generally not feasible. Rather, reliance is made on engineering analysis of the process affected by the improvements. Major factors in ADM’s engineering analysis of process savings are operating schedules and load factors. Information on these factors is developed through short-term monitoring of the affected equipment, be it pumps, heaters, compressors, or other. The monitoring is done after the process change, and the data gathered on operating hours and load factors are used in the engineering analysis to define “before” conditions for the analysis of savings.

3.1.4.2 Procedures for Estimating Savings for the Standard Incentives Program

The Illinois Statewide Technical Reference Manual (TRM) Version 3.0 was used to estimate gross savings for measures implemented through the Standard Incentives Program. Project specific parameters for the gross savings analysis were taken from project documentation and information collected during site visits. Non-TRM savings measures implemented through the Standard Incentives Program were estimated using proven techniques, including industry standard engineering calculations and verification of computer simulations developed by program contractors to determine energy savings as outlined in Section 3.1.4.1.

Depending on the measure type, savings were calculated using up to three different TRM approaches. These approaches were as follows:

- TRM-Calculated: Savings calculated as per Illinois’s Statewide TRM Version 3.0.

- TRM-Calculated (Errata Corrected): Savings calculated as per an erratum in Version 4.0 of the TRM.
- ADM-Calculated: Savings calculated using a non-TRM methodology. ADM-Calculated savings were performed when the measure was not in the TRM or when the methodology in the TRM was not applicable because the assumptions provided were not appropriate for that measure.

Appendix A contains project-level M&V reports providing information regarding the factors determining ex post energy savings and variances between ex post and ex ante energy savings.

Gross savings were developed for measures not covered by the Illinois TRM using the methods described in Section 3.1.4.1.

3.2 Results of Gross Savings Estimation

This section presents the results of the gross savings estimation analysis. To estimate gross electricity (kWh) savings, peak demand (kW) reductions, and gross natural gas (therm) savings for the Custom and Standard Incentives Programs, data were collected and analyzed for samples of 56 Custom Incentives Program and New Construction Program projects and 71 Standard Incentives Program projects. The data were analyzed using the methods described in Section 2.1 to estimate project kWh savings and peak kW reductions and to determine realization rates for the three programs.

3.2.1 Realized Gross kWh and Therm Savings

The gross kWh savings for the Custom Incentives and New Construction Programs during the period June 2014 through May 2015 are summarized by sampling stratum in Table 3-10. Overall, the gross ex post savings of 36,218,444 kWh were equal to 78% of the expected savings.

Table 3-10 Ex Ante and Gross Ex Post kWh Savings for the Custom Incentives and New Construction Programs by Sample Stratum

Stratum	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*
5	17,033,317	14,488,032	85%
4	15,209,533	11,334,330	75%
3	9,288,124	6,140,145	66%
2	4,282,856	3,562,548	83%
1	700,046	693,389	99%
Total	46,513,875	36,218,444	78%

The gross ex post kWh savings for the Standard Incentives Program for the period June 2014 through May 2015 is summarized in Table 3-11. Overall, the gross ex post savings of 67,972,825 kWh were equal to 128% of the expected savings.

Table 3-11 Ex Ante and Gross Ex Post kWh Savings for the Standard Incentives Program by Sample Stratum

Stratum	*Ex Ante kWh Savings*	*TRM-Calculated*	*TRM-Calculated (Errata Corrected)*	*ADM Calculated*	*Gross Realization Rate*
		Gross Ex Post kWh Savings	*Gross Ex Post kWh Savings*	*Gross Ex Post kWh Savings*	
5	4,191,661	3,695,835	3,756,391	3,825,958	91%
4	12,361,949	13,256,799	13,507,308	15,292,442	124%
3	19,370,064	22,222,798	22,788,731	24,640,123	127%
2	11,123,518	17,275,415	17,066,398	17,546,325	158%
1	5,892,430	6,083,106	6,342,472	6,667,977	113%
Total	52,939,622	62,533,953	63,461,300	67,972,825	128%

Table 3-12 shows the expected and gross ex post kWh energy savings by sampled project for the Custom Incentives Program.

Table 3-12 Ex Ante and Gross Ex Post kWh Savings for the Custom Incentives Program by Project

Project ID	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*
C2	701,895	851,445	121%
C12	3,819	5,084	133%
C13	457,302	247,433	54%
C19	543,129	367,533	68%
C20	274,395	163,451	60%
C26	201,843	0	0%
C32	1,207,536	0	0%
C41	382,776	362,484	95%
C65	3,446,667	1,467,406	43%
C69A	5,055,917	6,069,210	120%
C74	2,526,666	1,004,437	40%
SC15	61,840	60,313	98%
SC29	4,476	4,655	104%
SC38	52,593	52,593	100%
SC45	109,459	126,391	115%
SC46	171,974	187,190	109%
SC50	65,435	23,211	35%
SC52	72,199	53,058	73%

Project ID	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Realization Rate*
SC53	71,376	17,988	25%
SC54	54,653	51,404	94%
SC59	113,332	108,898	96%
SC64	389,650	254,592	65%
SC66	3,935,043	3,877,955	99%
SC67	1,394,031	1,156,374	83%
SC68	834,517	834,517	100%
SC73	2,957	1,406	48%
All Non-Sample Projects	19,039,886	13,530,908	71%
Total	41,175,366	30,879,936	75%

Table 3-13 shows the expected and gross ex post kWh energy savings by sampled project for the Standard Incentives Program.

Table 3-13 Ex Ante and Gross Ex Post kWh Savings for Standard Incentives Program by Project

Project ID	*Ex Ante kWh Savings*	*TRM-calculated*	*TRM-calculated (errata corrected)*	*ADM Calculated*	*Gross Realization Rate*
	Ex Ante kWh Savings	*Gross Ex Post kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Ex Post kWh Savings*	
S1	342,664	156,998	156,998	309,618	90%
S3	267,704	232,724	255,740	255,740	96%
S4	460,321	176,947	185,676	633,946	138%
S5	56,410	60,449	60,449	60,449	107%
S6	37,021	24,401	24,401	24,401	66%
S7	7,827	9,251	9,251	9,251	118%
S8	14,742	15,556	15,556	15,556	106%
S9	73,982	57,814	57,964	57,964	78%
S10	292,084	84,910	90,262	360,267	123%
S11	22,679	25,705	25,705	25,705	113%
S14	346,645	220,822	221,804	370,336	107%
S16	200,874	165,114	165,114	196,810	98%
S17	203,420	171,784	188,646	188,646	93%
S18	33,265	89,686	89,686	89,686	270%
S21	38,340	83,288	84,222	84,222	220%
S22	5,497	2,541	2,793	6,040	110%
S23	13,510	19,644	21,587	21,587	160%
S24	14,636	21,782	23,936	49,772	340%

Project ID	*Ex Ante kWh Savings*	*TRM-calculated*	*TRM-calculated (errata corrected)*	*ADM Calculated*	*Gross Realization Rate*
	Ex Ante kWh Savings	*Gross Ex Post kWh Savings*	*Gross Ex Post kWh Savings*	*Gross Ex Post kWh Savings*	
S26	784,569	582,775	640,412	640,412	82%
S27	108,276	40,098	44,064	281,120	260%
S28	359,145	401,285	440,973	440,973	123%
S30	978,683	903,894	903,894	903,894	92%
S31	231,976	292,479	321,405	321,405	139%
S33	30,053	34,564	37,983	60,788	202%
S34	133,352	154,505	141,432	141,432	106%
S35	25,160	28,491	25,244	25,244	100%
S36	129,556	187,531	152,023	152,023	117%
S37	45,629	73,322	62,134	62,134	136%
S39	226,220	273,926	301,018	301,018	133%
S40	391,153	440,901	484,507	484,507	124%
S43	494,945	358,618	359,299	634,433	128%
S44	878,175	950,299	950,299	950,299	108%
S48	249,727	241,146	248,784	253,279	101%
S55	309,156	212,048	212,048	291,502	94%
S56	1,442	1,502	1,502	1,502	104%
S57	227,121	275,018	302,217	302,217	133%
S58	113,902	129,878	127,286	127,286	112%
S61	727,439	660,780	660,780	660,780	91%
S63	211,720	237,163	237,163	237,163	112%
S69B	687,829	515,651	515,651	515,651	75%
SC15	432,834	291,822	293,801	293,801	68%
SC29	189,307	152,689	152,689	152,689	81%
SC38	9,306	11,365	17,921	17,921	193%
SC45	9,189	9,533	9,533	5,363	58%
SC50	6,426	1,504	7,520	7,520	117%
SC53	2,581	4,042	6,972	6,972	270%
SC54	6,792	11,885	11,885	11,885	175%
SC59	438,364	899,455	899,455	360,371	82%
SC64	610,823	959,073	959,073	959,073	157%
SC66	134,277	664,809	664,809	664,809	495%
SC67	44,555	220,209	220,209	220,209	494%
SC68	506,781	1,142,880	1,142,880	1,027,798	203%
SC70	822,796	598,087	601,006	670,573	81%
SC73	24,074	25,281	25,281	25,281	105%

Project ID	Ex Ante kWh Savings	TRM-calculated	TRM-calculated (errata corrected)	ADM Calculated	Gross Realization Rate
	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Ex Post kWh Savings	Gross Ex Post kWh Savings	
All non-sample projects	39,958,423	48,926,029	49,598,358	52,999,502	133%
Total	52,973,375	62,533,953	63,461,300	67,972,825	128%

Table 3-14 shows the expected and gross ex post kWh energy savings by project for the New Construction Program.

Table 3-14 Ex Ante and Gross Ex Post kWh Savings for New Construction Program by Project

Project ID	Ex Ante kWh Savings	Gross Ex Post kWh Savings	Gross Realization Rate
NC71	2,069,024	2,069,024	100%
NC72	1,274,900	1,274,900	100%
All Non-Sample Projects	1,994,585	1,994,585	100%
Total	5,338,509	5,338,509	100%

Table 3-15 summarizes the gross ex post therm savings for the Custom Incentives and New Construction Programs for the period June 2014 through May 2015. Overall, the gross ex post savings of 1,522,243 therms were equal to 80% of the expected savings.

Table 3-15 Ex Ante and Gross Ex Post Therm Savings for the Custom Incentives and New Construction Programs by Sample Stratum

Stratum	Ex Ante Therm Savings	Gross Ex Post Therm Savings	Gross Realization Rate
4	456,853	312,002	68%
3	853,206	710,271	83%
2	493,298	402,944	82%
1	110,770	97,025	88%
Total	1,914,127	1,522,243	80%

Table 3-16 summarizes the gross ex post therm savings for the Standard Incentives Program for the period June 2014 through May 2015. Overall, the gross ex post savings of 234,402 therms were equal to 115% of the expected savings.

Table 3-16 Ex Ante and Gross Ex Post Therm Savings for the Standard Incentives Program by Sample Stratum

Stratum	Ex Ante Therm Savings	TRM-Calculated	TRM-Calculated (Errata Corrected)	ADM Calculated	Gross Realization Rate
		Gross Ex Post Therm Savings	Gross Ex Post Therm Savings	Gross Ex Post Therm Savings	
3	58,340	62,238	62,238	62,238	107%
4	87,494	110,208	112,432	112,432	129%
2	52,466	53,002	53,002	53,002	101%
1	13,751	14,635	15,731	15,731	114%
Total	212,051	240,082	243,402	243,402	115%

Table 3-17 shows the expected and gross ex post therm savings by sampled project for the Custom Incentives Program.

Table 3-17 Ex Ante and Gross Ex Post Therm Savings for the Custom Incentives Program by Project

Project ID	Ex Ante Therm Savings	Gross Ex Post Therm Savings	Gross Realization Rate
C12	35,872	25,264	70%
C13	16,810	14,665	87%
C20	28,790	26,389	92%
C26	35,921	0	0%
C41	8,220	8,220	100%
C62	95,000	155,754	164%
SC15	7,567	7,226	95%
SC29	15,631	0	0%
SC38	4,096	4,096	100%
SC45	15,181	13,710	90%
SC46	19,727	20,690	105%
SC49	1,000	311	31%
SC50	6,573	2,146	33%
SC51	1,799	1,620	90%
SC52	6,458	2,762	43%
SC53	14,968	11,283	75%
SC54	10,526	22,832	217%
SC67	33,936	31,236	92%
SC68	308,908	141,927	46%

Project ID	*Ex Ante Therm Savings*	*Gross Ex Post Therm Savings*	*Gross Realization Rate*
SC70	45,968	37,609	82%
All Non-Sample Projects	1,001,834	765,342	76%
Total	1,714,785	1,293,082	75%

Table 3-18 shows the expected and gross ex post therm savings by sampled project for the Standard Incentives Program.

Table 3-18 Ex Ante and Gross Ex Post Therm Savings for the Standard Incentives Program by Project

Project ID	*Ex Ante Therm Savings*	*TRM-Calculated*	*TRM-Calculated (Errata Corrected)*	*ADM Calculated*	*Gross Realization Rate*
		Gross Ex Post Therm Savings	*Gross Ex Post Therm Savings*	*Gross Ex Post Therm Savings*	
S8	4,200	6,720	6,720	6,720	160%
S9	6,301	8,238	8,238	8,238	131%
S11	5,250	7,875	7,875	7,875	150%
S18	13,435	13,384	13,384	13,384	100%
S34	3,321	2,526	2,947	2,947	89%
S35	895	680	794	794	89%
S36	881	670	781	781	89%
S37	6,276	6,610	6,940	6,940	111%
S47	496	614	614	614	124%
S56	9,079	12,666	12,666	12,666	140%
S58	25,609	25,968	25,968	25,968	101%
SC38	2,995	2,055	2,055	2,055	69%
SC46	56	124	124	124	221%
SC49	4,200	5,250	5,250	5,250	125%
SC51	994	994	994	994	100%
SC52	248	248	248	248	100%
SC54	2,644	3,652	3,652	3,652	138%
SC70	248	668	668	668	269%
SC73	10,218	10,220	10,220	10,220	100%
All Non-Sample Projects	114,707	130,920	133,264	133,264	116%
Total	212,051	240,082	243,402	243,402	115%

Table 3-19 displays the expected and gross ex post therm savings by project for the New Construction Program.

Table 3-19 Ex Ante and Gross Ex Post Therm Savings for the New Construction Program by Project

Project ID	*Ex Ante Therm Savings*	*Gross Ex Post Therm Savings*	*Gross Realization Rate*
NC42	147,945	173,142	117%
NC72	20,503	20,503	100%
All Non-Sample Projects	30,895	35,516	115%
Total	199,343	229,161	115%

3.2.2 Discussion of Gross Savings Analysis

The project realization rates were reviewed to assess whether there were factors that were causing systematic differences in the realization rates.

For the Custom Incentives and New Construction Programs projects, sample project realization rates and expected kWh savings are plotted in Figure 3-1. There is not a strong association between realization rates and expected kWh savings. Figure 3-2 plots the custom incentive project realized kWh savings against the expected kWh savings for each sample point.

Similarly, for the Standard Incentives Program projects, sample project realization rates and expected kWh savings are plotted in Figure 3-3. There is not a strong association between realization rates and expected kWh savings. Figure 3-4 plots the standard incentive project realized kWh savings against the expected kWh savings for each sample point.

Case-by-case examination showed that project-specific factors were more likely to cause realized kWh savings to differ from expected savings. Project-specific factors include type of measure implemented, building type, facility operating schedule, and other parameters that may affect energy efficiency measure savings.

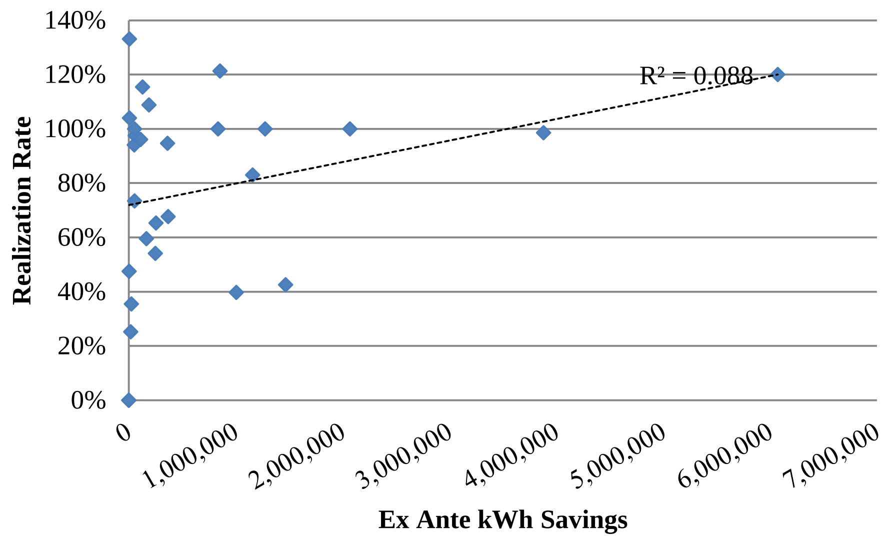


Figure 3-1 Custom Incentives and New Construction Programs Sample Project Realization Rate versus Ex Ante kWh Savings

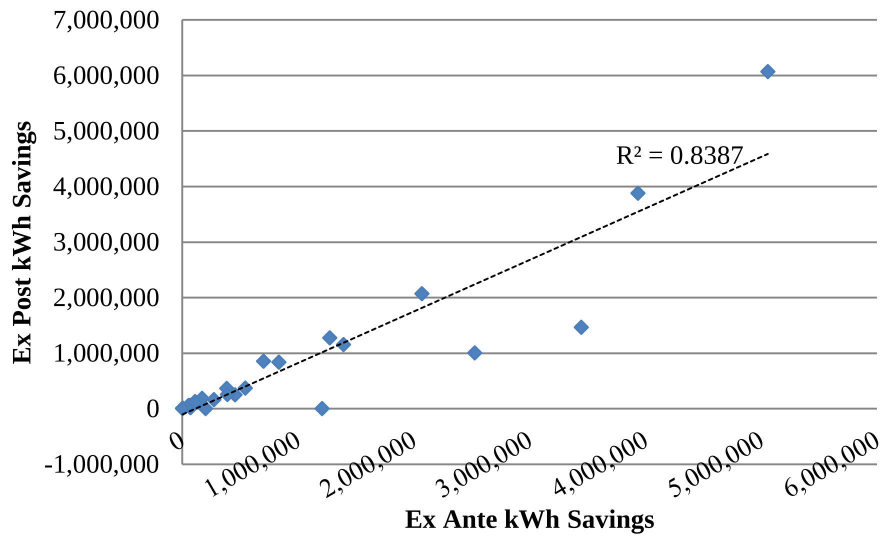


Figure 3-2 Custom Incentives and New Construction Programs Sample Project Ex Post kWh Savings versus Ex Ante kWh Savings

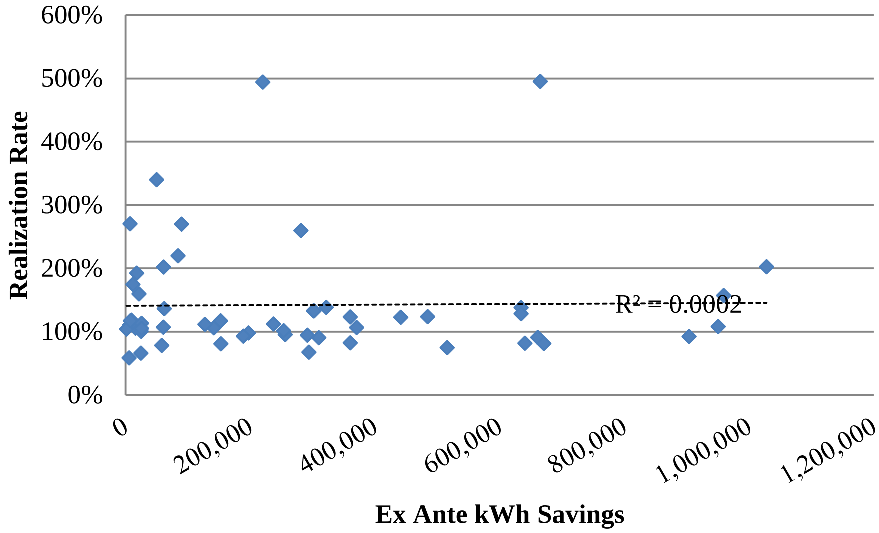


Figure 3-3 Standard Incentives Program Sample Project Realization Rate versus Ex Ante kWh Savings

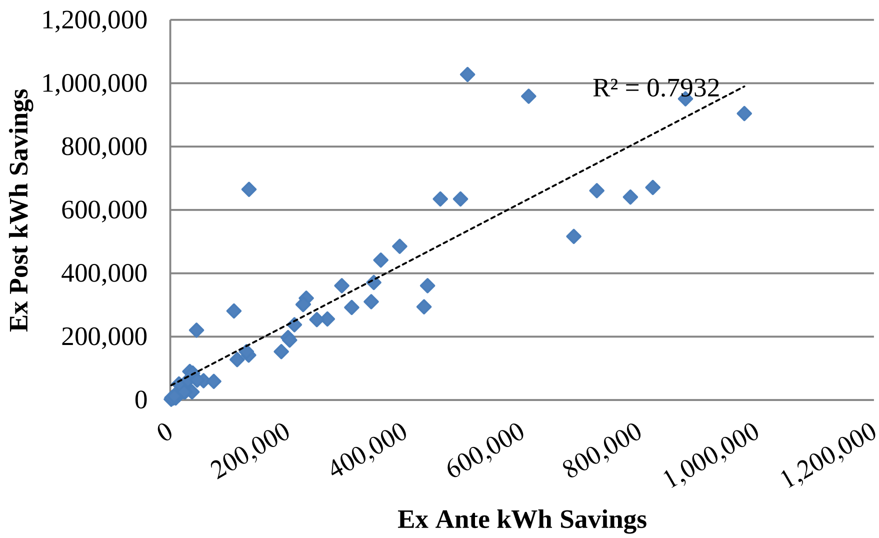


Figure 3-4 Standard Incentives Program Sample Project Ex Post kWh Savings (ADM Calculated) versus Ex Ante kWh Savings

Similarly, for the Custom Incentives and New Construction Programs, sample project realization rates and expected therm savings are plotted in Figure 3-5. There is not a strong association between realization rates and expected therm savings. Figure 3-6 plots the Custom Incentives and New Construction Programs' projects realized therm savings against the expected therm savings for each sample point. For the Standard Incentives Program, sample project realization rates and expected therm savings are plotted in Figure 3-7. There is not a strong association between realization rates and expected therm savings. Figure 3-8 plots the Standard Incentive

Program's project realized therm savings against the expected therm savings for each sample point.

Case-by-case examination showed that project-specific factors were more likely to cause realized therm savings to differ from expected savings. Project-specific factors include type of measure implemented, building type, facility operating schedule, and other parameters that may affect energy efficiency measure savings.

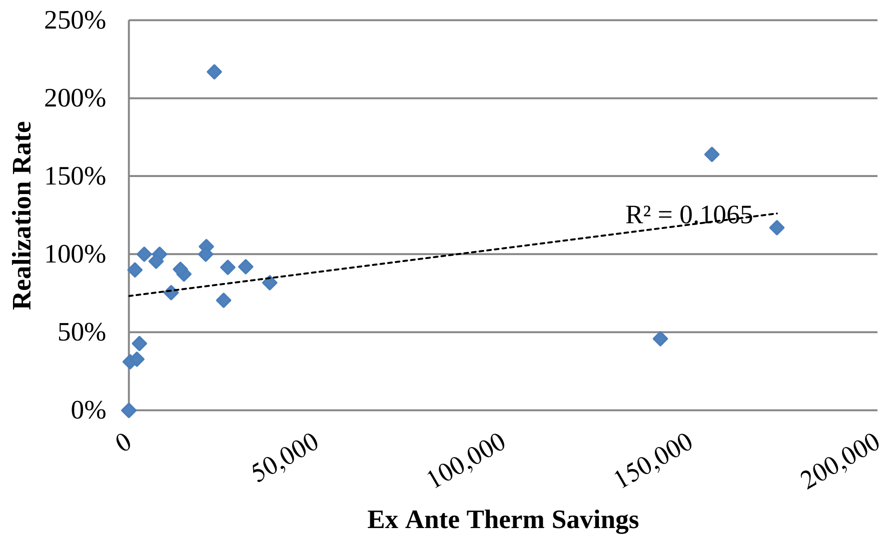


Figure 3-5 Custom Incentives and New Construction Programs Sample Project Realization Rate versus Ex Ante Therm Savings

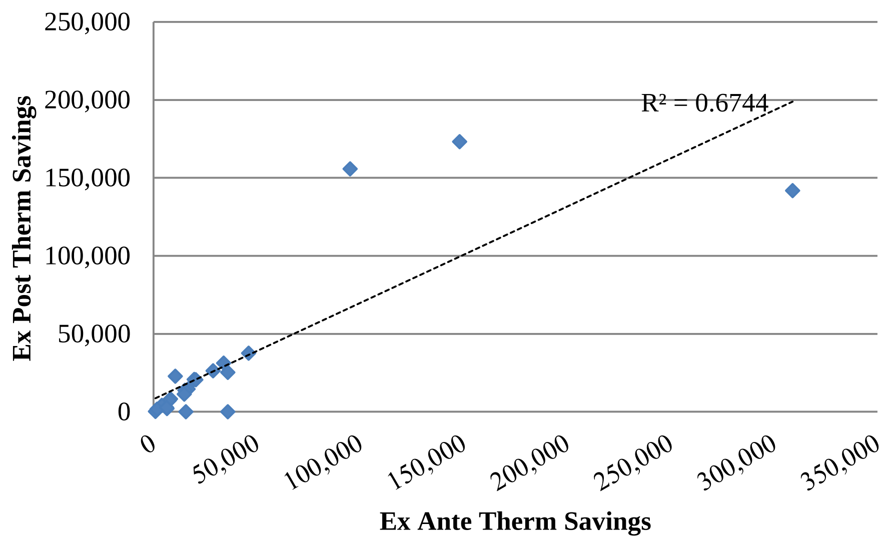


Figure 3-6 Custom Incentives and New Construction Programs Sample Project Ex Post Therm Savings versus Ex Ante Therm Savings

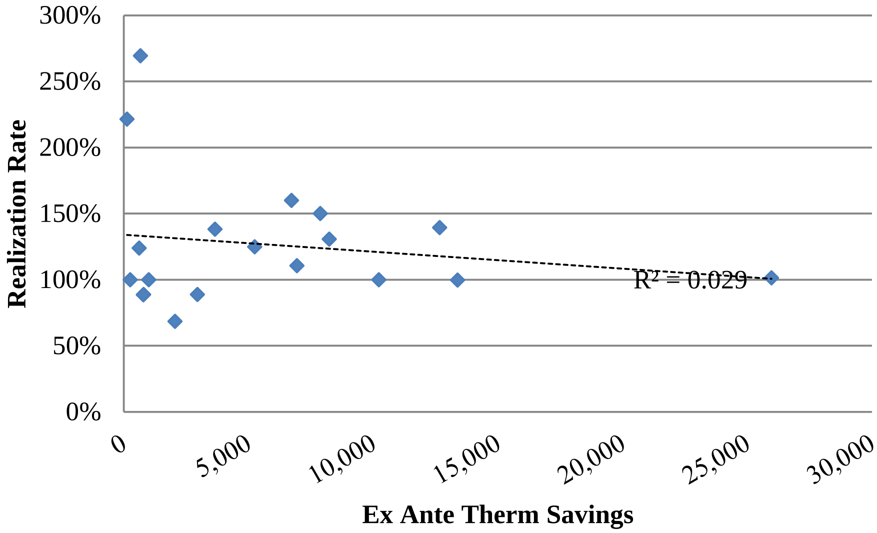


Figure 3-7 Standard Incentives Program Sample Project Realization Rate versus Ex Ante Therm Savings

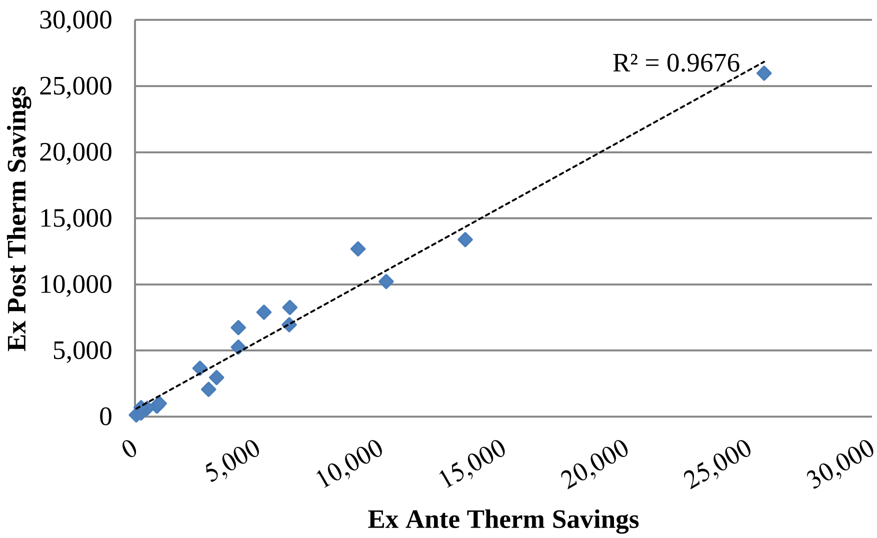


Figure 3-8 Standard Incentives Program Sample Project Ex Post Therm Savings (ADM Calculated) versus Ex Ante Therm Savings

As noted, for the Custom and Standard Incentives Programs, project specific factors accounted for most of the differences between expected and realized savings. These differences were generally due to the use of prescriptive per unit savings that did not incorporate site-specific factors, as well as inaccurate assumptions about how the equipment was operated. In a few cases the estimated annual project savings exceeded the total annual energy consumption for the projects. It is recommended that the program collect utility bills including energy consumption data in the future and use this information as a check on estimated project savings.

4. Estimation of Net Savings

This chapter presents the net impacts of the Custom and Standard Incentives Programs and New Construction Program during the period June 2014 through May 2015.

4.1 Procedures Used to Estimate Net Savings

Net savings are defined as the portion of gross savings that can be attributed to the effects of the program. The savings attributed to the program are comprised of the program gross savings, less any free ridership, and spillover effects.

Free riders of a program are defined as those participants that would have implemented the same energy efficiency measures and achieved the observed energy changes, even in the absence of the program. That is, because the energy savings realized by free riders are not induced by the program, these savings should not be included in the estimates of the program's actual (net) impacts. Without an adjustment for free ridership, some savings that would have occurred naturally would be incorrectly attributed to the program.

Spillover effects occur when energy savings accrue that are not included in program gross energy savings but are attributable to the program. That is, spillover savings result from program induced measures implemented outside of the program.

ADM performed a net savings analysis to estimate the impacts of the energy efficiency measures attributable to the Custom and Standard Incentives Programs and New Construction Program that were net of free ridership and inclusive of participant spillover using a self-report methodology. Information on the program's impact on the participants' decision making was collected from a sample of program participants through a decision-maker survey. Appendix B provides a copy of the survey instrument used for Custom and Standard Incentives Program participants. Appendix D provides a copy of the survey instrument used for New Construction Program participants. The following sections describe the procedures used to estimate net savings.

4.1.1 Free Ridership

The following subsections describe the procedures used to develop participant free ridership scores.

Free ridership was calculated using the procedures outlined in the Core Non-Residential Free Ridership Protocol presented in the Illinois Statewide Technical Reference Manual (TRM) Version 5.0, Vol. 4 (p.28). The attachment provides for the calculation of multiple free ridership scores. Analysis and discussion of the alternative approaches and the results are presented in Appendix F.

4.1.1.1 Free Ridership Scores

Three component scores to estimate the likelihood that a participant would have implemented the project in the absence of the program were calculated to estimate free ridership.

The No-Program Score is based on the participant's assessment of the likelihood of completing the project in the absence of the program. Survey respondents are asked the following question:

> Using a scale where 0 is "Not at all likely" and 10 is "Extremely likely, if the program had not been available, what is the likelihood that you would have completed the project?"

The No-Program Score is equal to:

> [*Likelihood in Absence of Program*]/10

The Program Components Score is based on ratings of the impact of various factors on the decision to implement the project. Participants rate the impact of the program and non-program factors. The Program Components Score is equal to:

> 1 – ([*Highest Rated Program Factor*]/10)

The program factors Custom Incentive and Standard Incentive Program respondents rated include the following:

- The availability of the program incentive;
- The impact of technical assistance you received from program staff;
- The impact of a recommendation from Department of Commerce Program staff;
- The impact of information from Department of Commerce marketing materials; or
- The impact of an endorsement or recommendation by the Energy Resources Center, Smart Energy Design Assistance Center, or Midwest Energy Efficiency Alliance.

The program factors New Construction Program respondents rated include the following:

- The availability of the program incentive;
- Design assistance you received through the Smart Energy Design Assistance Center;
- The impact of a recommendation from Department of Commerce program staff; or
- The impact of information from Department of Commerce marketing materials.

Additionally, program respondents are asked if any other factor influenced the project. These responses were coded as program or non-program factors and incorporated in the analysis.

The Program Influence Score is based on the relative importance of program and non-program factors in the decision to implement the measure. After rating the program and non-program factors, survey respondents were asked to allocate 100 points to program and non-program factors that reflected the importance of the program and other considerations to their decision to implement the project. Specifically, respondents were asked the following:

> "If you were given a TOTAL of 100 points that reflect the importance in your decision to implement the [MEASURE], and you had to divide those 100 points between: 1) the program and 2) other factors, how many points would you give to the importance of the PROGRAM?"

The Program Influence Score is equal to:

1 – ([*Program Points*]/100)

The preliminary free ridership score is calculated as the average of the No-Program, Program Components, and Program Influence Score.

To account for the effect the program may have had on project timing, a timing adjustment factor was developed and applied to the overall free ridership score for Custom and Standard Incentive Program projects.[5] This adjustment factor is based on responses to questions on when the project would have occurred in the absence of the program. The adjustment factor was based on the number of months the respondent reported the program expedited the project. Respondents who reported that in the absence of the program they would have completed the project at the same time were scored as zero months expedited. For those that reported that without the program they never would have completed the project, the months expedited was scored as 48. For all other responses, the number of months expedited were scored as shown in Table 4-1.

Table 4-1 Number of Months Expedited Scoring

Survey Response	*Number of Months Expedited*
0 to 6 months	3
7 months to 1 year	9
more than 1 year up to 2 years	18
more than 2 years up to 3 years	30
more than 3 years up to 4 years	42
Over 4 years	48

[5] A timing adjustment was not made for New Construction Program projects because it is unlikely that the availability of incentives impacted when the project was completed.

Respondents also estimated the likelihood of completing the project in the next 12 months. The response to this question was incorporated into the calculation of the timing adjustment factor. Specifically, the timing adjustment factor is equal to:

1 - ((*Number of Months Expedited* - 6)/42)*((10 - *Likelihood of Implementing within One Year*)/10)

4.1.1.2 Consistency Checks

Additional questions were administered to respondents that provided responses that appeared inconsistent with other responses. Specifically, respondents were asked to provide explanations or provide a new response if:

- The Program Influence Score was inconsistent with the ratings of the importance of the program components;
- The No Program Score was inconsistent with the ratings of the importance of the program components; or
- The respondent indicated that they learned of the program after deciding to complete the project, but the Program Influence Score was greater than 70, the likelihood of completing the project was rated as less than three, or any of the ratings of the importance of the program factors were rated greater than seven.

4.1.1.3 Energy Efficiency Plans Score

ADM developed an Energy Efficiency Plans Score and incorporated it into the algorithm for calculation of participant free ridership. Program participants were asked a series of questions regarding plans they may have had prior to deciding to participate in the program. Respondents that provided a response that indicated the presence of plans were asked to rate how certain they were of the indication that they had plans using a 0 – 10 scale, where zero indicated that they were "Not at all certain" and 10 indicated that they were "Extremely certain."

The Energy Efficiency Plans Score is equal to zero for participants if either of the following was true:

- The respondent stated that they did not have plans before deciding to participate and provided a certainty rating greater than seven;
- The respondent stated that their plans did not specify the specific measure they implemented; or
- The respondent stated that they did not have funds to implement the measure before deciding to participant and provided a certainty rating greater than seven.

4.1.1.4 Calculation of Project Free Ridership

Overall, Custom and Standard Incentives project free ridership is equal to:

> ([*No Program Score*] + [*Program Influence Score*] + [*Program Components Score*]) * *Timing Adjustment Factor* Energy Efficiency Plans Score*

Free ridership for New Construction projects is equal to:

> ([*No Program Score*] + [*Program Influence Score*] + [*Program Components Score*]) * *Timing Adjustment Factor* Energy Efficiency Plans Score*

4.1.1.5 Application of Free Ridership Scores to Additional Projects

The questions used to calculate free ridership were asked in regards to a single project. Respondents that completed additional project(s) were asked the following question:

Participants who implemented the same measure as the focal measure at other locations were asked the following question:

> Our records show that [ORGANIZATION] also completed projects through [PROGRAM ADMINISTRATOR]'s [PROGRAM] at [NSAME] other [FACILITY/IES]. Was it a single decision to complete the additional [PROJECT/PROJECTS] through the program or did each project go through its own decision process?

Free ridership scores calculated for the focal project were applied to additional projects at other locations if the respondent indicated that it was a single decision.

Participants who implemented other measures at the same facility where the focal measure was implemented were asked the following question:

> Our records show that [ORGANIZATION] also received an incentive from [PROGRAM ADMINISTRATOR>'s [PROGRAM] for a [FDESC] project at [ADDRESS]. Was the decision making process for that project the same as for the [ENDUSE] project we have been talking about?

Free ridership scores calculated for the focal project were applied to additional projects at other locations if the respondent indicated that it was the same decision making process.

4.1.1.6 Participant Spillover

To assess whether or not spillover savings were associated with program participants, survey respondents were asked about energy saving projects implemented outside of the program.

Respondents that reported installing additional measures were asked to provide information on the project. To determine whether or not the savings associated with measures are attributable to the program respondents were asked the following two questions:

1) “How important was your experience in the <PROGRAM> in your decision to implement this Measure, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?”
2) “If you had not participated in the <PROGRAM>, how likely is it that your organization would still have implemented this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have implemented this measure and 10 means you definitely WOULD have implemented this measure?”

Based on responses to these two questions, a program attribution score is calculated as follows:

(Rating of Program Importance + (10 – Likelihood of Implementing without Participation)) / 2

Savings are considered attributable to the program if the score is greater than seven.

4.1.2 Survey Administration

The EPY7/GPY4 program participants were surveyed by telephone. The sample was developed from data reported in the program-tracking database. Data were reviewed for missing or incomplete information. Additionally, participants were crosschecked across participation records from other programs to prevent the administration of multiple surveys to the same participant.

Program projects were defined based on unique identifiers in program tracking data. In total there were 389 unique decision-makers who completed projects through the Custom and Standard Incentives Programs. Additionally, there were 11 unique decision makers who completed projects through the New Construction Program.

Program participants were contacted up to five times to complete the survey. In total 159 decision-makers who completed projects through the Custom and Standard Incentive Programs completed the survey. Seven decision makers who completed new construction projects responded to the survey as well.

Table 4-2 displays final response and cooperation rates for the survey.

Table 4-2 Final Dispositions and Response and Cooperation Rates

	Percent of Contacts	
	Custom / Standard	*New Construction*
Interview		
Complete	41%	58%
Partial	0%	0%
Eligible, non-interview	44%	42%
Unknown eligibility, non-interview	13%	0%
Not eligible	0%	0%
Response Rate	42%	58%
Cooperation Rate	73%	100%

**AAPOR Cooperation Rate 1 and Response Rate 1 were used for the purpose of calculating response and cooperation rates.*

4.2 Results of Nets Savings Estimation

The procedures described in the preceding section were used to estimate free ridership, spillover and net-to-gross ratios for the Custom Incentives, Standard Incentives, and New Construction Programs for the period June 2014 through May 2015.

4.2.1 Free Ridership

Table 4-3, Table 4-4, and Table 4-5 summarize the free ridership sample characteristics for the electricity saving projects of the Custom Incentives, Standard Incentives, and New Construction Programs, respectively. Overall program level free ridership for kWh savings was lowest for the Standard Incentives Program (10%) and highest for the New Construction Program (39%).

Table 4-3 Summary of Free Ridership Scores for Custom Incentive kWh Savings Sample

Stratum	*Number of Respondents*	*Ex Post kWh Saving*	*Average Free Ridership (Weighted by Ex Post Savings)*	*Percent of Savings in Sample*
Custom1	4	2,667,604	12%	13%
Custom2	19	2,124,634	31%	22%
Total	23	4,792,238	18%	16%

Table 4-4 Summary of Free Ridership Scores for Standard Incentive kWh Savings Sample

Stratum	*Number of Respondents*	*Ex Post kWh Savings*	*Average Free Ridership (Weighted by Ex Post Savings)*	*Percent of Savings in Sample*
Standard1	11	4,374,346	13%	13%
Standard2	71	5,387,176	7%	18%
Standard3	35	317,130	4%	7%
Total	117	10,078,652	10%	15%

Table 4-5 Summary of Free Ridership Scores for New Construction kWh Savings Sample

Number of Respondents	*Ex Post kWh Savings*	*Average Free Ridership (Weighted by Ex Post Savings)*	*Percent of Savings in Sample*
6	5,166,802	39%	97%

Summaries of the free ridership sample characteristics for natural gas saving projects are presented in Table 4-6, Table 4-7, and Table 4-8 for the Custom Incentives, Standard Incentives, and New Construction Programs, respectively. Free ridership ranged from 16% for the Custom Incentives program to 48% for the Standard Incentives Program.

Table 4-6 Summary of Free Ridership Scores for Custom Therm Savings Sample

Stratum	*Number of Respondents*	*Ex Post Therm Savings*	*Average Free Ridership (Weighted by Ex Post Savings)*	*Percent of Savings in Sample*
Custom1	14	372,520	13%	34%
Custom2	7	25,280	32%	13%
Total	21	397,799	16%	31%

Table 4-7 Summary of Free Ridership Scores for Standard Therm Savings Sample

Stratum	*Number of Respondents*	*Ex Post Therm Savings*	*Average Free Ridership (Weighted by Ex Post Savings)*	*Percent of Savings in Sample*
Standard1	8	44,415	53%	22%
Standard2	8	12,322	20%	29%
Total	16	56,737	48%	23%

Table 4-8 Summary of Free Ridership Scores for New Construction Therm Savings Sample

Number of Respondents	*Ex Post Therm Savings*	*Average Free Ridership (Weighted by Ex Post Savings)*	*Percent of Savings in Sample*
5	222,232	33%	97%

4.2.2 Participant Spillover

Table 4-9 displays the results of the spillover analysis. As shown, 58 participants in the Custom and Standard Incentive Programs reported implementing additional energy saving projects and of these, five respondents reported projects that met the attribution criteria for inclusion in program spillover savings. All five respondents were contacted to get additional project details. One respondent was able to provide sufficient information from which project spillover savings could be calculated. As shown in Table 4-10, none of the New Construction Program survey respondents reported implementing additional projects that qualified as spillover.

Table 4-11 summarizes the results of the spillover analysis for the participant in the Standard Incentives Program. The project included the installation of LED and fluorescent lighting. Savings were calculated using TRM section numbers 4.5.4 and 4.5.3.

Table 4-9 Summary of Spillover Projects for Custom and Standard Incentive Program Participants

Spillover Metric	*Number of Respondents*
Number of Participants Reporting Additional Measures	58
Number of Participants with Projects that Met Attribution Criteria	5
Number of Respondents with Quantified Spillover Savings	1

Table 4-10 Summary of Spillover Projects for New Construction Program Participants

Spillover Metric	*Number of Respondents*
Number of Participants Reporting Additional Measures	3
Number of Participants with Projects that Met Attribution Criteria	0
Number of Respondents with Quantified Spillover Savings	0

Table 4-11 Summary of Spillover Savings for the Standard Incentives Program

Project Number	*Spillover kWh Savings*	*Spillover kW Savings*
Project 1	7,381	.69
Total Spillover Savings	7,381	.69
Total Gross Savings for NTG Sample		
TRM-Calculated	62,533,953	4,360.33
TRM-Calculated (Errata Corrected)	63,461,300	4,372.68
ADM Calculated	67,972,825	5,512.24
Spillover Rate		
TRM-Calculated	< 1%	<1%
TRM-Calculated (Errata Corrected)	< 1%	< 1%
ADM Calculated	< 1%	< 1%

Additionally, a project that was identified during ex post verification efforts was implemented without receiving a program incentive. The program was implemented by a customer that completed both Standard Incentives and Custom Incentives projects. Two of the measures were standard, TRM measures: demand controlled ventilation and the installation of a variable speed drive for an HVAC system. Savings were calculated for these two measures using TRM section 4.4.19 and 4.4.17. The savings totaled 11,246 kWh and 2.80 kW. These savings were added to the Standard Incentives Program total and were not extrapolated to the population. The third measure implemented was a non-standard hot water pump control. Savings were estimated using a custom bin analysis and totaled 1,725 kWh. There are no peak demand reductions for this measure. The savings for this project were added to the Custom Incentive Program total and were not extrapolated to the population.

4.2.3 Net Savings by Utility

The net ex post electric savings of the Custom and Standard Incentives and New Construction Programs during the period June 2014 through May 2015 are summarized by utility in Table 4-12, Table 4-13, and Table 4-14. For the period, net ex post kWh savings for the Custom Incentives Program total 25,343,904 and net ex post kWh savings for the Standard Incentives Program total 61,217,664. For the New Construction Program, net ex post kWh savings total 3,241,471. The net-to-gross ratio for the Custom Incentives Program is 82%, while the net-to-gross ratio for the Standard Incentives Program is 90%; for the New Construction Program, the net-to-gross ratio is 61%.

Table 4-12 Summary of kWh Savings for the Custom Incentives Program

Utility	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	13,485,862	11,073,223	9,252,437	84%
ComEd	27,689,505	19,806,713	16,091,467	81%
Total	41,175,366	30,879,936	25,343,904	82%

Table 4-13 Summary of kWh Savings for the Standard Incentives Program

Utility	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	11,446,308	14,810,450	13,618,320	92%
ComEd	41,493,314	53,162,374	47,599,344	90%
Total	52,939,622	67,972,825	61,217,664	90%

Table 4-14 Summary of kWh Savings for the New Construction Program

Utility	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	4,944,843	4,944,843	2,898,452	59%
ComEd	393,666	393,666	343,019	87%
Total	5,338,509	5,338,509	3,241,471	61%

The net ex post natural gas savings of the Custom and Standard Incentives, and New Construction Programs during the period June 2014 through May 2015 are summarized by utility in Table 4-15, Table 4-16, and Table 4-17. For the period, net ex post natural gas savings for the Custom Incentives Program total 1,090,456 therms and net ex post natural gas savings for the Standard Incentives Program total 127,513 therms. Net ex post natural gas savings total 152,612 therms for the New Construction Program. The net-to-gross ratio for the Custom Incentives Program is 84%, and the net-to-gross ratio for the Standard Incentives Program is 52%. For the New Construction Program, the net-to-gross ratio is 67%.

Table 4-15 Summary of Therm Savings for the Custom Incentives Program

Utility	*Ex Ante Therm Savings*	*Gross Ex Post Therm Savings*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Ameren	239,768	180,621	151,788	84%
Nicor	625,166	480,991	377,312	78%
North Shore	173,611	134,264	104,182	78%
Peoples	676,240	497,205	457,174	92%
Total	1,714,785	1,293,082	1,090,456	84%

Table 4-16 Summary of Therm Savings for the Standard Incentives Program

Utility	*Ex Ante Therm Savings*	*Gross Ex Post Therm Savings*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Ameren	30,455	30,810	19,787	64%
Nicor	119,821	139,431	68,113	49%
North Shore	5,756	6,769	3,291	49%
Peoples	56,019	66,392	36,322	55%
Total	212,051	243,402	127,513	52%

Table 4-17 Summary of Therm Savings for the New Construction Program

Utility	*Ex Ante Therm Savings*	*Gross Ex Post Therm Savings*	*Net Ex Post Therm Savings*	*Net-to-Gross Ratio*
Ameren	27,252	31,328	5,803	19%
Nicor	172,091	197,832	146,810	74%
Total	199,343	229,161	152,612	67%

4.2.4 Net Ex Post Peak Demand Reductions

The net ex post peak demand reductions for the Custom and Standard Incentives Programs during the period June 2014 through May 2015 are summarized by utility in Table 4-18 and Table 4-19. There were no peak demand reductions for the New Construction Program.

The net ex post peak demand savings for the Custom Incentives Program total 1,943.57 kW and the net ex post peak demand savings for the Standard Incentives Program total 5,161.78 kW.

Table 4-18 Summary of Net Peak kW Reductions for the Custom Incentives Program

Utility	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	0.00	724.50	700.452416	97%
ComEd	0.00	1,346.70	1,243.12	92%
Total	0.00	2,071.20	1,943.57	94%

Table 4-19 *Summary of Net Peak kW Reductions for the Standard Incentives Program*

Utility	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Net Ex Post kWh Savings*	*Net-to-Gross Ratio*
Ameren	1,641.00	1,193.12	1,120.96	94%
ComEd	6,051.95	4,319.12	4,040.82	94%
Total	7,692.95	5,512.24	5,161.78	94%

5. Process Evaluation

This chapter presents the results of the process evaluation of the Public Sector Custom and Standard Incentives Programs (Custom and Standard Incentives Programs) and the Public Sector New Construction Program (New Construction Program) during electric program year seven and natural gas program year four (EPY7/GPY4). Limited process evaluation activities were performed for the year because the program has remained essentially unchanged from prior years. The process evaluation focused on analysis of participant feedback and a review of program activity.

5.1. Evaluation Objectives

Key research questions to be addressed by this evaluation of EPY7/GPY4 activity include:

- How do participants learn about the incentives provided through the Department of Commerce Programs?
- Did participants identify any problems with the participation process? Are program application materials clear and do participants know where to seek additional assistance?
- What trends are there in participation in the program?

5.2. Summary of Primary Data Collection

Multiple sources of information informed the process evaluation of the Standard, Custom, and New Construction Programs.

- **Surveys of Program participants**: Data collected through surveys program participants provide feedback on program processes.
- **Review of Program Tracking Data**: Review of program tracking provides inside into the types of organizations participant and the distribution of participation.

5.3. Summary of Conclusions and Recommendations

The following presents a selection of key findings from EPY7/GPY4:

- Survey respondents indicate that participants are learning about the program through a variety of sources. Trade allies and other contractors, equipment vendors, or energy consultants were a source of awareness for 26% of participants in the Custom and Standard Incentives Programs. Other common sources of awareness mentioned were friends or colleagues (18%), presentation at a conference or workshop (14%), and through a professional group or association (13%).
- Most program participants that worked on application materials rated the materials as clear and few (<5%) gave ratings that indicated there were significant clarity issues. Additionally,

most respondents, 92% indicated that they knew whom to go to for additional assistance with the application.

- Participant satisfaction was high. Ninety-six percent of respondents indicated that they were satisfied with the program overall and nearly all respondents were satisfied with their interactions with program staff. The time to get the rebate was the aspect of the program that the largest share of respondents reported dissatisfaction with.
- A significant share of New Construction Program respondents, 43%, reported that they received new construction design assistance from the Smart Design and Assistance Center (SEDAC). These respondents also rated this assistance as having a high impact on the decision to incorporate the energy efficient design features or equipment into the project.
- All New Construction Program Participants were satisfied with the program overall. None of the respondents reported dissatisfaction with any aspect of the program.

5.4. Custom and Standard Incentives Program Activity

The following sections summarize EPY7/GPY4 program activity.

5.4.1. **Activity during the Program Year**

Figure 5-1 and Figure 5-2 display the monthly and cumulative electricity savings for the Custom Incentives and Standard Incentives Programs, respectively. The shaded areas correspond to the periods during which Sweet Deal bonuses were offered for completed projects. As shown, there were increases in project savings shortly before the cutoff dates for the bonus periods. However, approximately two-thirds of the custom and one-half of standard electricity savings occurred after the bonus period.

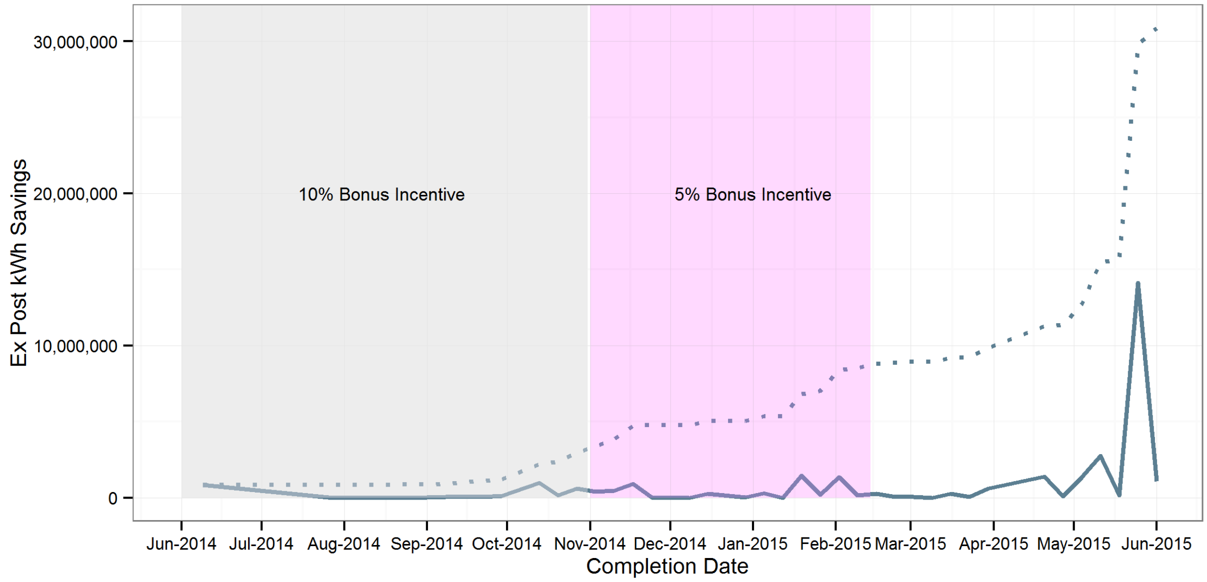


Figure 5-1 Custom Electricity Savings by Final Application Date during EPY7/GPY4

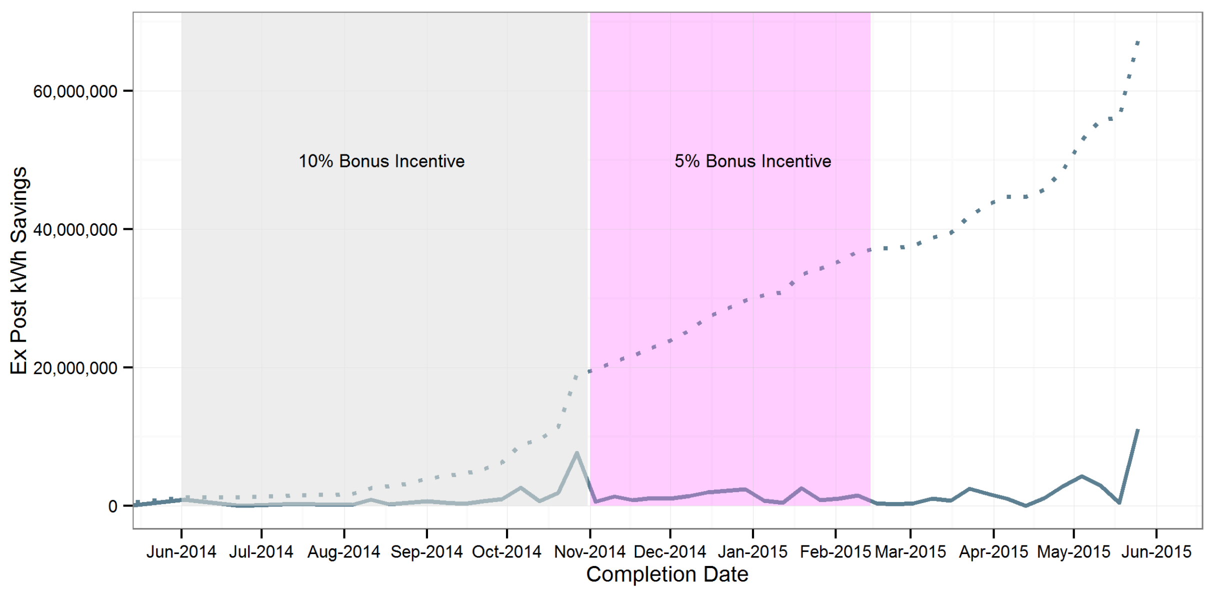


Figure 5-2 Standard Electricity Savings by Final Application Date during EPY7/GPY4

Similarly, Figure 5-3 and Figure 5-4 display the monthly and cumulative natural gas savings for the Custom Incentives and Standard Incentives Programs, respectively. For custom projects, there is an increase in savings around the cutoff date for the 10% incentive bonus, but no appreciable increase around the 5% incentive bonus cutoff date. Approximately 50% of savings came after the bonus periods. For standard projects, savings accrued more quickly during the bonus periods than during the remainder of the year. Approximately two-thirds of project savings occurred during the bonus periods.

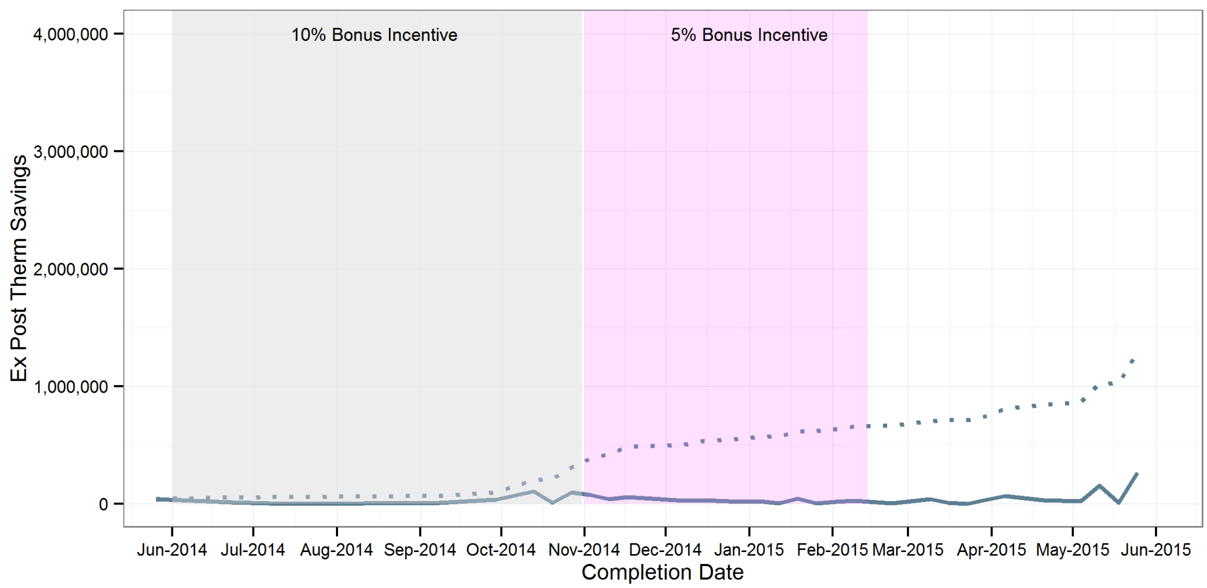


Figure 5-3 Custom Natural Gas Savings by Final Application Date during EPY7/GPY4

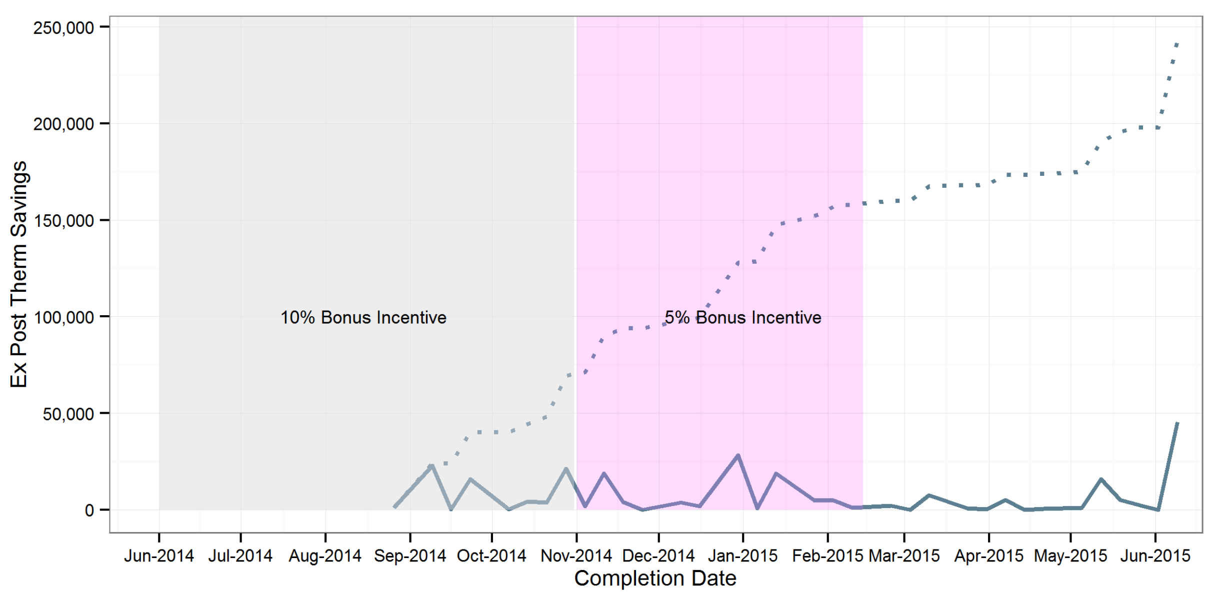


Figure 5-4 Standard Natural Gas Savings by Final Application Date during EPY7/GPY4

5.4.1. **Energy Savings by Applicant Type**

Figure 5-5 displays electricity savings from custom incentive projects by applicant type. As shown, more than one-half of program activity came from local government projects.

Universities and K-12 schools also accounted for sizable shares of custom project electricity savings.

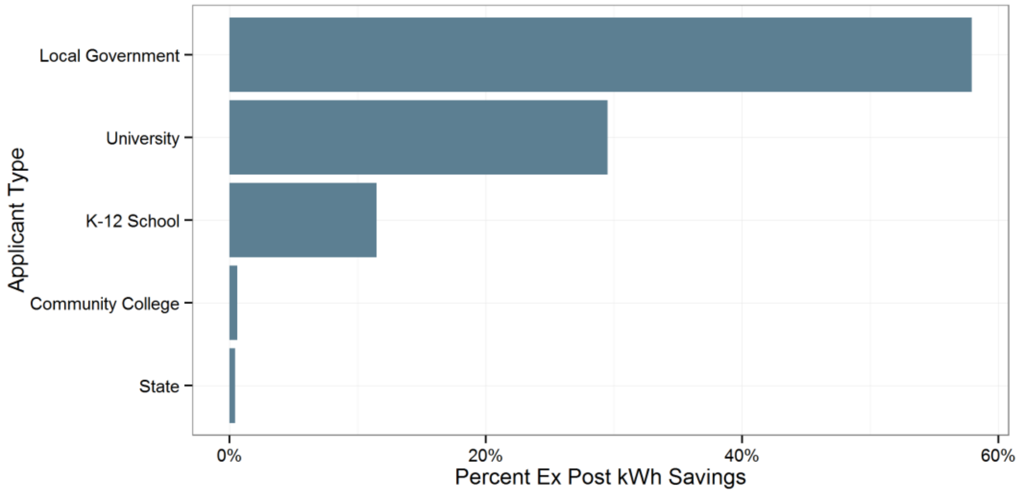


Figure 5-5 Custom Electricity Savings by Applicant Type

However, the amount of savings generated by applicant types varied by the utility service territory. Whereas local governments accounted for approximately two-thirds of program activity in the ComEd service territory, University applicants accounted for approximately one-half of program activity in the Ameren service territory.

Table 5-1 Custom Electricity Savings by Applicant Type and Utility

Applicant Type	*Ameren*	*ComEd*
Community College	-	1%
K-12 School	6%	15%
Local Government	39%	68%
State	1%	0%
University	55%	15%

Local government organizations, followed by K-12 schools, accounted for the largest shares of standard incentive project electricity savings.

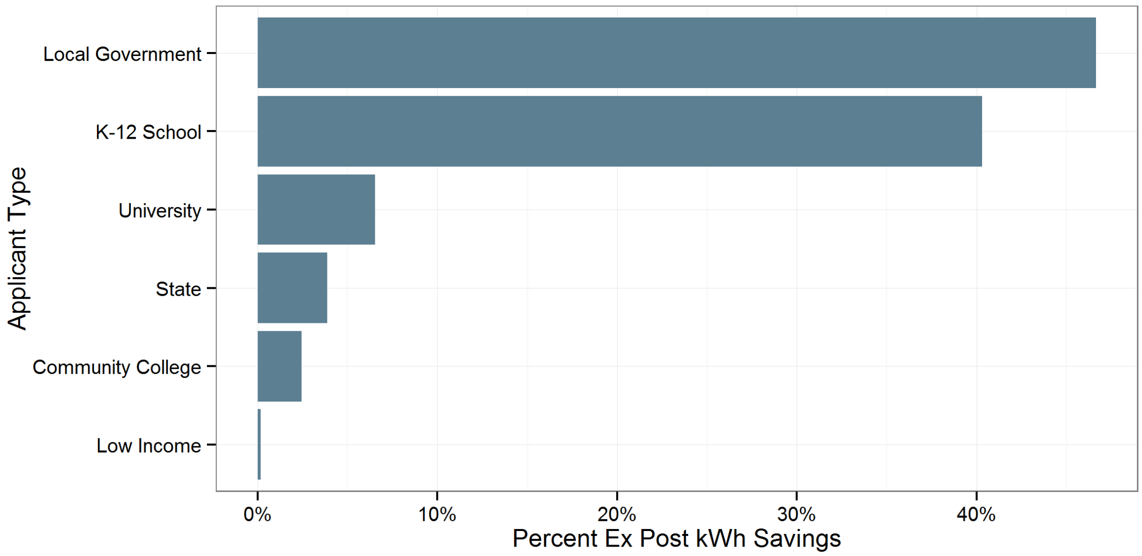


Figure 5-6 Standard Electricity Savings by Applicant Type

Moreover, as shown in Table 5-2, the distribution of savings across applicant types was similar for projects completed in each of the two electric utility service territories.

Table 5-2 Standard Electricity Savings by Applicant Type and Utility

Applicant Type	*Ameren*	*ComEd*
Community College	5%	2%
K-12 School	29%	43%
Local Government	37%	49%
Low Income	1%	-
State	16%	1%
University	12%	5%

Figure 5-7 displays the share of Custom Incentive Program natural gas project savings by applicant type. As was the case with custom incentive electricity saving projects, local governments accounted for the largest share of natural gas custom project savings. Universities and K-12 facilities also accounted for larger share of custom natural gas savings.

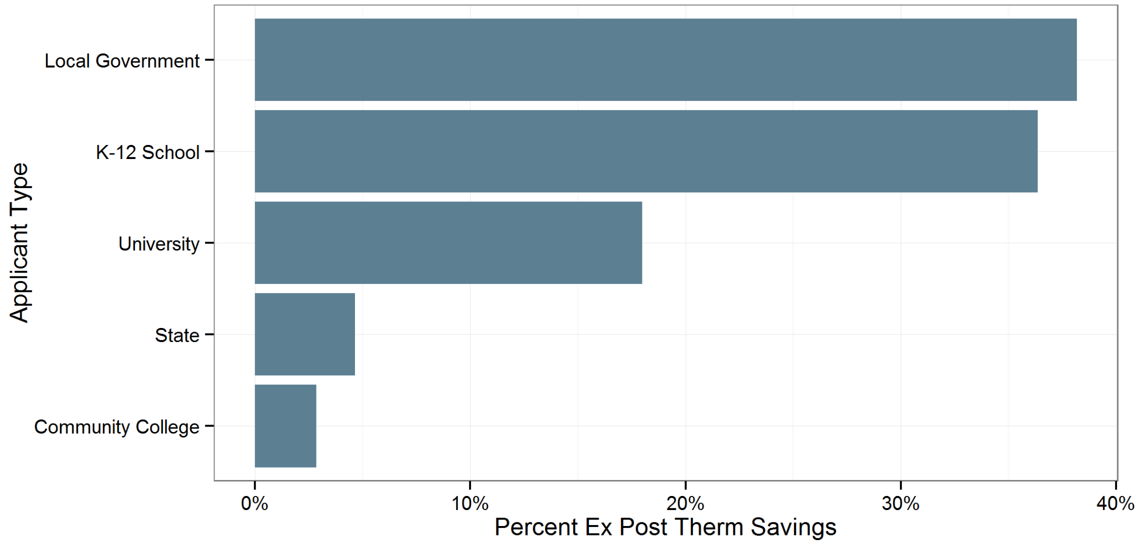


Figure 5-7 Custom Natural Gas Savings by Applicant Type

Custom natural gas savings were nearly equality distributed across four applicant types in the Ameren Service territory: K-12 schools, local governments, state buildings, and universities. Local government applicants accounted for 52% of custom natural gas savings in the Peoples service territory, but accounted for 37% of savings in the Nicor territory and 11% in the North Shore territory.

Table 5-3 Custom Natural Gas Savings by Applicant Type and Utility

Applicant Type	*Ameren*	*Nicor*	*North Shore*	*Peoples*
Community College	5%	4%	-	1%
K-12 School	23%	56%	89%	8%
Local Government	24%	37%	11%	52%
State	25%	3%	-	-
University	22%	-	-	39%

As shown in Figure 5-8, K-12 schools, followed by local governments, accounted for the largest share of Standard Incentive Program natural gas saving projects.

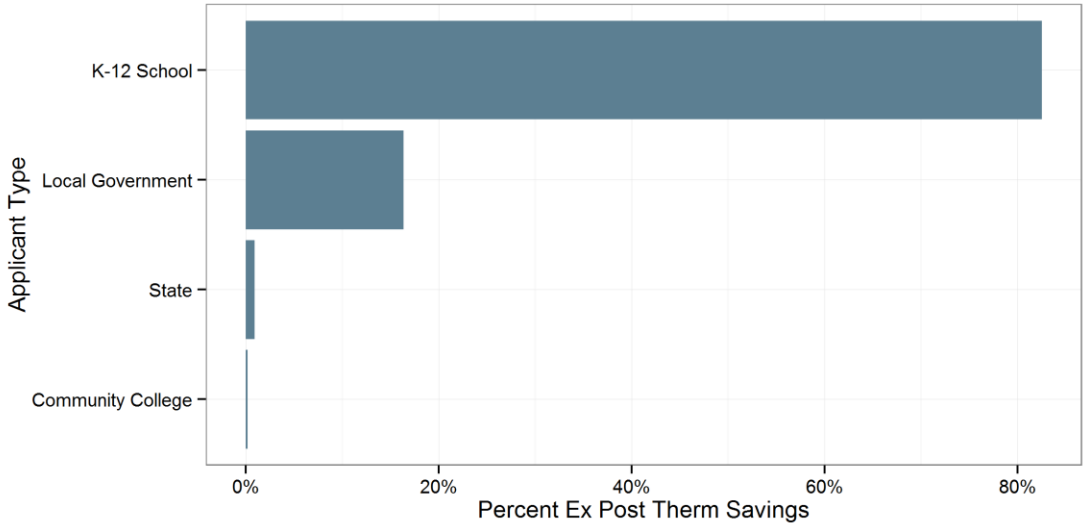


Figure 5-8 Standard Natural Gas Savings by Applicant Type

The distribution of natural gas saving projects in each utility service territory was similar to the program overall, with the exception of North Shore; local government organizations accounted for two-thirds of natural gas savings and K-12 schools accounted for one-third of natural gas savings.

Table 5-4 Standard Natural Gas Savings by Applicant Type and Utility

Applicant Type	*Ameren*	*Nicor*	*North Shore*	*Peoples*
Community College	-	0%	-	-
K-12 School	78%	78%	33%	100%
Local Government	15%	22%	67%	-
State	7%	-	-	-

5.4.2. Geographical Distribution of Energy Savings

Figure 5-9 and Figure 5-10 display the geographical distribution of gross ex post electricity and natural gas savings.

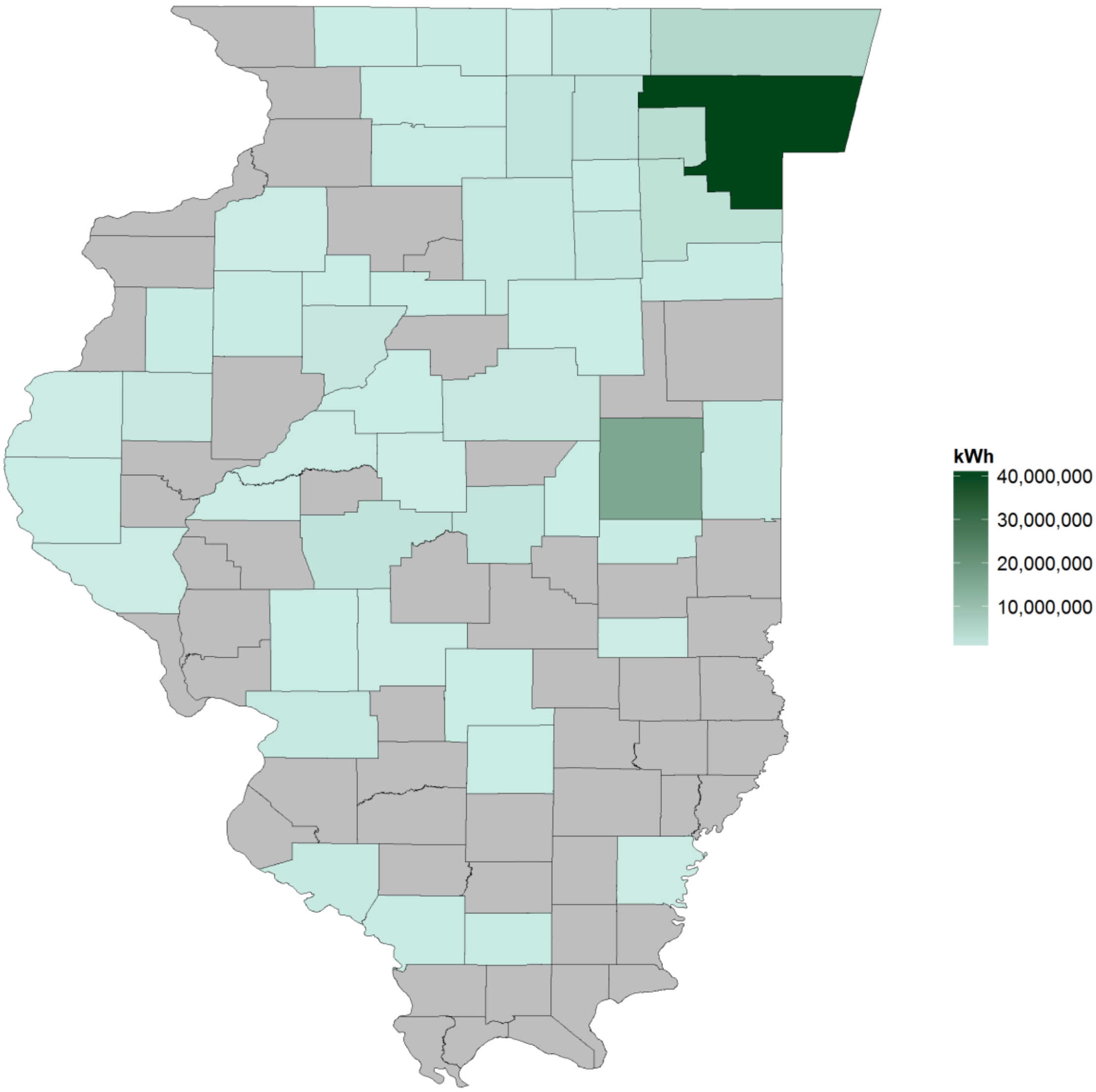


Figure 5-9 Geographical Distribution of Gross Ex Post Electricity Savings

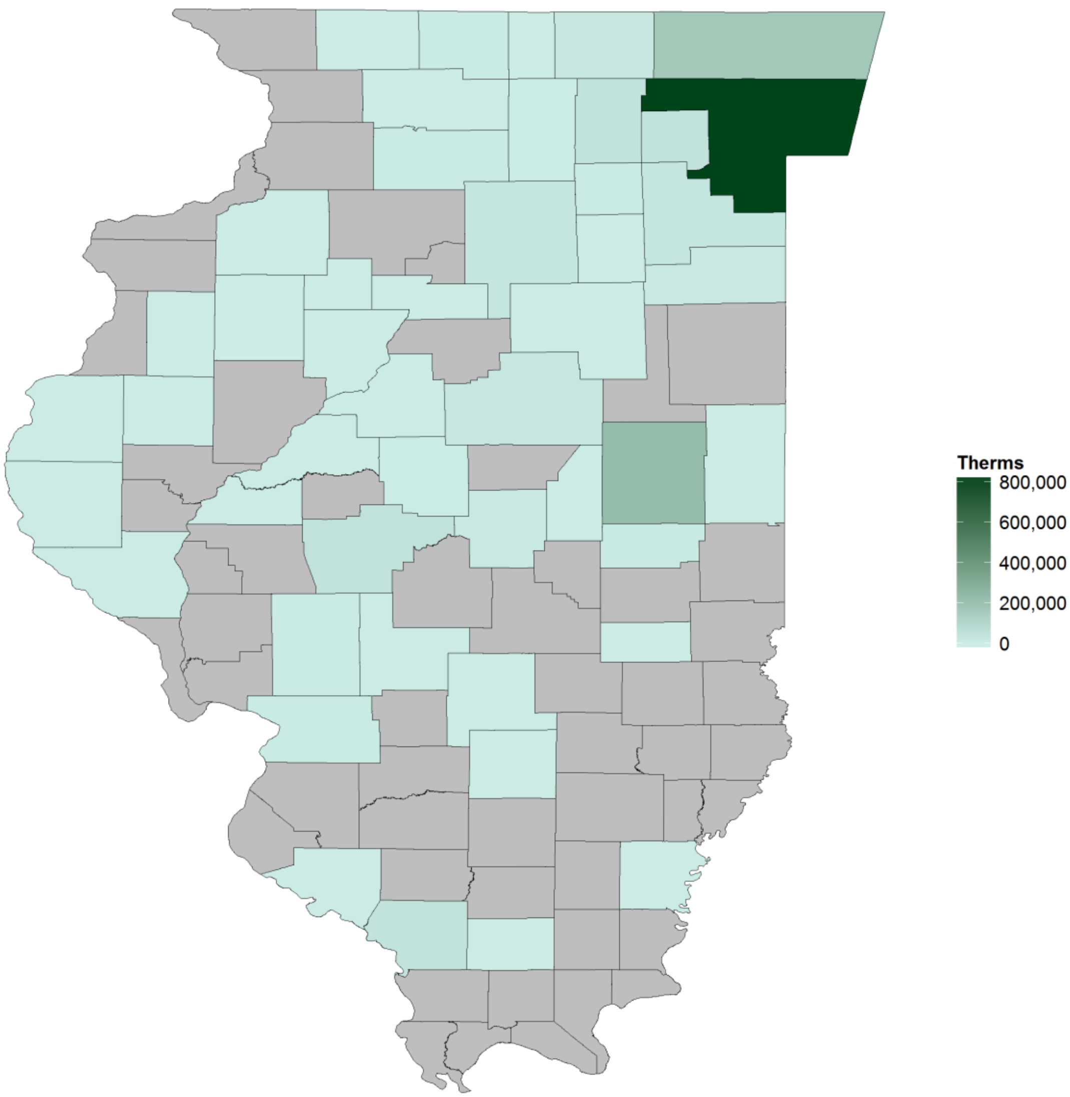


Figure 5-10 Geographical Distribution of Gross Ex Post Natural Gas Savings

5.5. Public Sector Custom and Standard Incentives Programs Participant Survey Findings

This section summarizes results from a survey of program participants. In total, 159 respondents who completed a Custom Incentives or Standard Incentives project during EPY7/GPY4 completed the participant survey. Table 5-5 displays the respondent's organization type. As shown, approximately one-half of respondents completed projects at K-12 schools, municipal facilities, or park district facilities.

Table 5-5 Survey Respondent Facility Types

Respondent Building Type	*Percent of Respondents (n =157)*
K-12 School	27%
Municipal Facility	15%
Park District Facility	13%
Police or Fire Station	9%
Wastewater Treatment Facility	8%
Public Library	4%
Community College	3%
Public Works Facility	3%
State University	3%
Garage	2%
Street Lighting	2%
Airport	1%
Correctional Facility	1%
Medical Facility	1%
911 Facility	1%
Community Center	1%
Courthouse	1%
Water Treatment Facility	1%
Other	4%

As shown in Table 5-6 less than 10% of organizations do not pay the full cost of electricity and natural gas service for the participating facility.

Table 5-6 Payment of Utilities

Payment of Utilities	*Natural Gas Service (n= 17)*	*Electricity Service (n= 17)*
Organization pays full cost for facility	87%	91%
Organization does not pay the full cost for facility	8%	6%
(Don't know)	4%	2%
(Refused)	1%	1%

The majority of respondents own and occupy the facility where the incentive project was completed.

Table 5-7 Facility Ownership

Ownership of Facility	*Percent of Respondents (n =157)*
Own and occupy	93%
Own and rent to someone else	4%
Don't know	2%

5.5.1. **Project Initiation and Participation Process**

Trade Allies, contractors, equipment vendors, or energy consultants, were the most frequently reported source of program awareness (26%) followed by learning of the program from a friend or colleague (18%). The program's direct outreach efforts also contributed to a significant share of program awareness. Fourteen percent of respondents learned of the program at a workshop or conference presentation and 7% learned of the program from a program representative.

Table 5-8 Source of Program Awareness

Source of Program Awareness	*Percent of Respondents (n =158)*
From a Trade Ally/contractor/equipment vendor/energy consultant	26%
From a friend or colleague	18%
A presentation at a conference or workshop	14%
From a professional group or association that you are a member of	13%
From a Department of Commerce Program representative	7%
Past participation	3%
The program website	3%
Previous participation	2%
IGEN	1%
Board member	1%
Metropolitan Mayors Caucus	1%
The Department of Commerce Illinois Energy Now Newsletter	1%
At a Department of Commerce Trade Ally Rally	1%
Through an internet search	1%
Other	8%
Don't know	1%

Table 5-9 displays the reasons participants gave for deciding to complete the project. Most respondents stated that the reason for completing the project was to replace old or outdate equipment and to save on energy costs or use. Thirteen percent of respondents stated that they decided to participate because of the rebate provided.

Table 5-9 Reasons for Deciding to Complete the Project

Reasons for Implementing Project	*Percent of Respondents (n =159)*
To replace old or outdated equipment	61%
To reduce energy costs	59%
To reduce energy use/power outages	23%
The maintenance downtime and associated expenses for the old equipment were too high	14%
To improve equipment performance	14%
To get a rebate from the program	13%
To improve the product quality	8%
To gain more control over how the equipment was used	5%
Had process problems and were seeking a solution	3%
As part of a planned remodeling, build-out, or expansion	1%
To protect the environment	1%
Improve safety	1%
Project payback was favorable	1%
Other	4%

Seventy-seven percent of survey respondents worked on completing the program application. Several respondents reported that were assisted by contractors (22%) and vendors (25%) in completing the application. Additionally, eight percent of respondents reported that they received assistance from Department of Commerce partner, the 360 Energy Group and two percent reported that they received assistance from Department of Commerce staff.

Table 5-10 Other Parties that Assisted with Completing the Application

Did anyone else help complete the application?	*Percent of Respondents (n = 153)*
An equipment vendor	25%
A contractor	22%
Another member of your company	11%
A designer or architect	8%
360 Energy Group	8%
Consultant	3%
Engineer	3%
Department of Commerce Staff	2%
Other	7%
Don't know	10%
Refused	1%

Respondents that worked on the application were asked to rate the clarity of the information on how to complete the application. As shown in Table 5-11, most respondents rated the clarity of the information as seven or higher.

Table 5-11 Clarity of the Application Process

Clarity of the Information on How to Complete the Application	*Percent of Respondents (n =117)*
0 (Not at all clear)	1%
1	0%
2	2%
3	1%
4	3%
5	4%
6	8%
7	17%
8	24%
9	13%
10 (Completely clear)	22%
Don't Know	6%

Most respondents, 92%, indicated that they knew whom to go to for additional assistance with the application.

5.1.1 Participant Satisfaction

Figure 5-11 displays participant satisfaction with the programs. As shown, most respondents were satisfied with the program. Nearly all respondents reported that they were satisfied with staffs' responses to their questions and the timeliness of those responses and the program overall. The aspects of the program that respondents were most likely to report dissatisfaction with were the time to get the rebate or incentive and the steps required to get through the program.

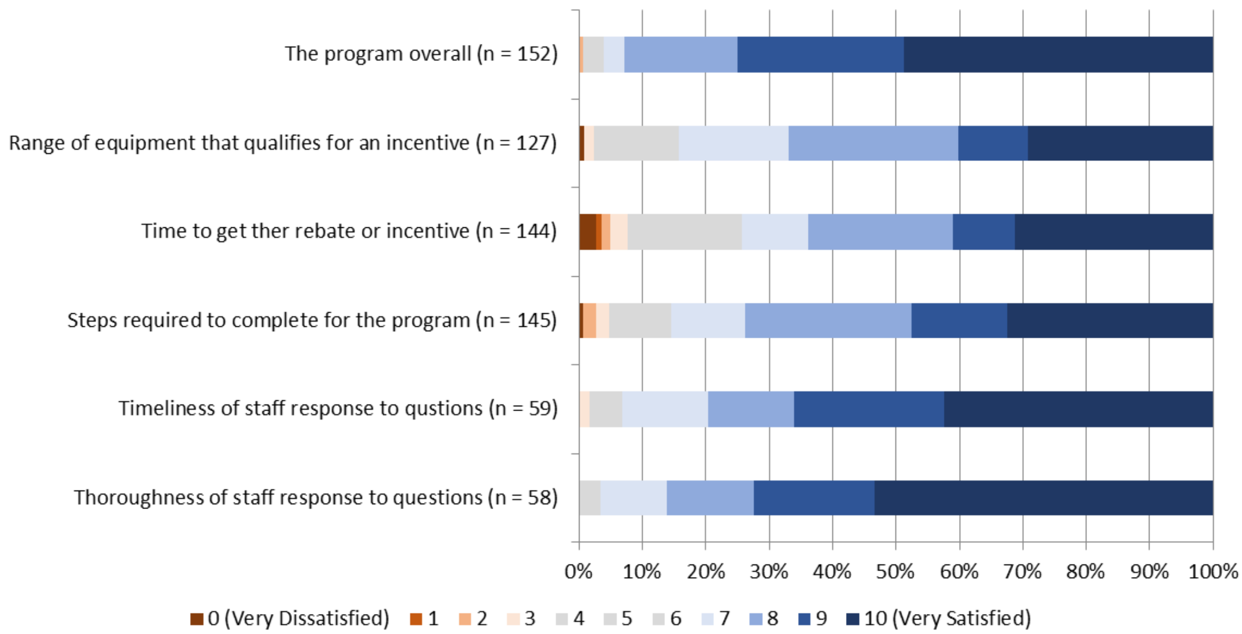


Figure 5-11 Participant Satisfaction

Fourteen respondents who reported dissatisfaction with one or more aspects of the program elaborated on the reason for their dissatisfaction. Their coded and tabulated responses are displayed in Table 5-12. The time to get the rebate was the most commonly mentioned reason for dissatisfaction by the amount or complexity of the paperwork.

Table 5-12 Reasons for Dissatisfaction

Reason for Dissatisfaction	*Percent of Respondents (n =14)*
Time to get rebate	50%
Amount / complexity of paperwork	21%
Prefer larger rebate	7%
Difficulty getting response from staff	7%
Not aware that Department could assist with application	7%
Geared towards organizations with engineering staff	7%

5.1.2 Preferred Method for Receiving Program Information

Table 5-13 displays the preferred methods for receiving program information. Email, presentations at conferences, and direct mailings are the most commonly preferred methods.

Table 5-13 Preferred Method for Receiving Program Information

Preferred Method for Receiving Program Information	*Percent of Respondents (n =153)*
E-mail	51%
Presentations at events or conferences	20%
Direct mailings	20%
Trade allies/Vendors/Contractors	14%
Website updates	10%
Telephone	4%
In person visit	2%
Social media	2%
Utility representative	2%
Through professional organizations / regional planning groups	1%
Utility bill message / insert	1%
Target energy managers	1%
Workshops	1%
Newsletters	1%
Webinar	1%

5.2 Public Sector New Construction Program Participant Profile

Figure 5-12 displays the share of electricity savings from new construction projects by applicant type. Projects completed at universities accounted for the majority of program electricity savings.

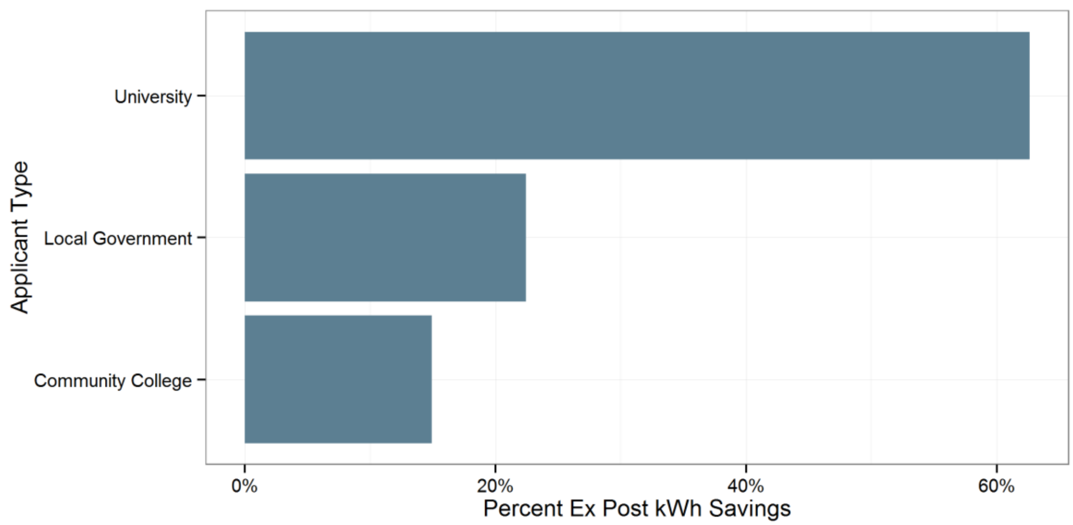


Figure 5-12 New Construction Electricity Savings by Applicant Type

Table 5-14 displays the distribution of projects across applicant types by utility service territory.

Table 5-14 New Construction Electricity Savings by Applicant Type and Utility

Applicant Type	Ameren	ComEd
Community College	12%	50%
Local Government	20%	50%
University	68%	-

Figure 5-13 displays the share of natural gas savings from new construction projects by applicant type. A project completed in a federal building accounted for the largest share of new construction natural gas savings.

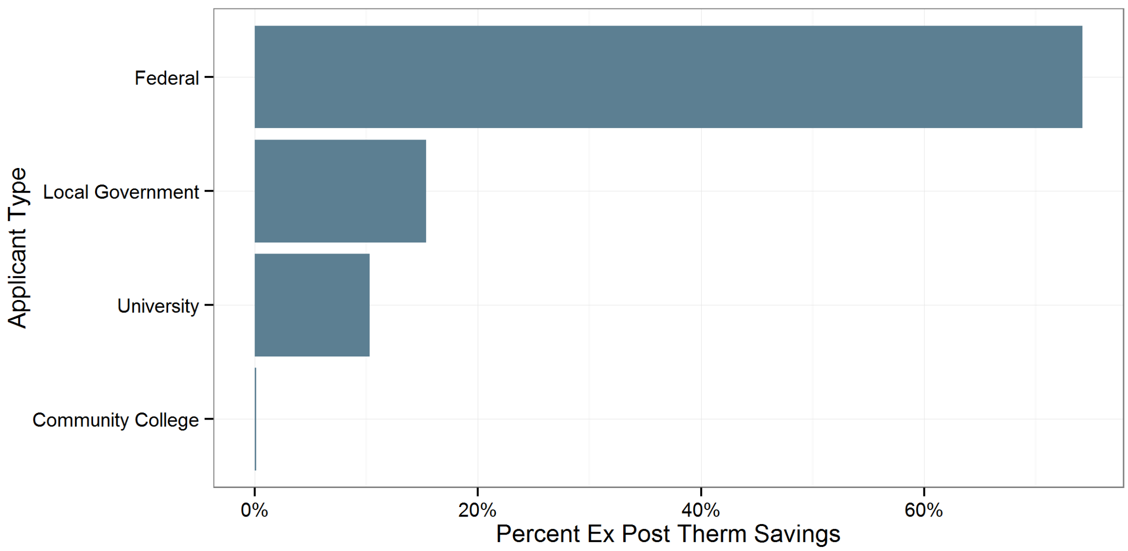


Figure 5-13 New Construction Natural Gas Savings by Applicant Type

Table 5-15 displays the distribution of projects across applicant types by utility service territory.

Table 5-15 New Construction Natural Gas Savings by Applicant Type and Utility

Applicant Type	Ameren	Nicor
Community College	1%	-
Federal	-	86%
Local Government	24%	14%
University	75%	-

5.3 Public Sector New Construction Program Participant Survey Findings

This section summarizes results from a survey of program participants. In total, seven respondents who completed a New Construction Project during EPY7/GPY4 completed the participant survey. Table 5-16 displays the respondent's facility type.

Table 5-16 Survey Respondent Facility Types

Respondent Building Type	*Percent of Respondents (n =7)*
Community college	29%
Recreation center	29%
State university	29%
Campus housing	14%

As shown in Table 5-17, all of the respondents reported that their organizations pay the full cost of electricity and natural gas service for the participating facility.

Table 5-17 Payment of Utilities

Payment of Utilities	*Natural Gas Service (n= 7)*	*Electricity Service (n= 7)*
Organization pays full cost	100%	100%
Organization does not pay the full cost	0%	0%

All of the respondents own and occupy the newly constructed facility.

Table 5-18 Facility Ownership

Ownership of Facility	*Percent of Respondents (n =7)*
Own and occupy	100%

5.3.1 Project Initiation and Participation Process

Each respondent reported a different source of program awareness. These responses are summarized in Table 5-19.

Table 5-19 Source of Program Awareness

Source of Program Awareness	*Percent of Respondents (n =7)*
A presentation at a conference or workshop	17%
From a friend or colleague	17%
Past participation	17%
From a Trade Ally/contractor/equipment vendor/energy consultant	17%
The program website	17%
Don’t know	17%

5.3.2 Project Initiation and Participation Process

Table 5-20 displays the reasons participants gave for deciding to complete the efficiency aspect of the project. The most commonly mentioned motivation was to reduce energy costs, which was given by 57% of respondents. Other motivations stated by respondents were, to reduce energy use/power outages, the organization's efficiency objectives, and to protect the environment (29%).

Table 5-20 Reasons for Deciding to Complete Efficiency Aspect of Project

Reasons for Implementing Project	*Percent of Respondents (n =7)*
To reduce energy costs	57%
To reduce energy use/power outages	43%
Organization's efficiency objectives	43%
To protect the environment	29%
The reduce maintenance costs	14%
Sought LEED certification	14%
Other	29%

Respondents most commonly reported that they were encouraged by a designer or architect to incorporate energy efficient equipment or design features into the construction project. Additionally, more than one-half of respondents reported that a general contractor encouraged them to incorporate energy efficiency aspects into the project. These responses suggest that multiple parties involved in the public sector construction process encourage the inclusion of energy efficient equipment or design features.

Table 5-21 Who Encouraged the Incorporation of Energy Efficient Equipment or Design Features

Party who Promoted Energy Efficiency	*Percent of Respondent (n =7)*
Designer or architect	86%
General Contractor	57%
Design or consulting engineer	43%

Although other service providers encourage the adoption of energy efficient equipment design features, design assistance from the Smart Energy Design Assistance Center (SEDAC) is also a frequently mentioned source for assistance with energy efficient new construction projects. Forty-three percent of respondents reported that they received design assistance from the Smart Energy Design Assistance Center (SEDAC).

Table 5-22 Whether or Not SEDAC Provided Design Assistance

Did you receive design assistance through the Smart Energy Design Assistance Center when planning this project?	*Percent of Respondents (n =7)*
Yes	43%
No	57%

Four respondents who completed smaller projects through the program and did not receive the extended battery of net savings questions were asked additional questions about their experience with the program.

Two respondents reported that they worked on the application and both indicated that the instructions for completing the application were clear and both had a clear sense of whom to go to for additional assistance with the application.

5.3.3 Participant Satisfaction

Figure 5-14 displays participant satisfaction with the programs. As shown, none of the respondents indicated any significant dissatisfaction with the program, and a large number of participants reported a high level of satisfaction with the program.

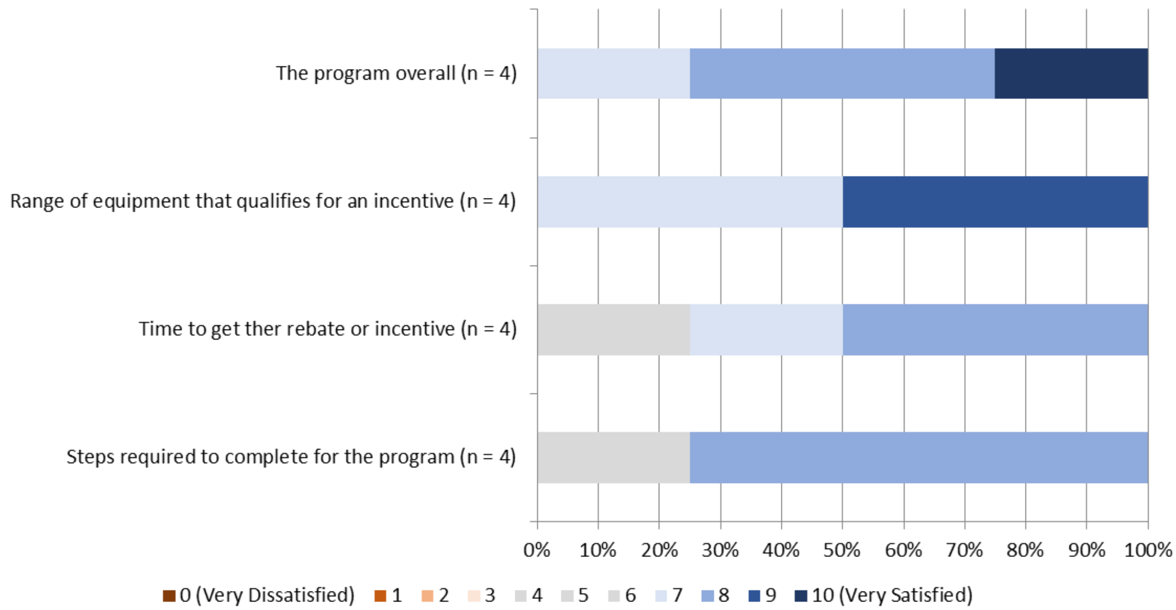


Figure 5-14 Participant Satisfaction

6. Appendix A: Site-Level Reports

Name S-1

Executive Summary

Under project S-1, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofit project. The realization rate for this project is 90%.

Project Description

The customer performed the following retrofit:

- (12) metal halide fixtures with LED wall mounted low bay fixtures
- (166) metal halide fixtures with (326) LED 2x2 grid lay-ins
- (5) metal halide fixtures with LED mid bay fixtures
- (81) metal halide fixtures with LED roadway luminaire

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHF e-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*ADM Calculated Ex Post*
LED Lamps and Fixtures	Base = 12 EE = 12	TRM = 295 Actual = 175	TRM = 160.2 Actual = 160	TRM = 4,903 Actual = 4,903	1	1	6,302	7,931	
LED Lamps and Fixtures	Base = 166 EE = 326	TRM = 61 Actual = 210	TRM = 44.9 Actual = 40	TRM = 8,766 Actual = 8,760	1	1	191,143	46,009	191,143
LED Lamps and Fixtures	Base = 5 EE = 5	TRM = 295 Actual = 465	TRM = 160 Actual = 159	TRM = 8,766 Actual = 8,760	1	1	15,724	5,917	13,403
LED Lamps and Fixtures	Base = 81 EE = 81	TRM = 361.4 Actual = 465	TRM = 116.8 Actual = 100	TRM = 4,903 Actual = 4,380	1	1	129,495	97,141	
							342,664	***156,999***	***204,546***

ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	6,302	7,931	126%	1.62	7	55,518	N/A	N/A
	4.5.4	191,143	191,143	100%	21.82	4	763,700	N/A	N/A
	4.5.4	15,724	13,403	85%	1.53	4	53,611	N/A	N/A
	4.5.4	129,495	97,141	75%	19.81	10	971,412	N/A	N/A
Total		***342,664***	***309,618***	***90%***	***44.78***		***1,844,241***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM *adjusted* baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 90%.

Based on algorithms in TRM 3.0 measure 4.5.4, the ex post savings for the first measure was 661 kWh per fixture, whereas the ex ante savings estimate was 525kWh per fixture.

The realization for the second measure is 100%.

The ex post savings for the third measure was 2681kWh per fixture, whereas the ex ante savings estimate was 3145kWh per fixture.

The ex post savings for the fourth measure was 1199kWh per fixture, whereas the ex ante savings estimate was 1599kWh per fixture.

Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contribute to the difference between ex ante savings and ex post savings.

Name C2

Executive Summary

Under application C2, the customer received custom incentives from the Illinois Department of Commerce for retrofitting the aerobic digestion process with new blowers at their waste water treatment plant. The electric realization rate for this project is 121%.

Project Description

The WWTP installed (2) new rotary lobe VFD blowers to replace the existing 75hp positive displacement blowers, which ran at full speed and over-aerated the digester tanks. The new blowers (#5 and #8) are controlled via timers and ORP feedback to modulate their speed so they can provide a more optimal air flow to the aerobic digestion process. The blowers are set to maximum speeds of 35% and 90%, respectively.

Methodology for Estimating Gross Savings

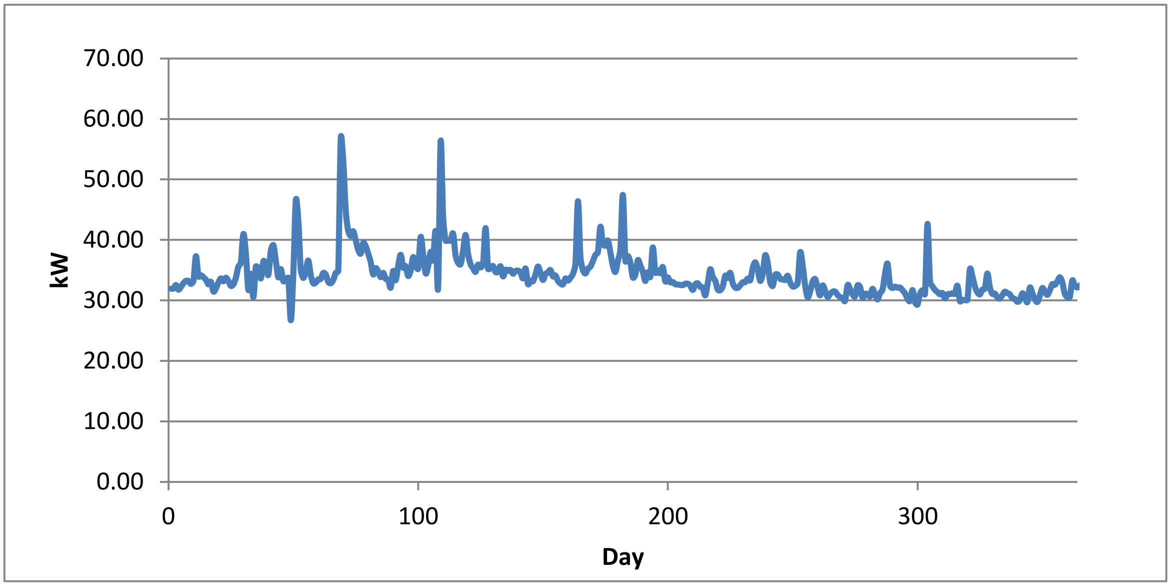
During the M&V visit, ADM staff verified equipment had been installed and was operating. ADM recorded equipment nameplates and took one-time power measurements at each blower's VFD. ADM also collected daily plant influent flow data over a 3-year period and collected blower speed data for a period of 16 days in January 2015.

To determine as-built blower consumption, blower speed and VFD frequency were correlated via the one-time power measurement, and VFD affinity laws were used to determine blower power from the speed data for each blower. These power data were combined and linearly regressed against daily plant influent flow during the data period, which yielded the following equation with an R^2 value of 0.882:

$$kW = 47.93 * MGD$$

Daily influent flow data were averaged over three years to determine typical flow for each day of the year. These flow data were used in the regression formula to yield the typical annual demand profile for the new blowers.

New Blowers' Typical Annual Demand Profile



Since the baseline blowers ran at constant full speed, the baseline consumption was determined by averaging 10 days of blower power data, which was provided by the contractor, applying it to two blowers, and multiplying it by 8,760 annual hours of operation.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for New Rotary Lobe VFD Blowers

Measure	*Average kW Demand*		*Operating Hours*	*Annual Gross kWh Savings*	
	Pre	*Post*		*Ex Ante*	*ADM Calculated Ex Post*
Rotary Lobe VFD Blowers	131.39	34.19	8,760	701,895	851,445
Total				701,895	851,445

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	Rotary Lobe VFD Blowers	701,895	851,445	121%	96.51	12,771,675
Total		***701,895***	***851,445***	***121%***	***96.51***	***12,771,675***

The realization rate for this project is 121%. The realization is high because the ex ante baseline demand was underestimated (by ~16%), as determined by interviewing the contractor about baseline blower usage and re-calculating baseline usage for two blowers running 8,760 hours, each.

Additionally, the ex-ante calculation of consumption for the new blowers was based on manufacturer performance data that provided blower shaft (brake) horsepower values at different blower speed settings. The brake horsepower values were directly used in the calculation of consumption, and motor and VFD efficiencies were neglected.

Name S-3

Executive Summary

Under project S-3, the program participant received Standard Program incentives from the Illinois Department of Commerce for a street lighting retrofit project. The gross realization rate for this project is 96%.

Project Description

The customer performed the following lighting fixture retrofit:

- (400) 175W Mercury Vapor Street Lamps retrofitted with 100W LED Street Lamps

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings of Lighting Retrofit

Measure	*Calculation inputs*						*Annual Gross kWh Savings*		
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe*	*Ex Ante*	*TRM-Calculated*	*TRM-Calculated Errata Corrected*
								Ex Post	*Ex Post*
LED Bulbs and Fixtures	400	TRM=182.9 Actual =203	TRM=52.5 Actual =53	4,903	TRM=0.91 Errata =1.0	1	267,704	232,724	255,740
Total							***267,704***	***232,724***	***255,740***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

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Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Quantity*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh (ADM Corrected if Applicable*)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (ADM Corrected if Applicable*)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	400	267,703	255,740	96%	0	15	3,836,107	0	0
Total			***267,703***	***255,740***	***96%***	***0***		***3,836,107***	***0***	***0***

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable

The project realization rate is 96%. The per fixture kWh reduction used in the tracking system for exterior LED lighting was 669.26, as opposed to the errata corrected kWh per fixture of 639.351.

For this measure (4.5.4), the program tracking system did not record the number of actually-implemented measures; instead, the number was based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differed from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

The Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence exists between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the tracking system.

Name S4

Executive Summary

Under project S4, the program participant received Standard Program incentives from the Illinois Department of Commerce for a retrofitting lighting project. The gross realization rate for this project is 138%.

Project Description

The customer performed the following lighting fixture retrofit:

- (180) 4’ 1LT8 32W lamps with 28W lamps
- (10) 75W Incandescent lamps with (10) 10.5W LED lamps
- (4) 200W Incandescent lamps with (4) 14W LED lamps
- (27) 200W Incandescent lamps with (27) 19W LED lamps
- (36) 200W Incandescent lamps with (36) 19W LED lamps
- (18) 250W Metal Halide lamps with (18) 19W LED lamps
- (1) 150W Metal Halide lamp with (1) 50W LED Wall Pack
- (4) 200W Incandescent fixtures with (2) 4’ 4LT5 fixtures
- (6) 200W Incandescent fixtures with (3) 4’ 4LT5 fixtures
- (22) 400W Metal Halide fixtures with (10) 4’ 4LT5 fixtures
- (12) 1000W Metal Halide fixtures with (20) 4’ 6LT5 fixtures
- (118) 200W Incandescent fixtures with (118) 2’ LED 32W
- (141) 100W Incandescent fixtures with (141) 2’ LED 32W
- (20) 1000W Metal Halide lamps with (40) LED High Bay
- (42) 400W Metal Halide lamps with (22) LED High Bay
- (8) 150W Metal Halide lamps with (8) LED Canopy
- (2) 150W Metal Halide fixtures with (2) LED Floods
- (1) 400W Metal Halide fixture with (1) LED Flood Light
- (5) 200W Incandescent fixtures with (5) 4’ 1LT8 fixtures
- (56) 300W Incandescent fixtures with (21) 4’ 2LT8 fixtures
- (97) 111W 4’ 4LT8 fixtures with (76) 4’ 3LT8 fixtures
- (80) 150W Incandescent fixtures with (40) 4’ 3LT8 fixtures
- (13) 1080W Metal Halide fixtures with (15) 4’ 6LT8 fixtures
- (28) 458W Metal Halide fixtures with (15) 4’ 6LT8 fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting project.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.3, 4.5.4, and 4.5.12. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*			
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated*	*Errata Corrected*	*ADM Calculated*
								Ex Post	*Ex Post*	*Ex Post*
HP & RW T8 Fixtures and Lamps	180	TRM = 32 Actual=28	TRM = 25 Actual = 25	TRM=4311 Actual=4581	1.00	1.23	4,581	6,681		
LED Bulbs and Fixtures	10	TRM = 40 Actual=43	TRM =10.6 Actual = 11	TRM=2327 Actual=200	TRM = 0.91 Errata = 1.00	1.23	7,522	766	841	787
LED Bulbs and Fixtures	4	TRM 50 Actual=20	TRM 14.4 Actual = 14	TRM=2327 Actual=3000	TRM = 0.91 Errata = 1.00	1.23		371	408	2,745
LED Bulbs and Fixtures	18	TRM = 50 Actual=195	TRM 22.5 Actual =19	TRM=2327 Actual=3640	TRM = 0.91 Errata = 1.00	1.23		1,289	1,417	14,184
LED Bulbs and Fixtures	63	TRM = 50 Actual=200	TRM =22.5 Actual = 19	TRM=2327 Actual=5460	TRM = 0.91 Errata = 1.00	1.23		4,512	4,959	76,580
LED Bulbs and Fixtures	1	TRM=182.9 Actual=188	TRM =52.5 Actual = 50	TRM=2422 Actual=2000	TRM = 0.91 Errata = 1.00	1.23	90	582	639	
HP & RW T8 Fixtures and Lamps	5	TRM = 57 Actual=200	TRM = 25 Actual=37	TRM=4311 Actual=3000	1.00	1.23	311,336	848		
HP & RW T8 Fixtures and Lamps	21	TRM = 94 Actual=300	TRM = 49 Actual=54	TRM =4311 Actual=5460	1.00	1.23		5,011		
HP & RW T8 Fixtures and Lamps	76	TRM =110 Actual=111	TRM =72 Actual=74	TRM =4311 Actual=3000	1.00	1.23		15,314		
HP & RW T8 Fixtures and Lamps	40	TRM = 147 Actual=150	TRM = 72 Actual=74	TRM =4311 Actual=3000	1.00	1.23		15,908		
HP & RW T8 Fixtures and Lamps	15	TRM = 455 Actual=1080	TRM = 206 Actual=218	TRM =4311 Actual=5460	1.00	1.23		19,805		
HP & RW T8 Fixtures and Lamps	15	TRM =455 Actual=458	TRM = 206 Actual=218	TRM =4311 Actual=5460	1.00	1.23		19,805		
LED Bulbs and Fixtures	118	TRM = 59 Actual=200	TRM =32.2 Actual = 32	TRM=4311 Actual=4000	TRM = 0.91 Errata = 1.00	1.23	102,804	15,260	16,769	97,534
LED Bulbs and Fixtures	141	TRM = 59 Actual=43	TRM =32.2 Actual = 32	TRM=4311 Actual=5460	TRM = 0.91 Errata = 1.00	1.23		18,234	20,037	10,416

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*			
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated*	*Errata Corrected*	*ADM Calculated*
								Ex Post	*Ex Post*	*Ex Post*
LED Bulbs and Fixtures	22	TRM = 295 Actual=458	TRM=160.2 Actual=160	TRM=4311 Actual=3500	TRM = 0.91 Errata = 1.00	1.23		14,310	15,725	28,224
LED Bulbs and Fixtures	40	TRM = 295 Actual=1085	TRM=160.2 Actual 225	TRM=4311 Actual=5460	TRM = 0.91 Errata = 1.00	1.23		26,018	28,591	231,024
LED Bulbs and Fixtures	1	TRM=361.4 Actual=458	TRM=116.8 Actual=112	TRM=4903 Actual=3000	TRM = 0.91 Errata = 1.00	1.00	7,808	1,091	1,199	
LED Bulbs and Fixtures	2	TRM=182.9 Actual=188	TRM =52.5 Actual = 30	TRM=4903 Actual=2000	TRM = 0.91 Errata = 1.00	1.00		1,164	1,279	
LED Bulbs and Fixtures	8	TRM=182.9 Actual=188	TRM =52.5 Actual = 52	TRM=4903 Actual=2000	TRM = 0.91 Errata = 1.00	1.00		4,654	5,115	
T5 Fixtures and Lamps	2	TRM = 295 Actual=200	TRM = 240 Actual=216	TRM=4311 Actual=2600	1.00	1	26,180	474		1,586
T5 Fixtures and Lamps	3	TRM = 295 Actual=200	TRM = 240 Actual=216	TRM=4311 Actual=5460	1.00	1.23		875		2,927
T5 Fixtures and Lamps	10	TRM = 295 Actual=458	TRM = 240 Actual=216	TRM=4311 Actual=2600	1.00	1.23		2,916		41,975
T5 Fixtures and Lamps	20	TRM = 360 Actual=1080	TRM =350 Actual=324	TRM=4311 Actual=2600	1.00	1.23		1,061		34,360
Total							***460,322***	***176,949***	***96,979***	***542,342***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values. For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-level Gross Realized Savings

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings					Lifetime Gross Savings	Spillover	
		Ex Ante kWh	Ex Post kWh (ADM Corrected if applicable*)	Realization Rate	Ex Post Peak kW Reduction	Measure Life (Years)	Ex Post kWh (ADM/Errata Corrected if Applicable)*	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.3	4,581	6,681	146%	0.21	15	100,218	0	0
	4.5.4	7,522	94,297	1254%	2.55	15	1,414,449	0	0
	4.5.4	91	639	703%	0.00	15	9,590	0	0
	4.5.3	311,336	76,690	25%	2.35	15	1,150,357	0	0
	4.5.4	102,804	367,197	357%	10.15	8.1	2,974,299	0	0
	4.5.4	7,808	7,593	97%	0.00	15	113,892	0	0
	4.5.12	26,180	80,849	309%	2.49	15	1,212,730	0	0
Total		***460,322***	***665,307***	***138%***	***17.99***		***6,975,535***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The project-level gross realization rate is 138%.

Based on algorithms in TRM version 3.0 measure 4.5.3, the calculated average ex post savings per fixture for the first and fourth program measures were 39.12 kWh and 445.87kWh, whereas the ex ante savings estimates were 25.45 kWh and 445.87 kWh per fixture, respectively.

Based on algorithms in TRM version 3.0 measure 4.5.4, the ADM corrected ex post savings per fixture for the second and fifth program measures were 992.60kWh and 1,143.92kWh, whereas the ex ante savings estimates were 79.18kWh and 320.26kWh per fixture, respectively.

Based on algorithms in TRM version 3.0 measure 4.5.4, the errata corrected ex post savings per fixture for the third and sixth program measures were 639.35kWh and 690.25KWh, whereas the ex ante savings estimate were 91kWh and 709.82kWh per fixture, respectively.

Based on algorithms in TRM version 3.0 measure 4.5.12, the ADM corrected ex post savings per fixture for the seventh program measure was 2,309.96kWh, whereas the ex ante savings estimate was 748kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For the second, third, fifth, and sixth measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

For the fourth and seventh measures (4.5.3 and 4.5.12), the program tracking system does not record the number of actually-implemented measures; instead, the number of measures is estimated based on the equation [Connected Watt Reduction / 116.0 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (116) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-5

Executive Summary

Under project S-5, the program participant received Standard Program incentives from Illinois Department of Commerce for a lighting retrofit project. The gross realization rate for this project is 107%.

Project Description

The customer performed the following lighting fixture retrofits:

- (1080) 4' 1LT8 fixtures were relamped with more efficient T8 lamps
- (50) 4' 4LT12 fixtures with (50) 4' 3LT8 fixtures
- (2) 4' 4LT12 fixtures with (2) 4' 2LT8 fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.3. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*	
	Qty.	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated* / *Ex Post*
HP & RW T8 Fixtures and Lamps	1080	TRM = 32 Actual = 28	TRM = 25 Actual=25	TRM=4,311 Actual=3,000	1.0	1.23	27,486	40,087
HP & RW T8 Fixtures and Lamps	50	TRM = 147 Actual=158	TRM = 72 Actual=74	TRM=4,311 Actual=4,368	1.0	1.23	28,924	19,884
HP & RW T8 Fixtures and Lamps	2	TRM = 94 Actual=158	TRM = 49 Actual=49	TRM=4,311 Actual=4,368	1.0	1.23		477
Total							***56,410***	***60,449***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Summary of Project-level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Lifetime of Equipment (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.3	27,486	40,087	146%	1.23	15	601,307	N/A	N/A
	4.5.3	28,924	20,362	70%	.63	15	305,426	N/A	N/A
Total		***56,410***	***60,449***	***107%***	***1.86***		***906,733***		

The realization rate for this project is 107%. Based on algorithms in TRM 3.0 measure 4.5.3, the ADM calculated ex post savings were 37.12 kWh and 391.57kWh, whereas the ex ante savings estimate was 25.45kWh and 556.23kWh per fixture, respectively.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

Name S-6

Executive Summary

Under project S-6, the program participant received Standard Program incentives from the Department of Commerce for a lighting retrofit project. The realization rate for this project is 66%.

Project Description

The customer performed the following retrofits:

- (50) 4' 4LT12 delamping
- (25) 4' 4LT12 relamped with 2LT8
- (27) 4' 4LT12 retrofitted with 4' 4LT8
- (6) 4' 4LT12 retrofitted with 4' 4LT8
- (4) Incandescent exit signs replaced with LED exit signs

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2, 4.5.3, and 4.5.5. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

<table>
<tr><th rowspan="3">Measure</th><th colspan="6">Calculation Inputs</th><th colspan="2">Annual Gross kWh Savings</th></tr>
<tr><th rowspan="2">Qty</th><th rowspan="2">Existing Wattage</th><th rowspan="2">Efficient Wattage</th><th rowspan="2">Hours</th><th rowspan="2">In-Service Rate</th><th rowspan="2">WHFe-IF</th><th rowspan="2">Ex Ante</th><th>TRM Calculated</th></tr>
<tr><th>Ex Post</th></tr>
<tr><td>Fluorescent Delamping</td><td>50</td><td>TRM = 33.7
Actual=39.5</td><td>TRM = 0
Actual = 0</td><td>TRM=4439
Actual=3500</td><td>1.00</td><td>1.25</td><td>8,545</td><td>9,350</td></tr>
<tr><td>HP & RW T8 Fixtures and Lamps</td><td>25</td><td>TRM = 82
Actual =79</td><td>TRM = 49
Actual =49</td><td>TRM=4439
Actual=3500</td><td>1.00</td><td>1.25</td><td rowspan="2">13,887</td><td>4,578</td></tr>
<tr><td>HP & RW T8 Fixtures and Lamps</td><td>27</td><td>TRM = 139
Actual =144</td><td>TRM = 94
Actual=111</td><td>TRM=4439
Actual=3500</td><td>1.00</td><td>1.25</td><td>6,742</td></tr>
<tr><td>Commercial LED Exit Signs</td><td>6</td><td>TRM = 35
Actual = 41</td><td>TRM = 3
Actual = 3</td><td>TRM=8760
Actual=8760</td><td>N/A</td><td>1.25</td><td>920</td><td>1,402</td></tr>
<tr><td>HP & RW T8 Fixtures and Lamps</td><td>6</td><td>TRM = 164
Actual =158</td><td>TRM = 94
Actual=99</td><td>TRM=4439
Actual=3500</td><td>1.00</td><td>1.25</td><td>13,669</td><td>2,330</td></tr>
<tr><td colspan="7">Total</td><td>37,021</td><td>24,401</td></tr>
</table>

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Measure Life (yrs)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.2	8,545	9,350	109%	1.45	11	102,846	N/A	N/A
	4.5.3	13,887	11,319	82%	1.75	15	169,792	N/A	N/A
	4.5.5	920	1,402	152%	0.11	16	22,426	N/A	N/A
	4.5.3	13,669	2,330	66%	0.36	15	34,957	N/A	N/A
Total		***37,021***	***24,401***	***66%***	***3.67***		***330,021***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 66%. Based on algorithms in TRM 3.0 measure 4.5.2, the calculated ex post savings for the first program measure was 186.99kWh per fixture, whereas the ex ante savings estimate was 170.9kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.3, the calculated average ex post savings for the second and fourth program measures were 217.68kWh and 388.41kWh per fixture, whereas the ex ante savings estimate was 267.06 kWh and 2,278.17kWh per fixture, respectively.

The calculated average ex pose savings from the third program measure was 350.40kWh per fixture, whereas the ex ante savings estimate was 230kWh per fixture.

The Department of Commerce incentivized the second and fourth measures(4.5.3) on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

Name S7

Executive Summary

Under application S7, the customer received standard incentives from the Illinois Department of Commerce for the installation of two high efficiency air cooled chillers. The electric realization rate for the project is 118%.

Project Description

The customer installed two (2) new air cooled electric chillers, one with a 98.3 ton capacity and the other with an 84 ton capacity. The installed chillers have a rated IPLV of 15.5 and 15.9 respectively and serve independent chilled water loops.

Methodology for Estimating Gross Savings

ADM staff performed a site inspection to ensure the claimed equipment was installed and proper as-built efficiencies were being applied.

Standard Incentives

For the chiller incentives, TRM Version 3.0, Section 4.4.6 Electric Chiller was used. It should be noted that the TRM does not apply for multiple chiller configurations; however, the facility utilizes two independent chilled water loops in which the chillers are not operating in parallel. Due to this, the TRM is able to be used to determine ex post savings.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = TONS * ((IPLV_{base}) - (IPLV_{ee})) * EFLH$$

Where:

TONS = chiller nominal cooling capacity in tons (note: 1 ton = 12,000 Btu/hr)

$IPLV_{base}$ = efficiency of baseline equipment expressed as Integrated Part Load Value(kW/ton).

$IPLV_{ee}$ = efficiency of high efficiency equipment expressed as Integrated Part Load Value (kW/ton)

EFLH = Equivalent Full Load Hours for cooling

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW_{SSP} = TONS * ((PE_{base}) - (PE_{ee})) * CF_{SSP}$$

$$\Delta kW_{PJM} = TONS * ((PE_{base}) - (PE_{ee})) * CF_{PJM}$$

Where:

PEbase = Peak efficiency of baseline equipment expressed as Full Load (kW/ton)

PEee = Peak efficiency of high efficiency equipment expressed as Full Load (kW/ton)

	= Actual installed
CF_{SSP}	= Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)
	= 91.3%
CF_{PJM}	= PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Air Cooled Chillers

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Tons*	*Path followed*	*Equipment type*	*Zone*	*Building Type*	*IPLVee*	*EERee*	*Ex Ante*	*TRM-Calculated Ex Post*
Electric Chiller	TOS	98.3	PATH A	Air Cooled Chillers	3 (Springfield)	Office - Low Rise	15.5	10.2	4,324	4,768
Electric Chiller	TOS	84.0	PATH A	Air Cooled Chillers	3 (Springfield)	Office - Low Rise	15.9	10.3	3,503	4,483
Total									7,827	9,251

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	Electric Chiller	7,827	9,251	118%	13.97	185,031		
Total		***7,827***	***9,251***	***118%***	***13.97***	***185,031***		

The project has an overall electric realization rate of 118%. ADM is unable to fully explain the difference between the ex ante and ex post savings as ex ante calculations were not provided. It can be assumed that different capacities, hours, and/or efficiencies were used.

Name S - 8

Executive Summary

Under application S-8, the customer received standard incentives from the Illinois Department of Commerce for the installation of two high efficiency boilers, one new air cooled chiller, and two VFDs on chilled water pumps at an elementary school. The electric realization rate is 106% and the natural gas realization rate for this project is 160%.

Project Description

The customer installed (2) new P-K Mach high efficiency boilers. The installed boilers have an efficiency of 96% AFUE, with an individual capacity of 2,000,000 Btu/h. The newly installed electric chiller has a total cooling capacity of 98.3 tons with a with a 15.4 IPLV efficiency rating. In addition to the new chiller, VFDs were installed on (2) 7.5 hp chilled water pumps to help reduce pumping costs.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied.

Standard Incentives

For the boiler incentives, TRM Version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = EFLH * Capacity * ((EffRating_{actual} - EffRating_{base})/EffRating_{base}) / 100{,}000$$

Where:

EFLH = Equivalent Full Load Hours for heating (see table)

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependent on year and boiler type. Baseline efficiency values by boiler type and capacity are found in the Definition of Baseline Equipment Section

EfficiencyRating(actual) = Efficient Boiler Efficiency Rating use actual value

For the chiller incentives, TRM Version 3.0, Section 4.4.6 Electric Chiller was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = TONS * ((IPLV_{base}) - (IPLV_{ee})) * EFLH$$

Where:

TONS = chiller nominal cooling capacity in tons (note: 1 ton = 12,000 Btu/hr)

$IPLV_{base}$ = efficiency of baseline equipment expressed as Integrated Part Load Value(kW/ton).

$IPLV_{ee}$ = efficiency of high efficiency equipment expressed as Integrated Part Load Value (kW/ton)

EFLH = Equivalent Full Load Hours for cooling

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW_{SSP} = TONS * ((PE_{base}) – (PE_{ee})) * CF_{SSP}

ΔkW_{PJM} = TONS * ((PE_{base}) – (PE_{ee})) * CF_{PJM}

Where:

PEbase = Peak efficiency of baseline equipment expressed as Full Load (kW/ton)

PEee = Peak efficiency of high efficiency equipment expressed as Full Load (kW/ton)

= Actual installed

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

CF_{PJM} = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak

For the chilled water pump VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $kW_{connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227

Application	ESF
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kWconnected * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Boiler btuh*	*Building Type*	*Efficient Measure*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Boiler	TOS	2,000,000	Elementary	Custom	2,100	3,360
High Efficiency Boiler	TOS	2,000,000	Elementary	Custom	2,100	3,360
Total					4,200	6,720

Annual kWh Savings for VFDs on Pumps

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5 HP	School(K-12)	4,611	4,606
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5 HP	School(K-12)	4,611	4,606
Total						9,222	9,212

Annual kWh Savings for Air Cooled Chillers

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Tons*	*Path followed*	*Equipment type*	*Zone*	*Building Type*	*IPLVee*	*EERee*	*Ex Ante*	*TRM-Calculated Ex Post*
Electric Chiller	TOS	98.3	PATH A	Air Cooled Chillers	2 (Chicago)	Elementary	15.4	10.1	5,520	6,344
Total									5,520	6,344

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
High Efficiency Boiler	High Efficiency Boiler	4,200	6,720	160%	134,400	
Total		***4,200***	***6,720***	***160%***	***134,400***	

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	VFDs	9,222	9,212	100%	2.89	138,186		
	Chiller	5,520	6,344	115%	6.00	126,882		
Total		***14,742***	***15,556***	***106%***	***8.89***	***265,068***		

The 160% verified natural gas realization rate is due to the ex ante analysis assuming that a single 95% efficient, 4,000,000 Btu/h boiler was installed. In actuality a pair of 96% efficient, 2,000,000 Btu/h boilers were installed. By performing the ex ante calculations with a 4,000,000 Btu/h capacity, the baseline efficiency is slightly higher than for a 2,000,000 Btu/h boiler. The ex ante analysis also underestimated the as-built boiler efficiency at 95% compared to the manufacturer reported efficiency of 96%

The electric measures have a combined verified realization rate of 106%. The higher realization rate is attributed to ADM calculating a higher than expected savings for the new electric chiller. ADM was not provided the ex ante calculations but it is assumed that different capacities and/or efficiencies were used.

Name S-9

Executive Summary

Under application S-9, the customer received standard incentives from the Illinois Department of Commerce for the installation of two high efficiency boilers, two high efficiency water heaters, one new air cooled chiller, two VFDs on chilled water pumps, and one high efficiency packaged air conditioner at a middle school. The electric realization rate is 78% and the natural gas realization rate for this project is 131%.

Project Description

The customer installed (2) new P-K Mach high efficiency boilers. The installed boilers have an efficiency of 95% AFUE, with an individual capacity of 3,000,000 Btu/h. Along with the boiler a pair of A.O. Smith BTH-120 hot water heaters were installed.

In order to decrease the schools' cooling energy consumption the customer also installed a new air cooled electric chiller which has a total cooling capacity of 277 tons with an 18 IPLV efficiency rating. In addition to the new chiller, VFDs were installed on (2) 25 hp chilled water pumps to help reduce pumping costs. A new three ton unitary packaged unit air conditioner was also installed.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied.

Standard Incentives

For the boiler incentives, TRM Version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = EFLH * Capacity * ((EffRating_{actual} - EffRating_{base})/EffRating_{base}) / 100{,}000$$

Where:

EFLH = Equivalent Full Load Hours for heating (see table)

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependent on year and boiler type. Baseline efficiency values by boiler type and capacity are found in the Definition of Baseline Equipment Section

EfficiencyRating(actual) = Efficient Boiler Efficiency Rating use actual value

For the water heaters, TRM Version 3.0, Section 4.3.1 Storage Water Heater was used.

NATURAL GAS ENERGY SAVINGS

TRM Section 4.3.1 provides a deemed savings estimated based upon the building type the new water heater is installed in. The following graphic presents the savings estimates from the section of the TRM:

Annual Therms Savings for Hot Water Heaters by Building Type

<table>
<tr><th>Gas, High Efficiency</th><th>Gas, Standard</th></tr>
<tr><td>The annual natural gas energy savings from this measure is a deemed value equaling 251[6]</td><td>Gas savings depend on building type and are based on measure case energy factor of 0.67 and a heating capacity of 75 MBtuh. These values are averages of qualifying units. Savings values are derived from 2008 DEER Miser, which provides MBtuh gas savings per MBtuh capacity. Savings presented here are per water heater.[7]
<table>
<tr><th>Building Type</th><th>Energy Savings (therms/unit)</th></tr>
<tr><td>Assembly</td><td>185</td></tr>
<tr><td>Education – Primary/Secondary</td><td>124</td></tr>
<tr><td>Education – Post Secondary</td><td>178</td></tr>
<tr><td>Grocery</td><td>191</td></tr>
<tr><td>Health/Medical - Hospital</td><td>297</td></tr>
<tr><td>Lodging - Hotel</td><td>228</td></tr>
<tr><td>Manufacturing - Light Industrial</td><td>140</td></tr>
<tr><td>Office – > 60,000 sq-ft</td><td>164</td></tr>
<tr><td>Office – < 60,000 sq-ft</td><td>56</td></tr>
<tr><td>Restaurant - FastFood</td><td>109</td></tr>
<tr><td>Restaurant – Sit Down</td><td>166</td></tr>
<tr><td>Retail</td><td>105</td></tr>
<tr><td>Storage</td><td>150</td></tr>
<tr><td>Multi-Family</td><td>119</td></tr>
<tr><td>Other</td><td>148</td></tr>
</table>
</td></tr>
</table>

For the chiller incentives, TRM Version 3.0, Section 4.4.6 Electric Chiller was used.

ELECTRIC ENERGY SAVINGS

$\Delta kWH = TONS * ((IPLV_{base}) - (IPLV_{ee})) * EFLH$

Where:

TONS = chiller nominal cooling capacity in tons (note: 1 ton = 12,000 Btu/hr)

$IPLV_{base}$ = efficiency of baseline equipment expressed as Integrated Part Load Value(kW/ton).

$IPLV_{ee}$ = efficiency of high efficiency equipment expressed as Integrated Part Load Value (kW/ton)

EFLH = Equivalent Full Load Hours for cooling

6 Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011. These deemed values should be compared to PY evaluation and revised as necessary

7 Gas Storage Water Heater 0.67. Work Paper WPRSGNGDHW106. Resource Solutions Group. December 2010

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW_{SSP} = TONS * ((PE_{base}) – (PE_{ee})) * CF_{SSP}

ΔkW_{PJM} = TONS * ((PE_{base}) – (PE_{ee})) * CF_{PJM}

Where:

PEbase = Peak efficiency of baseline equipment expressed as Full Load (kW/ton)

PEee = Peak efficiency of high efficiency equipment expressed as Full Load (kW/ton)

= Actual installed

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

CF_{PJM} = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak

For the chilled water pump VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $kW_{connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kW_{connected} * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

For the high efficiency packaged unit, the erratum TRM Version 4.0 Section 4.4.15 Single-Package and Split System Unitary Air Conditioners was used.

ELECTRIC ENERGY SAVINGS

For units with cooling capacities less than 65 kBtu/h:

$\Delta kWH = (kBtu/h) * [(1/SEER_{base}) – (1/SEER_{ee})] * EFLH$

For units with cooling capacities equal to or greater than 65 kBtu/h:

$\Delta kWH = (kBtu/h) * [(1/EER_{base}) – (1/EER_{ee})] * EFLH$

Where:

kBtu/h = capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).

$SEER_{base}$ = Seasonal Energy Efficiency Ratio of the baseline equipment; see table

$SEER_{ee}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).

EER_{base} = Energy Efficiency Ratio of the baseline equipment; see table above for default values. Since IECC 2006 does not provide EER requirements for air-cooled air conditioners < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1

EER_{ee} = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EER_{ee} is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.

= Actual installed

EFLH = cooling equivalent full load hours; see table

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW_{SSP} = (kBtu/h * (1/EER$_{base}$ - 1/EER$_{ee}$)) * CF_{SSP}

Where:

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Boiler btuh*	*Building Type*	*Efficient Measure*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Boiler	TOS	3,000,000	Elementary	Custom	3,026	3,995
High Efficiency Boiler	TOS	3,000,000	Elementary	Custom	3,026	3,995
Total					6,052	7,990

Annual Therms Savings for Storage Hot Water Heaters

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Measure Type*	*Tank Size*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	Gas, Standard	60 Gallon	Education – Primary/Secondary	124	124
Storage Water Heater	TOS	Gas, Standard	60 Gallon	Education – Primary/Secondary	124	124
Total					248	248

Annual kWh Savings for Air Cooled Chillers

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Tons*	*Path followed*	*Equipment type*	*Zone*	*Building Type*	*IPLVee*	*EERee*	*Ex Ante*	*TRM-Calculated Ex Post*
Electric Chiller	TOS	277	PATH A	Air Cooled Chillers	2 (Chicago)	Elementary	18	10.3	43,124	27,146
Total									43,124	27,146

Annual kWh Savings for VFDs on Pumps

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	25 HP	School(K-12)	15,370	15,268
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	25 HP	School(K-12)	15,370	15,268
Total						30,740	30,536

Annual kWh Savings for Unitary Air Conditioners

Measure	*Measure Metrics*							*Annual Gross kWh Savings*		
	Building Type	*Equipment type*	*Subcategory or rating Condition*	*New Cooling Capacity (kbtu/h)*	*SEER of Efficient Equipement*	*Zone*	*Electric Resistance Heat?*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Single-Package and Split System Unitary Air Conditioners	Elementary	Air conditioners, Air cooled	Single Package	36	15	2 (Chicago)	FALSE	118	132	282
Total								118	132	282

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings			Lifetime Gross Savings	Spillover
		Ex Ante Therms	Ex Post Therms	Realization Rate	Ex Post Therms	Annual Therms
Standard	High Efficiency Boiler	6,052	7,990	132%	159,805	
	Storage Water Heater	248	248	100%	3,720	
Total		***6,300***	***8,238***	***131%***	***163,525***	

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings	Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	Variable Speed Drives for HVAC	30,740	30,536	99%	9.59	458,042		
	Electric Chiller	43,124	27,146	63%	22.74	542,920		
	Single-Package and Split System Unitary Air Conditioners	118	282	239%	0.37	4,231		
Total		***73,982***	***57,964***	***78%***	***32.70***	***1,005,193***		

The natural gas measures have a combined realization rate of 131%. The cause of the higher realization rate can be attributed to ADM calculating a higher than expected natural gas savings for the new boiler. ADM calculated the annual natural gas savings for the boiler through the use of installed efficiency and EFLH for the correct building type in the IL TRM. It is likely that the ex ante analysis used average efficiencies and building types to estimate savings.

The electric measures have a combined realization rate of 78%. The cause of the lower realization rate can be attributed to ADM calculating a lower than expected electric savings for the new chiller. ADM calculated the annual electric savings for the chiller through the use of the

IL TRM and actual installed efficiencies, capacity, and building type. It is likely that the ex ante analysis used average efficiencies, capacity, and/or building types to estimate savings.

Name S-10

Executive Summary

Under project S-10, the program participant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofit project of T5 and LED fixtures. The realization rate for this project is 123%.

Project Description

The customer retrofitted the following fixtures:

- (94) 400W Metal Halide fixture with (94) 3LT5 High Bay fixture
- (32) 400W Metal Halide fixture with (24) 4LT5 High Bay fixture
- (40) 400W Metal Halide fixture with (40) 6LT5 High Bay fixture
- (34) 400W Metal Halide fixture with (34) 61W Wall Pack
- (52) 295W Metal Halide fixture with (52) 50W LED Garage/Canopy fixture

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.4 and 4.5.12. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*			
	Qty.	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated*	*Errata Corrected*	*ADM Calculated*
								Ex Post	*Ex Post*	*Ex Post*
T5 Fixtures and Lamps	94	TRM = 232 Actual = 458	TRM = 180 Actual=147	4,311	1.00	1.23		25,919		155,014
T5 Fixtures and Lamps	24	TRM = 295 Actual = 458	TRM = 240 Actual=216	4,311	1.00	1.23	245,359	6,999		50,226
T5 Fixtures and Lamps	40	TRM = 350 Actual = 458	TRM = 360 Actual=324	4,311	1.00	1.23		(2,121)		28,422
LED Bulbs and Fixtures	34	TRM = 182.9 Actual = 458	TRM =52.5 Actual= 61	4,311	TRM = 0.91 Errata = 1.00	1.23	46,725	21,393	23,509	65,132
LED Bulbs and Fixtures	52	TRM = 182.9 Actual = 295	TRM =52.5 Actual= 50	4,311	TRM = 0.91 Errata = 1.00	1.23		32,719	35,955	61,474
Total							***292,084***	***84,910***	***90.262***	***360,268***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh (Errata Corrected if Applicable)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (Errata Corrected if Applicable)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.12	245,359	233,661	95%	7.17	15	3,504,919	N/A	N/A
	4.5.4	46,725	126,606	271%	4.27	11.6	1,468,633	N/A	N/A
Total		***292,084***	***360,267***	***123%***	***11.45***		***4,973,552***	***N/A***	***N/A***

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 123%. Based on algorithms in TRM 3.0 measure 4.5.12, the ADM calculated average ex post savings for the first measure was 1,479kWh per fixture, whereas the average ex ante savings estimate was 1553kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.4, the ADM corrected ex post savings for the second measure was 1,472kWh per fixture, whereas the ex ante savings estimate was 543 kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For the first measure (4.5.12), the program tracking system does not record the number of actually-implemented measures; instead, the number of measures is estimated based on the equation [Connected Watt Reduction / 116.0 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (116) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

For the second measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt

Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S11

Executive Summary

Under application S11, the customer received standard incentives from the Illinois Department of Commerce for the installation of two high efficiency boilers, one new air cooled chiller, two VFDs on chilled water pumps, and two VFDs on hot water pumps at a middle school. The electric realization rate is 113% and the natural gas realization rate for this project is 150%.

Project Description

The customer installed (2) new P-K Mach high efficiency boilers. The installed boilers have an efficiency of 95% AFUE, with an individual capacity of 2,500,000 Btu/h. In order to decrease the schools' cooling energy consumption the customer also installed a new air cooled electric chiller, which has a total cooling capacity of 96.3 tons with a 15.4 IPLV efficiency rating. In addition to the new chiller, VFDs were installed on (2) 7.5 hp chilled water pumps and (2) 7.5 hp hot water pumps to help reduce pumping energy.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied.

Standard Incentives

For the boiler incentives, TRM Version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = EFLH * Capacity * ((EffRating_{actual} - EffRating_{base})/EffRating_{base}) / 100{,}000$$

Where:

EFLH = Equivalent Full Load Hours for heating (see table)

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependent on year and boiler type. Baseline efficiency values by boiler type and capacity are found in the Definition of Baseline Equipment Section

EfficiencyRating(actual) = Efficient Boiler Efficiency Rating use actual value

For the chiller incentives, TRM Version 3.0, Section 4.4.6 Electric Chiller was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = TONS * ((IPLV_{base}) - (IPLV_{ee})) * EFLH$$

Where:

TONS = chiller nominal cooling capacity in tons (note: 1 ton = 12,000 Btu/hr)

$IPLV_{base}$ = efficiency of baseline equipment expressed as Integrated Part Load Value(kW/ton).

$IPLV_{ee}$ = efficiency of high efficiency equipment expressed as Integrated Part Load Value (kW/ton)

EFLH = Equivalent Full Load Hours for cooling

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW_{SSP} = TONS * $((PE_{base}) – (PE_{ee}))$ * CF_{SSP}

ΔkW_{PJM} = TONS * $((PE_{base}) – (PE_{ee}))$ * CF_{PJM}

Where:

PEbase = Peak efficiency of baseline equipment expressed as Full Load (kW/ton)

PEee = Peak efficiency of high efficiency equipment expressed as Full Load (kW/ton)

= Actual installed

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

CF_{PJM} = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak

For the chilled and hot water pump VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $kW_{connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227

Application	ESF
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kW_{connected} * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Boiler btuh*	*Building Type*	*Efficient Measure*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Boiler	TOS	2,500,000	Elementary	Custom	2,625	3,938
High Efficiency Boiler	TOS	2,500,000	Elementary	Custom	2,625	3,938
Total					5,250	7,875

Annual kWh Savings for Air Cooled Chillers

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Tons*	*Path followed*	*Equipment type*	*Zone*	*Building Type*	*IPLVee*	*EERee*	*Ex Ante*	*TRM-Calculated Ex Post*
Electric Chiller	TOS	96.3	PATH A	Air Cooled Chillers	2 (Chicago)	Elementary	15.4	10.1	4,235	6,215
Total									4,235	6,215

Annual kWh Savings for VFDs on Pumps

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5 HP	School(K-12)	4,611	4,606
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5 HP	School(K-12)	4,611	4,606
Variable Speed Drives for HVAC	Hot Water Pump	TOS	HVAC	7.5 HP	School(K-12)	4,611	5,139
Variable Speed Drives for HVAC	Hot Water Pump	TOS	HVAC	7.5 HP	School(K-12)	4,611	5,139
Total						13,272	19,490

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	High Efficiency Boiler	5,250	7,875	150%	157,500	
Total		***5,250***	***7,875***	***150%***	***157,500***	

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	Variable Speed Drives for HVAC	18,444	19,490	106%	2.89	138,186		
	Electric Chiller	4,235	6,215	147%	5.88	124,301		
Total		***22,679***	***25,705***	***113%***	***8.77***	***262,487***		

The natural gas measure has a verified realization rate of 150%. The cause of the higher realization rate can be attributed to ADM calculating a higher than expected natural gas savings for the new boiler. ADM calculated the annual natural gas savings for the boiler through the use actual installed boiler efficiencies and EFLH for an elementary school according to the IL TRM. It is likely that the ex ante analysis used average efficiencies and building types to estimate savings.

The electric measures have a combined verified realization rate of 113%. The cause of the higher realization rate can be attributed to ADM calculating a higher than expected electric savings for the new chiller and VFDs. ADM calculated the annual electric savings for the chiller through the use of the IL TRM and actual installed efficiencies, capacity, and building type. It is likely that the ex ante analysis used average efficiencies, capacity, and/or building types to estimate savings. For the VFDs, the ex ante considered the VFDs installed on the hot water pumps as “VSD on HVAC Chiller,” this was an incorrect assumption and also contributed to the difference in realized savings.

Name C12

Executive Summary

Under application C12, the customer received custom incentives from the Illinois Department of Commerce for the installation of two high efficiency boilers. The electric realization rate is 133% and the natural gas realization rate for this project is 70%.

Project Description

The customer installed (2) two new high efficiency condensing boilers to handle the annual heating system baseload. The old system consisted of two identical forced-draft, hot water boilers with rated efficiency of 80% and rated capacity of 4,184 MBH output operating at equal capacity (no staging). The main hot water loop operated to make 180°F hot water supply temperature year-round to air handlers and zone terminal unit reheats.

The new system has two identical forced-draft, hot water boilers with rated efficiency of 98% at 80°F RWT and rated capacity of 785 MBH output at 80°F RWT in addition to the two old boilers. The main hot water loop operates on a temperature reset schedule. The new system operates with the new boilers operating together until their maximum capacity is reached, then the existing boilers fire one at a time to meet the load.

Methodology for Estimating Gross Savings

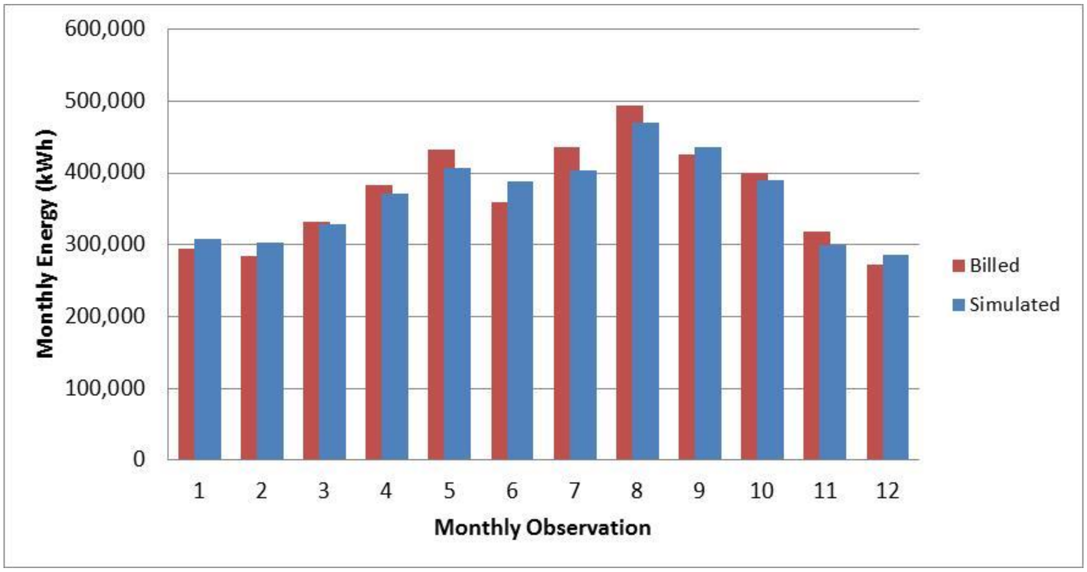
ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied. As-built operational characteristics of the HVAC equipment were collected through the facility's energy management system, and site contacts were interviewed to determine the baseline operation.

Custom Incentives

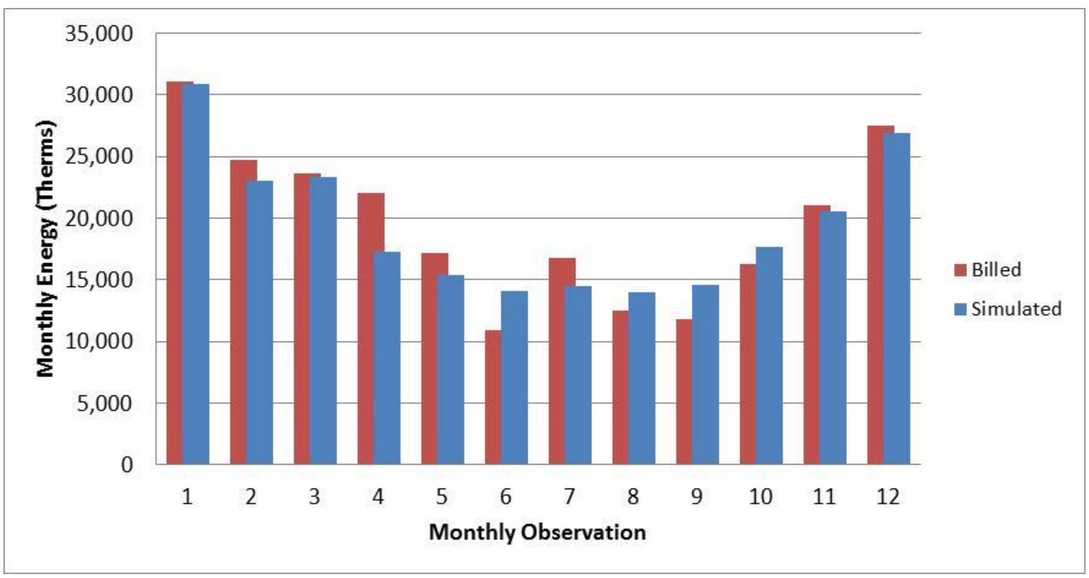
Savings for the installation of the boilers were calculated using an eQuest model. ADM verified inputs and calibrated the ex-ante model of the baseline facility. This was done using the details and construction documents collected during the on-site M&V visit and from the project documentation.

A custom weather file was created using August 2013 Thru July 2014 NOAA weather data for the region. The time period was selected because it was exactly one year before the retrofit. Using this weather file and the utility provided billing data for the project; ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

August 2013 Thru July 2014 Monthly Electric Calibration



August 2013 Thru July 2014 Monthly Natural Gas Calibration



Upon completion of the calibration for the baseline eQuest model, the impacts of the installed measures were added to create an as-built model. Once the as-built model was completed, the baseline and as-built models were run using St. Louis Missouri TMY3 weather data. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Electric and Natural Gas Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	*1,852,823*	*1,852,823*	*0*	*0*	*0*	*0*
Base HW	*995,974*	*994,267*	*1707*	*136,591*	*113,695*	*22,896*
Heating	*7,565*	*7,703*	*-138*	*89,510*	*87,142*	*2,368*
Cooling	*606,830*	*606,799*	*31*	*0*	*0*	*0*
Heat Rejection	*24,285*	*24,284*	*1*	*0*	*0*	*0*
Pumps	*216,440*	*212,968*	*3,472*	*0*	*0*	*0*
Fans	*492,864*	*492,853*	*11*	*0*	*0*	*0*
Exterior	*164,250*	*164,250*	*0*	*0*	*0*	*0*
Total	**4,361,031**	**4,355,947**	**5,084**	**226,101**	**200,837**	**25,264**

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for Boilers

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Boilers	3,819			5,084
Total	3,819			5,084

Annual Therms Savings for Boilers

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated*	*TRM-Calculated (Errata Corrected)*	*ADM Calculated*
		Ex Post	*Ex Post*	*Ex Post*
Boilers	35,872			25,264
Total	35,872			25,264

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	Boilers	35,872	25,264	70%	378,960
Total		***35,872***	***25,264***	***70%***	***378,960***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	Boilers	3,819	5,084	133%	0.00	76,260
Total		***3,819***	***5,084***	***133%***	***0.00***	***76,260***

The natural gas realization rate is 70%. The ex-ante analysis relied on an uncalibrated eQuest model. The ex-post analysis uses calibrated simulation that accounts for actual system operations. The ex-ante model assumed 24/7 heating, cooling, and ventilation. During the M&V site visit, ADM found that there were unoccupied setbacks and the fans turned off. This resulted in the ex-ante model overheating.

The electric realization rate is 133%. The ex-ante model had negative savings for pumps. The calibrated ex-post model realized positive savings for pumps. The negative savings were the result of the higher pump operation in the ex-ante model.

Name C13

Executive Summary

Under application C13, the customer received custom incentives from the Illinois Department of Commerce for the installation of Direct Digital Controls (DDC) on the HVAC system serving the facility. The overall electric realization rate is 54% and the overall natural gas realization rate for this project is 87%.

Project Description

The administration building recently retrofitted the existing pneumatic control system on six multi-zone air handling units and 51 fan coils with DDC controls. With the addition of the DDC, the facility was able to implement time-of-use controls to limit HVAC operation to when building is in use. Originally, the HVAC system operated 24/7 regardless of whether or not it was occupied, resulting in an excess of energy consumption. The new DDC also eliminate simultaneous heating and cooling and added enthalpy controls to the multi-zone air handling units.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the installation of the DDC on the multi-zone air handling units and fan coils. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational set-points from the building's energy management system (EMS).

Custom Incentives

Electric and natural gas energy savings were calculated using a pre/post billing regression. The regression compared the monthly billing data to the local weather in an effort to determine the effects that weather has on energy consumption.

The electric billing regression utilized the following variables: Cooling Degree Days (CDD), Heating Degree Days (HDD), number of days in the billing period, and a pre/post flag. Through the regression effort, ADM determined that the CDD base temperature was 58^{o}F and the HDD base temperature was 56^{o}F, resulting in an R^2 of 0.89. From the regression, the following equation was derived and used to calculate the monthly electric energy consumption for the pre and post configurations:

$$kWh_{Monthly} = 78.87 \times CDD - 29.07 \times HDD + 1{,}557.01 \times \#Days - 20{,}619.40 \times Post + 53{,}119.35$$

Where:

$kWh_{Monthly}$ = *Monthly kWh consumption*

CDD = *Number of Cooling Degree Days for the month*

HDD = *Number of Heating Degree Days for the month*

#Days = *Number of days in the month*

Post = *Pre/Post Binary Value, Pre = 0, Post =1*

The natural gas billing regression was performed in the same manner as the electric regression and utilized the following variables: Cooling Degree Days (CDD), Heating Degree Days (HDD), number of days in the billing period, and a pre/post flag. Through the regression effort, ADM determined that the CDD base temperature was 58°F and the HDD base temperature was 56°F, resulting in an R^2 of 0.99. From the regression, the following equation was derived and used to calculate the monthly electric energy consumption for the pre and post configurations:

$$Therm_{Monthly} = -1.70 \times CDD + 3.55 \times HDD + 221.69 \times \#Days - 1{,}222.05 \times Post - 4{,}375.24$$

Where:

$Therm_{Monthly}$ = *Monthly Therm consumption*

CDD = *Number of Cooling Degree Days for the month*

HDD = *Number of Heating Degree Days for the month*

#Days = *Number of days in the month*

Post = *Pre/Post Binary Value, Pre = 0, Post =1*

The annual energy savings for the DDC controls were determined by using the above derived equations to calculate the monthly pre/post energy consumption of the facility for TMY3 weather. The annual energy savings are the difference between the baseline and as-built energy consumption for the location.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for DDC Controls

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
DDC Controls	457,302			247,433
Total	457,302			247,433

Annual Therms Savings for DDC Controls

Measure	Annual Gross Therms Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
DDC Controls	16,810			14,665
Total	16,810			14,665

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings	Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Custom	DDC Controls	457,302	247,433	54%	31.67	3,711,492		
Total		***457,302***	***247,433***	***54%***	***31.67***	***3,711,492***		

Verified Natural Gas Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings			Lifetime Gross Savings	Spillover
		Ex Ante Therms	Ex Post Therms	Realization Rate	Ex Post Therms	Annual Therms
Custom	DC Controls	16,810	14,665	87%	219,969	
Total		***16,810***	***14,665***	***87%***	***219,969***	

The project has an overall electric realization rate of 54% and an overall natural gas realization rate of 87%. The overall low realization rate can be attributed to the ex ante analysis utilizing an uncalibrated Trane Trace model. Due to the model not being calibrated the consumption in the baseline was significantly overestimated, thus, resulting in an overestimation of savings for electricity and natural gas.

Name S-14

Executive Summary

Under project S-14, the program participant received Standard Program incentives from the Illinois Department of Commerce for retrofitting street lighting. The gross realization rate for this project is 107%.

Project Description

The customer retrofitted the following fixtures:

- (2) 175W Metal Halide fixtures with 30W mounted area lights
- (2) 175W Metal Halide fixtures with 50W mounted area lights
- (5) 250W Metal Halide fixtures with 60W mounted area lights
- (25) 150W Metal Halide fixtures with 4' 2LT8 2 x 4 fixtures
- (34) 400W Metal Halide fixtures with (18) 6LT5 high bay fixtures
- (56) 400W Metal Halide fixtures with 3LT5 high bay fixtures
- (140) 400W Metal Halide fixtures with 4LT5 high bay fixtures
- (1) 400W Metal Halide fixtures with 145W LED high bay fixtures
- (4) 1000W Metal Halide fixtures with LED Outdoor Pole Arm

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.3, 4.5.4, and 4.5.12. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*			
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated*	*Errata Corrected*	*ADM Calculated*
								Ex Post	*Ex Post*	*Ex Post*
LED Bulbs and Fixtures	4	TRM=361.4 Actual=1080	TRM =116.8 Actual =209	TRM=4903 Actual=4368	TRM = 0.91 Errata = 1.00	1.00	15,545	4,365	4,797	15,218
LED Bulbs and Fixtures	1	TRM = 295 Actual = 458	TRM= 160.2 Actual = 145	TRM=4311 Actual=4992	TRM = 0.91 Errata = 1.00	1.23	557	650	715	1,922
LED Bulbs and Fixtures	2	TRM =124.3 Actual = 215	TRM = 18.6 Actual = 30	TRM=4,903 Actual=4368	TRM = 0.91 Errata = 1.00	1.00	181	943	1,036	
LED Bulbs and Fixtures	5 2	TRM=182.9 Actual = 295 TRM=182.9 Actual = 215	TRM = 52.5 Actual = 60 TRM = 52.5 Actual = 50	TRM=4903 Actual=4368	TRM = 0.91 Errata = 1.00	1.00	1,235	2,909 1,164	3,197 1,279	
T5 Fixtures and Lamps	Post=18 Base=34	TRM = 476 Actual = 458	TRM = 360 Actual = 324	TRM=4311 Actual=4992	1.00	1.23	49,581	11,072		59,805
T5 Fixtures and Lamps	56	TRM = 295 Actual = 458	TRM = 180 Actual = 147	TRM=4311 Actual=4992	1.00	1.23	88,655	34,148		106,937
T5 Fixtures and Lamps	140	TRM = 455 Actual = 458	TRM = 240 Actual = 216	TRM=4311 Actual=4992	1.00	1.23	172,464	159,606		
HP & RW T8 Fixtures and Lamps	25	TRM = 94 Actual = 188	TRM = 49 Actual = 49	TRM=4311 Actual=4992	1.00	1.23	18,426	5,965		21,337
Total							***346,644***	***220,823***	***11,024***	***205,219***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values. TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh (ADM if applicable) **	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (ADM if applicable) **	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	15,545	15,218	98%	0.0	10.2	155,225	N/A	N/A
	4.5.4	557	1,922	345%	0.05	8.1	15,567	N/A	N/A
	4.5.4	181	1,036	572%	0.0	10.2	10,572	N/A	N/A
	4.5.4	1,235	4,475	362%	0.0	10.2	45,650	N/A	N/A
	4.5.12	49,581	59,805	121%	1.59	15	897,077	N/A	N/A
	4.5.12	88,655	106,937	121%	2.84	15	1,604,055	N/A	N/A
	4.5.12	172,464	159,606	93%	4.90	15	2,394,092	N/A	N/A
	4.5.3	18,426	21,337	116%	0.57	15	320,056	N/A	N/A
Total		***346,644***	***370,337***	***107%***			***5,442,295***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The project realization is 107%. Based on algorithms in TRM 3.0 measure 4.5.4, the ADM ex post savings for the first and second measures were 3,805kWh and 1,922KWh per fixture, whereas the ex ante savings estimates were 3,886kWh and 557kWh per fixture, respectively.

The TRM errata corrected ex post savings for the third and fourth measures were 518kWh and 639kWh per fixture, whereas the ex ante savings estimates were 91kWh and 176.4 kWh per fixture, respectively.

Based on algorithms in TRM 3.0 measure 4.5.12, the ADM calculated ex post savings for the fifth and sixth measures were 3,323kWh and 1,910kWh per fixture, whereas the ex ante savings estimates were 1,583kWh and 1,232kWh per fixture, respectively.

The TRM calculated ex post savings for the seventh measure was 1,140kWh per fixture, while the ex ante savings estimate was 1,232kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.3, the ADM calculated average ex post savings for the eighth measure was 853kWh per fixture, whereas the ex ante savings estimate was 737kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For the first, second, third, and fourth measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

For the fifth, sixth, and seventh measures (4.5.12), the program tracking system does not record the number of actually-implemented measures; instead, the number of measures is estimated based on the equation [Connected Watt Reduction / 116.0 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (116) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name SC-15

Executive Summary

Under project SC-15, the applicant received Standard and Custom Program incentives from the Illinois Department of Commerce for lighting and VAV retrofit projects. The realization rate for this project is 72%.

Project Description

The customer performed the following retrofits:

- (832) 4' T8 lamps delamped,
- (108) Incandescent lamps with LED lamps,
- (28) Incandescent Exit signs with LED Exit signs,
- (84) Remote-mounted lighting occupancy sensors were installed,
- (344) 4' 6LT5 fixtures retrofit, and
- Constant Volume (CV) to Variable Air Volume (VAV) Air Handling Unit (AHU).

Air handlers were supplying a constant volume of conditioned air to the space. By reducing the volume of the air, heating, cooling, and fan energy are conserved.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation and verified the installation of the lighting and VAV retrofit.

Standard Incentives

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2, 4.5.4, 4.5.5, and 4.5.12. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

ADM staff inspected project documentation pertaining to the lighting controls.

Energy savings for the lighting controls were calculated according to the Illinois TRM 3.0, measure 4.5.10. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled = total lighting load connected to the control in kilowatts

ESF = Energy Savings Factor

WHFe = waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd = heat factor to account for cooling demand savings

CFbaseline = Baseline Summer Peak Coincidence Factor

CFos = Retrofit Summer Peak Coincidence Factor

Custom Incentives

Annual energy savings for the installation of the conversion of the constant volume AHUs to VAV were calculated through the use a temperature bin analysis. The analysis was performed using two degree temperature bins and was informed by TMY3 weather data for the Chicago Waukegan. The temperature bin analysis relied on standard engineering heat transfer equations to determine the annual energy savings as a result of the reduction in outside air being supplied to the zones during occupied and non-occupied periods. The following table presents the calculated natural gas and electric savings for the VAV retrofit:

Annual Savings for VAV Retrofit

				Baseline				*As-Built*			
From	*To*	*Operating Hrs*	*Outdoor Enthalpy*	*Fan CFM*	*Fan kWh*	*Cooling kWh*	*Heating Therms*	*Supply Fan CFM*	*Fan kWh*	*Cooling kWh*	*Heating Therms*
94	92	4	44	36,000	69	285	0	26,362	32	209	0
92	90	26	42	36,000	447	1,674	0	22,077	132	1,027	0
90	88	26	40	36,000	447	1,530	0	22,005	131	935	0

				Baseline				*As-Built*			
From	*To*	*Operating Hrs*	*Outdoor Enthalpy*	*Fan CFM*	*Fan kWh*	*Cooling kWh*	*Heating Therms*	*Supply Fan CFM*	*Fan kWh*	*Cooling kWh*	*Heating Therms*
88	86	33	39	36,000	568	1,783	0	22,029	166	1,091	0
86	84	40	38	36,000	688	2,056	0	20,471	168	1,169	0
84	82	65	37	36,000	1,118	3,128	0	19,907	254	1,730	0
82	80	81	35	36,000	1,394	3,373	0	18,541	265	1,737	0
80	78	90	35	36,000	1,548	3,718	0	18,460	292	1,906	0
78	76	76	33	36,000	1,308	2,820	0	18,061	233	1,415	0
76	74	95	33	36,000	1,634	3,296	0	17,169	257	1,572	0
74	72	147	32	36,000	2,529	4,663	0	16,002	333	2,073	0
72	70	89	31	36,000	1,531	2,486	0	14,670	162	1,013	0
70	68	70	30	36,000	1,204	1,780	0	14,476	123	716	0
68	66	44	28	36,000	757	875	0	14,763	82	359	0
66	64	66	27	36,000	1,135	0	0	14,848	124	0	0
64	62	71	25	36,000	1,222	0	0	13,776	111	0	0
62	60	76	24	36,000	1,308	0	0	13,452	112	0	0
60	58	51	23	36,000	877	0	0	14,729	94	0	0
58	56	89	22	36,000	1,531	0	0	13,965	144	0	0
56	54	138	20	36,000	2,374	0	601	13,687	212	0	228
54	52	78	19	36,000	1,342	0	461	13,074	107	0	168
52	50	47	18	36,000	809	0	254	13,071	64	0	92
50	48	93	17	36,000	1,600	0	540	12,923	124	0	194
48	46	116	17	36,000	1,996	0	708	12,820	151	0	252
46	44	127	16	36,000	2,185	0	799	12,800	165	0	284
44	42	118	15	36,000	2,030	0	761	13,182	165	0	279
42	40	54	14	36,000	929	0	358	12,879	71	0	128
40	38	55	13	36,000	946	0	368	12,877	72	0	132
38	36	232	13	36,000	3,991	0	1,859	13,661	354	0	705
36	34	117	12	36,000	2,013	0	1,030	17,097	313	0	489
34	32	28	11	36,000	482	0	242	16,618	70	0	112
32	30	62	10	36,000	1,067	0	561	17,093	166	0	266
30	28	60	9	36,000	1,032	0	581	16,991	158	0	274
28	26	95	9	36,000	1,634	0	948	19,145	337	0	504
26	24	76	8	36,000	1,308	0	802	17,809	225	0	397
24	22	33	7	36,000	568	0	359	22,382	173	0	223

				Baseline				As-Built			
From	*To*	*Operating Hrs*	*Outdoor Enthalpy*	*Fan CFM*	*Fan kWh*	*Cooling kWh*	*Heating Therms*	*Supply Fan CFM*	*Fan kWh*	*Cooling kWh*	*Heating Therms*
22	20	58	7	36,000	998	0	606	24,293	373	0	409
20	18	83	6	36,000	1,428	0	886	24,939	570	0	614
18	16	24	5	36,000	413	0	252	28,889	238	0	202
16	14	12	5	36,000	206	0	124	27,726	107	0	96
14	12	19	4	36,000	327	0	199	28,466	182	0	157
12	10	18	4	36,000	310	0	193	28,071	166	0	151
10	8	10	3	36,000	172	0	107	28,977	100	0	86
8	6	6	3	36,000	103	0	68	27,770	54	0	53
6	4	4	2	36,000	69	0	46	25,958	30	0	33
4	2	4	1	36,000	69	0	48	24,210	26	0	32
2	0	5	1	36,000	86	0	61	23,546	30	0	40
0	-2	1	0	36,000	17	0	13	24,210	6	0	9

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Location	*Measure*	*Calculation Inputs*						*Annual Gross kWh Savings*		
		QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated*	*TRM-Calculated (Errata Corrected)*
									Ex Post	*Ex Post*
Office	Fluorescent Delamping	832	ADM = 48 TRM = 33.7	ADM = 0 TRM = 0	4,439	1	1.25	79,981	155,578	
Office	LED Bulbs and Fixtures	108	ADM = 48 TRM = 54.3	ADM = 20 TRM = 17.6	4,439	ADM = 1 TRM =.91	1.25	11,532	20,014	21,993
Office	LED Exit Sign	28	ADM = 25 TRM = 35	ADM = 2.2 TRM = 2	8,760	1	1.25	6,443	10,118	
Office	T5 Fixtures and Lamps	344	ADM = 96 TRM = 94	ADM = 56 TRM = 64	4,439	1	1.25	286,028	57,263	
Total								***383,984***	***242,973***	***21,993***

ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values. TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

The table below presents the realized gross energy savings of the lighting occupancy sensors, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings of Occupancy Sensors

Location	*Measure*	*Calculation Inputs*					*Annual Gross kWh Savings*	
		QTY	*kW Controlled*	*Hours*	*WHFe-IF*	*Ocs ESF*	*Ex Ante*	*TRM-Calculated Ex Post*
Office	Remote mounted occupancy sensors	84	21.472	4,439	1.25	.41	48,849	48,849
Total							***48,849***	***48,849***

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for the VAV Retrofit

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
VAV Retrofit	7,567			7,226
Total	7,567			7,226

Annual kWh Savings for the VAV Retrofit

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
VAV Retrofit	61,840			60,313
Total	61,840			60,313

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, and lighting controls.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*
Standard	4.5.2	79,981	155,578	195%	24.06	11	1,711,359
	4.5.4	11,532	21,993	174%	3.4	11	247,725
	4.5.5	6,443	10,118	157%	0.79	16	161,885
	4.5.10	48,849	48,849	100%	14.24	8	390,788
	4.5.12	286,028	57,263	20%	8.85	15	858,947
Subtotal		*432,833*	*293,801*	*68%*	*51.34*	-	*3,370,704*
Custom	CV to VAV	61,840	60,313	98%	0	15	904,690
Subtotal		*61,840*	*60,313*	*98%*	*0*	-	*904,690*
Total		***494,673***	***354,114***	***72%***	***51.34***	**-**	***4,275,394***

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	CV to VAV	7,567	7,226	95%	108,387
Total		***7,567***	***7,226***	***95%***	***108,387***

The electric realization rate for this project is 72%. The natural gas realization rate is 95%.

The realization rate for the first measure (4.5.2) was 195%. The high realization rate was due to the application materials listing an inaccurate number of lamps. The application materials listed the number of fixtures, rather than the number of lamps, leading to inaccuracies.

The realization rate for the second measure (4.5.4) was 174%. The Department of Commerce incentivized this measure on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

The realization rate for the third measure (4.5.5) was 157%. The high realization rate was due primarily to the difference between the actual and assumed wattages of the base and energy efficient fixtures.

The realization rate for the fourth measure (4.5.10) was 100%

The realization rate for the fifth measure (4.5.12) was 20%. The realization rate for this measure is low because of an error made in calculating the ex ante value. The ex ante figure was calculated by including the lamps that were delamped as well as those that were retrofitted, resulting in a very high ex ante figure. The correct ex ante should have been based only on the fixtures that were retrofitted.

The realization rates for the CV to VAV measure are 98% electric and 95% natural gas. The ex-post used a similar methodology as the ex-ante analysis; however, the e- post analysis made several significant changes. The ex-post analysis used enthalpy instead of dry-bulb temperature data because the local area is subject to significant humidity during the cooling season. The ex-post analysis also derived post fan load profiles from an eQuest model of the affected air handler. The ex-ante analysis relied on an assumed stepped profile, which was conservative. The ex-post analysis applied a derived heating load factor from eQuest. The ex-ante analysis assumed 100% of the return air always needed to be conditioned. While these were significant changes, the ex-ante estimate was conservative in one way while overestimating in another direction. The results were realization rates close to 100% for the measure.

Name S-16

Executive Summary

Under project S-16, the applicant received Standard Program incentives from the Illinois Department of Commerce for a lighting retrofit project. The realization rate for this project is 98%.

Project Description

The customer performed the following lighting retrofits:

- (4) Incandescent lamps with CFL lamps
- (2,401) 4' T12 lamps with T8 lamps
- (231) 8’ T12 lamps with T8 lamps
- (47) 2' T12 lamps with T8 lamps
- (19) Exit Signs with LED Exit Signs
- (82) T8 lamps removed

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.1, 4.5.2, 4.5.3, and 4.5.5. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*ADM Calculated Ex Post*
Commercial ENERGY STAR Standard CFL	4	TRM=72 Actual = 72	TRM = 25 Actual = 26	2588	1.00	1.14	389	555	
HP & RW T8 Fixtures and Lamps	2,401	TRM = 40 Actual = 40	TRM = 25 Actual = 28	3540	1.00	1.14	153,481	145,342	
HP & RW T8 Fixtures and Lamps	231	TRM = 62 Actual = 96	TRM = 57 Actual = 57	3540	1.00	1.14	31,322	4,661	36,357
HP & RW T8 Fixtures and Lamps	47	TRM = 16 Actual = 20	TRM = 14 Actual = 17	3540	1.00	1.14	1,502	379	
Commercial LED Exit Signs	19	TRM = 23 Actual = Unknown	TRM = 2 Actual = Unknown	8760	1.00	1.14	3,987	3,985	
Fluorescent Delamping	82	TRM=30.8 Actual= Unknown	TRM=0 Actual = 0	3540	1.00	1.14	10,192	10,192	
Total							***200,873***	***165,114***	***36,357***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.1	389	555	142%	0.16	3.9	2,163	N/A	N/A
	4.5.3	153,481	145,342	95%	30.25	15	2,180,132	N/A	N/A
	4.5.3	31,322	36,357	116%	7.57	15	545,351	N/A	N/A
	4.5.3	1,502	379	25%	0.08	15	5,690	N/A	N/A
	4.5.5	3,987	3,985	100%	0.34	16	63,753	N/A	N/A
	4.5.2	10,192	10,192	100%	2.12	11	112,115	N/A	N/A
Total		***200,873***	***196,810***	***98%***	***40.51***		***2,909,205***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The project level realization rate is 98%. Based on algorithms in TRM 3.0 measure 4.5.1, the TRM calculated ex post savings for the first measure was 139kWh per fixture, whereas the ex ante savings estimate was 97kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.3, the calculated ex post savings for the second, and fourth measures were 61kWh and 8kWh per fixture, whereas the ex ante savings estimates were 62kWh and 32kWh per fixture, respectively.

The ADM calculated ex post savings for the third measure was 157kWh per fixture, whereas the ex ante savings estimate was 136kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.5, the TRM ex post savings for the fifth measure was 210kWh per fixture, whereas the ex ante savings estimate was 210kWh per fixture.

Based on the algorithms in TRM 3.0 measure 4.5.2, the calculated ex post savings for the sixth measure equals the ex ante savings estimate.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

Name S-17

Executive Summary

Under project S-17, the program participant received Standard Program incentives from the Illinois Department of Commerce for parking garage LED retrofit. The realization rate for this project is 93%

Project Description

The customer performed the following retrofit:

- (7) baseline Exit Signs with LED Exit Signs
- (18) 400W Metal Halide fixture with LED Outdoor Pole Arm
- (144) 175W Metal Halide Canopy fixture with LED Garage Canopy fixture
- (2) 175W Metal Halide Wall Pack with LED Wall Pack

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting project.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.4, and 4.5.5. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
LED Bulbs and Fixtures	18	TRM=361.4 Actual=458	TRM=116.8 Actual =104	4,903	TRM = 0.91 Errata =1.00	1	28,430	19,644	21,587
LED Bulbs and Fixtures	144	TRM=182.9 Actual=210	TRM = 52.5 Actual = 73	8,760	TRM = 0.91 Errata =1.00	1	172,817	149,688	164,492
LED Bulbs and Fixtures	2	TRM=182.9 Actual=210	TRM = 52.5 Actual = 71	4,903	TRM = 0.91 Errata =1.00	1	884	1,164	1,278
Commercial LED Exit Signs	7	TRM = 23 Actual =23	TRM = 2 Actual = 4	8,760	N/A	1	1,288		
Total							***203,420***	***170,496***	***187,357***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-level Gross Realized Savings

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh (ADM Calculated if applicable)**	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (ADM Calculated if applicable)**	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	28,430	21,587	76%	0.0	10.2	220,187	N/A	N/A
	4.5.4	172,817	164,492	95%	18.78	5.7	937,603	N/A	N/A
	4.5.4	884	1,279	145%	0.0	10.2	13,043	N/A	N/A
	4.5.5	1,289	1,288	100%	0.15	16	20,604	N/A	N/A
Total		***203,420***	***188,645***	***93%***	***18.92***		***1,191,436***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The project-level gross realization rate is 93%.

Based on algorithms in TRM 3.0 measure 4.5.4, the errata corrected ex post savings for the first, second, and third program measure was 1,199 kWh, 1,142kWh, and 639kWh per fixture, whereas the ex ante savings estimate was 1579 kWh, 1,200kWh, and 442kWh per fixture, respectively.

Based on algorithms in TRM 3.0 measure 4.5.5, the TRM calculated average ex post savings for the fourth program measure was 184 kWh per fixture, whereas the ex ante savings estimate was 184kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For the first, second, and third measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S18

Executive Summary

Under application S18, the customer received standard incentives from the Department of Commerce for the installation of hot water boilers, condensing unit heaters, and VFDs on pool pumps and supply fans at a middle school. The electric realization rate is 461% and the natural gas realization rate for this project is 100%.

Project Description

The actual installed measures focused on reducing the overall HVAC energy use of the middle school. The school's HVAC hot water system was in need of replacement. Included in the renovation were four new high efficiency boilers to supply hot water to the heating system, as well as new cabinet heaters, hot water unit heaters, and baseboard heaters to replace aged equipment.

The customer also installed VFDs on the supply fans of four air handling units and twelve unit ventilators. Originally the fans were constant speed. The addition of the VFDs will efficiently modulate air flow based on the cooling/heating demand of the space.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices and interviewed site staff to ensure the claimed equipment was installed and operational and that proper values were applied to algorithm variables.

Standard Incentives

For the hot water boilers, the TRM version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

ΔTherms = EFLH * Capacity * ((EfficiencyRating(actual) - EfficiencyRating(base))/ EfficiencyRating(base) / 100,000

Where:

EFLH = Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use

Capacity = Nominal Heating Input Capacity Boiler Size (Btu/hr) for efficient unit not existing unit

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependant on year and boiler type.

EfficiencyRating(actual) = Efficent Boiler Efficiency Rating use actual value

For the cabinet heaters, hot water unit heaters, and baseboard heaters, ADM determined that savings for these measures is zero. They were originally classified as condensing unit heaters, but they utilize the hot water loop and fan coils to provide heat to the school.

For the hot water pump and supply fan VFDs, the TRM version 3.0, Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $kW_{connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW = $kW_{connected}$ * DSF

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13

Application	DSF
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*						*Annual Gross kWh Savings*	
	Program Type	*Boiler Capacity (btuh)*	*Base Boiler type*	*Efficient Measure*	*Zone*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Boiler	TOS	3,000,000	Hot Water >2,500,000 Btu/h	AFUE = 93.3%	2 (Chicago)	High School	3,026	3,346
High Efficiency Boiler	TOS	3,000,000	Hot Water >2,500,000 Btu/h	AFUE = 93.3%	2 (Chicago)	High School	3,026	3,346
High Efficiency Boiler	TOS	3,000,000	Hot Water >2,500,000 Btu/h	AFUE = 93.3%	2 (Chicago)	High School	3,026	3,346
High Efficiency Boiler	TOS	3,000,000	Hot Water >2,500,000 Btu/h	AFUE = 93.3%	2 (Chicago)	High School	3,026	3,346
Total							12,105	13,384

Annual Therms Savings for Cabinet Heaters, Hot Water Unit Heaters, and Baseboard Heaters

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Program Type	*Unit Capacity (kbtuh)*	*Quantity*	*Zone*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Cabinet Heater	TOS	47.2	6	2 (Chicago)	High School	266	0
Cabinet Heater	TOS	101.2	6	2 (Chicago)	High School	266	0
Cabinet Heater	TOS	101.2	8	2 (Chicago)	High School	266	0

Hot Water Unit Heater	TOS	51.7	3	2 (Chicago)	High School	266	0
Baseboard Heater	TOS	4.5	3	2 (Chicago)	High School	266	0
Total						1,330	0

Annual kWh Savings for HVAC VSDs

Measure	*Measure Metrics*						*Annual Gross kWh Savings*	
	Program Type	*Application*	*Type*	*Qty*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	TOS	Hot Water Pump	HVAC	2	40 HP	School(K-12)	17,280	79,728
Variable Speed Drives for HVAC	TOS	Forward Curved Fan, with discharge dampers	HVAC	2	10 HP	School(K-12)	12,296	7,440
Variable Speed Drives for HVAC	TOS	Forward Curved Fan, with discharge dampers	HVAC	2	1.5 HP	School(K-12)	1,844	1,110
Variable Speed Drives for HVAC	TOS	Air Foil/inlet Guide Vanes	HVAC	12	0.25 HP	School(K-12)	1,844	1,408
Total							*33,264*	*89,686*

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	High Efficiency Boilers	12,105	13,384	111%	267,688
	Cabinet Heaters	798	0	0	0
	Hot Water Unit Heaters	266	0	0	0

	Baseboard Heater	266	0	0	0
Total		***13,435***	***13,384***	***100%***	***267,688***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Standard	Variable Speed Drives for HVAC	33,264	89,686	270%	2.26	1,345,288
Total		***33,264***	***89,686***	***270%***	***2.26***	***1,345,288***

The natural gas measures have a verified realization rate of 100%. The realization would have been above 100% if the incented cabinet heaters, unit heaters, and baseboard heaters had provided savings; however, it was determined that because the aged hot water system needed replacing and there was no efficiency gain with the installed heating equipment, there was no savings associated with these measures. The realization for the boilers was high, likely as a result of ex-ante calculations using averaged and deemed TRM values. Ex-ante savings were calculated in the Department of Commerce database, which commonly averages TRM input values. Additionally, custom as-built boiler efficiency values were used for the ex-post calculations.

The electric measures have a verified realization rate of 461%. The high realization is likely as a result of ex-ante calculations using averaged and deemed TRM input values and the two 40 Hp hot water pumps being rebated as pool pumps, which was determined after interviewed the site contact.

Name C19

Executive Summary

Under application C19, the applicant received custom incentives from the Illinois Department of Commerce for replacing a centrifugal aeration blower with a VSD turbo blower and installing dissolved oxygen (DO) feedback control. The electric realization rate for this project is 68%.

Project Description

The applicant installed (1) new 200 HP VSD turbo blower to take over the aeration load previously handled by a single 250 HP centrifugal blower. The existing blower ran at a fixed speed, controlled by a valve regulating the air flow rate. The new VSD blower is controlled via DO feedback, allowing for precise blower speed control to maintain a specified DO set point, which reduces power consumption and over-aeration by the blower. The existing blowers were left in place as back-up.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment installation and operation, recorded equipment nameplates, and took one-time power measurements at the existing and new blowers. ADM installed power monitoring equipment on the existing blower for a period of ten days and collected SCADA trending data for the VSD blower for a period of one month, which includes blower power, plant effluent flow, and DO concentration. ADM also collected plant effluent flow and DO concentration data for the full post-project period.

Custom Incentives

In order to calculate the typical blower consumption of the new blower (power/effluent flow), ADM performed a multivariable linear regression using effluent flow and DO as variables. The form of the regression model with an R^2 of 0.85, is as follows:

$$\frac{kW}{Eff} = -2.67 \times DO - 10.15 \times Eff + 77.54$$

Where,

kW/eff = *Specific power of the power, kW per Effluent flow*

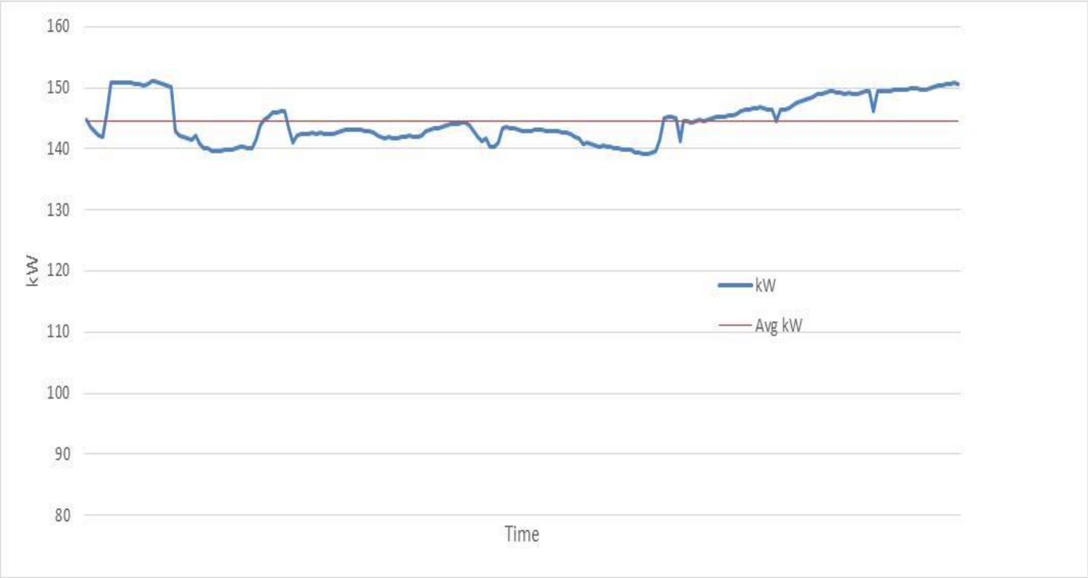
DO = *Dissolved Oxygen Concentration, Parts per Millon*

Eff = *Effluent flow of the plant, Million Gallons Per Day*

The regression formula was applied to 6 months of effluent flow and dissolved oxygen data during the post-project period. The resulting data was manipulated to account for the minimum blower power that was recorded during the month-long power trending period. This follows the operating characteristics of the new blower as described by site personnel, who stated that the blower must maintain a minimum speed in order to maintain pressure and allow for mixing at the furthest aeration point, because of pressure losses from pipe friction. The resulting power was averaged over 6 months and multiplied by 8,760 hours to calculate annual energy consumption.

Pre-project annual blower consumption was determined by averaging the monitored centrifugal blower power over a ten-day period and multiplying it by 8,760 hours. This was a viable method, as the power fluctuations were minimal (within 5% of the average), due to the constant speed set point of the blower. A graph of the power data is shown below:

Centrifugal Blower Power Data



Measure-level Gross Savings Results

Custom Incentives

The table shown below presents the verified gross savings for measures that received custom incentives.

Annual kWh Savings for New VSD Turbo Blower

Measure	*Average kW Demand*		*Operating Hours*	*Annual Gross kWh Savings*			
	Pre	*Post*		*Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
VSD Turbo Blower w/ DO Feedback Control	144.65	102.69	8,760	543,129			367,533
Total				543,129			367,533

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	VSD Turbo Blower w/ DO Feedback Control	543,129	367,533	68%	41.96	5,512,995
Total		***543,129***	***367,533***	***68%***	***41.96***	***5,512,995***

The realization rate for this project is 68%. The realization is low due to an underestimation of average post-project blower demand. The ex-ante estimation relied on influent flow, biological oxygen demand, and ammonium nitrate data used in conjunction with manufacturer blower curves to estimate blower power demand. The ex post analysis utilizes trended power data, which portrays true blower operating behavior, along with plant effluent and DO data. The effluent data portrays the true amount of aerated water, as it includes treatment of influent flow and reprocessed water used at the plant.

Name C20

Executive Summary

Under application C20, the customer received custom incentives from the Illinois Department of Commerce for the installation of Direct Digital Controls (DDC) on a total of seven package multi-zone rooftop units. The overall electric realization rate is 60%, and the overall natural gas realization rate for this project is 92%.

Project Description

The customer recently retrofitted the existing pneumatic control system on seven package multi-zone (MZ) rooftop units (RTUs) with DDC controls. With the addition of the DDC controls, the customer was able to implement time-of-use controls to limit HVAC operation to when the facility is in use. Originally, the HVAC system operated 24/7 regardless of whether or not the facility was in use, resulting in an excess of energy consumption.

Methodology for Estimating Gross Savings

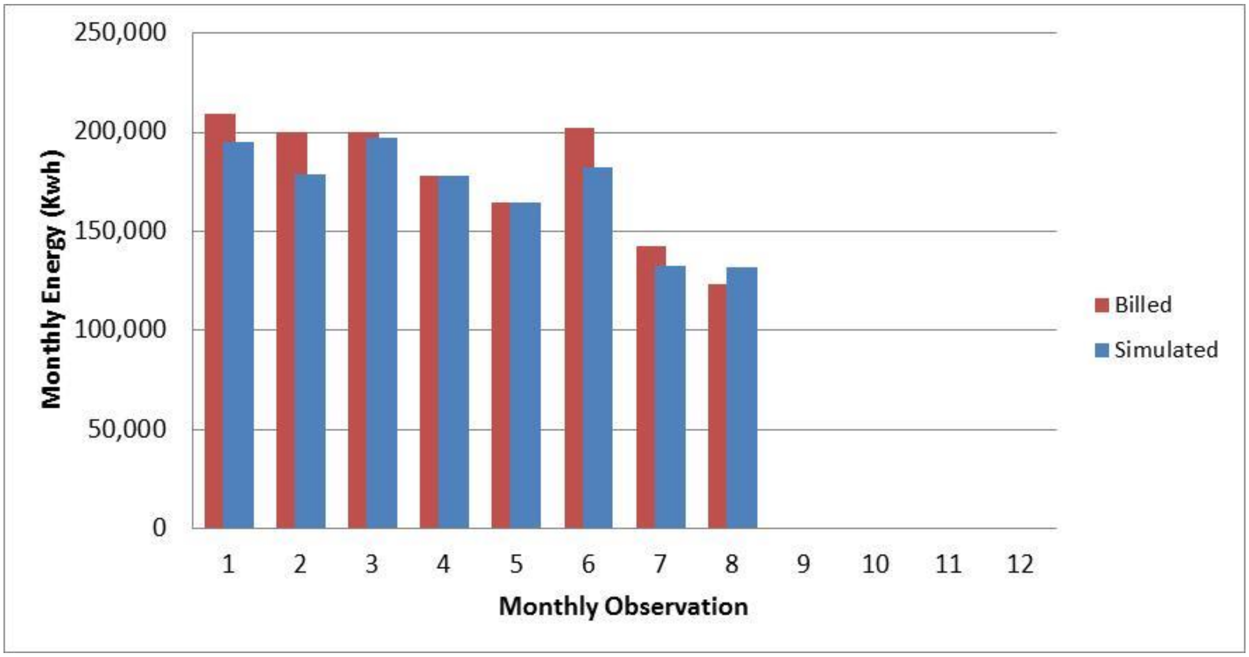
During the M&V visit, ADM staff verified the installation of the DDC controls on the seven package multi-zone rooftop units. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational setpoints from the building's energy management system (EMS).

Custom Incentives

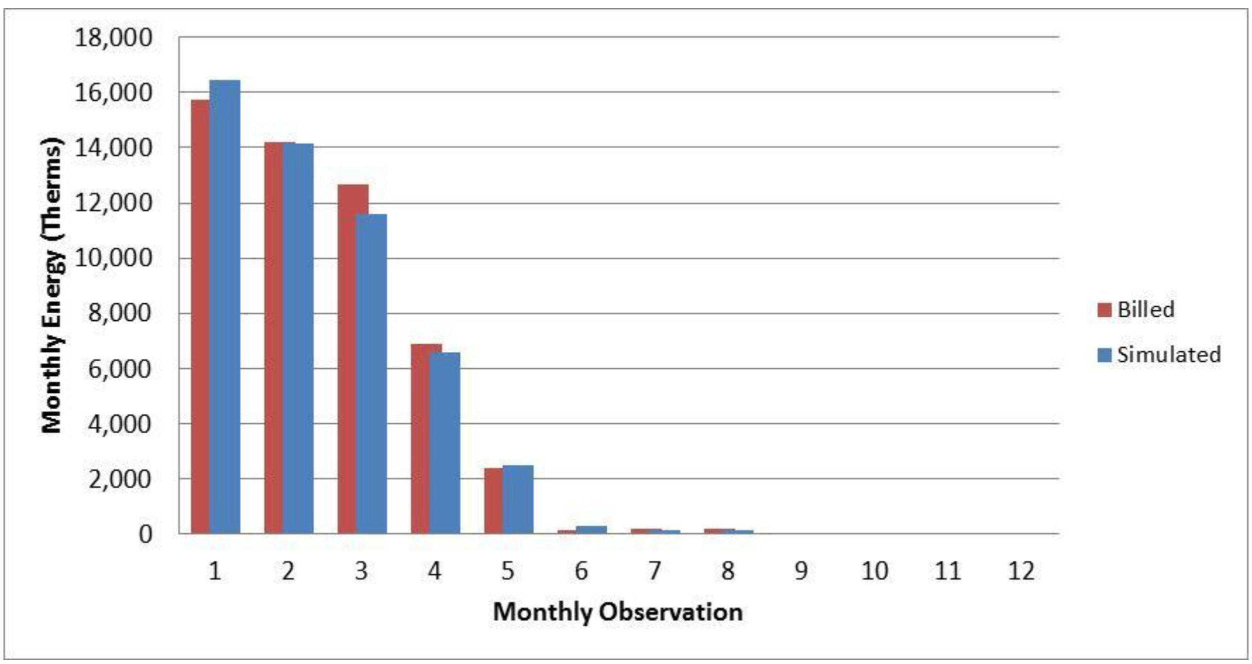
Energy savings were calculated using an eQuest model of the facility. ADM compiled a model of the baseline using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Upon completion of the initial model, a custom weather file was created using 2014 NOAA weather data for the Chicago O'Hare area. ADM ensured that the model's energy load shape matched that of the bills using the custom weather file and the utility provided billing data. The results of this calibration effort can be seen below:

2014 Monthly kWh Calibration



2014 Monthly Natural Gas Calibration



It should be noted that ADM opted to only calibrate to the first eight months of 2014, as the retrofit of the pneumatic control system began in September of 2014 and was completed in October of 2014.

Upon completion of the calibration for the baseline eQuest model, the impacts of the installed DDC controls with time-of-use scheduling were modeled through the use of a parametric run.

Once the parametric run was defined, the baseline model and parametric run were run using Chicago O'Hare TMY3 weather data. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Electric and Natural Gas Energy Consumption

End-Use	Baseline kWh	As-Built kWh	Annual kWh Savings	Baseline Therms	As-Built Therms	Annual Therm Savings
Lighting	501,765	501,765	0	0	0	0
Misc. Equipment	819,608	819,608	0	0	0	0
Heating	0	0	0	71,497	45,108	26,389
Cooling	346,943	291,375	55,568	0	0	0
Heat Rejection	0	0	0	0	0	0
Pumps	46,541	37,795	8,746	332	332	0
Fans	445,819	346,682	99,137	0	0	0
Exterior	22,324	22,324	0	0	0	0
Total	**2,183,000**	**2,019,549**	**163,451**	**71,829**	**45,440**	**26,389**

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for DDC Controls

Measure	Annual Gross kWh Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
DDC Controls	274,395			163,451
Total	274,395			163,451

Annual Therms Savings for DDC Controls

Measure	Annual Gross Therms Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
DDC Controls	28,790			26,389
Total	28,790			26,389

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings	Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Custom	DDC Controls	274,395	163,451	60%	0.00	2,451,765		
Total		***274,395***	***163,451***	***60%***	***0.00***	***2,451,765***		

Verified Natural Gas Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings			Lifetime Gross Savings	Spillover
		Ex Ante Therms	Ex Post Therms	Realization Rate	Ex Post Therms	Annual Therms
Custom	DC Controls	28,790	26,389	92%	395,835	
Total		***28,790***	***26,389***	***92%***	***395,835***	

The project has an overall electric realization rate of 60% and an overall natural gas realization rate of 92%. The overall realization for the electrical energy savings may be attributed to the ex ante savings being based on the savings from a pre-existing SEDAC report that took place in 2010. The calculated savings was based upon 2010 billing data which may no longer accurately represent the typical energy consumption of the facility.

In order to double check the savings being reported by ADM's eQuest model, ADM also performed a pre/post billing analysis. Using the provided utility billing data, a monthly regression was developed which correlates the monthly energy consumption of the facility to the number of occupied days in the month, the monthly Cooling Degree Days, and the monthly Heating Degree Days. The following table presents the coefficients derived from this analysis in which the “Pre/Post” variable represents the typical monthly savings for the installation of the DDC controls. This results in a typical annual energy savings of 151,595 kWh. Comparing this to the eQuest reported savings of 163,451k kWh, validates the eQuest calculated savings.

Electric Billing Regression Coefficients

Coefficient	*Value*
Intercept	*151,113*
# Facility Days	*816*
CDD	*-1,066*
HDD	*28*
Pre/Post	*-12,633*
R2	*0.9020*

Name S-21

Executive Summary

Under project S-21, the applicant received Standard Program incentives from the Illinois Department of Commerce for LED Lighting Retrofit. The realization rate for this project is 220%.

Project Description

The customer performed the following retrofit:

- (145) 36W HID Fixtures with (0) 2 x 2 LED Fixtures
- (50) 400W Metal Halide fixture with (46) 156W LED High Bay fixtures
- (24) 400W Metal Halide fixtures with (24) 156W LED High Bay fixtures
- (19) 175W HID fixtures with 80W (19) LED High Bay fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4 and 4.5.8. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation inputs*						*Annual Gross kWh Savings*		
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe*	*Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*
LED Bulbs and Fixtures	0*	TRM = 61 Actual = 42	TRM = 44.9 Actual = 36	3540	TRM=0.91 Errata=1.00	1		0	
Misc. Commercial / Industrial Lighting	46	TRM = 454 Actual = 454	TRM = 156 Actual =156	3540	TRM =1.00 Errata=1.00	1	27,320	48,526	
Misc. Commercial / Industrial Lighting	24	TRM = 454 Actual =454	TRM = 156 Actual =156	3540	TRM =1.00 Errata=1.00	1		25,318	
LED Bulbs and Fixtures	19	TRM = 295 Actual =210	TRM=160.2 Actual = 80	3540	TRM =0.91 Errata=1.00	1	11,021	9,444	10,378
Total							***38,341***	***83,288***	***10,378***

*The applicant did not install fixtures by the time of the verification site visit, resulting in an ex post kWh savings value of 0.

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Quantity*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh (ADM if Applicable)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (ADM if Applicable)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	0		0		0.0	N/A	0	N/A	N/A
	4.5.8	46	27,319	48,526	270%	11.52	15	727,895	N/A	N/A
	4.5.8	24		25,318		6.01	15	379,771	N/A	N/A
	4.5.4	19	11,020	10,378	94%	0	10	105,830	N/A	N/A
Total			***38,341***	***84,222***	***220%***	***17.52***		***1,213,496***		

The project level realization rate is 220%.

The applicant did not install incentivized fixtures by the time of the site visit and further investigation on the measure found that they would likely not be installed by our reporting deadline. For this reason, the realization rate for the first measure is 0%.

Based on equations in TRM 3.0 (4.5.8), the ex post savings per fixture for the second and third measure were 1,054.92 kWh, whereas the ex ante savings estimate was 124.75 kWh per fixture.

Based on equations in TRM 3.0 (4.5.4), the ex post savings per fixture for the fourth measure was 546.19 kWh per fixture, whereas the ex ante savings estimate was 580.05 kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For these measures (4.5.4 and 4.5.8), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-22

Executive Summary

Under project S-22, the applicant received Standard Program incentives from the Illinois Department of Commerce for LED Outdoor lighting retrofit. The realization rate for this project is 110%.

Project Description

The customer performed the following retrofit:

- (16) 85W HID with PAR 30 13W LED

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	Calculation inputs						Annual Gross kWh Savings			
	Qty	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe	Ex Ante	TRM-Calculated	TRM-Calculated Errata Corrected	ADM Calculated
								Ex Post	Ex Post	Ex Post
LED Bulbs and Fixtures	16	TRM = 45 Actual=90	TRM=11.9 Actual =13	4903	TRM=0.91 Errata=1.00	1	5,497	2,541	2,792	6,040
Total							***5,497***	***2,541***	***2,792***	***6,040***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Quantity	Annual Gross Savings				Lifetime Gross Savings		Spillover	
			Ex Ante kWh	Ex Post kWh (Errata Corrected)	Realization Rate	Ex Post Peak kW Reduction	Measure Life (Years)	Ex Post kWh (Errata Corrected)	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.4	16	5,497	6,040	110%	0.0	13.5	81,547	N/A	N/A
Total			***5,497***	***6,040***	***110%***	***0.0***		***81,547***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The project level realization rate is 110%.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

The ex ante per fixture savings (343.56) was slightly lower than the ADM calculated savings (377.53) per fixture.

For this measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-23

Executive Summary

Under project S-23, the applicant received Standard Program incentives from the Illinois Department of Commerce for a LED lighting retrofit. The gross realization rate for this project is 160%.

Project Description

The customer performed the following retrofit:

- (3) 100W Metal Halide Fixtures with LED Street Lighting Fixtures
- (2) 400W Metal Halide Fixtures with Decorative LED Street Lighting Fixtures
- (13) 175W Metal Halide Fixtures with Decorative LED Street Lighting Fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation inputs*						*Annual Gross kWh Savings*		
	Quantity	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe*	*Ex Ante*	*TRM-Calculated*	*TRM-Calculated Errata Corrected*
								Ex Post	*Ex Post*
LED Bulbs and Fixtures	3	TRM=361.4 Actual =125	TRM=116.8 Actual = 95	4903	TRM=0.91 Errata=1.00	1.0	13,510	3,274	3,598
LED Bulbs and Fixtures	2	TRM=361.4 Actual =454	TRM=116.8 Actual = 80	4903	TRM =0.91 Errata=1.00	1.0		2,183	2,399
LED Bulbs and Fixtures	13	TRM=361.4 Actual =210	TRM=116.8 Actual = 80	4903	TRM =0.91 Errata=1.00	1.0		14,187	15,591
Total							***13,510***	***19,644***	***21,587***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Quantity	Annual Gross Savings				Lifetime Gross Savings		Spillover	
			Ex Ante kWh	*Ex Post kWh (Errata Corrected)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (Errata Corrected)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	18	13,510	21,587	160%	0.0	10.2	220,187	N/A	N/A
Total			***13,510***	***21,587***	***160%***	***0.0***		***220,187***		

The project level realization rate is 160%. Based on algorithms in TRM version 3.0 measure 4.5.4, the ex post savings per fixtures were 1,199.27 kWh, whereas the ex ante savings estimate was 750.56 kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For these measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-24

Executive Summary

Under project S-24, the applicant received Standard Program incentives from the Illinois Department of Commerce for LED lighting retrofit. The realization rate for this project is 340%.

Project Description

The customer performed the following retrofit:

- (44) 450W Metal Halide Fixtures with High Bay LED Fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	Calculation inputs						Annual Gross kWh Savings			
	Quantity	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe-IF	Ex Ante	TRM-Calculated	TRM-Calculated Errata Corrected	ADM Calculated
								Ex Post	Ex Post	Ex Post
LED Bulbs and Fixtures	44	TRM=295 Actual=454	TRM=160.2 Actual=173.7	3,540	TRM=0.91 Errata=1.00	1.14	14,636	21,782	23,936	49,772
Total							***14,636***	***21,782***	***23,936***	***49,772***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Quantity	Annual Gross Savings				Lifetime Gross Savings		Spillover	
			Ex Ante kWh	Ex Post kWh (ADM calculated)	Realization Rate	Ex Post Peak kW Reduction	Measure Life (Years)	Ex Post kWh (Errata Corrected)	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.4	44	14,636	49,772	340%	10.36	10	497,719	N/A	N/A
Total			***14,636***	***49,772***	***340%***	***10.36***		***497,719***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 340%. Based on algorithms in TRM 3.0 measure 4.5.4, the ADM calculated ex post savings for the first project measure was 1,131.18 kWh per fixture, whereas the average ex ante savings estimate was 542.07 kWh per fixture. The discrepancy between the ex ante and ex post savings estimates are due to several reasons.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For this measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-26

Executive Summary

Under project S-26, the applicant received Standard Program incentives from the Illinois Department of Commerce for Street lighting retrofit. The realization rate for this project is 82%.

Project Description

The customer performed the following retrofit:

- (517) 400W Metal Halide Fixture with 95W LED street lighting fixtures
- (17) 175W HID Fixture with 80W Decorative LED street lighting fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

	Calculation inputs						*Annual Gross kWh Savings*		
Measure	*Quantity*	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated*	*TRM-Calculated Errata Corrected*
								Ex Post	*Ex Post*
LED Bulbs and Fixtures	517	TRM=361.4 Actual =454	TRM=116.8 Actual = 95	4,903	TRM=0.91 Errata=1.00	1	784,569	564,222	620,025
LED Bulbs and Fixtures	17	TRM=361.4 Actual =210	TRM=116.8 Actual = 80	4,903	TRM =0.91 Errata=1.00	1		18,553	20,388
Total								**582,775**	**640,412**

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Quantity*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh (Errata Corrected)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (Errata Corrected)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	534	784,564	640.412	82%	0.0	10.2	6,532,205	N/A	N/A
Total			**784,564**	**640,412**	**82%**	***0.0***		**6,532,205**		

The realization rate for this project is 82%. Based on algorithms in TRM 3.0 measure 4.5.4, the errata corrected ex post savings for the first and second measures was 1,199 kWh per fixture, whereas the ex ante savings estimate was 1,469 kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For these measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name C26

Executive Summary

Under application C26, the customer received custom incentives from the Illinois Department of Commerce for an HVAC controls conversion from pneumatic to direct digital controls (DDC). The electric realization rate is 0% and the natural gas realization rate for this project is 0%.

Project Description

New DDC controls were installed for all existing HVAC equipment, including multi-zone (MZ) rooftop units (RTU, qty. 3) and associated zone controls, air handling units (AHUs, qty. 3) and exhaust fans (qty.12).

Energy savings were claimed for night temperature setback and fan cycling during off hours.

For each MZ RTU, controls installed include fan start/stop/status, outside air temperature (OAT), mixed air temperature (MAT), hot deck, cold deck sensors, steam control valves, chilled water control valves, and zone dampers.

For each AHU, controls installed include sensors for return air temperature (RAT), MAT, and supply air temperature (SAT), actuators for outside air (OA) and return air (RA) dampers, fan start/stop/status, steam coil valve, and filter differential pressure (dp).

For the exhaust fans, controls installed include start/stop/status.

Existing pneumatic devices (thermostats, valves, actuators, sensors, etc.) were removed.

The building was changed over from direct expansion (DX) coils to the campus chilled water system during the same period as the DDC upgrade. However, this was not part of the incentive.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and obtained the DOE-2 input files driving the claimed savings. A side-by-side comparison of the baseline and post-implementation DOE-2 input files indicated savings being based on night temperature setback and fan cycling during off hours.

ADM performed a site visit to verify scope of work implemented. ADM learned, while interviewing the site representative, that the building operates 24/7 and no night temperature setback or fan cycling during off hours had been implemented. The DDC controls upgrade had been implemented, but the scope of work did not involve any specific energy savings measures.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for HVAC Controls Upgrade

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
HVAC Controls Upgrade	201,843			0
Total	201,843			0

Annual Therms Savings for HVAC Controls Upgrade

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
HVAC Controls Upgrade	35,921			0
Total	35,921			0

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	HVAC Controls Upgrade	35,921	0	0%	0
Total		***35,921***	***0***	***0%***	***0***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	HVAC Controls Upgrade	201,843	0	0%	0	0
Total		***201,843***	***0***	***0%***	***0***	***0***

The electric and gas realization rates are both 0%. This is due to the two claimed measures, night temperature setback and fan cycling during off hours, not being implemented.

Name S-27

Executive Summary

Under project S-27, the applicant received Standard Program incentives from the Illinois Department of Commerce for LED lighting retrofit. The realization rate for this project is 260%.

Project Description

The customer performed the following retrofit:

- (81) 1000W Metal Halide Fixtures with 240W LED High Bay Fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	Calculation inputs						Annual Gross kWh Savings			
	Quantity	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe	Ex Ante	TRM-Calculated	TRM-Calculated Errata Corrected	ADM Calculated
								Ex Post	Ex Post	Ex Post
LED Bulbs and Fixtures	81	295	160.2	3540	TRM=0.91 Errata=1.00	1.0	108,276	40,098	44,063	281,120
Total							***108,276***	***40,098***	***44,063***	***281,120***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Quantity	Annual Gross Savings				Lifetime Gross Savings		Spillover	
			Ex Ante kWh	Ex Post kWh (ADM Calculated)	Realization Rate	Ex Post Peak kW Reduction	Measure Life (Years)	Ex Post kWh (Errata Corrected)	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.4	81	108,276	281,120	260%	58.51	10	2,558,191	N/A	N/A
Total			***108,276***	***281,120***	***260%***	***58.51***		***2,811,199***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The project level realization rate is 260%. Based on algorithms in TRM version 3.0 measure 4.5.4, the ADM calculated ex post savings per fixture for this measure was 3,470.62 kWh, whereas the ex ante savings estimate was 1,336.74 kWh per fixture. The high realization can be attributed to the actual base wattage for the measure (1100) being considerably greater than what was allowed for in the TRM (295).

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For this measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-28

Executive Summary

Under project S-28, the program participant received Standard Program incentives from the Illinois Department of Commerce for outdoor street lighting retrofit. The realization rate for this project is 123%.

Project Description

The customer performed the following retrofit:

- (321) 100W Cobrahead street lighting fixture with 40W LED Lamps
- (98) 150 W Cobrahead street lighting fixture with 50W LED Lamps
- (40) 175 W Cobrahead street lighting fixture with 60W LED Lamps
- (35) 250 W Cobrahead street lighting fixture with 80W LED Lamps
- (88) 400 W Cobrahead street lighting fixture with 130W LED Lamps

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM Calculated*	*Errata Corrected*
								Ex Post	*Ex Post*
LED Bulbs and Fixtures	321	TRM = 182.9 Actual = 120	TRM = 52.5 Actual = 40	4,903	TRM = 0.91 Errata = 1.00	1	114,578	186,761	205,232
LED Bulbs and Fixtures	98	TRM = 182.9 Actual = 180	TRM = 52.5 Actual = 50	4,903	TRM = 0.91 Errata = 1.00	1	56,843	57,017	62,656
LED Bulbs and Fixtures	40	TRM = 182.9 Actual = 210	TRM = 52.5 Actual = 60	4,903	TRM = 0.91 Errata = 1.00	1	26,771	23,272	25,574
LED Bulbs and Fixtures	35	TRM = 361.4 Actual = 286	TRM = 116.8 Actual = 80	4,903	TRM = 0.91 Errata = 1.00	1	32,169	38,197	41,975
LED Bulbs and Fixtures	88	TRM = 361.4 Actual = 458	TRM = 116.8 Actual = 130	4,903	TRM = 0.91 Errata = 1.00	1	128,784	96,038	105,536
Total							***359,145***	***401,285***	***440,973***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh (errata corrected if applicable)	Realization Rate	Ex Post Peak kW Reduction	Measure Life (Years)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.4	114,578	205,232	179%	0.0	10.2	2,093,364	N/A	N/A
	4.5.4	56,843	62,656	110%	0.0	10.2	639,095	N/A	N/A
	4.5.4	26,771	25,574	96%	0.0	10.2	260,855	N/A	N/A
	4.5.4	32,169	41,975	130%	0.0	10.2	428,141	N/A	N/A
	4.5.4	128,784	105,536	82%	0.0	10.2	1,076,468	N/A	N/A
Total		***359,145***	***440,973***	***123%***	***0.0***		***4,497,923***		

TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 123%. Based on algorithms in TRM 3.0 measure 4.5.4, the errata corrected ex post savings for the first, second, and third program measures was 639kWh per fixture, whereas the ex ante savings estimates were 357kWh, 580kWh, and 669kWh per fixture respectively.

The errata corrected ex post savings for the fourth and fifth program measures was 1199kWh per fixture, whereas the ex ante savings estimates were 919kWh, and 1463kWh per fixture respectively.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For these measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name SC-29

Executive Summary

Under project SC-29, the applicant received standard and custom incentives from the Illinois Department of Commerce for lighting retrofits, replacement of the burner on a forced draft boiler and adding a VFD to the burner's blower fan motor. The natural gas realization rate is 0% and the electric realization rate for this project is 81%.

Project Description

The customer performed the following lighting retrofit:

- (180) 4' T12 lamps delamped
- (25) LED Exit Sign retrofit
- (170) 4' T12 with 4' T8
- (99) Metal Halide fixtures with 4' T8
- (43) High Pressure Sodium fixtures with 4' T8
- (37) Occupancy Sensors Installed

The customer replaced a Gordon-Piatt burner (R12.1-G-50) with a new high efficiency Riello burner (RS160/EV) on a Burnham 165HP boiler that provides hot water for space heat to the facility. The new burner is intended to increase system efficiency by removing system losses from linkage wear, improving combustion, improving PID system modulation, and increasing turndown.

The blower on the new burner operated constant volume and in order to maximize system efficiency the customer also added a VFD to modulate air flow to the boiler based on boiler load.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2, 4.5.3, and 4.5.5. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

ADM staff inspected project documentation pertaining to the lighting controls.

Energy savings for the lighting controls were calculated according to the Illinois TRM 3.0, measure 4.5.10. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled	= total lighting load connected to the control in kilowatts
ESF	= Energy Savings Factor
WHFe	= waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd	= heat factor to account for cooling demand savings
CFbaseline	= Baseline Summer Peak Coincidence Factor
CFos	= Retrofit Summer Peak Coincidence Factor

During the M&V visit, ADM staff verified that equipment was installed and operational. ADM recorded equipment nameplates and took power measurements at the blower VFD. ADM also collected boiler combustion analysis tapes and gas billing data for the pre- and post-retrofit period.

Custom Incentives

ADM determined electric savings for the installation of the VFD on the blower combustion fan using the algorithm from the Illinois TRM v3.0, section 4.4.17 Variable Speed Drives for HVAC.

$$\Delta kWh = [kW]_{connected} \times Hours \times ESF$$

Where,

kWconnected = kW of equipment

= (HP * 0.746 kw/HP * load factor) / motor efficiency

Hours = Hours of use, varies by building type

ESF = Energy Savings Factor, varies by VFD application

Using the provided pre/post burner retrofit combustion test results, it was determined that the new burner with VFD is approximately 0.95% less efficient than the original burner. Due to the results of the provided tests, the annual natural gas savings for the new burner is zero.

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Location	*Measure*	*Calculation Inputs*						*Annual Gross kWh Savings*	
		QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*
Light Industrial – All Areas	Fluorescent Delamping	145	ADM = 25 TRM= 33.7	ADM = 0 TRM= 0	5,360	1	1.03	21,021	26,977
	Fluorescent Delamping	11	ADM = 24 TRM= 33.7	ADM = 0 TRM= 0	5,360	1	1.03	2,051	2,047
	Fluorescent Delamping	24	ADM = 24 TRM= 33.7	ADM = 0 TRM= 0	5,360	1	1.03	9,322	4,465
	LED Exit Signs	25	ADM = 20 TRM= 23	ADM = 2 TRM= 2	8,766	1	1.03	5,753	4,740
	T8 Fixtures and Lamps	160	ADM = 72 TRM= 68	ADM = 48 TRM= 49	5,360	1	1.03	40,517	16,783
	T8 Fixtures and Lamps	10	ADM = 144 TRM= 139	ADM = 128 TRM= 94	5,360	1	1.03		2,484
	T8 Fixtures	99	ADM = 215	ADM = 128	5,360	1	1.03	39,846	47,004

Location	Measure	Calculation Inputs						Annual Gross kWh Savings	
		QTY	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe-IF	Ex Ante	TRM-Calculated Ex Post
	and Lamps		TRM= 232	TRM= 146					
	T8 Fixtures and Lamps	43	ADM = 295 TRM= 295	ADM = 128 TRM= 146	5,360	1	1.03	47,791	35,372
								166,301	***139,873***

The table below presents the realized gross energy savings of the lighting occupancy sensors, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings of Occupancy Sensors

Location	Measure	Calculation Inputs					Annual Gross kWh Savings	
		QTY	kW Controlled	Hours	WHFe-IF	Ocs ESF	Ex Ante	TRM-Calculated Ex Post
Light Industrial – All Areas	Wall mounted occupancy sensors	13	.35	5,360	1	.41	19,039	9,999
	Fixture mounted occupancy sensors	24	.073	5,360	1	.3	3,968	2,817
							23,007	***12,816***

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for Blower VFD

Measure	Measure Metrics						Annual Gross kWh Savings			
	Application	$kW_{connected}$	Hours	Load Factor	Efficiency	ESF	Ex Ante	TRM-Calculated	TRM-Calculated (Errata Corrected)	ADM Calculated

								Ex Post	*Ex Post*	*Ex Post*
Variable Speed Drives for HVAC	Blower VFD	3.529	2,465	0.800	0.930	0.535	4,476			4,655
Total							4,476			4,655

Annual Therms Savings for Boiler Burner Retrofit

Measure	*Pre-retrofit efficiency*	*Post-retrofit efficiency*	*Annual Gross Therms Savings*			
			Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Burner Retrofit	0.8320	0.8225	15,631			0
Total			15,631			0

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	Burner Retrofit	15,631	0	0%	0
Total		***15,631***	***0***	***0%***	***0***

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Measure Life (yrs)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.2	21,021	26,977	128%	4.77	11	296,751	N/A	N/A
	4.5.2	2,051	2,047	100%	0.36	11	22,512	N/A	N/A
	4.5.2	9,322	4,465	48%	0.79	11	49,117	N/A	N/A
	4.5.5	5,753	4,740	82%	0.51	16	75,843	N/A	N/A
	4.5.3	40,517	19,268	48%	3.40	7.45	287,087	N/A	N/A
	4.5.3	39,846	47,004	118%	8.30	7.45	350,180	N/A	N/A
	4.5.3	47,791	35,372	74%	6.25	7.45	263,520	N/A	N/A
	4.5.10	19,039	9,999	53%	0.29	8	79,993	N/A	N/A
	4.5.10	3,968	2,817	71%	0.06	8	22,538	N/A	N/A
Subtotal		***189,308***	***152,689***	***81%***	***24.73***		***1,447,542***		
Custom	Blower VFD	4,476	4,655	104%	1.23		69,819	N/A	N/A
Subtotal		***4,476***	***4,655***	***104%***	***1.23***		***69,819***		
Total		***193,784***	***157,344***	***81%***	***25.96***		***1,517,361***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The natural gas realization rate for this project is 0%. The ex post savings are zero due to a decrease in the combustion efficiency after the burner retrofit. The pre-retrofit combustion test was performed in December 2013 when the existing burner was in use. The boiler was out-of-service during the heating season of 2014, before the boiler was retrofitted with a new burner in December 2014. According to the customer, the post-retrofit combustion test was performed after a tune-up, so the boiler would have been operating at peak performance. The pre- and post-combustion analyses indicate a decrease of 0.95% in boiler combustion efficiency, resulting in zero savings. The decrease in efficiency was corroborated by a billing regression analysis that indicated negative savings between the pre- and post-retrofit periods.

The electric realization rate for this project is 81%.

Applicant inaccurately labeled this site as “office” on application materials. Appropriate building type is light industrial. This led to low realization rates on several measures.

The realization rate for the first measure (4.5.2) was 128%. This was due to two main factors; the difference between the actual and assumed wattages for the base and energy efficient lamps, and inaccurate lamp counts on the application. The second measure (4.5.2) had a realization rate of 100%. The third measure (4.5.2) had a realization rate of 48%. The applicant claimed an incentive for 8’ T8 delamping, when the actual lamps delamped were 4’ T8. This lead to a low realization rate.

The realization rate for the fourth measure (4.5.5) was 82%. The reason for the low realization rate is that the incorrect building site was used to calculate savings for this site.

The realization rate for the fifth measure (4.5.3) was 48%. The low realization rate was due to several factors including the applicant listing inaccurate number of fixtures in the application materials, and the difference between the actual and assumed wattages of the base and energy efficient fixtures. The realization rates for the sixth and seventh measures (4.5.3) were 98%, and 89%. The reason for the low realization rate was due primarily to the difference between the assumed and actual wattages for the base and energy efficient fixtures.

The realization rates for the eighth and ninth measures (4.5.10) were 53% and 71%. The realization rate for this measure is low mainly because the applicant listed an inaccurate number of occupancy sensors on the application materials.

The custom realization rate is 104%. The ex ante savings were determined using a calculator that references the ASHRAE Handbook, HVAC Applications Volume. The calculator used a rated motor horsepower of 5 HP and did not factor in load factor or motor efficiency when determining the connected load. The calculator used an energy savings factor related to pumps, rather than fans, calculated as the difference between power ratios of the baseline and as-built conditions (no control vs. VFD). The calculator also used a seemingly-arbitrary value of 2,000 for the operating hours. The TRM was chosen due to its use of a VFD boiler draft fan load shape. The actual motor horsepower is 5.5 HP, and the TRM provides default values of 0.8 and 0.93 for load factor and efficiency, respectively. The TRM also provides an energy savings factor based on the VFD application and operating hours based on facility type.

Name S-30

Executive Summary

Under project S-30, the program participant received Standard Program incentives from the Illinois Department of Commerce for an LED lighting retrofit project. The realization rate for this project is 92%.

Project Description

The customer performed the following retrofit:

- (14) 150W Metal Halide with 3LT8 high bay
- (224) 250W Metal Halide with 4LT8 high bay
- (539) 400W Metal Halide with 6LT8 high bay

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.3. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*	
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHF e-IF*	*Ex Ante*	*TRM-Calculated Ex Post*
HP & RW T8 Fixtures and Lamps	14	TRM = 147 Actual =185	TRM = 72 Actual = 70	4,439	1.0	1.0	8,933	5,628
HP & RW T8 Fixtures and Lamps	224	TRM= 295 Actual =285	TRM = 146 Actual =128	4,439	1.0	1.0	195,138	178,895
HP & RW T8 Fixtures and Lamps	539	TRM = 455 Actual =455	TRM = 206 Actual =196	4,439	1.0	1.0	774,611	719,371
Total							***978,682***	***903,894***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.3	8,933	5,628	63%	1.05	84,420	N/A	N/A
	4.5.3	195,138	178,895	92%	33.38	2,683,430	N/A	N/A
	4.5.3	774,611	719,371	93%	134.21	13,790,415	N/A	N/A
Total		***978,682***	***903,894***	***92%***		***13,558,415***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 92%. Based on algorithms in TRM 3.0 measure 4.5.3, the TRM calculated average ex post savings for the first, second, and third measures are 402kWh, 799kWh, and 1,335kWh per fixture, whereas the ex ante savings estimates were 638kWh, 871kWh, and 1,437kWh per fixture, respectively.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

In addition, the building type in the application was listed as miscellaneous (4,576 annual hours of use) and in the database as office (4,439 annual hours of use). In actuality the facility is light industry (5,360 annual hours of use) with no HVAC.

Name S-31

Executive Summary

Under project S-31, the participant received Standard Program incentives from the Illinois Department of Commerce for street lighting retrofit project. The realization rate for this project is 139%.

Project Description

The customer performed the following lighting retrofit:

- (268) 295W Metal Halide street lights with LED street lights.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHF e-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
LED Bulbs and Fixtures	268	TRM=361 Actual=295	TRM =116 Actual=101	4,903	TRM = 0.91 Errata = 1.00	1	231,974	292,479	321,405
Total							***231,974***	***292,479***	***321,405***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Quantity*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh (errata)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Yrs)*	*Ex Post kWh (errata)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	268	231,976	321,405	139%	0.00	10.2	3,278,335	N/A	N/A
Total			***231,976***	***321,405***	***139%***	***0.00***		***3,278,335***		

The project level realization rate is 139%. Based on algorithms in TRM 3.0 measure 4.5.4, the errata corrected ex post savings for this measure was 1199.27 kWh per fixture, whereas the ex ante savings estimate was 865.58 kWh per fixture. This occurs with the deemed wattage difference for the fixtures from the TRM.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For this measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name C32

Executive Summary

Under application C32, the applicant received custom incentives from the Illinois Department of Commerce for retrofitting the high service pumps with VFDs at its water district pump station. The electric realization rate for this project is 0%.

Project Description

The water district pump station installed VFDs on (4) 100hp high service pumps that feed treated water to the district water towers to maintain water levels of 50 to 55 feet. Each VFD is set at a constant frequency and is operated as needed to maintain the water level in the towers. The pumps previously operated full-speed as needed with no throttling.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating as intended. ADM recorded equipment nameplates and took one-time power measurements at each pump's VFD. ADM also collected individual pump monthly runtime and flow data from January 2013 to July 2015 and received a copy of the manufacturer pump curves.

Using the provided data ADM compared the provided pump runtime and flow logs to one another to determine the typical flow rate of each pump in both the pre-and post- retrofit configurations, while one time power measurements and pump affinity laws were consulted to determine the corresponding kW demand of the pumps. The findings of this exercise are presented in the following table:

Baseline Vs As-Built Typical Flow Rate and Demand

Pump	*Gal/Hr*		*kW Demand*		*% Usage*	
	Baseline	*As-Built*	*Baseline*	*As-Built*	*Baseline*	*As-Built*
1	82,312	61,707	70.1	60.3	18%	25%
2	77,092	64,405	67.7	60.9	56%	29%
3	79,431	67,252	69.3	62.3	18%	44%
4	76,868	64,455	69.0	61.2	8%	2%
Average	78,926	64,455	69.04	61.17	-	-

In order to calculate the typical annual energy savings of the VFDs, ADM performed a multivariable linear regression using local heating degree days (HDD), cooling degree days (CDD) and number of days in the period as variables. This allowed ADM to normalize the provided flow data to TMY3 weather data to allow for the calculation of typical monthly flow profiles. The form of the regression model with an R^2 of 0.90, is as follows:

$$Gallons = -667{,}447 \times CDD - 12{,}750 \times HDD + {,}426{,}781 \times Days - 3{,}494{,}863$$

Where,

Gallons = *Total Monthly gallons pumped by high service pumps*

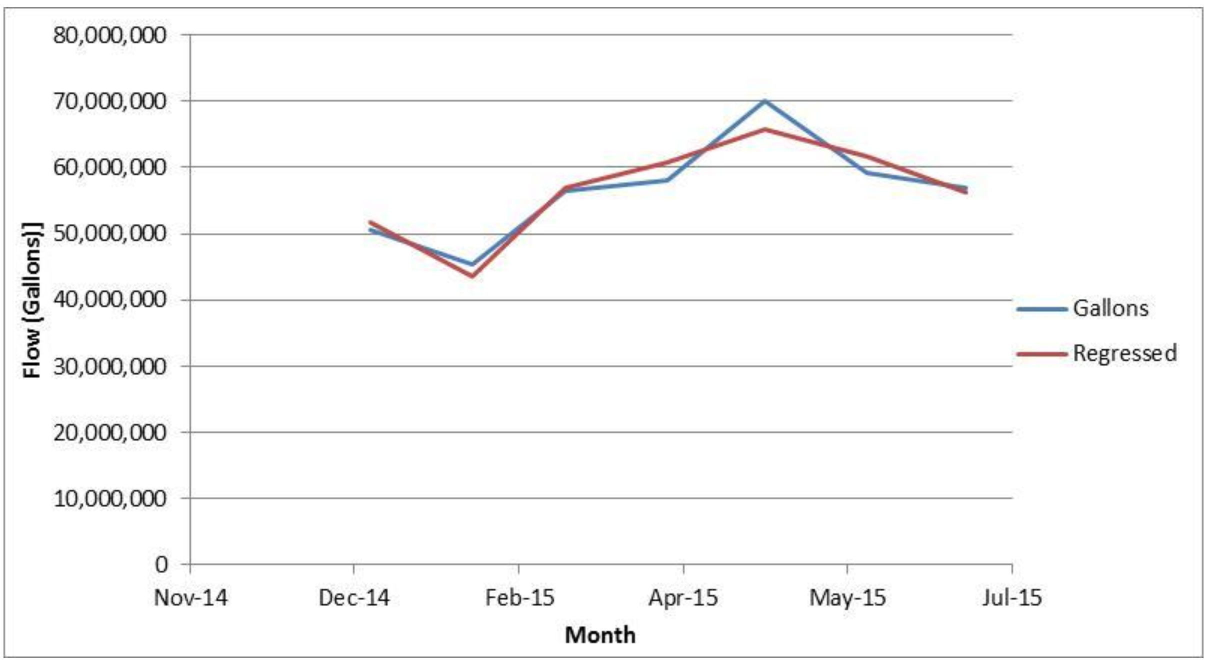
CDD = *Cooling degree days, to account for weather seasonality impacts*

HDD = *Heating degree days, to account for weather seasonality impacts*

Days = *Number of days in the month*

The following graph illustrates the comparison of the provided monthly flow data to that predicted by the aforementioned regression:

Actual Flow vs. Regression



TMY3 HDD and CDD values were input into the regression formula to produce typical total annual flow. Using the pump metrics from the previous table annual energy consumption for the baseline and as-built system was determined; which, can be seen in the following tables:

Typical Baseline kWh Consumption

Metric	*Pump 1*	*Pump 2*	*Pump 3*	*Pump 4*	*Total*
Gallons	116,794,899	363,359,992	115,350,325	54,281,491	649,786,707
Hours	1,489	4,633	1,471	692	8,285
kW	70.08	67.74	69.29	69.04	-
kWh	104,360	313,833	101,918	47,782	567,892

Typical As-Built kWh Consumption

Metric	*Pump 1*	*Pump 2*	*Pump 3*	*Pump 4*	*Total*
Gallons	162,563,065	191,681,365	285,522,280	10,019,996	649,786,707
Hours	2,502	2,950	4,394	154	10,000
kW	60.30	60.90	62.30	61.17	-
kWh	150,851	179,641	273,739	9,432	613,662

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for High Service Pump VFDs

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
High Service Pump VFDs	1,207,536			0
Total	1,207,536			0

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	High Service Pump VFDs	1,207,536	0	0%	0.00	0
Total		***1,207,536***	***0***	***0%***	***0.00***	***0***

The realization rate for this project is 0%. The zero savings attributed to this site is due to the site being a processed based site and the fact that the VFDs are ran at near full speed. Though VFDs do save energy, they have an inherited efficiency loss that can result in a negative savings when ran at full speed. This is further compounded by the fact that the total gallons needed to be pumped in both the baseline and as-built configurations remains the same. Even though kW demand of the system is decreased so is the flow; therefore, annual operating hours have to increase to meet volume demand. The combination of these items results in an increase in annual energy consumption but does increase the life of the pumps as the VFDs allow for a soft start operation.

As for the ex-ante savings calculation, they do not consider the pumps' actual usage—intermittent pumping at constant speed. Instead, it applies a usage profile consisting of varying pump speeds from a generic VFD savings calculator.

Name S-33

Executive Summary

Under application S-33 received Standard incentives from the Illinois Department of Commerce for LED retrofit project. The realization rate for this project is 211%.

Project Description

The customer retrofitted the following fixtures:

- (80) 43W Incandescent bulb with 10.5W LED bulb
- (4) 150W Metal Halide with 23W Small Wall Mounted Area Light
- (7) 175W Metal Halide with 23W Small Wall Mounted Area Light
- (24) 400W Metal Halide with LED High Bay
- (4) 400W Metal Halide with LED Flood Light
- (2) 300W Quartz fixture with LED Flood Light
- (1) 250 Metal Halide with LED Flood Light

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting project.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*			
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
LED Bulbs and Fixtures	80	TRM = 40 Actual = 43	TRM = 10.6 Actual = 10.5	2,327	TRM = 0.91 Errata = 1.00	1.23	6,334	6,125	6,732	
LED Bulbs and Fixtures	4	TRM = 124.3 Actual = 188	TRM = 18.6 Actual = 23	4903	TRM = 0.91 Errata = 1.00	1.00	997	1,886	2,073	
LED Bulbs and Fixtures	7	TRM = 124.3 Actual = 215	TRM = 18.6 Actual = 23	4,903	TRM = 0.91 Errata = 1.00	1.00		3,301	3,628	
LED Bulbs and Fixtures	24	TRM = 295 Actual = 458	TRM = 160.2 Actual = 153	4,311	TRM = 0.91 Errata = 1.00	1.23	12,737	15,611	17,155	38,815
LED Bulbs and Fixtures	4	TRM = 295 Actual = 458	TRM = 160.2 Actual = 112	4,903	TRM = 0.91 Errata = 1.00	1.00	6,175	4,365	4,797	
LED Bulbs and Fixtures	1	TRM = 295 Actual = 295	TRM = 160.2 Actual = 112	4,903	TRM = 0.91 Errata = 1.00	1.00	1,678	1,091	1,199	2,344
LED Bulbs and Fixtures	2	TRM = 295 Actual = 300	TRM = 160.2 Actual = 112	4,903	TRM = 0.91 Errata = 1.00	1.00	2,133	2,183	2,399	
Total							***30,054***	***34,564***	***37,982***	***41,159***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-level Gross Realized Savings

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Quantity*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	80	6,334	6,732	106%	0.38	15	100,979	N/A	N/A
	4.5.4	4	997	2,073	572%	0.0	10.2	21,144	N/A	N/A
	4.5.4	7		3,628		0.0	10.2	37,003	N/A	N/A
	4.5.4	24	12,737	38,815	249%	1.19	8.1	314,398	N/A	N/A
	4.5.4	4	6,175	4,797	78%	0.0	10.2	48,930	N/A	N/A
	4.5.4	1	1,678	2,344	140%	0.0	10.2	23,905	N/A	N/A
	4.5.4	2	2,133	2,399	107%	0.0	10.2	24,465	N/A	N/A
Total			***30,054***	***60,788***	***202%***	***1.57***		***628,972***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 211%. Based on algorithms in TRM version 3.0 measure 4.5.4, the TRM errata corrected ex post savings per fixture for the first, second, fourth, and sixth measures were 84.15 kWh, 518.25 kWh, 1,199.27 kWh, and 1,199.27 kWh, whereas the ex ante savings estimates were 79.18 kWh, 530.71 kWh, 1,543.75 kWh, and 425.5 kWh per fixture, respectively.

The ADM calculated ex post savings per fixture for the third and fifth measures were 1,617.27 kWh and 2,343.63 kWh, whereas the ex ante savings estimates were 530.71 kWh and 1,678 kWh per fixture, respectively.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For these measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-34

Executive Summary

Under project S-34, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofits, installation of beverage machine occupancy sensors, installation of demand control ventilation and VFDs on a supply and return fan. The natural gas realization rate for this project is 89% and the electric realization rate is 106%.

Project Description

The customer performed the following lighting retrofits:

- (28) 4’ T12 lamps with 4’ T8 Lamps
- (16) 8’ T12 lamps with 8’ T8 Lamps
- (24) Fluorescent lamps with LED lamps
- Installed (3) beverage machine occupancy sensor
- Installed (4) wall mounted occupancy sensor
- (45) Metal Halide fixtures with 4’ T5 fixtures
- (1) Fluorescent lamp with T8 fluorescent lamp
- (21) Wall packs with LED wall packs
- (4) Metal Halide fixture with Exterior LEDs

The installed measures focused on reducing the overall HVAC energy use of the junior high school. In order to accomplish this, the customer installed VFDs on the supply and return fans of an air handling unit. Originally, the fans were constant speed and the addition of the VFDs will efficiently modulate air flow based on the cooling/heating demand of the space.

In order to maximize the energy savings at the school, Demand Control Ventilation (DCV) controls were installed throughout the school. DCV saves energy by reducing the minimum outside air being supplied to the space through the use of CO2 sensors located throughout the school.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.1, 4.5.3, 4.5.4, 4.5.12, and 4.6.2. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled	= total lighting load connected to the control in kilowatts
ESF	= Energy Savings Factor
WHFe	= waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd	= heat factor to account for cooling demand savings
CFbaseline	= Baseline Summer Peak Coincidence Factor
CFos	= Retrofit Summer Peak Coincidence Factor

For the beverage and snack machine occupancy controls, TRM section 4.6.2 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = WATTSbase/1000 * \ Hours * ESF$$

Where:

WATTSbase = total lighting load connected to the control in watts

ESF = Energy Savings Factor

For the Demand Control Ventilation, the erratum TRM Version 4.0 Section 4.4.19 Demand Control Ventilation was used.

ELECTRIC ENERGY SAVINGS

ΔkWh = Condition Space/1000 * Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Elec_Savings_Factor = value in table below based on building type and weather zone[8]

SUMMER COINCIDENT PEAK DEMAND SAVINGS

NA

NATURAL GAS ENERGY SAVINGS

ΔTherms = Condition Space/1000 * Therm_Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Therm _Savings_Factor = value in table below based on building type and weather zone[9]

[8] The electric energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

[9] The natural gas energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1 and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

For the supply and return fan VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $kW_{connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW = $kW_{connected}$ * DSF

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13

Application	DSF
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHF e-IF*	*Ex Ante*	*TRM-Calculated*	*TRM Errata*
								Ex Post	*Ex Post*
T8 Lamps and Fixtures	28	TRM = 40 Actual = 36	TRM = 25 Actual = 32	TRM = 4311 Actual = 4311	1	1.23	2,352	2,227	
T8 Lamps and Fixtures	16	TRM = 82 Actual = 99	TRM = 49 Actual = 57	TRM = 4311 Actual = 4311	1	1.23	2,851	2,800	
LED Lamps and Fixtures	4	TRM = 40 Actual = 60	TRM = 10.6 Actual = 11	TRM = 2327 Actual = 2327	TRM = 0.91 Errata = 1	1.23	1,900	306	337
LED Lamps and Fixtures	6	TRM = 45 Actual = 90	TRM = 17.7 Actual = 17	TRM = 2327 Actual = 2327	TRM = 0.91 Errata = 1	1.23		427	469
LED Lamps and Fixtures	10	TRM = 40 Actual = 100	TRM = 10.6 Actual = 11	TRM = 2327 Actual = 2327	TRM = 0.91 Errata = 1	1.23		766	841
LED Lamps and Fixtures	4	TRM = 40 Actual = 60	TRM = 10.6 Actual = 11	TRM = 2327 Actual = 2327	TRM = 0.91 Errata = 1	1.23		306	337
T5 Lamps and Fixtures	12	TRM = 455 Actual = 460	TRM = 180 Actual = 159	TRM = 4311 Actual = 4311	1	1.23	18,387	17,498	
T5 Lamps and Fixtures	18	TRM = 455 Actual = 460	TRM = 240 Actual = 264	TRM = 4311 Actual = 4311	1	1.23	17,959	20,521	
T5 Lamps and Fixtures	15	TRM = 455 Actual = 460	TRM = 240 Actual = 212	TRM = 4311 Actual = 4311	1	1.23	18,936	17,101	
T8 Lamps and Fixtures	1	TRM = 455 Actual = 300	TRM = 206 Actual = 48	TRM = 4311 Actual = 4311	1	1.23	1,336	1,320	
LED Lamps and Fixtures	18	TRM =182.9 Actual = 210	TRM = 52.5 Actual = 33	TRM = 4311 Actual = 4311	TRM = 0.91 Errata = 1	1.23	1,903	11,326	12,446
LED Lamps and Fixtures	3	TRM =182.9 Actual = 185	TRM = 52.5 Actual = 33	TRM = 4311 Actual = 4311	TRM = 0.91 Errata = 1	1.23		1,888	2,074
LED Lamps and Fixtures	2	TRM =361.4 Actual = 295	TRM = 116.8 Actual = 92	TRM = 4311 Actual = 4385	TRM = 0.91 Errata = 1	1.23	1,780	2,361	2,594
LED Lamps and Fixtures	1	TRM =182.9 Actual = 295	TRM = 52.5 Actual = 69	TRM = 4311 Actual = 4385	TRM = 0.91 Errata = 1	1.23	991	629	691
LED Lamps	1	TRM =361.4	TRM = 116.8	TRM = 4311	TRM = 0.91	1.23	1,614	1,180	1,297

and Fixtures		Actual = 460	Actual = 92	Actual = 4385	Errata = 1				
Total							***70,009***	***80,656***	***82,553***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Annual kWh Savings for Lighting Occupancy Controls

Measure	*Calculation Inputs*					*Annual Gross kWh Savings*	
	Qty	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Wall-mounted Occupancy Sensors	1 4	2 10.542	3 4,311	4 0.41	5 0.74	6 22,919	7 22,919
Fixture-mounted Occupancy Sensors*	0	0.00	0	0.00	0	1,464	0
Total						***24,383***	***22,919***

*This measure was incentivized under 4.5.10 (Fixture mounted lighting). The correct measure is 4.6.2 (Beverage machine occupancy sensor), analyzed in table below.

Annual kWh Savings for Beverage and Snack Machine Occupancy Controls

Measure	*Calculation Inputs*				*Annual Gross kWh Savings*	
	Qty	*Watts Controlled*	*Hours*	*ESF*	*Ex Ante*	*TRM-Calculated Ex Post*
Beverage and Snack Machine Controls	3	400	8,766	0.46	0	4,839
Total					***0***	***4,839***

Annual Therms Savings for Demand Control Ventilation

Measure	*Measure Metrics*				*Annual Gross Therms Savings*			
	Building Type	*Zone*	*Conditioned Space (Sq. Ft.)*	*Savings Factor (Therm/1000 SqFt)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
Demand Control Ventilation	High School	3 (Springfield)	46,780	63	3,321	2,526	2,947	
Total					3,321	2,526	2,947	

Annual kWh Savings for Demand Control Ventilation

Measure	*Measure Metrics*				*Annual Gross kWh Savings*		
	Building Type	*Zone*	*Conditioned Space (Sq. Ft.)*	*Savings Factor (kWh/1000 SqFt)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Demand Control Ventilation	High School	3 (Springfield)	46,780	340	26,665	30,875	15,905
Total					26,665	30,875	15,905

Annual kWh Savings for VFDs on Fans

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	15 HP	School(K-12)	9,222	11,409
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	5 HP	School(K-12)	3,074	3,807
Total						12,296	15,216

Summary of Project-Level Gross Realized Savings

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	Demand Control Ventilation	3,321	2,947	89%	29,471	
Total		***3,321***	***2,947***	***89%***	***29,471***	

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting and occupancy sensor retrofits.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.3	2,352	2,227	95%	0.07	7	15,498	N/A	N/A
	4.5.3	2,851	2,800	98%	0.09	6	15,587	N/A	N/A
	4.5.4	1,900	1,984	104%	0.11	11	21,310	N/A	N/A
	4.5.10	22,919	22,919	100%	2.18	8	183,350	N/A	N/A
	4.5.10	1,464	N/A	N/A	0.00	8	0	N/A	N/A
	4.6.2	N/A	4,839	N/A	0.00	5	24,194	N/A	N/A
	4.5.12	18,387	17,498	95%	0.54	5	81,180	N/A	N/A
	4.5.12	17,959	20,521	114%	0.63	5	95,202	N/A	N/A
	4.5.12	18,936	17,101	91%	0.53	5	79,335	N/A	N/A
	4.5.3	1,336	1,320	99%	0.04	6	7,350	N/A	N/A
	4.5.4	1,903	14,520	763%	0.45	12	168,412	N/A	N/A
	4.5.4	1,780	2,594	146%	0.08	11	29,578	N/A	N/A
	4.5.4	991	691	70%	0.02	11	7,884	N/A	N/A
	4.5.4	1,614	1,297	80%	0.04	11	14,789	N/A	N/A
	Demand Control Ventilation	26,665	15,905	60%	0.00		159,052	N/A	N/A
	Variable Speed Drives for HVAC	12,296	15,216	124%	4.49		228,237	N/A	N/A
Total		***133,353***	***141,432***	***106%***	***9.26***		***1,130,958***		

* TRM calculated ex post values are used if errata corrected values are not applicable.

The natural gas measures have a combined verified realization rate of 89%. The cause of the lower realization rate can be attributed to ADM calculating a lower than expected natural gas savings for the Demand Control Ventilation measure. ADM calculated the annual natural gas savings for DCV through the use of the IL TRM, and so did the ex ante analysis. However, the ex ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0. The ex ante calculation also used the Therms savings factor for a high school located in the Chicago weather zone, when the school is actually located in the Springfield weather zone.

The electric realization rate for this project is 106%.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the first measure was 80 kWh per fixture, whereas the ex ante savings estimate was 84 kWh per fixture.

The ex post savings for the second measure was 175 kWh per fixture, whereas the ex ante savings estimate was 178 kWh per fixture.

The ex post savings for the tenth measure was 1320 kWh per fixture, whereas the ex ante savings estimate was 1336 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.4, the ex post savings for the third measure was 496 kWh per fixture, whereas the ex ante savings estimate was 79 kWh per fixture.

The ex post savings for the eleventh measure was 807 kWh per fixture, whereas the ex ante savings estimate was 91 kWh per fixture.

The ex post savings for the twelfth measure was 1,297 kWh per fixture, whereas the ex ante savings estimate was 890 kWh per fixture.

The ex post savings for the thirteenth measure was 691 kWh per fixture, whereas the ex ante savings estimate was 991 kWh per fixture.

The ex post savings for the fourteenth measure was 1,297 kWh per fixture, whereas the ex ante savings estimate was 1,614 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.10, the ex post savings for the fourth measure was 5,730 kWh per fixture, whereas the ex ante savings estimate was 5,730 kWh per fixture. The realization rate for this measure was 100%.

The incentive given for the fifth measure was based on fixture mounted occupancy sensors (4.5.10), however, the correct measure to be used is beverage machine controls (4.6.2). The program participant will be given credit for this installation under measure 4.6.2. Based on algorithms in TRM 3.0 measure 4.6.2, the ex post savings for the sixth measure was 1,613 kWh per fixture, whereas the ex ante savings estimate for the fifth measure was 488 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.12, the ex post savings for the seventh measure was 1,458 kWh per fixture, whereas the ex ante savings estimate was 1,532 kWh per fixture.

The ex post savings for the eighth measure was 1,140 kWh per fixture, whereas the ex ante savings estimate was 998 kWh per fixture.

The ex post savings for the ninth measure was 1,140 kWh per fixture, whereas the ex ante savings estimate was 1,262 kWh per fixture.

The divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contribute to the difference between ex ante savings and ex post savings.

The Demand Control Ventilation and Variable Speed Drive measures have a combined verified realization rate of 80%. The cause of the lower realization rate can be attributed to ADM calculating a lower than expected electric savings for the Demand Control Ventilation measure. ADM calculated the annual electric savings for DCV through the use of the IL TRM, and so did the ex ante analysis. However, the ex ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0. The ex ante calculation also used the kWh savings factor for a high school located in the Chicago weather zone, when the school is actually located in the Springfield weather zone.

Name S-35

Executive Summary

Under project S-35, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofits and installation of demand control ventilation. The natural gas realization rate for this project is 89% and the electric realization rate is 100%.

Project Description

The customer performed the following lighting retrofits:

- (1) Fluorescent lamp with Compact Fluorescent lamp
- (6) 4' T12 lamps with 4' T8 Lamps
- (6) Fluorescent lamps with LED lamps
- Installed (1) wall mounted occupancy sensor
- (12) Metal Halide fixtures with 4' T5 fixtures
- (11) Wall packs with LED wall packs

In order reduce the HVAC energy consumption at the school, Demand Control Ventilation (DCV) controls were installed throughout the school. DCV saves energy by reducing the minimum outside air being supplied to the space through the use of CO_2 sensors located throughout the school.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.1, 4.5.3, 4.5.4, and 4.5.12. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled	= total lighting load connected to the control in kilowatts
ESF	= Energy Savings Factor
WHFe	= waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd	= heat factor to account for cooling demand savings
CFbaseline	= Baseline Summer Peak Coincidence Factor
CFos	= Retrofit Summer Peak Coincidence Factor

For the Demand Control Ventilation, the erratum TRM Version 4.0 Section 4.4.19 Demand Control Ventilation was used.

ELECTRIC ENERGY SAVINGS

ΔkWh = Condition Space/1000 * Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Elec_Savings_Factor = value in table below based on building type and weather zone[10]

SUMMER COINCIDENT PEAK DEMAND SAVINGS

NA

NATURAL GAS ENERGY SAVINGS

ΔTherms = Condition Space/1000 * Therm_Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Therm _Savings_Factor = value in table below based on building type and weather zone[11]

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated*	*TRM Errata*
								Ex Post	*Ex Post*
Compact Fluorescent Lamps	1	TRM = 150 Actual =150	TRM = 42 Actual = 42	2,327	TRM = .91 Errata = 1	1.23	309	309	
HP and RW T8 Fixtures and Lamps	6	TRM = 40 Actual = 36	TRM = 25 Actual = 32	4,311	TRM = .91 Errata = 1	1.23	504	477	
LED Lamp/Fixture	5	TRM = 40 Actual = 72	TRM = 10.6 Actual = 11	2,327	TRM = .91 Errata = 1	1.23	475	383	421
LED Lamps and Fixtures	1	TRM = 40 Actual =150	TRM = 10.6 Actual = 11	2,327	TRM = .91 Errata = 1	1.23		77	84
T5 New Fluorescent Fixtures	12	TRM = 295 Actual =295	TRM = 180 Actual = 159	4,311	TRM = .91 Errata = 1	1.23	11,545	7,317	

[10] The electric energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

[11] The natural gas energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1 and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

LED Wall Pack	8	TRM=182.9 Actual =129	TRM = 52.5 Actual = 30	4,903	TRM = .91 Errata = 1	1.23	997	5,725	6,291
LED Wall Pack	3	TRM=124.3 Actual =100	TRM = 18.6 Actual = 10	4,903	TRM = .91 Errata = 1	1.23		1,740	1,912
Total							***13,830***	***16,029***	***16,812***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Annual kWh Savings for Lighting Controls

Measure	*Calculation Inputs*					*Annual Gross kWh Savings*	
	Qty	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Occupancy Sensor Lighting Control	1	1.908	4,311	0.41	1.23	4,148	4,148
Total						***4,148***	***4,148***

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for Demand Control Ventilation

Measure	*Measure Metrics*				*Annual Gross Therms Savings*		
	Building Type	*Zone*	*Conditioned Space (Sq. Ft.)*	*Savings Factor (Therm/1000 SqFt)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Demand Control Ventilation	High School	3 (Springfield)	12,600	63	895	680	794
Total					895	680	794

Annual kWh Savings for Demand Control Ventilation

Measure	*Measure Metrics*				*Annual Gross kWh Savings*		
	Building Type	*Zone*	*Conditioned Space (Sq. Ft.)*	*Savings Factor (kWh/1000 SqFt)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Demand Control	High School	3	46,780	340	7,182	8,316	4,284

Ventilation		(Springfield)					
Total					7,182	8,316	4,284

[2] The natural gas energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1 and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

Summary of Project-Level Gross Realized Savings

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	Demand Control Ventilation	895	794	89%	7,938	
Total		***895***	***794***	***89%***	***7,938***	

The table below presents the realized gross energy savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.1	309	309	100%	0.02	4	1,328	N/A	N/A
	4.5.3	504	477	95%	0.01	6	2,657	N/A	N/A
	4.5.4	475	505	106%	0.02	11	5,424	N/A	N/A
	4.5.10	4,148	4,148	100%	0.32	8	33,185	N/A	N/A
	4.5.12	11,545	7,317	63%	0.17	5	33,948	N/A	N/A
	4.5.4	997	8,204	823%	0.05	10	83,658	N/A	N/A
	Demand Control Ventilation	7,182	4,284	60%	0.00		42,840	N/A	N/A
Total		***25,160***	***25,244***	***100%***	***0.61***		***160,200***		

*TRM calculated ex post values are used if errata corrected values are not applicable.

The natural gas measure has a verified realization rate of 89%. The cause of the lower realization rate can be attributed to ADM calculating a lower than expected natural gas savings for the Demand Control Ventilation control measure. ADM calculated the annual natural gas savings for DCV through the use of the IL TRM, and so did the ex ante analysis. However, the ex ante analysis utilized TRM Version 3.0; while, ADM used errata Version 4.0. The ex ante calculation also used the Therms savings factor for a high school located in the Chicago weather zone, when in the school is actually located in the Springfield weather zone.

The electric realization rate for this project is 100%.

The realization for the first measure, 4.5.1, is 100%.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the second measure was 80 kWh per fixture, whereas the ex ante savings estimate was 84 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.4, the ex post savings for the third measure was 101 kWh per fixture, whereas the ex ante savings estimate was 79 kWh per fixture.

The ex post savings for the sixth measure was 1025 kWh per fixture, whereas the ex ante savings estimate was 91 kWh per fixture.

The realization rate for the fourth measure, 4.5.10, is 100%.

Based on algorithms in TRM 3.0 measure 4.5.12, the ex post savings for the fifth measure was 610 kWh per fixture, whereas the ex ante savings estimate was 962 kWh per fixture.

The divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contribute to the difference between ex ante savings and ex post savings.

The Demand Control Ventilation measure has a verified realization rate of 60%. The cause of the low realization rate can be attributed to ADM calculating a lower than expected electric savings for the Demand Control Ventilation control measure. ADM calculated the annual electric savings for DCV through the use of the IL TRM, and so did the ex ante analysis. However, the ex ante analysis utilized TRM Version 3.0; while, ADM used errata Version 4.0. The ex ante calculation also used the kWh savings factor for a high school located in the Chicago weather zone, when the school is actually located is located in the Springfield weather zone.

Name S-36

Executive Summary

Under project S-36, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofits, installation of demand control ventilation, and VFDs on three supply fans for make-up air handling units. The electric realization rate for this project is 117% and the natural gas realization rate is 89%.

Project Description

The customer performed the following lighting retrofits:

- (4) Fluorescent lamp with Compact Fluorescent lamp
- (2) 4’ T12 lamps with 4’ T8 lamps
- (2) 2’ T12 lamps with 4’ T8 lamps
- (72) Fluorescent lamps with LED lamps
- Installed (4) wall mounted occupancy sensor
- Installed (2) beverage machine occupancy sensors
- (56) Metal Halide fixtures with 4’ T5 fixtures
- (24) Wall packs with LED wall packs
- (2) Exterior metal halide fixtures with exterior LED fixtures

The installed measures focused on reducing the overall HVAC energy use of the high school. In order to accomplish this, the customer installed VFDs on the supply fans of three make-up air handling units. Originally the fans were constant speed. The addition of the VFDs will efficiently modulate air flow based on the cooling/heating demand of the space.

In order to maximize the energy savings at the school, Demand Control Ventilation (DCV) was installed throughout the school. DCV saves energy by reducing the minimum outside air being supplied to the space through the use of CO_2 sensors located throughout the school.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings were calculated according to the Illinois TRM 3.0, measures 4.5.1, 4.5.3, 4.5.4, 4.5.12, and 4.6.2. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled	= total lighting load connected to the control in kilowatts
ESF	= Energy Savings Factor
WHFe	= waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd	= heat factor to account for cooling demand savings
CFbaseline	= Baseline Summer Peak Coincidence Factor
CFos	= Retrofit Summer Peak Coincidence Factor

For the beverage and snack machine occupancy controls, TRM section 4.6.2 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = WATTSbase/1000 * \ Hours * ESF$$

Where:

WATTSbase = total lighting load connected to the control in watts

ESF = Energy Savings Factor

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied.

For the Demand Control Ventilation, the erratum TRM Version 4.0 Section 4.4.19 Demand Control Ventilation was used.

ELECTRIC ENERGY SAVINGS

ΔkWh = Condition Space/1000 * Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Elec_Savings_Factor = value in table below based on building type and weather zone[12]

SUMMER COINCIDENT PEAK DEMAND SAVINGS

NA

NATURAL GAS ENERGY SAVINGS

ΔTherms = Condition Space/1000 * Therm_Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Therm _Savings_Factor = value in table below based on building type and weather zone[13]

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[12] The electric energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

[13] The natural gas energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1 and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

For the supply fan VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

$\Delta kWH = kW_{connected} * Hours * ESF$

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kW_{connected} * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM Errata Ex Post*
Compact Fluorescent Lamps	4	TRM = 150 Actual = 150	TRM = 42 Actual = 42	2327	1	1.23	1,236	1,236	
T8 Fixtures and Lamps	2	TRM = 40 Actual = 36	TRM = 25 Actual = 32	4311	1	1.23	168	159	
T8 Fixtures and Lamps	2	TRM = 32 Actual = 26	TRM = 25 Actual = 14	4311	1	1.23	84	74	
LED Fixture	5	TRM = 43 Actual = 43	TRM = 16.4 Actual = 11	2327	TRM = .91 Errata = 1	1.23	5,701	346	381
LED Fixture	10	TRM = 72 Actual = 72	TRM = 16.4 Actual = 11	2327	TRM = .91 Errata = 1	1.23		1,448	1,591
LED Fixture	16	TRM = 72 Actual = 120	TRM = 16.4 Actual = 11	2327	TRM = .91 Errata = 1	1.23		2,317	2,546
LED Fixture	6	TRM = 40 Actual = 50	TRM = 10.6 Actual = 10	2327	TRM = .91 Errata = 1	1.23		459	505
LED Fixture	2	TRM = 72 Actual = 72	TRM = 10.6 Actual = 10	2327	TRM = .91 Errata = 1	1.23		320	351
LED Fixture	3	TRM = 40 Actual = 150	TRM = 10.6 Actual = 10	2327	TRM = .91 Errata = 1	1.23		230	252

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM Errata Ex Post*
LED Fixture	4	TRM = 50 Actual = 65	TRM = 22.5 Actual = 14	2327	TRM = .91 Errata = 1	1.23		287	315
LED Fixture	26	TRM = 50 Actual = 90	TRM = 22.5 Actual = 14	2327	TRM = .91 Errata = 1	1.23		1,862	2,046
T5 Fluorescent Fixtures	1	TRM = 455 Actual = 460	TRM = 240 Actual = 212	4311	1	1.23	1,262	1,140	
T5 Fluorescent Fixtures	45	TRM = 455 Actual = 460	TRM = 240 Actual = 264	4311	1	1.23	44,898	51,302	
T5 Fluorescent Fixtures	10	TRM = 455 Actual = 460	TRM = 180 Actual = 159	4311	1	1.23	15,322	14,582	
LED Wall Pack	2	TRM = 124.3 Actual = 91	TRM = 18.6 Actual = 10	4903	TRM = .91 Errata = 1	1.23		1,160	1,275
LED Wall Pack	20	TRM = 124.3 Actual = 129	TRM = 18.6 Actual = 30	4903	TRM = .91 Errata = 1	1.23	2,175	11,601	12,749
LED Wall Pack	2	TRM = 182.9 Actual = 210	TRM = 52.5 Actual = 30	4903	TRM = .91 Errata = 1	1.23		1,431	1,573
Exterior LED fixture	2	TRM = 182.9 Actual = 210	TRM = 52.5 Actual = 45	4903	TRM = .91 Errata = 1	1.23	1,447	1,431	1,573
Total								***129,576***	***25,158***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Annual kWh Savings for Occupancy Controls

Measure	*Calculation Inputs*					*Annual Gross kWh Savings*	
	Qty	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Occupancy Sensor Lighting Control	4	16.76	4,311	0.41	0.74	36,432	36,433
Occupancy Sensor Beverage Machine Control*	0	0.00	0	0.00	N/A	1,464	0
Total						***37,836***	***36,433***

*This measure was incorrectly incentivized under 4.5.10 (Fixture mounted lighting). The correct measure is 4.6.2 (Beverage machine occupancy sensor)

Annual kWh Savings for Beverage and Snack Machine Occupancy Controls

Measure	Calculation Inputs				Annual Gross kWh Savings	
	Qty	Watts Controlled	Hours	ESF	Ex Ante	TRM-Calculated Ex Post
Beverage and Snack Machine Controls	2	400	8,766	0.46	0	3,226
Total					***0***	***3,226***

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for Demand Control Ventilation

Measure	Measure Metrics				Annual Gross Therms Savings		
	Building Type	Zone	Conditioned Space (Sq. Ft.)	Savings Factor (Therm/1000 SqFt)	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Demand Control Ventilation	High School	3 (Springfield)	12,403	63	881	670	781
Total					881	670	781

Annual kWh Savings for Demand Control Ventilation

Measure	Measure Metrics				Annual Gross kWh Savings		
	Building Type	Zone	Conditioned Space (Sq. Ft.)	Savings Factor (kWh/1000 SqFt)	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Demand Control Ventilation	High School	3 (Springfield)	12,403	340	7,070	8,186	4,217
Total					7,070	8,186	4,217

Annual kWh Savings for VFDs on Fans

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	7.5 HP	School(K-12)	4,611	5,704
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	7.5 HP	School(K-12)	4,611	5,704
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	5 HP	School(K-12)	3,074	3,807
Total						12,296	15,215

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	Demand Control Ventilation	881	781	89%	7,814	
Total		***881***	***781***	***89%***	***7,814***	

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.1	1,236	1,236	100%	0.07	4	5,314	N/A	N/A
	4.5.3	168	159	95%	0.00	9	1,476	N/A	N/A
	4.5.3	84	74	88%	0.00	11	689	N/A	N/A
	4.5.4	5,701	7,269	128%	0.45	12	85,823	N/A	N/A
	4.5.10	36,432	36,433	100%	3.47	8	291,460	N/A	N/A
	4.5.10	1,464	N/A	N/A	0.00	8	0	N/A	N/A
	4.6.2		3,226	N/A	0.00	5	16,129	N/A	N/A
	4.5.12	1,262	1,140	90%	0.04	15	17,101	N/A	N/A
	4.5.12	44,898	51,302	114%	1.58	15	769,530	N/A	N/A
	4.5.12	15,322	14,582	95%	0.45	15	218,729	N/A	N/A
	4.5.4	2,175	15,597	717%	0.42	10	159,051	N/A	N/A
	4.5.4	1,447	1,573	109%	0.04	10	16,039	N/A	N/A
	Demand Control Ventilation	7,070	4,217	60%	0.00		42,170	N/A	N/A
	Variable Speed Drives for HVAC	12,296	15,215	124%	4.48		171,133	N/A	N/A
Total		***129,555***	***152,023***	***117%***	***11.01***		***1,787,166***		

* TRM calculated ex post values are used if errata corrected values are not applicable.

The natural gas measure has a verified realization rate of 89%. The cause of the lower realization rate can be attributed to ADM calculating a lower than expected natural gas savings for the Demand Control Ventilation measure. ADM calculated the annual natural gas savings for DCV through the use of the IL TRM, and so did the ex ante analysis. However, the ex ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0. The ex ante calculation also used the Therms savings factor for an elementary school located in the Chicago weather zone, when the school is actually located in the Springfield weather zone.

The electric realization rate for this project is 117%.

The realization for the first measure, 4.5.1, is 100%.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the second measure was 80 kWh per fixture, whereas the ex ante savings estimate was 84 kWh per fixture.

The ex post savings for the third measure was 37 kWh per fixture, whereas the ex ante savings estimate was 42 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.4, the ex post savings for the fourth measure was 111 kWh per fixture, whereas the ex ante savings estimate was 79 kWh per fixture.

The ex post savings for the tenth measure was 7,798 kWh per fixture, whereas the ex ante savings estimate was 1,088 kWh per fixture.

The ex post savings for the eleventh measure was 786 kWh per fixture, whereas the ex ante savings estimate was 724 kWh per fixture.

The realization for the fifth measure, 4.5.10, is 100%.

The incentive given for the sixth measure was based on fixture mounted occupancy sensors (4.5.10), however, the correct measure is beverage machine controls (4.6.2). The program participant will be given credit for this installation under measure 4.6.2. Based on algorithms in TRM 3.0 measure 4.6.2, the ex post savings for the seventh measure was 1,613 kWh per fixture, whereas the ex ante savings estimate for the sixth measure was 732 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.12, the ex post savings for the eighth measure was 1,140 kWh per fixture, whereas the ex ante savings estimate was 1,262 kWh per fixture.

The ex post savings for the ninth measure was 1,140 kWh per fixture, whereas the ex ante savings estimate was 998 kWh per fixture.

The ex post savings for the tenth measure was 1,458 kWh per fixture, whereas the ex ante savings estimate was 1,532 kWh per fixture.

The divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contribute to the difference between ex ante savings and ex post savings.

It should be noted that ADM calculated a lower than expected electric savings for the Demand Control Ventilation control measure. ADM calculated the annual electric savings for DCV through the use of the IL TRM, and so did the ex ante analysis. However, the ex ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0. The ex ante calculation also used the kWh savings factor for an elementary school located in the Chicago weather zone, when the school is actually located in the Springfield weather zone. This resulted in an individual realization rate of 60%.

Name S-37

Executive Summary

Under project S-37, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofits, installation of two high efficiency boilers, one high efficiency split air conditioner, one high efficiency furnace, and demand control ventilation. The natural gas realization rate for this project is 111% and the electric realization rate is 136%.

Project Description

The customer performed the following retrofit:

- (2) Fluorescent lamp with Compact Fluorescent lamp
- (18) 4’ T12 lamps with 4’ T8 Lamps
- (17) Fluorescent lamps with LED lamps
- (16) Wall packs with LED wall packs
- Installed (1) wall mounted occupancy sensor
- Installed (2) beverage machine occupancy sensor
- (16) Metal Halide fixtures with 4’ T5 fixtures
- (1) Metal Halide fixture with LED Spot

The installed measures focused on reducing the overall HVAC energy use of the elementary school. In order to accomplish this, the customer installed (2) new Lochinvar high efficiency boilers with an efficiency of 92% AFUE. Each of the boilers provides a heating capacity of 1,500,000 Btu/h to the schools. The school also installed a new high efficiency 4 ton split system air conditioner mated with a 98.5% efficient furnace.

In order to maximize the energy savings at the school, Demand Control Ventilation (DCV) controls were installed throughout the school. DCV saves energy by reducing the minimum outside air being supplied to the space through the use of CO2 sensors located throughout the school.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings were calculated according to the Illinois TRM 3.0, measures 4.5.1, 4.5.3, 4.5.4, 4.5.12, and 4.6.2. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled	= total lighting load connected to the control in kilowatts
ESF	= Energy Savings Factor
WHFe	= waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd	= heat factor to account for cooling demand savings
CFbaseline	= Baseline Summer Peak Coincidence Factor
CFos	= Retrofit Summer Peak Coincidence Factor

For the beverage and snack machine occupancy controls, TRM section 4.6.2 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = WATTSbase/1000 * \; Hours * ESF$$

Where:

WATTSbase = total lighting load connected to the control in watts

ESF = Energy Savings Factor

For the boiler incentives, TRM Version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

ΔTherms = EFLH * Capacity * (($EffRating_{actual}$ – $EffRating_{base}$)/$EffRating_{base}$) / 100,000

Where:

EFLH = Equivalent Full Load Hours for heating (see table)

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependent on year and boiler type. Baseline efficiency values by boiler type and capacity are found in the Definition of Baseline Equipment Section

EfficiencyRating(actual) = Efficient Boiler Efficiency Rating use actual value

For the high efficiency furnace, TRM Version 3.0 Section 4.4.15 High Efficiency Furnace was used.

ELECTRIC ENERGY SAVINGS

ΔkWh = Heating Savings + Cooling Savings + Shoulder Season Savings

Where:

Heating Savings = Brushless DC motor or electronically commutated motor (ECM)
= 418 kWh[14]

Cooling Savings = Brushless DC motor or electronically commutated motor (ECM) savings during cooling season

[14] To estimate heating, cooling and shoulder season savings for Illinois, VEIC adapted results from a 2009 Focus on Energy study of BPM blower motor savings in Wisconsin. This study included effects of behavior change based on the efficiency of new motor greatly increasing the amount of people that run the fan continuously. The savings from the Wisconsin study were adjusted to account for different run hour assumptions (average values used) for Illinois. See: FOE to IL Blower Savings.xlsx.

If air conditioning = 263 kWh

If no air conditioning = 175 kWh

If unknown (weighted average) = 241 kWh[15]

Shoulder Season Savings = Brushless DC motor or electronically commutated motor (ECM) savings during shoulder seasons

= 51 kWh

SUMMER COINCIDENT PEAK DEMAND SAVINGS

For units that have evaporator coils and condensing units and are cooling in the summer in addition to heating in the winter the summer coincident peak demand savings should be calculated. If the unit is not equipment with coils or condensing units, the summer peak demand savings will not apply.

$\Delta kW = (\Delta kWh/HOURS_{year}) * CF$

Where:

$HOURS_{year}$ = Actual hours per year if known, otherwise use hours from Table below for building type[16].

Building Type	Pumps and fans (h/yr)
College/University	4216
Grocery	5840
Heavy Industry	3585
Hotel/Motel	6872
Light Industry	2465
Medical	6871
Office	2301
Restaurant	4654

[15] The weighted average value is based on assumption that 75% of buildings installing BPM furnace blower motors have Central AC.

[16] ComEd Trm June 1, 2010 page 139. The Office hours is based upon occupancy from the eQuest model developed for EFLH, since it was agreed the ComEd value was too low.

Building Type	Pumps and fans (h/yr)
Retail/Service	3438
School(K-12)	2203
Warehouse	3222
Average=Miscellaneous	4103

CF =Summer Peak Coincidence Factor for measure is provided below for different building types[17]:

Location	CF
Restaurant	0.80
Office	0.66
School (K-12)	0.22
College/University	0.56
Medical	0.75

NATURAL GAS ENERGY SAVINGS

Time of Sale:

ΔTherms = EFLH * Capacity * ((AFUE(eff) – AFUE(base)/AFUE(base))/ 100,000 Btu/Therm

Early replacement[18]:

ΔTherms for remaining life of existing unit (1st 5.5 years):

ΔTherms = EFLH * Capacity * (AFUE(eff) – AFUE(exist)/ AFUE(exist)) / 100,000 Btu/Therm

ΔTherms for remaining measure life (next 11 years):

ΔTherms = EFLH * Capacity * (AFUE(eff) - AFUE(base)/AFUE(base)) / 100,000 Btu/Therm

Where:

EFLH = Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use

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17 Based on DEER 2008 values

18 The two equations are provided to show how savings are determined during the initial phase of the measure (existing to efficient) and the remaining phase (new baseline to efficient). In practice, the screening tools used may either require a First Year savings (using the first equation) and then a “number of years to adjustment” and “savings adjustment” input which would be the (new base to efficient savings)/(existing to efficient savings).

Capacity = Nominal Heating Input Capacity Furnace Size (Btu/hr) for efficient unit not existing unit

= custom Furnace input capacity in Btu/hr

AFUE(exist) = Existing Furnace Annual Fuel Utilization Efficiency Rating

= Use actual AFUE rating where it is possible to measure or reasonably estimate.

If unknown, assume 64.4 AFUE%[19].

AFUE(base) = Baseline Furnace Annual Fuel Utilization Efficiency Rating, dependant on year:

AFUE(eff) = Efficent Furnace Annual Fuel Utilization Efficiency Rating.

= Actual. If Unknown, assume 95%[20]

For the Demand Control Ventilation, the erratum TRM Version 4.0 Section 4.4.19 Demand Control Ventilation was used.

ELECTRIC ENERGY SAVINGS

ΔkWh = Condition Space/1000 * Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Elec_Savings_Factor = value in table below based on building type and weather zone[21]

SUMMER COINCIDENT PEAK DEMAND SAVINGS

NA

NATURAL GAS ENERGY SAVINGS

ΔTherms = Condition Space/1000 * Therm_Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

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[19] Average nameplate efficiencies of all Early Replacement qualifying equipment in Ameren PY3-PY4.

[20] Minimum ENERGY STAR efficiency after 2.1.2012.

[21] The electric energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

Therm _Savings_Factor = value in table below based on building type and weather zone[22]

For the high efficiency package unit, the erratum TRM Version 4.0 Section 4.4.15 Single-Package and Split System Unitary Air Conditioners was used.

ELECTRIC ENERGY SAVINGS

For units with cooling capacities less than 65 kBtu/h:

ΔkWH = (kBtu/h) * [(1/$SEER_{base}$) – (1/$SEER_{ee}$)] * EFLH

For units with cooling capacities equal to or greater than 65 kBtu/h:

ΔkWH = (kBtu/h) * [(1/EER_{base}) – (1/EER_{ee})] * EFLH

Where:

kBtu/h = capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).

$SEER_{base}$ = Seasonal Energy Efficiency Ratio of the baseline equipment; see table

$SEER_{ee}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).

EER_{base} = Energy Efficiency Ratio of the baseline equipment; see table above for default values. Since IECC 2006 does not provide EER requirements for air-cooled air conditioners < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1

EER_{ee} = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EER_{ee} is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.

= Actual installed

EFLH = cooling equivalent full load hours; see table

[22] The natural gas energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1 and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW_{SSP} = (kBtu/h * (1/EER_{base} - 1/EER_{ee})) * CF_{SSP}$$

Where:

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM Errata Ex Post*
Compact Fluorescent Lamps	2	TRM = 150 Actual = 150	TRM = 42 Actual = 32	2327	1	1.23	554	618	
T8 Fixtures and Lamps	18	TRM = 32 Actual = 36	TRM = 25 Actual = 32	4311	1	1.23	836	668	
LED Lamp/Fixture	5	TRM = 40 Actual = 72	TRM = 10.6 Actual = 11	2327	TRM = 0.91 Errata = 1	1.23		383	421
LED Lamp/Fixture	6	TRM = 40 Actual = 50	TRM = 10.6 Actual = 10	2327	TRM = 0.91 Errata = 1	1.23	1,205	459	505
LED Lamp/Fixture	6	TRM = 124.3 Actual = 100	TRM = 18.6 Actual = 10	4903	TRM = 0.91 Errata = 1	1		2,830	3,109
LED Wall Pack	2	TRM = 182.9 Actual = 80	TRM = 52.5 Actual = 33	4903	TRM = 0.91 Errata = 1	1		1,164	1,279
LED Wall Pack	1	TRM = 182.9 Actual = 90	TRM = 52.5 Actual = 33	4903	TRM = 0.91 Errata = 1	1	1,299	582	639
LED Wall Pack	7	TRM = 182.9 Actual = 130	TRM = 52.5 Actual = 33	4903	TRM = 0.91 Errata = 1	1		4,073	4,475
LED Wall Pack	6	TRM = 182.9 Actual = 188	TRM = 52.5 Actual = 33	4903	TRM = 0.91 Errata = 1	1		3,491	3,836
T5 Fixtures	16	TRM = 455	TRM = 240	4311	1	1.23	11,163	18,241	

LED Bulbs and Fixtures	1	Actual = 460 TRM = 361.4 Actual = 460	Actual = 212 TRM = 116.8 Actual = 92	4903	TRM = 0.91 Errata = 1	1.23	1,614	1,342	1,475
Total							***16,671***	***33,850***	***35,267***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Annual kWh Savings for Lighting Occupancy Controls

Measure	*Calculation Inputs*					*Annual Gross kWh Savings*	
	Qty	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Wall Mounted Lighting Control	4	16.76	4,311	0.41	0.74	4,076	7,374
Fixture Mounted Ltg Control*	0	0.00	0	0.00	0.00	404	0
Total						***4,476***	***7,374***

*This measure was incentivized under 4.5.10 (Fixture mounted lighting). The correct measure is 4.6.2 (Beverage machine occupancy sensor), analyzed in table below.

Annual kWh Savings for Beverage and Snack Machine Occupancy Controls

Measure	*Calculation Inputs*				*Annual Gross kWh Savings*	
	Qty	*Watts Controlled*	*Hours*	*ESF*	*Ex Ante*	*TRM-Calculated Ex Post*
Beverage and Snack Machine Controls	2	400	8,766	0.46	0	3,226
Total					***0***	***3,226***

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Boiler btuh*	*Building Type*	*Efficient Measure*	*Ex Ante*	*TRM-Calculated* *Ex Post*
High Efficiency Boiler	TOS	1,500,000	Elementary	92%	1,575	2,086
High Efficiency Boiler	TOS	1,500,000	Elementary	92%	1,575	2,086
Total					3,150	4,172

Annual Therms Savings for High Efficiency Furnace

Measure	*Measure Metrics*						*Annual Gross Therms Savings*	
	Program Type	*AC or No AC*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated* *Ex Post*
High Efficiency Furnace	TOS	Air Conditioning	98.5%	Elementary	3 (Springfield)	60,000	116	129
Total							116	129

Annual Therms Savings for Demand Control Ventilation

Measure	*Measure Metrics*				*Annual Gross Therms Savings*		
	Building Type	*Zone*	*Conditioned Space (Sq. Ft.)*	*Savings Factor (Therm/1000 SqFt)*	*Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*
Demand Control Ventilation	Elementary	3 (Springfield)	41,230	64	3,010	2,309	2,639
Total					3,010	2,309	2,639

Annual kWh Savings for Unitary Air Conditioners

Measure	Measure Metrics							Annual Gross kWh Savings		
	Building Type	*Equipment type*	*Subcategory or rating Condition*	*New Cooling Capacity (kbtu/h)*	*SEER of Efficient Equipment*	*Zone*	*Electric Resistance Heat?*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Single-Package and Split System Unitary Air Conditioners	Elementary	Air conditioners, Air cooled	Split System	46.5	19	3 (Springfield)	FALSE	199	433	1,022
Total								199	433	1,022

Annual kWh Savings for High Efficiency Furnace

Measure	Measure Metrics						Annual Gross kWh Savings	
	Program Type	*AC or No AC*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Furnace	TOS	Air Conditioning	98.5%	Elementary	3 (Springfield)	60,000	284	732
Total							284	732

Annual kWh Savings for Demand Control Ventilation

Measure	Measure Metrics				Annual Gross kWh Savings		
	Building Type	*Zone*	*Conditioned Space (Sq. Ft.)*	*Savings Factor (kWh/1000 SqFt)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Demand Control Ventilation	Elementary	3 (Springfield)	41,230	352	23,996	27,707	14,513
Total					23,996	27,707	14,513

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the retrofit.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	High Efficiency Boiler	3,150	4,172	132%	83,430	
	High Efficiency Furnace	116	129	111%	2,155	
	Demand Control Ventilation	3,010	2,639	88%	26,387	
Total		***6,276***	***6,940***	***111%***	***111,972***	

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.1	554	618	112%	0.04	4	2,657	N/A	N/A
	4.5.3	836	668	80%	0.02	6	3,720	N/A	N/A
	4.5.4	1,206	4,035	335%	0.05	15	60,527	N/A	N/A
	4.5.4	1,299	10,230	787%	0.00	10	104,320	N/A	N/A
	4.5.10	4,076	7.374	181%	0.18	8	58,995	N/A	N/A
	4.5.10	404	N/A	N/A	0.00	8	0	N/A	N/A
	4.6.2	N/A	3,226	N/A	0.00	5	16,129	N/A	N/A
	4.5.12	11,163	18,241	163%	0.56	15	273,611	N/A	N/A
	4.5.4	1,614	1,475	83%	0.04	10	13,689	N/A	N/A
	Single-Package and Split System Unitary Air Conditioners	199	1,022	514%	1.13		15,334	N/A	N/A
	High Efficiency Furnace	284	732	258%	0.07		12,078	N/A	N/A
	Demand Control Ventilation	23,996	14,513	60%	0.00		145,130	N/A	N/A
Total		***45,630***	***62,134***	***136%***	***2.08***		***706,189***		

* TRM calculated ex post values are used if errata corrected values are not applicable.

The natural gas measures have a combined verified realization rate of 132%. The cause of the high realization rate can be attributed to ADM calculating a higher than expected natural gas savings for the new boiler. ADM calculated the annual natural gas savings for the boiler using the IL TRM and actual efficiency and EFLH inputs, and it is likely that the ex ante analysis used average efficiencies and building types to estimate savings.

The electric realization rate for this project is 136%.

Based on algorithms in TRM 3.0 measure 4.5.1, the ex post savings for the second measure was 309 kWh per fixture, whereas the ex ante savings estimate was 277 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the second measure was 37 kWh per fixture, whereas the ex ante savings estimate was 46 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.4, the ex post savings for the third measure was 237 kWh per fixture, whereas the ex ante savings estimate was 71 kWh per fixture.

The ex post savings for the fourth measure was 639 kWh per fixture, whereas the ex ante savings estimate was 81 kWh per fixture.

The ex post savings for the ninth measure was 1,342 kWh per fixture, whereas the ex ante savings estimate was 1,614 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.10, the ex post savings for the fifth measure was 7,374 kWh per fixture, whereas the ex ante savings estimate was 4,076 kWh per fixture.

The incentive given for the sixth measure was based on fixture mounted occupancy sensors (4.5.10), however, the correct measure to be used is beverage machine controls (4.6.2). The program participant will be given credit for this installation under measure 4.6.2. Based on algorithms in TRM 3.0 measure 4.6.2, the ex post savings for the seventh measure measure was 1,613 kWh per fixture, whereas the ex ante savings estimate for the sixth measure was 202 kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.12, the ex post savings for the eighth measure was 1,140 kWh per fixture, whereas the ex ante savings estimate was 698 kWh per fixture.

The divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contribute to the difference between ex ante savings and ex post savings.

The furnace, air conditioners, and demand control ventilation measures have a combined verified realization rate of 66%. The cause of the lower realization rate can be attributed to ADM calculating a lower than expected electric savings for the Demand Control Ventilation control measure. ADM calculated the annual electric savings for DCV through the use of the IL TRM, and so did the ex ante analysis. However, the ex ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0. The ex ante calculation also used the kWh and Therms savings factors for an elementary school located in the Chicago weather zone, when the school is actually located in the Springfield weather zone.

Name SC38

Executive Summary

Under application SC38, the customer received standard incentives from the Illinois Department of Commerce for the installation of high efficiency furnaces, split system air conditioners, a condensing unit heater and a storage hot water heater. The customer also received custom incentives for the installation of network based thermostats. The electric realization rate is 114%, and the natural gas realization rate for this project is 87%.

Project Description

The customer installed (13) new high efficiency furnaces, which included (10) 110,000 Btu/h, (2) 88,000 Btu/h, and (1) 66,000 Btu/h furnaces, all of which have a rated efficiency of 96% AFUE. Paired with the furnaces was the installation of (13) new split system air conditioners, which have a rated SEER greater than 15. The installed split systems consist of (9) 5 ton, (2) 4 ton, (1) 3.5 ton, and (1) 3 ton unit. The facility also installed a condensing unit heater and a 60 gallon hot water heater.

In order to maximize the savings of the new furnaces and split system air conditioners, the facility replaced (22) existing non-programmable thermostats with network based thermostats. Originally, the HVAC system operated 24/7 regardless of occupancy and offered no setback controls. The new thermostats allow for daily schedules, night setbacks, and for facility staff to remotely control the operation of each HVAC system.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied.

Standard Incentives

For the high efficiency furnace, TRM Version 3.0 Section 4.4.15 High Efficiency Furnace was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \text{Heating Savings} + \text{Cooling Savings} + \text{Shoulder Season Savings}$$

Where:

Heating Savings = Brushless DC motor or electronically commutated motor (ECM)
= 418 kWh[23]

Cooling Savings = Brushless DC motor or electronically commutated motor (ECM) savings during cooling season

If air conditioning = 263 kWh

If no air conditioning = 175 kWh

If unknown (weighted average) = 241 kWh[24]

Shoulder Season Savings = Brushless DC motor or electronically commutated motor (ECM) savings during shoulder seasons

= 51 kWh

SUMMER COINCIDENT PEAK DEMAND SAVINGS

For units that have evaporator coils and condensing units and are cooling in the summer in addition to heating in the winter the summer coincident peak demand savings should be calculated. If the unit is not equipment with coils or condensing units, the summer peak demand savings will not apply.

$\Delta kW = (\Delta kWh/HOURS_{year}) * CF$

Where:

$HOURS_{year}$ = Actual hours per year if known, otherwise use hours from Table below for building type[25].

Building Type	Pumps and fans (h/yr)
College/University	4216
Grocery	5840
Heavy Industry	3585
Hotel/Motel	6872

[23] To estimate heating, cooling and shoulder season savings for Illinois, VEIC adapted results from a 2009 Focus on Energy study of BPM blower motor savings in Wisconsin. This study included effects of behavior change based on the efficiency of new motor greatly increasing the amount of people that run the fan continuously. The savings from the Wisconsin study were adjusted to account for different run hour assumptions (average values used) for Illinois. See: FOE to IL Blower Savings.xlsx.

[24] The weighted average value is based on assumption that 75% of buildings installing BPM furnace blower motors have Central AC.

[25] ComEd Trm June 1, 2010 page 139. The Office hours is based upon occupancy from the eQuest model developed for EFLH, since it was agreed the ComEd value was too low.

Building Type	Pumps and fans (h/yr)
Light Industry	2465
Medical	6871
Office	2301
Restaurant	4654
Retail/Service	3438
School(K-12)	2203
Warehouse	3222
Average=Miscellaneous	4103

CF =Summer Peak Coincidence Factor for measure is provided below for different building types[26]:

Location	CF
Restaurant	0.80
Office	0.66
School (K-12)	0.22
College/University	0.56
Medical	0.75

NATURAL GAS ENERGY SAVINGS

Time of Sale:

ΔTherms = EFLH * Capacity * ((AFUE(eff) – AFUE(base)/AFUE(base))/ 100,000 Btu/Therm

Early replacement[27]:

ΔTherms for remaining life of existing unit (1st 5.5 years):

ΔTherms = EFLH * Capacity * (AFUE(eff) – AFUE(exist)/ AFUE(exist)) / 100,000 Btu/Therm

ΔTherms for remaining measure life (next 11 years):

ΔTherms = EFLH * Capacity * (AFUE(eff) - AFUE(base)/AFUE(base)) / 100,000 Btu/Therm

[26] Based on DEER 2008 values

[27] The two equations are provided to show how savings are determined during the initial phase of the measure (existing to efficient) and the remaining phase (new baseline to efficient). In practice, the screening tools used may either require a First Year savings (using the first equation) and then a "number of years to adjustment" and "savings adjustment" input which would be the (new base to efficient savings)/(existing to efficient savings).

Where:

EFLH	= Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use
Capacity	= Nominal Heating Input Capacity Furnace Size (Btu/hr) for efficient unit not existing unit
	= custom Furnace input capacity in Btu/hr
AFUE(exist)	= Existing Furnace Annual Fuel Utilization Efficiency Rating
	= Use actual AFUE rating where it is possible to measure or reasonably estimate.
	If unknown, assume 64.4 AFUE%[28].
AFUE(base)	= Baseline Furnace Annual Fuel Utilization Efficiency Rating, dependant on year:
AFUE(eff)	= Efficent Furnace Annual Fuel Utilization Efficiency Rating.
	= Actual. If Unknown, assume 95%[29]

For the high efficiency split system air conditioners, the erratum TRM Version 4.0 Section 4.4.15 Single-Package and Split System Unitary Air Conditioners was used.

ELECTRIC ENERGY SAVINGS

For units with cooling capacities less than 65 kBtu/h:

$$\Delta kWH = (kBtu/h) * [(1/SEER_{base}) - (1/SEER_{ee})] * EFLH$$

For units with cooling capacities equal to or greater than 65 kBtu/h:

$$\Delta kWH = (kBtu/h) * [(1/EER_{base}) - (1/EER_{ee})] * EFLH$$

Where:

kBtu/h	= capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).
$SEER_{base}$	= Seasonal Energy Efficiency Ratio of the baseline equipment; see table
$SEER_{ee}$	= Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).
EER_{base}	= Energy Efficiency Ratio of the baseline equipment; see table above for default values. Since IECC 2006 does not provide EER requirements for air-cooled air conditioners < 65 kBtu/h, assume the following conversion from SEER to EER: $EER \approx SEER/1.1$

[28] Average nameplate efficiencies of all Early Replacement qualifying equipment in Ameren PY3-PY4.
[29] Minimum ENERGY STAR efficiency after 2.1.2012.

EER_{ee} = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EER_{ee} is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.

= Actual installed

EFLH = cooling equivalent full load hours; see table

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW_{SSP} = (kBtu/h * (1/EER_{base} - 1/EER_{ee})) * CF_{SSP}$$

Where:

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

For the condensing unit heater, TRM Version 3.0, Section 4.4.5 Condensing Unit Heaters was used.

NATURAL GAS ENERGY SAVINGS

The annual natural gas energy savings from this measure is a deemed value equaling 266 Therms.

For the storage hot water heater, TRM Version 3.0, Section 4.3.1 Storage Water Heater was used.

NATURAL GAS ENERGY SAVINGS

TRM Section 4.3.1 provides a deemed savings estimated based upon the building type the new water heater is installed in. The following graphic presents the savings estimates from the section of the TRM:

Annual Therms Savings for Hot Water Heaters by Building Type

Gas, High Efficiency	Gas, Standard
The annual natural gas energy savings from this measure is a deemed value equaling 251[30]	Gas savings depend on building type and are based on measure case energy factor of 0.67 and a heating capacity of 75 MBtuh. These values are averages of qualifying units. Savings values are derived from 2008 DEER Miser, which provides MBtuh gas savings per MBtuh capacity. Savings presented here are per water heater.[31]

Building Type	Energy Savings (therms/unit)
Assembly	185
Education – Primary/Secondary	124
Education – Post Secondary	178
Grocery	191
Health/Medical - Hospital	297
Lodging - Hotel	228
Manufacturing - Light Industrial	140
Office – > 60,000 sq-ft	164
Office – < 60,000 sq-ft	56
Restaurant - FastFood	109
Restaurant – Sit Down	166
Retail	105
Storage	150
Multi-Family	119
Other	148

Custom Incentives

The ex ante savings for the installation of networked thermostats were calculated through the use of a calibrated simulation model. ADM reviewed the provided Carrier Hourly Analysis Program (Carrier HAP) inputs and outputs for consistency with the operational characteristics of the facility verified during the on-site visit. ADM also compared the monthly Therm/kWh consumption of the model to corresponding billing data and found that the normalized mean bias

[30] Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011. These deemed values should be compared to PY evaluation and revised as necessary

[31] Gas Storage Water Heater 0.67. Work Paper WPRSGNGDHW106. Resource Solutions Group. December 2010

error was within 10%. From the review of the model inputs/outputs and calibration effort, ADM found that the claimed savings was to be within reason.

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for High Efficiency Furnaces

Measure	*Measure Metrics*							*Annual Gross Therms Savings*	
	Program Type	*AC or No AC*	*# of Units*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Furnace	TOS	Air Conditioning	10	96.0%	Office - Low Rise	3 (Springfield)	110,000	2,191	1,420
High Efficiency Furnace	TOS	Air Conditioning	2	96.0%	Office - Low Rise	3 (Springfield)	88,000	351	228
High Efficiency Furnace	TOS	Air Conditioning	1	96.0%	Office - Low Rise	3 (Springfield)	66,000	131	85
Total								2,673	1,733

Annual kWh Savings for High Efficiency Furnaces

Measure	*Measure Metrics*							*Annual Gross kWh Savings*	
	Program Type	*AC or No AC*	*# of Units*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Furnace	TOS	Air Conditioning	10	96.0%	Office - Low Rise	3 (Springfield)	110,000	5,207	7,320
High Efficiency Furnace	TOS	Air Conditioning	2	96.0%	Office - Low Rise	3 (Springfield)	88,000	833	1,464
High Efficiency Furnace	TOS	Air Conditioning	1	96.0%	Office - Low Rise	3 (Springfield)	66,000	312	732
Total								6,352	9,516

Annual kWh Savings for Split System Air Conditioners

Measure	Measure Metrics								Annual Gross kWh Savings		
	Building Type	Equipment type	Subcategory or rating Condition	# of Units	New Cooling Capacity (kbtu/h)	SEER of Efficient Equipment	Zone	Electric Resistance Heat?	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Single-Package and Split System Unitary Air Conditioners	Office - Low Rise	Air conditioners, Air cooled	Split System	9	56	15	3 (Springfield)	FALSE	2,234	1,344	6,110
Single-Package and Split System Unitary Air Conditioners	Office - Low Rise	Air conditioners, Air cooled	Split System	2	46.5	15.5	3 (Springfield)	FALSE	397	300	1,364
Single-Package and Split System Unitary Air Conditioners	Office - Low Rise	Air conditioners, Air cooled	Split System	1	42	15	3 (Springfield)	FALSE	174	112	509
Single-Package and Split System Unitary Air Conditioners	Office - Low Rise	Air conditioners, Air cooled	Split System	1	34.8	15	3 (Springfield)	FALSE	149	93	422
Total									2,954	1,849	8,405

Annual Therms Savings for Condensing Unit Heaters

Measure	Measure Metrics		Annual Gross Therms Savings	
	Program Type	Quantity	Ex Ante	TRM-Calculated Ex Post
Condensing Unit Heater	TOS	1	266	266
Total			*266*	*266*

Annual Therms Savings for Storage Hot Water Heater

Measure	Measure Metrics				Annual Gross Therms Savings	
	Program Type	Measure Type	Tank Size	Building Type	Ex Ante	TRM-Calculated Ex Post
Storage Water Heater	TOS	Gas, Standard	60 Gallon	Office – < 60,000 SF	56	56
Total					56	56

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for Network Thermostats

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Network Thermostats	4,096			4,096
Total	4,096			4,096

Annual kWh Savings for Network Thermostats

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Network Thermostats	52,593			52,593
Total	52,593			52,593

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	Storage Water Heater	56	56	100%	840	
	Condensing Unit Heater	266	266	100%	3,192	
	High Efficiency Furnace	2,673	1,733	65%	28,595	
Subtotal		2,995	2,055	69%	32,627	
Custom	Network Thermostats	4,096	4,096	100%	61,440	
Subtotal		*4,096*	*4,096*	100%	*61,440*	
Total		***7,091***	***6,151***	***87%***	***94,067***	

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	High Efficiency Furnace	6,352	9,516	150%	3.56	157,014		
	Single-Package and Split System Unitary Air Conditioners	2,954	8,405	285%	7.14	126,074		
Subtotal		9,306	17,921	193%	10.70	283,088		
Custom	Network Thermostats	52,593	52,593	100%	0.00	788,895		
Subtotal		*52,593*	*52,593*	100%	*0.00*	*788,895*		
Total		***61,899***	***70,514***	***114%***	***10.70***	***1,071,983***		

The natural gas measures have a combined realization rate of 87%. The cause of the realization rate can be attributed to ADM calculating a lower natural gas savings for the new high efficiency furnaces than the ex ante estimates. ADM was not supplied with the ex ante calculations for the high efficiency furnaces, but it appears that the ex ante analysis may have used “Office-Mid

Rise" instead of the appropriate "Office-Low Rise" as the building is only single story, thus using a higher EFLH value.

The electric measures have a combined realization rate of 114%. The cause of the realization rate can be attributed to ADM calculating a higher electric savings for the high efficiency furnaces and split system air conditioners. ADM calculated the annual electric savings for the chiller through the use of the IL TRM and actual installed efficiencies, capacity, and building type. It is likely that the ex ante analysis used average efficiencies, capacity, and/or building types to estimate savings.

Name S-39

Executive Summary

Under project S-39, the applicant received Standard Project incentives from the Illinois Department of Commerce for street lighting retrofit project. The realization rate for this project is 133%.

Project Description

The customer retrofitted the following fixtures:

- (251) 250W High Pressure Sodium with LED Street lights

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	Calculation Inputs						Annual Gross kWh Savings		
	Qty	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WH Fe-IF	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
LED Bulbs and Fixtures	251	TRM=361.4 Actual =303	TRM=116.8 Actual =101	4,903	TRM = 0.91 Errata =1.00	1	226,219	273,926	301,018
Total							***226,219***	***273,926***	***301,018***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Quantity	Annual Gross Savings				Lifetime Gross Savings		Spillover	
			Ex Ante kWh	Ex Post kWh (errata if applicable)	Realization Rate	Ex Post Peak kW Reduction	Measure Life (yrs)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.4	251	226,219	301,018	133%	0.00	10.2	3,070,381	N/A	N/A
Total			***226,219***	***301,018***	***133%***	***0.00***		***3,070,381***		

The project level realization rate is 133%. Based on algorithms in TRM version 3.0 measure 4.5.4, the errata corrected ex post savings per fixture for this measure was 1199.3 kWh, whereas the ex ante savings estimate was 901.27 kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For these measures (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-40

Executive Summary

Under project S-40, the applicant received Standard Program incentives from the Illinois Department of Commerce for LED street lighting retrofit. The realization rate for this project is 124%.

Project Description

The customer retrofitted the following fixtures:

- (404) 250W High Pressure Sodium Fixtures with 88W LED Street Lighting

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*			
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHF e-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
LED Bulbs and Fixtures	404	TRM=361.4 Actual =203	TRM=116.8 Actual =88	4,903	TRM =0.91 Errata=1.00	1	391,153	440,901	484,507	429,836
Total							***391,153***	***440,901***	***484,507***	***429,836***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Quantity*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.4	4-4	391,153	484,507	124%		10.2	4,941,967	N/A	N/A
Total			***391,153***	***484,507***	***124%***	***0.0***		***4,941,967***		

The project level realization rate is 124%. Based on algorithms in TRM version 3.0 measure 4.5.4, the errata corrected ex post savings per fixture for this measure was 1199.27 kWh, whereas the ex ante savings estimate was 968.20 kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For this measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name C41

Executive Summary

Under application C41, the customer received custom incentives from the Department of Commerce for HVAC control system improvements. The electric realization rate is 95% and the natural gas realization rate for this project is 100%.

Project Description

The facility previously had existing air handling units (AHUs) and fan coil units (FCUs) run continuously with dated control strategies. The facility implemented chilled and hot water reset, altered scheduling and temperature setbacks, installed variable frequency drives (VFDs) on motors, and added demand controlled ventilation (DCV) and enthalpy economizers. Occupancy sensors were installed in zones served by HVAC-1 and were tied to the variable air volume (VAV) controllers. In rooms where occupancy sensors were already tied in to lighting, they also were integrated and wired to the corresponding VAV serving the space.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and visited the site to verify scope of work implemented. As-built operational characteristics of the HVAC equipment were collected through the facility's energy management system, and the site contact was interviewed to answer technical questions. Building mechanical plans and controls sheets, including sequences of operation, were also obtained and reviewed.

Custom Incentives

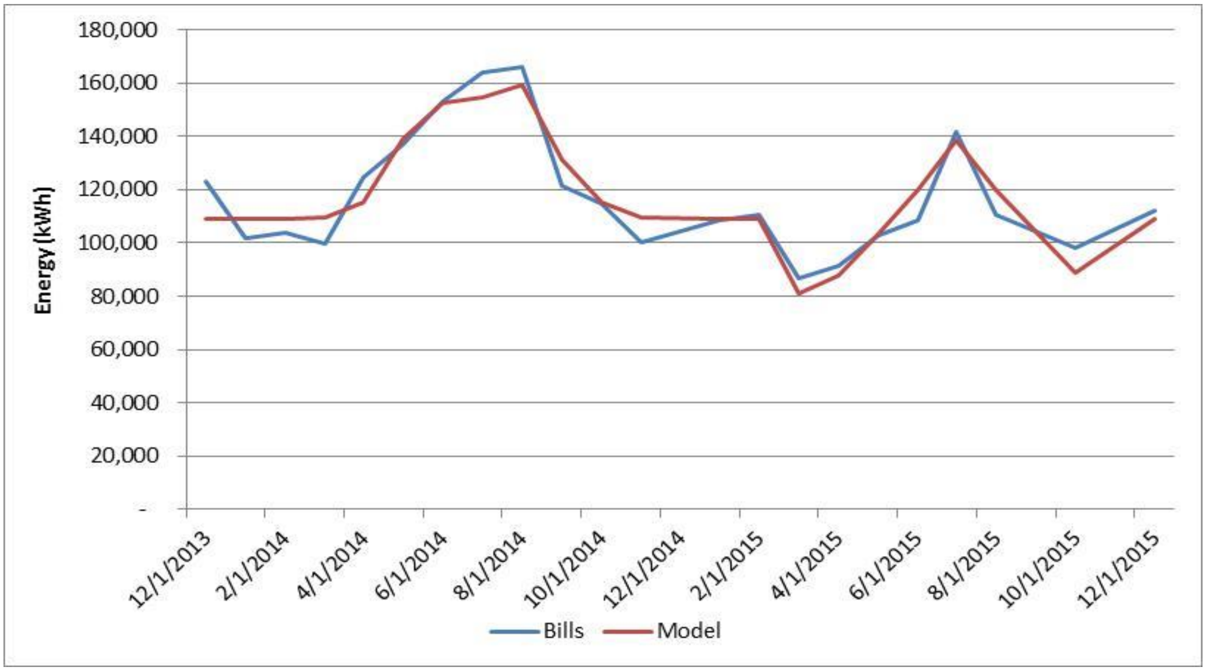
Electric savings were calculated using a cooling degree day (CDD) billing regression. Seven months of post-implementation billing data had accrued since completion of the project, which represented shoulder months and the summer period. The controls upgrade had a well-defined impact as observed in the bills and in the performance indicators of the regression (i.e. R^2=0.89, T-test values of 8.1 for the Pre/Post flag coefficient and 11.4 for CDD coefficient). The form of the model, with coefficients tabulated, is as follows:

$$kWh = 99x_1 - 30{,}207x_2 + 109{,}014$$

Where,

kWh	*= Monthly electricity consumed by the facility*
x_1	*=Cooling degree days, to account for weather seasonality impacts*
x_2	*=Pre/Post-upgrade flag; set equal to "0" for the baseline and "1" for post-upgrade*

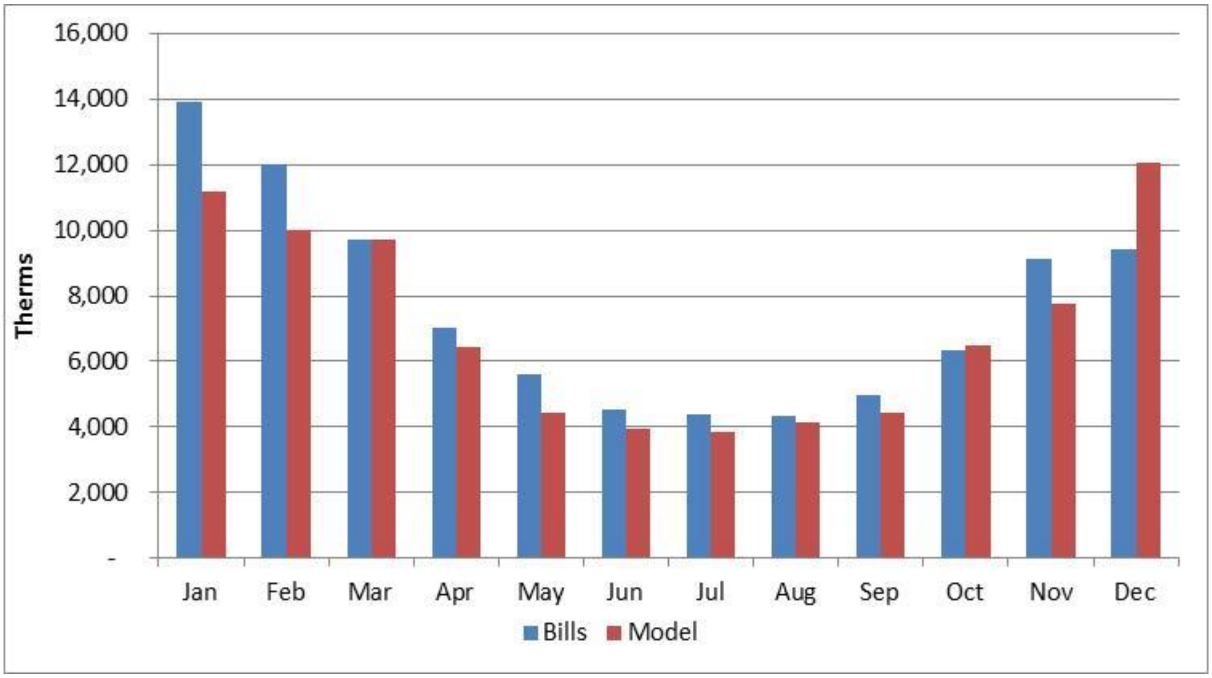
Electric Consumption as Modeled Compared to Billing Data



Annual electric savings were calculated simply by multiplying the Pre/Post-upgrade flag coefficient by twelve (i.e. number of months in a year). The negative sign convention of the coefficient indicates less energy being consumed post-upgrade, and the magnitude of the coefficient equates to monthly energy savings.

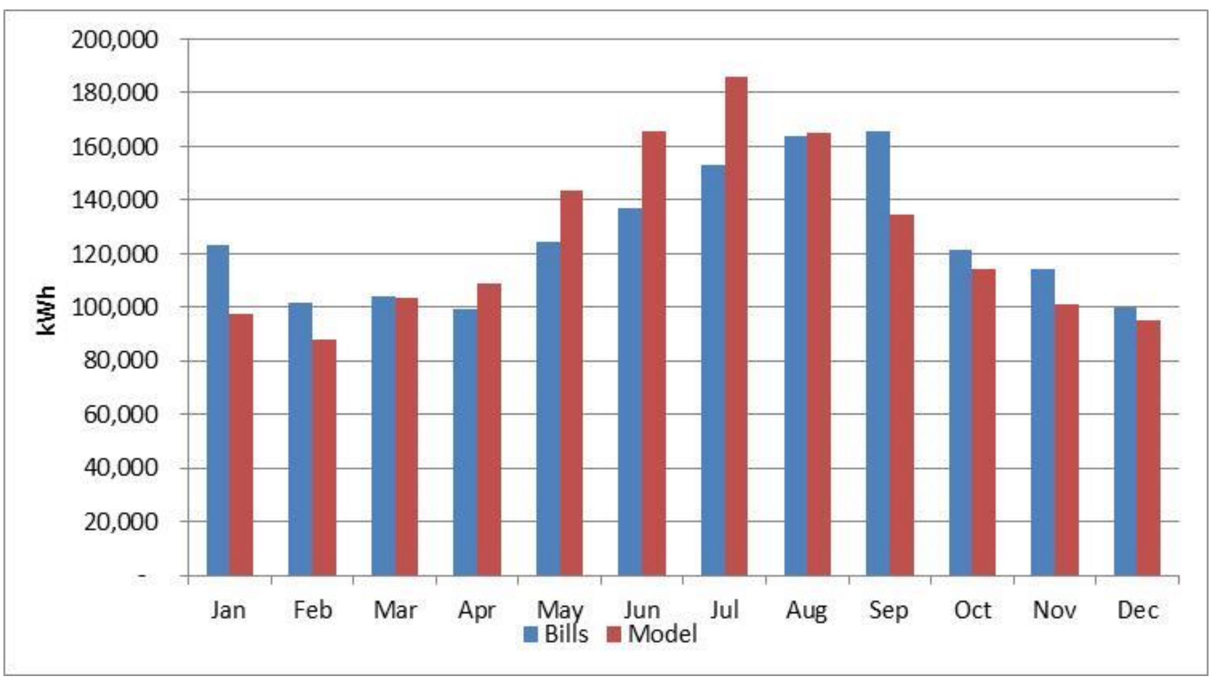
Gas savings were not explicitly calculated by ADM, but the ex-ante Trane Trace 700 whole building model was reviewed and checked against billing data. The model was calibrated by the developer, who follows ASHRAE Guideline 14 “Measurement of Energy, Demand and Water Savings”. This was evident in ADM’s comparison of model output to billing data, shown as follows:

2014 Monthly Natural Gas Calibration



ADM also gained confidence in claimed gas savings in observing the high *electric* realization rate of 95%. Claimed *electric* savings were also based on the same Trane Trace 700 model, and they also correlated well with billing data:

2014 Monthly Electric Calibration



ADM did review the Trace 700 model inputs to see if they accurately represented the scope of work implemented. There appears to be several discrepancies, which is one reason why the billing regression was used by ADM to estimate electric savings. A regression could also be used to estimate gas savings, but this would involve waiting for post-implementation winter season billing data to accrue. Unlike electric savings, gas savings predominantly occur during the winter and shoulder months, and are affected by a smaller portion of the scope of work implemented. These include hot water reset, DCV, and altered scheduling and temperature setbacks. The Trace 700 model does not appear to have modeled hot water reset or DCV, so claimed savings may be conservative.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for HVAC Controls Upgrade

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
HVAC Controls Upgrade	382,776			362,484
Total	382,776			362,484

Annual Therms Savings for HVAC Controls Upgrade

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
HVAC Controls Upgrade	8,220			8,220
Total	8,220			8,220

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	HVAC Controls Upgrade	8,220	8,220	100%	123,300
Total		***8,220***	***8,220***	***100%***	***123,300***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	HVAC Controls Upgrade	382,776	362,484	95%	41.38	5,437,263
Total		***382,776***	***362,484***	***95%***	***41.38***	***5,437,263***

The electric realization rate is 95%. The ex-ante analysis utilized an IPMVP[32] Option D: Calibrated Simulation to estimate savings, while ADM utilized an IPMVP Option C: Whole Facility approach. The latter incorporates the *real* impact of the scope of work implemented on energy consumption, so is thought to be more accurate for this project's set of conditions, one being that savings comprise a large percentage (i.e. 24%) of the facility's annual baseline consumption. The developer of the Trace 700 model agreed with this approach.

The natural gas realization rate is 100%. No changes were made by ADM to claimed savings, which were thought to be reasonable.

[32] International Performance Measurement and Verification Protocol. "Concepts and Options for Determining Energy and Water Savings, Volume 1". January 2012.

Name NC42

Executive Summary

Under application NC42, the customer received custom incentives from the Illinois Department of Commerce for above-code construction of a new 174,000 ft^2 laboratory building. The natural gas realization rate for this project is 117%.

Project Description

During the construction and planning phase of the new laboratory building, the customer opted to build above IECC 2009 minimum standards, which was the governing code during the time of the permit application process. The table below provides a summary of the code requirement and as-built construction details for the new laboratory building:

IECC 2009 Vs As-Built Construction Details

Parameter	*IECC 2009*	*As-Built*
Roof U-Factor	U-0.063	U-0.030
Roof Reflectivity	0.30	0.45
Wall U-Factor	U-0.084	U-0.059
Window U-Factor	U-0.57	U-0.29 & U-0.50
Window SHGC	0.39	0.80 & 0.38
Lighting (LPD)	1.4 w/ft^2 – Labs 1.0 w/ft^2 – Remainder	1.3 w/ft^2 – Labs 0.9 w/ft^2 – Remainder
Daylighting Controls	None	Office Dimmable Controls
Air Side HVAC	System 7: VAV w/HW Reheat	VAV w/HW Reheat
Supply Air Temperature Reset	5ºF	10ºF
Cooling Efficiency**	5.5 COP	7.29 COP
Heating Efficiency**	80%	66.8%
Exhaust Air Heat Recovery	None	Run-around loop with 37.5% efficiency

**Note: Chilled and hot water are supplied from the campus central plant.

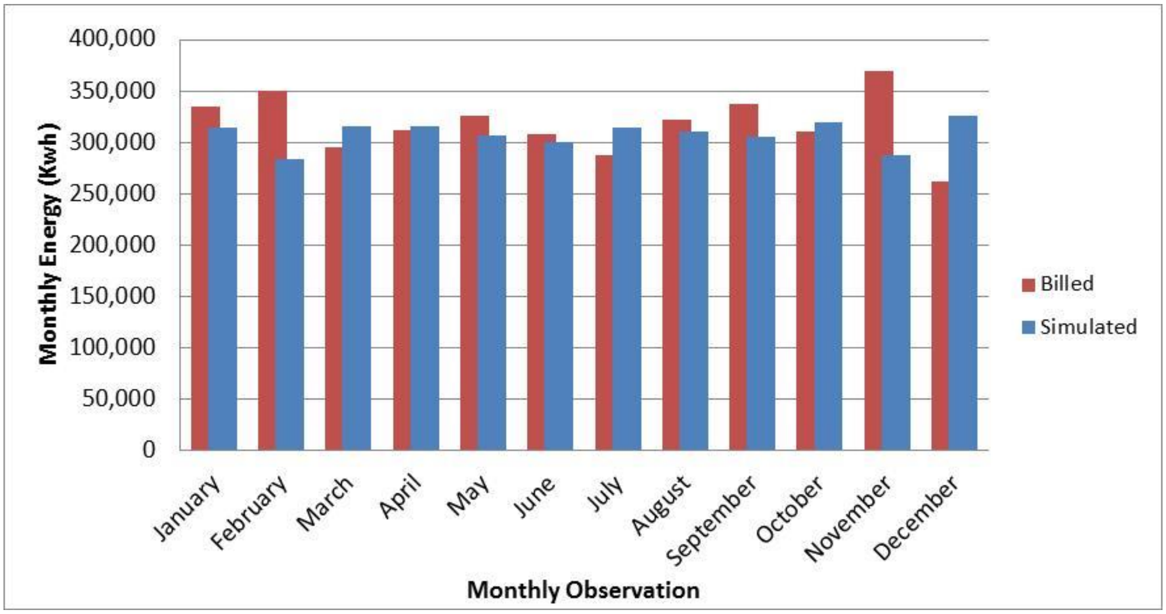
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the above-code measures. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational setpoints from the building's energy management system.

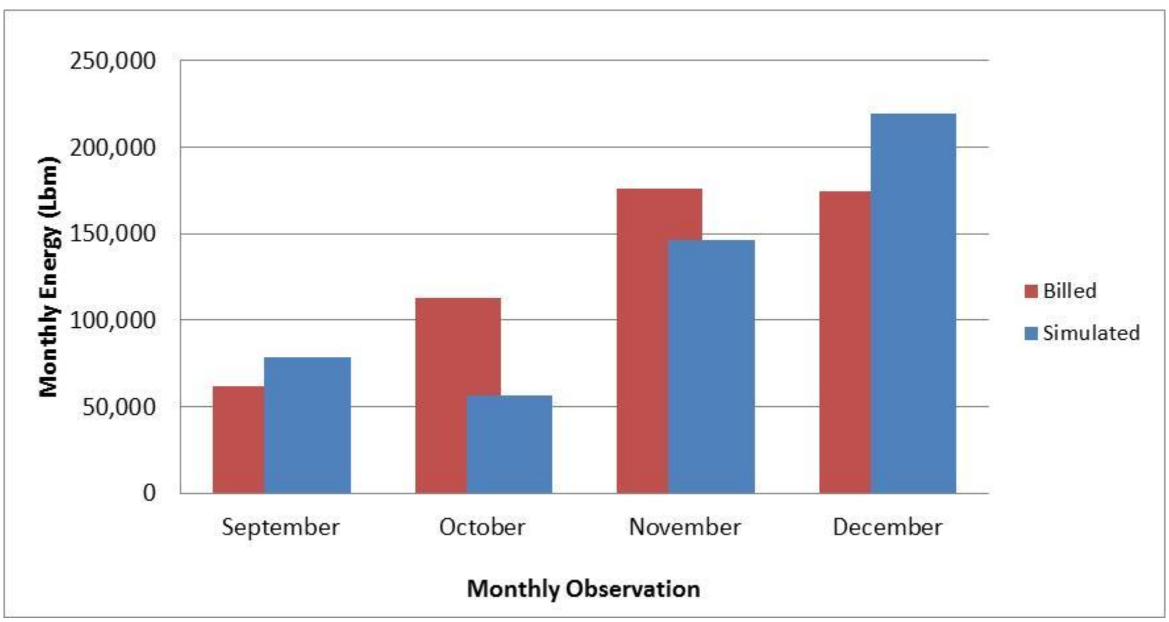
Custom Incentives

Energy savings were calculated using an eQuest model of the laboratory building. ADM compiled a model of the as-built facility using the details and construction documents collected during the on-site M&V visit and from the SEDAC LEED report. Upon completion of the initial model, a custom weather file was created using 2014 NOAA weather data for the Chicago O'Hare area. Using this weather file, sub metered electrical and steam billing data for the facility, ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2014 Monthly kWh Calibration



2014 Monthly Lbm Steam Calibration



It should be noted that ADM was only able to calibrate to four months of steam sub metering data as the facility experienced issues with their steam meters and holding valves during the early part of 2014.

Upon completion of the calibration for the as-built eQuest model, a baseline model was created with ASHRAE IECC 2009 minimum standards. Once the baseline model was completed, the baseline and as-built models were run using Chicago O'Hare TMY3 weather data. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Natural Gas Energy Consumption

End-Use	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	0	0	0
Misc. Equipment	0	0	0
Heating	206,903	33,761	173,142
Cooling	0	0	0
Heat Rejection	0	0	0
Pumps	0	0	0
Fans	0	0	0
Exterior	0	0	0
Total	**206,903**	**33,761**	**173,142**

Annual electrical energy saving are not reported as the savings were claimed in PY6.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for Above Code Construction

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
LEED New Construction	147,945	-	-	173,142
Total	147,945	-	-	173,142

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Custom	LEED New Construction	147,945	173,142	117%	2,597,127[33]	
Total		***147,945***	***173,142***	***117%***	***2,597,127***	

The project has an overall natural gas realization rate of 117%. The 117% verified natural gas realization rate can be attributed to the ex-ante eQuest models not being calibrated to actual electric and steam sub metering data, as at the time of model construction the building was not yet commissioned. The eQuest calibration effort by ADM ensured that the eQuest model properly represented the actual building and showed that there were greater savings than initially anticipated.

[33] The lifetime savings were calculated by multiplying typical first year savings by the expected useful life of 15 years. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls

Name S-43

Executive Summary

Under project S-43, the applicant received Standard Program incentives from the Illinois Department of Commerce for a lighting retrofit project. The realization rate for this project is 128%.

Project Description

The customer performed the following retrofit:

- (184) 4' Fluorescent lamps were removed (delamped)
- (52) 3' Fluorescents lamps with more efficient lamps
- (1,619) 4' Fluorescent lamps with more efficient lamps
- (4,230) U-Tube Fluorescent lamps with more efficient lamps
- (7) 250w Metal Halide fixtures with (7) 50w LED Wall Pack fixtures
- (5) 8' Fluorescent fixtures with (5) 4' T8 fixtures
- (54) 175w Mercury Vapor fixtures with (54) 4' T8 fixtures
- (32) 400w Metal Halide fixtures with (32) 4' T8 fixtures
- (116) 175w Metal Halide fixtures with (116) 4' T8 fixtures
- (80) 250w Metal Halide fixtures with (80) 4' T8 fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2, 4.5.3, and 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation inputs*						*Annual Gross kWh Savings*			
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated Errata Corrected Ex Post*	*ADM Calculated Ex Post*
Fluorescent Delamping	184	TRM = 33.7 Actual = 66	TRM = 0 Actual = 0	5802	1.00	1.43	31,446	51,447		
HP & RW T8 Fixtures and Lamps	117	TRM = 23 Actual = 26	TRM = 20 Actual=25	5802	1.00	1.43	6,130	1,294		
HP & RW T8 Fixtures and Lamps	1,619	TRM = 28 Actual = 33	TRM = 25 Actual=28	5802	1.00	1.43	42,643	40,298		
HP & RW T8 Fixtures and Lamps	4,230	TRM = 28 Actual = 32.5	TRM = 26 Actual=28	5802	1.00	1.43	141,160	70,191		157,931
LED Bulbs and Fixtures	7	TRM=182.9 Actual =290	TRM=52.5 Actual=50	5802	TRM=-0.91 Errata=1.00	1.43	4,173	6,782	7,573	
HP & RW T8 Fixtures and Lamps	5	TRM = 94 Actual = 98	TRM = 49 Actual=49	5802	1.00	1.43	1,088	1,867		

Measure	*Calculation inputs*						*Annual Gross kWh Savings*			
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated*	*TRM-Calculated Errata Corrected*	*ADM Calculated*
								Ex Post	*Ex Post*	*Ex Post*
HP & RW T8 Fixtures and Lamps	54	TRM = 94 Actual = 197	TRM = 49 Actual=49	5802	1.00	1.43	44,346	20,161		66,309
HP & RW T8 Fixtures and Lamps	32	TRM = 182 Actual = 458	TRM = 94 Actual=98	5802	1.00	1.43	63,922	23,364		95,580
HP & RW T8 Fixtures and Lamps	116	TRM =182 Actual = 205	TRM = 94 Actual=98	5802	1.00	1.43	74,808	84,694		
HP & RW T8 Fixtures and Lamps	80	TRM = 182 Actual = 290	TRM = 94 Actual=98	5802	1.00	1.43	85,229	58,410		127,440
Total							***494,945***	***358,619***	***7,573***	***447,260***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh (Errata Corrected &/or ADM corrected if Applicable)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (Errata Corrected &/or ADM corrected if applicable)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.2	31,446	51,447	164%	6.50	11	565,919	N/A	N/A

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh (Errata Corrected &/or ADM corrected if Applicable)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (Years)*	*Ex Post kWh (Errata Corrected &/or ADM corrected if applicable)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
	4.5.3	6,130	1,294	21%	0.16	15	19,415	N/A	N/A
	4.5.3	42,643	40,298	95%	5.09	15	604,468	N/A	N/A
	4.5.3	141,160	157,931	112%	19.96	15	2,368,961	N/A	N/A
	4.5.4	4,173	7,573	181%	0.96	10.9	82,754	N/A	N/A
	4.5.3	1,088	1,867	172%	0.24	15	28,002	N/A	N/A
	4.5.3	44,346	66,309	150%	8.38	15	994,628	N/A	N/A
	4.5.3	63,922	95,580	150%	12.08	15	1,433,697	N/A	N/A
	4.5.3	74,808	84,694	113%	13.02	15	1,270,415	N/A	N/A
	4.5.3	85,229	127,440	150%	16.11	15	1,911,597	N/A	N/A
Total		***494,945***	***634,433***	***128%***	***80.20***		***9,279,855***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 128%.

This facility has multiple annual hours of use. The application stated miscellaneous (4,576), the database (4,439), where in actuality the average of the multiple hours of use was grocery (5,802). The project manager confirmed this should have been the building type entered so the analysis was performed with the accurate hours of use.

Based on algorithms in TRM 3.0 measure 4.5.2, the TRM calculated ex post savings for the first program measure was 280kWh per fixture, whereas the ex ante savings estimate was 171kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.3, the TRM calculated ex post savings for the second, third, sixth, and ninth program measures were 25kWh, 25kWh, 373kWh, and 730kWh per fixture, whereas the ex ante savings estimate was 118kWh, 26kWh, 218kWh, and 645kWh per fixture, respectively.

The ADM calculated ex post savings for the fourth, seventh, eighth, and tenth program measure was 37kWh, 1,228kWh, 2,987kWh, and 1,593kWh per fixture, whereas the ex ante savings estimate was 33kWh, 821kWh, 1,998kWh, and 1,065kWh per fixture, respectively.

Based on algorithms in TRM 3.0 measure 4.5.4, the errata corrected ex post savings for the fifth program measure was 1,082kWh per fixture, whereas the ex ante savings estimate was 596kWh per fixture.

Department of Commerce incentivized measures six through ten (4.5.3) on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For the fifth measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-44

Executive Summary

Under project S-44, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofit project. The realization rate for this project is 108%.

Project Description

The customer performed the following retrofit:

- (291) 3’ T8 lamps delamped
- (2,379) 4’ T8 lamps delamped
- (7,310) 4’ T8 lamps with 4’ T8 reduced wattage lamps
- (4,542) 4’ T8 U-lamps with 4’ T8 reduced wattage U-lamps
- (1,294) 3’ T8 lamps with 3’ T8 reduced wattage lamps

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2 and 4.5.3. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*	
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe -IF*	*Ex Ante*	*TRM-Calculated Ex Post*
Fluorescent Delamping 3’	Ex ante = 0 Actual = 291	TRM =14.6 Actual = 26	TRM = 0 Actual = 0	5802	1	1.43	456,307	35,250
Fluorescent Delamping 4’	Ex ante =2,670 Actual = 2,379	TRM =19.4 Actual = 33	TRM = 0 Actual = 0	5802	1	1.43		382,922
HP & RW T8 Fixtures and Lamps (32w 4' T8 to 28W 4' T8)	Ex ante =8,661 Actual = 7,310	TRM = 32 Actual = 33	TRM = 25 Actual=28	5802	1	1.43	230,677	424,550
HP & RW T8 Fixtures and Lamps (4’UTube)	Ex ante =4,472 Actual = 4,542	TRM = 28 Actual = 32	TRM = 26 Actual=28	5802	1	1.43	148,884	75,369
HP & RW T8 Fixtures and Lamps (3’Lamps)	Ex ante = 642 Actual = 1,294	TRM = 23 Actual = 26	TRM = 20 Actual=25	5802	1	1.43	42,315	32,208
Total							***878,183***	***950,299***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.2	456,303	418,172	92%	4.76	11	4,599,889	N/A	N/A
	4.5.3	230,686	424,550	184%	4.84	15	6,368,255	N/A	N/A
	4.5.3	148,873	75,369	51%	0.86	15	1,130,530	N/A	N/A
	4.5.3	42,314	32,208	76%	0.37	15	483,126	N/A	N/A
Total		***878,175***	***950,299***	***108%***	***10.83***		***12,581,800***		

* TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 108%.

Based on algorithms in TRM 3.0 measure 4.5.2, the ex post savings for the first measure was 156.62 kWh per fixture, whereas the ex ante savings estimate was 170.90 kWh per fixture. The realization rate for this measure was low because it included both 3’ T8 and 4’ T8 lamps, but was incentivized only under 4’ T8 delamping.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the second measure was 58.08 kWh per fixture, whereas the ex ante savings estimate was 31.56 kWh per fixture.

The ex post savings for the third measure was 16.59 kWh per fixture, whereas the ex ante savings estimate was 32.78 kWh per fixture.

The ex post savings for the fourth measure was 24.89 kWh per fixture, whereas the ex ante savings estimate was 32.70 kWh per fixture.

For the second, third, and fourth measures the quantity listed in the application materials were different than the actual quantity installed. This discrepancy resulted in varied realization rates for those measures. In addition, the divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contributed to the difference between ex ante savings and ex post savings for this project.

Name SC45

Executive Summary

Under application SC45, the customer received standard and custom incentives from the Illinois Department of Commerce. Standard incentives were received for the installation of a new 155 ton high efficiency air cooled chiller. Custom incentives were given for the retrofit of pneumatic controls to DDC, which allowed for time-of-use scheduling and demand control ventilation (DCV). Also included in the custom incentives was the installation of two new high efficiency boilers. The overall electric realization rate is 90%, and the overall natural gas realization rate for this project is 111%.

Project Description

Recently, the customer replaced the original unit ventilators (UVs) with new UVs equipped with DDC controls. Originally the unit ventilators were equipped with pneumatic controls and provided conditioning to the spaces 24/7 regardless of the occupancy. With the addition of the DDC system, time-of-use scheduling was added, allowing the systems to setback during unoccupied periods. With the addition of the DDC system, demand control ventilation was installed on the air handling unit serving the gymnasium. The addition of the DCV controls, allows the air handler to modulate the quantity of outdoor air being brought into the space based upon the occupancy in the gym.

In addition to the DDC controls, the customer also installed a new air cooled chiller and two new high efficiency boilers. The chiller and boilers are interconnected in an atypical water side system referred to a Two Pipe System. In this configuration the served UVs and air handling units (AHUs) do not have separate heating and cooling coils that you would normally see. Instead the UVs and AHUs only have single coil that is connected to a single hydronic loop. Both the chiller and boilers are attached to this loop, so it prevents simultaneous heating and cooling in a properly commissioned system.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the installation of: DDC controls, air cooled chiller, and high efficiency boilers. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational setpoints from the building's energy management system.

Standard Incentives

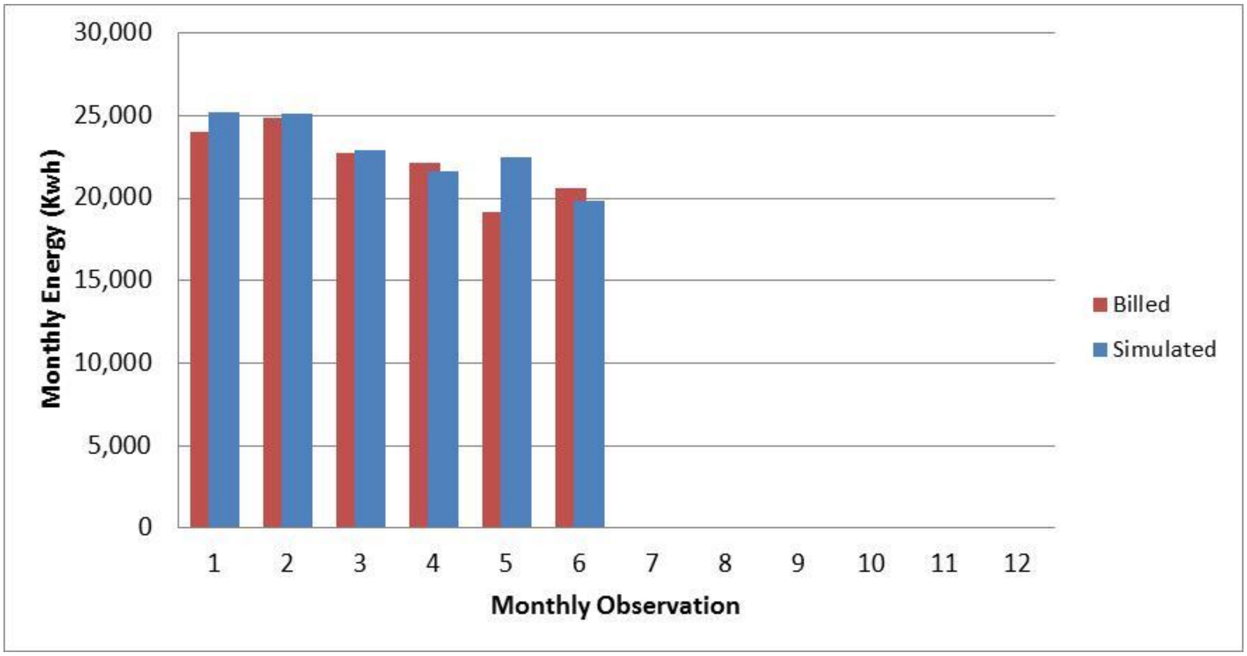
For the high efficiency air cooled chiller, TRM Version 3.0 Section 4.4.6 Electric Chiller would be used; however, due to the atypical nature in which the chiller was installed, TRM based calculations are not appropriate. Due to this, the savings for this measure were calculated using an eQuest simulation which is described in the following "Custom Incentives" section.

Custom Incentives

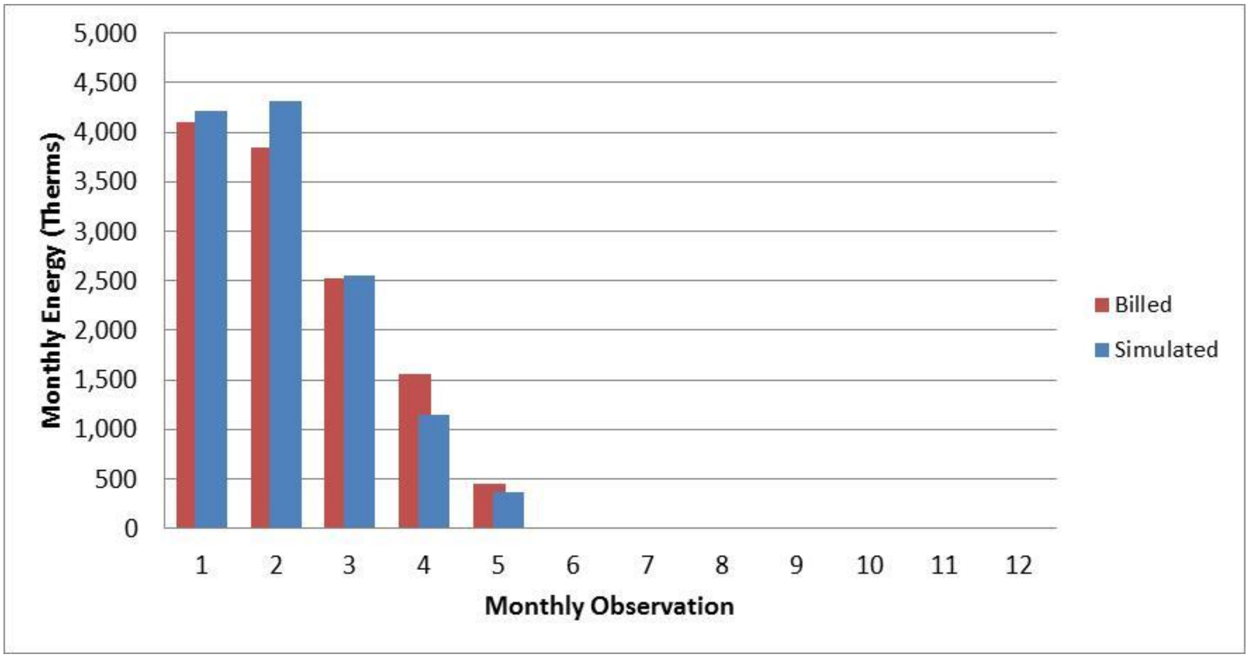
Energy savings were calculated using an eQuest model of the facility. ADM compiled a model of the as-built facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Upon completion of the initial model, a custom weather file was created using 2015 NOAA weather data for the Lockport area. This weather file and the utility provided billing data were used to ensure that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2015 Monthly kWh Calibration



2015 Monthly Natural Gas Calibration



Upon completion of the calibration for the as-built eQuest model, the impacts of the installed measures were removed through the uses of parametric runs. Once the parametric runs were defined, the as-built model and parametric runs were run using Chicago O'Hare TMY3 weather data. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Electric and Natural Gas Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	87,893	87,893	0	0	0	0
Misc. Equipment	20,645	20,645	0	0	0	0
Heating	0	0	0	31,300	17,591	13,710
Cooling	100,821	55,868	44,953	0	0	0
Heat Rejection	0	0	0	0	0	0
Pumps	111,031	64,047	46,984	0	0	0
Fans	103,671	63,854	39,817	0	0	0
Exterior	6,479	6,479	0	680	680	0
Total	**430,540**	**298,786**	**131,754**	**31,980**	**18,270**	**13,710**

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Air Cooled Chiller

Measure	*Measure Metrics*								*Annual Gross kWh Savings*			
	Program Type	*Tons*	*Path followed*	*Equipment type*	*Zone*	*Building Type*	*IPLVee*	*EERee*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
Electric Chiller	TOS	155.3	PATH A	Air Cooled Chillers	2 (Chicago)	Elementary	15.6	10.1	9,189	9,533		5,363
Total									9,189	9,533		5,363

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for HVAC & DDC Upgrades

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
HVAC & DDC Upgrades	109,459			126,391
Total	109,459			126,391

Annual Therms Savings for HVAC & DDC Upgrades

Measure	Annual Gross Therms Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
HVAC & DDC Upgrades	15,181			13,710
Total	15,181			13,710

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings	Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	Electric Chiller	9,189	5,363	58%	2.41	107,260		
Subtotal		9,189	5,363	58%	2.41	107,260		
Custom	HVAC & DDC Upgrades	109,459	126,391	115%	16.73	1,895,865		
Subtotal		109,459	126,391	115%	16.73	1,895,865		
Total		***118,648***	***131,754***	***111%***	***19.14***	***2,003,125***		

Verified Natural Gas Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings			Lifetime Gross Savings	Spillover
		Ex Ante Therms	Ex Post Therms	Realization Rate	Ex Post Therms	Annual Therms
Custom	HVAC & DDC Upgrades	15,181	13,710	90%	214,912	
Total		***15,181***	***13,710***	***90%***	***214,912***	

The project has an overall electric realization rate of 111% and an overall natural gas realization rate of 90%. The 58% realization rate for the air cooled chiller can be attributed to the ex ante analysis using TRM based calculations. It was determined that the chiller serves a 2-Pipe system, so standard equations are not applicable. Therefore, ADM utilized eQuest simulation to calculate the annual energy savings.

The realization rates for the custom incentive HVAC and DDC upgrades can be attributed to the differences between the ex ante and ex post savings calculation methodologies. The ex ante analysis relied on a temperature bin analysis with an assumed load profile for occupancy and thermal loads. ADM chose to use calibrated energy simulation to calculate the natural gas and electric savings, which is more accurate because it relies on billing data to fine tune the operation of the HVAC system.

Name SC46

Executive Summary

Under application SC46, the customer received custom standard incentives from the Illinois Department of Commerce for the installation of one high efficiency water heater and Ground Source Heat Pumps (GSHPs). The electric realization rate is 109% and the natural gas realization rate for this project is 105%.

Project Description

The customer installed an A.O. Smith BTH-199 100 gallon hot water heater. The customer also replaced its aging hot water boiler system with a new GSHP system. The new GSHP system also allowed the customer to add cooling to areas that didn't already have cooling.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied. As-built operational characteristics of the HVAC equipment were collected through the facility's energy management system, and site contacts were interviewed to determine the system operation.

Standard Incentives

For the water heater, TRM Version 3.0, Section 4.3.1 Storage Water Heater was used.

NATURAL GAS ENERGY SAVINGS

TRM Section 4.3.1 provides a deemed savings estimated based upon the building type the new water heater is installed in. The following graphic presents the savings estimates from the section of the TRM:

Annual Therms Savings for Hot Water Heaters by Building Type

Gas, High Efficiency	Gas, Standard
The annual natural gas energy savings from this measure is a deemed value equaling 251[34]	Gas savings depend on building type and are based on measure case energy factor of 0.67 and a heating capacity of 75 MBtuh. These values are averages of qualifying units. Savings values are derived from 2008 DEER Miser, which provides MBtuh gas savings per MBtuh capacity. Savings presented here are per water heater.[35]

[34] Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011. These deemed values should be compared to PY evaluation and revised as necessary

Building Type	Energy Savings (therms/unit)
Assembly	185
Education – Primary/Secondary	124
Education – Post Secondary	178
Grocery	191
Health/Medical - Hospital	297
Lodging - Hotel	228
Manufacturing - Light Industrial	140
Office – > 60,000 sq-ft	164
Office – < 60,000 sq-ft	56
Restaurant - FastFood	109
Restaurant – Sit Down	166
Retail	105
Storage	150
Multi-Family	119
Other	148

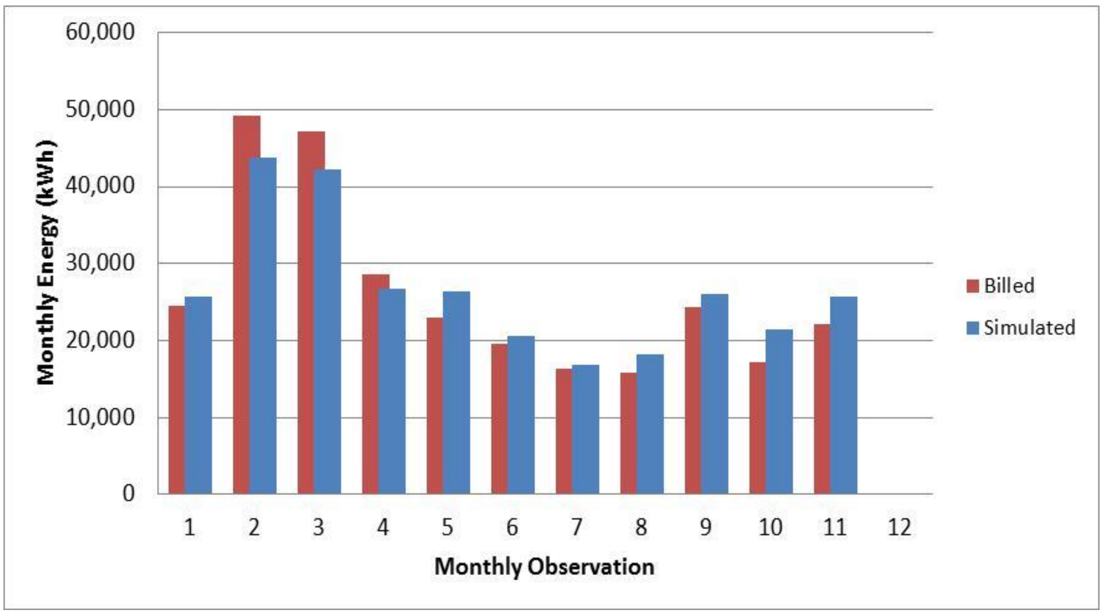
[35] Gas Storage Water Heater 0.67. Work Paper WPRSGNGDHW106. Resource Solutions Group. December 2010

Custom Incentives

Energy savings for the installation of the GSHPs were calculated using a calibrated eQuest model. ADM compiled a model of the as-built 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 2015 NOAA weather data for the region. Using this weather file and the utility provided billing data for the project; ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2015 Monthly Electric Calibration



Upon completion of the calibration for the as-built eQuest model, the GSHPs were changed to code compliant air-source heat pumps (ASHPs) to create a baseline for the electric savings. A third model with code compliant boilers as the heating system was created for the baseline natural gas savings. Once the baseline ASHPs model and the baseline boilers model were completed, the baseline and as-built models were run using Chicago O'Hare TMY3 weather data. The typical year annual electric savings are the difference between the baseline ASHPs model and the as-built GSHPs model. The typical year annual natural gas savings are the difference in energy usage in BTUs of the ASHPs model and the boilers model. The energy savings can be seen in the table below:

As-Built Vs. Baseline Annual Electric and Natural Gas Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therms Savings*
Lighting	*94,876*	*94,876*	*0*	*0*	*0*	*0*
Misc. Equipment	*13,927*	*13,927*	*0*	*0*	*0*	*0*
Heating	*392,929*	*144,671*	*248,258*	*34,954*	*14,262*	*20,692*
Cooling	*9,805*	*4,516*	*5,289*	*0*	*0*	*0*
Heat Rejection	*0*	*0*	*0*	*0*	*0*	*0*
Pumps	*1,642*	*66,303*	*-64,661*	*0*	*0*	*0*
Fans	*64,267*	*65,963*	*-1,696*	*0*	*0*	*0*
DHW	*0*	*0*	*0*	*1,128*	*1,130*	*-2*
Total	**577,446**	**390,256**	**187,190**	**36,082**	**15,392**	**20,690**

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for Storage Hot Water Heaters

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Measure Type*	*Tank Size*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	Gas, Standard	100 Gallon	Education – Primary/Secondary	56	124
Total					56	124

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for DDC Controls

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated*	*TRM-Calculated (Errata Corrected)*	*ADM Calculated*
		Ex Post	*Ex Post*	*Ex Post*
GSHPs	171,974			187,190
Total	171,974			187,190

Annual Therms Savings for DDC Controls

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated*	*TRM-Calculated (Errata Corrected)*	*ADM Calculated*
		Ex Post	*Ex Post*	*Ex Post*
GSHPs	19,727			20,690
Total	19,727			20,690

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	Storage Water Heater	56	124	221%	1,860
Subtotal		*56*	*124*	*221%*	*1,860*
Custom	GSHPs	19,727	20,690	105%	310,350
Subtotal		*19,727*	*20,690*	*105%*	*310,350*
Total		***19,783***	***20,814***	***105%***	***312,210***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	GSHPs	171,974	187,190	109%	0.00	2,807,850
Total		***171,974***	***187,190***	***109%***	***0.00***	***2,807,850***

The electric realization rate is 109%. The ex-ante analysis relied on an uncalibrated, design energy simulation for expected savings. The ex post analysis used calibrated simulation that accounts for interactive effects, equipment efficiencies, and actual system operations.

The natural gas measures have a combined realization rate of 105%. The water heater measure has a 221% realization rate because the ex-ante likely selected the wrong building type. The 105% for the GSHPs is again due to the ex post analysis using a calibrated energy simulation.

Name S- 47

Executive Summary

Under application S-47, the customer received standard incentives from the Illinois Department of Commerce for installation of two high efficiency boilers, and a high efficiency tanked water heater at their administrative office building. The natural gas realization rate for this project is 124%.

Project Description

The customer installed (2) new Hydrotherm KN-2 high efficiency boilers. The installed boilers have an efficiency of 92.7% AFUE. The installed water heater is an A.O. Smith 60 gallon tanked water heater that has a thermal efficiency of 94%.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied.

Standard Incentives

For the boiler incentives, TRM Version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = EFLH * Capacity * ((EffRating_{actual} - EffRating_{base})/EffRating_{base}) / 100{,}000$$

Where:

EFLH = Equivalent Full Load Hours for heating (see table)

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependent on year and boiler type. Baseline efficiency values by boiler type and capacity are found in the Definition of Baseline Equipment Section

EfficiencyRating(actual) = Efficient Boiler Efficiency Rating use actual value

For the water heater, TRM Version 3.0, Section 4.3.1 Storage Water Heater was used.

NATURAL GAS ENERGY SAVINGS

TRM Section 4.3.1 provides a deemed savings estimated based upon the building type the new water heater is installed in. The following graphic presents the savings estimates from the section of the TRM:

Annual Therms Savings for Hot Water Heaters by Building Type

<table>
<tr><th>Gas, High Efficiency</th><th>Gas, Standard</th></tr>
<tr><td>The annual natural gas energy savings from this measure is a deemed value equaling 251[36]</td><td>Gas savings depend on building type and are based on measure case energy factor of 0.67 and a heating capacity of 75 MBtuh. These values are averages of qualifying units. Savings values are derived from 2008 DEER Miser, which provides MBtuh gas savings per MBtuh capacity. Savings presented here are per water heater.[37]
<table>
<tr><th>Building Type</th><th>Energy Savings (therms/unit)</th></tr>
<tr><td>Assembly</td><td>185</td></tr>
<tr><td>Education – Primary/Secondary</td><td>124</td></tr>
<tr><td>Education – Post Secondary</td><td>178</td></tr>
<tr><td>Grocery</td><td>191</td></tr>
<tr><td>Health/Medical - Hospital</td><td>297</td></tr>
<tr><td>Lodging - Hotel</td><td>228</td></tr>
<tr><td>Manufacturing - Light Industrial</td><td>140</td></tr>
<tr><td>Office – > 60,000 sq-ft</td><td>164</td></tr>
<tr><td>Office – < 60,000 sq-ft</td><td>56</td></tr>
<tr><td>Restaurant - FastFood</td><td>109</td></tr>
<tr><td>Restaurant – Sit Down</td><td>166</td></tr>
<tr><td>Retail</td><td>105</td></tr>
<tr><td>Storage</td><td>150</td></tr>
<tr><td>Multi-Family</td><td>119</td></tr>
<tr><td>Other</td><td>148</td></tr>
</table>
</td></tr>
</table>

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

[36] Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011. These deemed values should be compared to PY evaluation and revised as necessary

[37] Gas Storage Water Heater 0.67. Work Paper WPRSGNGDHW106. Resource Solutions Group. December 2010

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*				*Annual Gross Therms Savings*		
	Program Type	*Boiler btuh*	*Building Type*	*Efficient Measure*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Boiler	TOS	200,000	Office - Mid Rise	93%	220	279	
High Efficiency Boiler	TOS	200,000	Office - Mid Rise	93%	220	279	
Total					***440***	***558***	

Annual Therms Savings for Storage Water Heater

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Measure Type*	*Tank Size*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	Gas, Standard	60 gallons	Office – < 60,000 SF	56	56
Total					***56***	***56***

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	High Efficiency Boiler	440	558	127%	11,163	
	Storage Water Heater	56	56	100%	840	
Total		***496***	***614***	***124%***	***12,003***	

The 124% verified natural gas realization rate is due to the ex ante analysis using a default 90% efficiency for the installed boilers, in the deemed saving calculations. Section 4.4.10, allows for a custom efficiency input when it is available, and since manufacturer literature shows that the boilers have an efficiency of 92.7%, ADM opted to use this value in the calculations.

Name S-48

Executive Summary

Under project S-48, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofit project. The realization rate for this project is 101%.

Project Description

The customer performed the following retrofit:

- (476) Removal 4’ Fluorescent lamp and ballast (delamping)
- (18) Removal 4’ Fluorescent lamp, add reflector (delamping)
- (79) U-Tube T12 lamps with (158) 2’ T8 lamps
- (786) 4’ T12 lamps with (786) 4’ T8 lamps
- (8) 250w MH fixtures with (8) LED wall packs
- (25) 295w MH fixtures with (25) LED 2x2 fixtures
- (25) 458w MH fixtures with (25) LED Street lighting fixtures
- (226) Incandescent lamps with (226) LED lamps

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2, 4.5.3, and 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*			
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated*	*Errata Corrected*	*ADM Calculated*
								Ex Post	*Ex Post*	*Ex Post*
Fluorescent Delamping	476	TRM =33.7 Actual= 36	TRM = 0 Actual = 0	4439	1.00	1.25	83,912	89,009		
Fluorescent Delamping	18	TRM =33.7 Actual= 36	TRM = 0 Actual = 0	4439	1.00	1.25	3,076	3,366		
HP & RW T8 Fixtures and Lamps	158	TRM = 32 Actual = 46	TRM = 25 Actual = 29	4439	1.00	1.25	6,943	6,137		
HP & RW T8 Fixtures and Lamps	786	TRM = 40 Actual = 41	TRM = 25 Actual = 25	4439	1.00	1.25	69,345	65,420		
LED Bulbs and Fixtures	8	TRM=182.9 Actual=295	TRM = 52.5 Actual = 50	4903	TRM=0.91 Errata=1.00	1.00	8,745	4,654	5,115	9,610
LED Bulbs and Fixtures	25	TRM=361.4 Actual =458	TRM=116.8 Actual =113	4903	TRM =0.91 Errata=1.00	1.00	38,483	27,283	29,982	
LED Bulbs and Fixtures	25	TRM = 295 Actual =295	TRM =160.2 Actual = 52	4439	TRM =0.91 Errata=1.00	1.25	15,091	17,016	18,699	
LED Bulbs and Fixtures	226	TRM = 50 Actual = 64	TRM = 14.4 Actual = 14	3088	TRM =0.91 Errata=1.00	1.25	24,132	28,261	31,056	
Total							***249,727***	***241,146***	***248,783***	***9,610***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values. TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh (errata corrected or ADM if applicable)*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh (errata corrected or ADM if applicable)*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.2	83,912	89,009	106%	13.76	11	979,095	N/A	N/A
	4.5.2	3,076	3,366	109%	0.52	11	37,025	N/A	N/A
	4.5.3	6,943	6,137	88%	0.95	15	92,054	N/A	N/A
	4.5.3	69,345	65,420	94%	10.12	15	981,296	N/A	N/A
	4.5.4	8,745	9,610	110%	0.00	10.2	98,021	N/A	N/A
	4.5.4	38,483	29,982	78%	0.00	10.2	305,815	N/A	N/A
	4.5.4	15,091	18,699	124%	2.89	7.9	147,350	N/A	N/A
	4.5.4	24,132	31,056	129%	6.90	15	465,840	N/A	N/A
Total		***249,727***	***253,278***	***101%***	***35.14***		***3,106,496***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 101%.

Based on algorithms in TRM 3.0 measure 4.5.2, the TRM calculated ex post savings for the first and second measures was 187kWh per fixture, whereas the ex ante savings estimates were 176kWh and 171kWh per fixture, respectively.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the third and fourth measures was 39kWh and 83kWh per fixture, whereas the ex ante savings estimate was 44kWh and 88kWh per fixture, respectively.

Based on algorithms in TRM 3.0 measure 4.5.4, the ADM corrected ex post savings for the fifth measure was 1,201kWh per fixture, whereas the ex ante savings estimate was 1,093kWh per fixture.

The errata corrected ex post savings for measures six through eight was 1,199kWh, 748kWh, and 137kWh per fixture, whereas the ex ante savings estimate was 1,539kWh, 604kWh, and 107kWh per fixture, respectively.

Department of Commerce incentivized (4.5.4) measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For the 4.5.4 measures, the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name SC- 49

Executive Summary

Under application SC- 49, the customer received standard incentives from the Illinois Department of Commerce for installation of two high efficiency boilers, and custom incentives for the installation of hot water reset controls at an elementary school. The natural gas realization rate for this project is 107%.

Project Description

The customer installed (2) new Fulton Hydronic EDR-2000 high efficiency boilers. The installed boilers have an efficiency of 92.5% AFUE with a maximum output of 1,850,000 Btus/h each. Along with the installation of the new boilers, hot water rest controls were installed on the hot water loop, allowing the temperature setpoint of the loop to vary based upon the outside air temperature.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied. During the site visit, field technicians verified nameplate information of the new boilers and collected details about the hot water reset controls from the EMS system.

Standard Incentives

For the boiler incentives, TRM Version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = EFLH * Capacity * ((EffRating_{actual} - EffRating_{base})/EffRating_{base}) / 100{,}000$$

Where:

EFLH = Equivalent Full Load Hours for heating (see table)

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependent on year and boiler type. Baseline efficiency values by boiler type and capacity are found in the Definition of Baseline Equipment Section

EfficiencyRating(actual) = Efficient Boiler Efficiency Rating use actual value

Custom Incentives

Savings for the installation of the hot water reset controls was calculated through the use of the primary school DEER prototypical eQuest model. The model was modified to use hot water as the primary heating source and being delivered to unit ventilators, in order to reflect the actual HVAC system being employed by the elementary school. Parametric runs were then used to model the school with hot water reset controls while the baseline model utilized a constant hot water temperature setpoint. The pair of models was the run using TMY3 weather for the region and savings was normalized to the heating capacity of the eQuest model's boiler. The normalized Therm savings was then multiplied by the total heating capacity of the elementary school to determine the annual Therm savings for the measure.

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Boiler btuh*	*Building Type*	*Efficient Measure*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Boiler	TOS	2,000,000	Elementary	92.5%	2,100	2,625
High Efficiency Boiler	TOS	2,000,000	Elementary	92.5%	2,100	2,625
Total					4,200	5,250

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for Hot Water Reset Controls

Measure	*Measure Metrics*			*Annual Gross Therms Savings*			
	Total Heating btuh	*Building Type*	*Therm Savings per btuh Capacity*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
HW Reset	4,000,000	Elementary	0.000055	1,000			311
Total				1,000			311

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	High Efficiency Boiler	4,200	5,250	125%	105,000	
Subtotal		4,200	5,250	125%	105,000	
Custom	HW Reset	1,000	311	31%	4,665	
Subtotal		1,000	311	31%	4,665	
Total		***5,200***	***5,561***	***107%***	***109,665***	

The combination of projects has a 105% verified natural gas realization. The low realization rate for the hot water reset controls is due to the ex ante using deemed savings. No background information was provided for the claimed savings; however, the realized savings are lower than expected due to the school employing a snap temperature control that only allows the heating hot water system to operate at temperature below 35°F. By limiting the operation of the hot water system the potential energy savings for the reset controls is reduced, contributing to the low realization rate.

Name SC50

Executive Summary

Under application SC50, the customer received standard and custom incentives from the Illinois Department of Commerce. The standard incentives were for the installation of (12) new high efficiency roof top package units. The custom incentives were for the retrofit of constant volume air side systems to single zone variable volume air side systems. The overall electric realization rate is 43% and the overall natural gas realization rate for this project is 33%.

Project Description

Recently the customer replaced (12) roof top package units with new high efficiency units ranging in size from 4.2 tons to 7.6 tons. During the RTU replacement, the customer also retrofitted the existing constant volume air system to a single variable air volume (SZVAV) system. The addition of the SZVAV system also included supporting control strategies in order to maximize the potential energy savings for the project.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the installation of the (12) roof top package units and the retrofit of the air side system to single zone variable air volume (SZVAV). To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational setpoints from the building’s energy management system.

Standard Incentives

For the high efficiency package units, the erratum TRM Version 4.0 Section 4.4.15 Single-Package and Split System Unitary Air Conditioners was used.

ELECTRIC ENERGY SAVINGS

For units with cooling capacities less than 65 kBtu/h:

$$\Delta kWH = (kBtu/h) * [(1/SEER_{base}) - (1/SEER_{ee})] * EFLH$$

For units with cooling capacities equal to or greater than 65 kBtu/h:

$$\Delta kWH = (kBtu/h) * [(1/EER_{base}) - (1/EER_{ee})] * EFLH$$

Where:

kBtu/h = capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).

$SEER_{base}$ = Seasonal Energy Efficiency Ratio of the baseline equipment; see table

$SEER_{ee}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).

EER_{base} = Energy Efficiency Ratio of the baseline equipment; see table above for default values. Since IECC 2006 does not provide EER requirements for air-cooled air conditioners < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1

EER_{ee} = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EER_{ee} is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.

= Actual installed

EFLH = cooling equivalent full load hours; see table

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW_{SSP} = (kBtu/h * (1/EER_{base} - 1/EER_{ee})) * CF_{SSP}$$

Where:

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

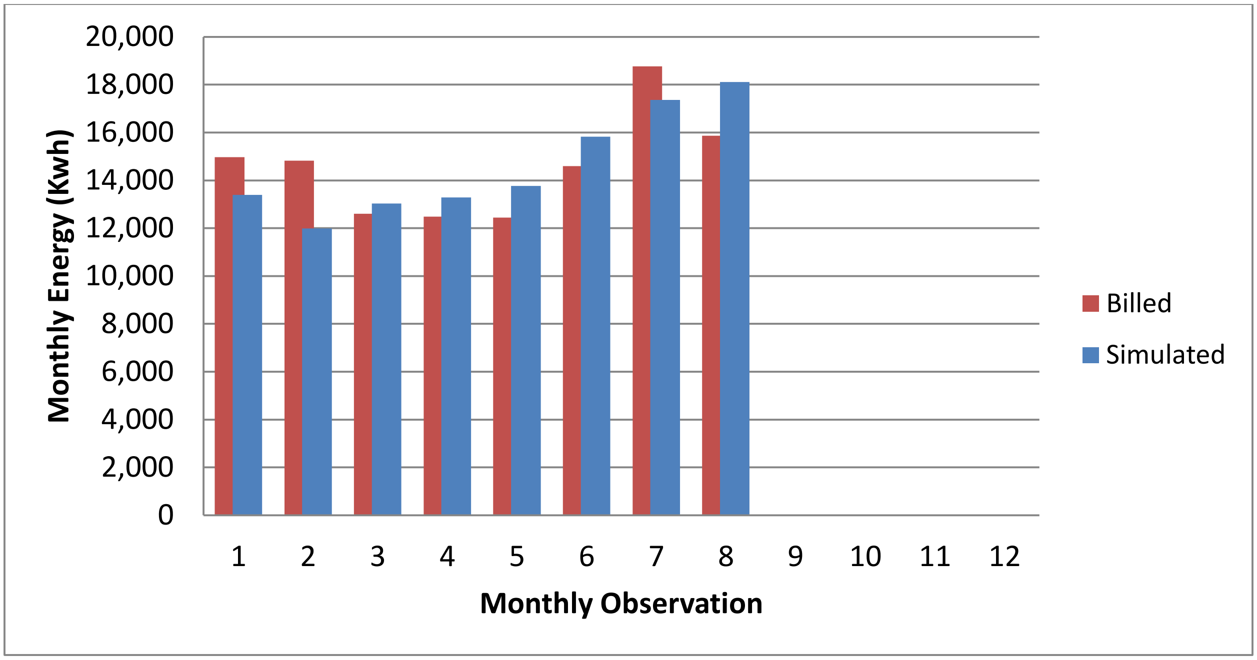
= 91.3%

Custom Incentives

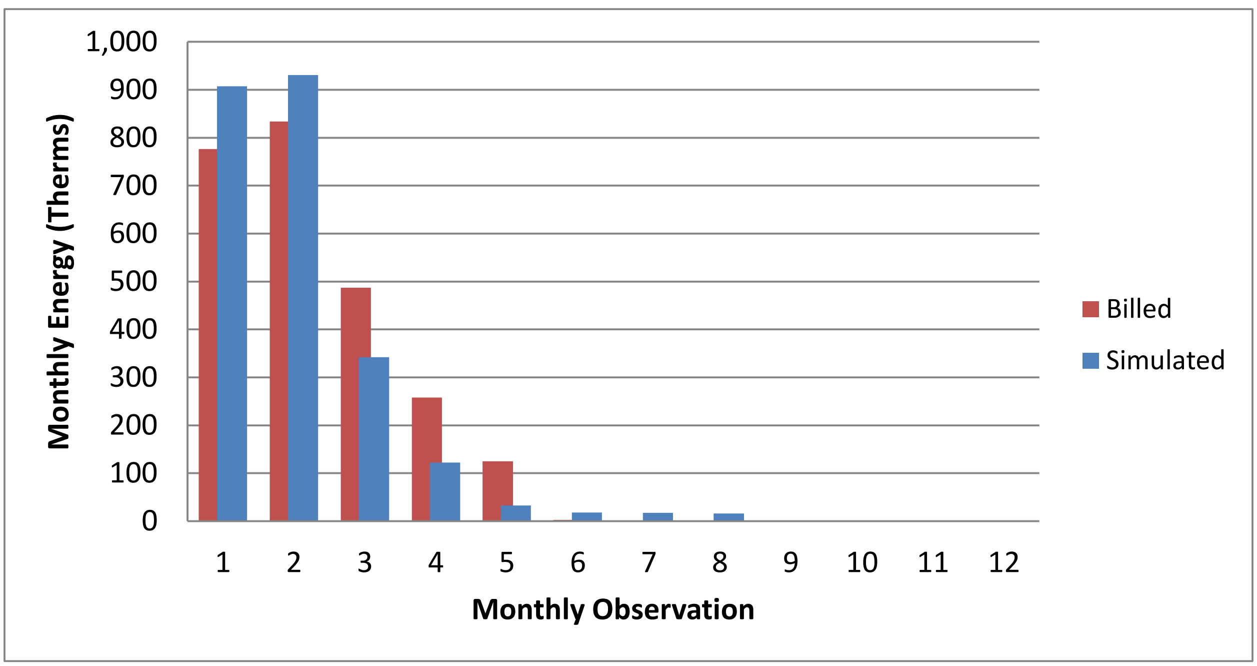
Energy savings were calculated using an eQuest model of the office portion of the facility. ADM compiled a model of the baseline office facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Since the facility comprises of multiple envelopes on single meter and only the office building was modeled, the bills for the complex were normalized to a kWh/ft^2 and Therm/ft^2 basis to determine what the office portion of the complex would typically consume. Upon completion of the initial model and billing normalization, a custom weather file was created using 2014 NOAA weather data for the Chicago O'Hare area. Using this weather file and the normalized billing data for the facility, ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2014 Monthly kWh Calibration



2014 Monthly Natural Gas Calibration



It should be noted that ADM opted to only calibrate to the first eight months of 2014, as the retrofit of the air side system occurred in September of 2014.

Upon completion of the calibration for the baseline eQuest model, the impacts of the retrofitted SZVAV air side system and additional controls were modeled through the use of a parametric run. Once the parametric run was defined, the baseline model and parametric run were run using Chicago O'Hare TMY3 weather data. The typical year annual savings are the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Electric and Natural Gas Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	*64,308*	*64,308*	*0*	*0*	*0*	*0*
Misc. Equipment	*35,396*	*35,396*	*0*	*0*	*0*	*0*
Heating	*0*	*0*	*0*	*2,762*	*616*	*2,146*
Cooling	*25,040*	*22,903*	*2,137*	*0*	*0*	*0*
Heat Rejection	*0*	*0*	*0*	*0*	*0*	*0*
Pumps	*2,568*	*2,568*	*0*	*0*	*0*	*0*
Fans	*24,717*	*3,643*	*21,074*	*0*	*0*	*0*
Exterior	*21,627*	*21,627*	*0*	*0*	*0*	*0*
Total	**173,656**	**150,445**	**23,211**	**2,762**	**616**	**2,146**

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Unitary AC

Measure	Measure Metrics							Annual Gross kWh Savings		
	Building Type	Equipment type	Subcategory or rating Condition	# of Units	New Cooling Capacity (kbtu/h)	SEER of Efficient Equipment	Zone	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Single-Package and Split System Unitary Air Conditioners	Office - Low Rise	Air conditioners, Air cooled	Single Package	4	50.5	17.5	2 (Chicago)	794	807	4,036
Single-Package and Split System Unitary Air Conditioners	Office - Low Rise	Air conditioners, Air cooled	Single Package	1	60	17.2	2 (Chicago)	248	228	1,138
Single-Package and Split System Unitary Air Conditioners	Office - Low Rise	Air conditioners, Air cooled	Single Package	7	92	12.6	2 (Chicago)	5,384	469	2,346
Total								6,426	1,504	7,520

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for Single Zone VAV Retrofit

Measure	Annual Gross kWh Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
Single Zone VAV	65,435			23,211
Total	65,435			23,211

Annual Therms Savings for Single Zone VAV Retrofit

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Single Zone VAV	6,573			2,146
Total	6,573			2,146

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Ex Post Peak kW Reduction*
Standard	Single-Package and Split System Unitary Air Conditioners	6,426	7,520	117%	7.27	112,805	7.27
Subtotal		6,426	7,520	117%	7.27	112,805	7.27
Custom	Single Zone VAV	65,435	23,211	35%	5.77	348,165	5.77
Subtotal		*65,435*	*23,211*	*35%*	*5.77*	*348,165*	*5.77*
Total		***71,861***	***30,731***	***43%***	***13.04***	***460,970***	***13.04***

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	Single Zone VAV	6,573	2,146	33%	32,190
Total		***6,573***	***2,146***	***33%***	***32,190***

The project has an overall electric realization rate of 43% and an overall natural gas realization rate of 33%. The overall realization rates can be attributed to an overestimation of ex ante savings for the SZVAV retrofit. The ex ante did not provide a detailed analysis on its estimation;

however, ADM was able to verify that the claimed savings are too high to be within reason. Using a simplified EFLH calculation for the baseline RTU systems, ADM was able to determine that the system would typically consume a total of 79,486 kWh annually for all 12 RTUs. The expected savings would result in a reduction of approximately 82% for the HVAC system, and that is not realistic.

Another vetting process of the expected savings involved using the same EFLH calculation. Instead of using the EFLH vales for a “High Rise Office” in the Chicago area, TRM Version 4.0 provides EFLH values based on air side system type and reports an EFLH of 1,452 for a constant volume system and 919 for a variable volume system. These hours were used to represent the conversion to a variable volume system. This resulted in a HVAC energy reduction of 37%. This supports ADM’s calibrated eQuest model, which reports a 44% reduction.

The expected natural gas savings are unreasonably high. Through the billing normalization process, it was determined that the office portion of the complex only consumed approximately 4,000 therms during 2014. The claimed savings is 6,573 therms, which exceeds the total usage of the building.

Name SC51

Executive Summary

Under application SC51, the customer received standard incentives from the Illinois Department of Commerce for the installation of demand controlled ventilation and custom incentives for the implementation of a new control strategy for hot water valves. The natural gas realization rate for this project is 94%.

Project Description

The installed incentivized measures focused on reducing the overall HVAC energy usage of the facility. In order to accomplish this, the customer installed Demand Controlled Ventilation (DCV) controls. DCV saves energy by reducing the minimum outside air being supplied to the space through the use of CO_2 sensors located in the spaces. The customer also revised the hot water valve logic in the energy management system (EMS) to close the valves during non-operating hours. Since the secondary hot water pumps operate when the outside air temperature is below 60°F, hot water continues to circulate through the coils; thus, it is acting like a radiator and wasting energy. By programing the valves to close during non-operating hours this effect will be eliminated.

The customer also installed VFDs on two supply fans and also reprogramed the hot water pump control strategy to limit their operation between outside air temperatures of 60°F and 40°F. Both of these measures were included in the project documentation; however, per conversations with the Department Program Manager electric incentives were not paid for these measures. Due to this, the savings are being reported as spillover.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and performed a site visit to ensure the claimed equipment was installed and proper as-built efficiencies were being applied. During this time, ADM staff also gathered site specific operating details about the hot water valves and pumps.

Standard Incentives

For the Demand Control Ventilation, the erratum TRM Version 4.0 Section 4.4.19 Demand Control Ventilation was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = Condition\ Space/1000 * Therm\_Savings\_Factor$$

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Therm _Savings_Factor = value in table below based on building type and weather zone[38]

Custom Incentives

Annual Therm savings for the implementation of the hot water valve control were calculated through the use of a custom temperature bin analysis. Using TMY3 weather data for the region, the weather was segmented into 2 degree bins. The weather data was used to calculate the number of actual hours for each bin and the number of air handler operating hours for each bin.

It was assumed that when the valves re open, hot water flows through each of the air handlers at a rate of 10 GPM and results in a temperature difference of 1^{o}F. Using this assumption and a general heat transfer equation, it was determined that there is an average heat loss of 5,000 BTU/H through each air handler when the valves are left open. Since the valves must cycle open during periods of non-operation and low outside air temperatures to prevent freezing of the coils, it was assumed that the rate of heat transfer decreases linearly through the temperature bins. The following bin analysis was used to determine annual therms savings:

Hot Water Valve Control Analysis

High	*Low*	*Average*	*Total Hours*	*Operating Hours*			*Hour Reduction*			*BTU/H Red.*	*Therm Savings*		
				AHU-1,3,7,8,9	*AHU-2,4,5*	*AHU-6*	*AHU-1,3,7,8,9*	*AHU-2,4,5*	*AHU-6*		*AHU-1,3,7,8,9*	*AHU-2,4,5*	*AHU-6*
60	58	59	285	82	74	46	203	211	239	5,000.00	63.44	39.56	14.94
58	56	57	275	70	66	37	205	209	238	4,852.94	62.18	38.03	14.44
56	54	55	274	73	69	52	201	205	222	4,705.88	59.12	36.18	13.06
54	52	53	249	57	50	34	192	199	215	4,558.82	54.71	34.02	12.25
52	50	51	254	70	64	40	184	190	214	4,411.76	50.74	31.43	11.80
50	48	49	231	64	57	35	167	174	196	4,264.71	44.51	27.83	10.45
48	46	47	207	52	43	32	155	164	175	4,117.65	39.89	25.32	9.01
46	44	45	227	49	44	31	178	183	196	3,970.59	44.17	27.25	9.73
44	42	43	253	62	57	39	191	196	214	3,823.53	45.64	28.10	10.23
42	40	41	222	57	52	37	165	170	185	3,676.47	37.91	23.44	8.50

[38] The natural gas energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1 and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

High	*Low*	*Average*	*Total Hours*	*Operating Hours*			*Hour Reduction*			*BTU/H Red.*	*Therm Savings*		
				AHU-1,3,7,8,9	*AHU-2,4,5*	*AHU-6*	*AHU-1,3,7,8,9*	*AHU-2,4,5*	*AHU-6*		*AHU-1,3,7,8,9*	*AHU-2,4,5*	*AHU-6*
40	38	39	195	61	57	35	134	138	160	3,529.41	29.56	18.26	7.06
38	36	37	272	68	60	34	204	212	238	3,382.35	43.13	26.89	10.06
36	34	35	398	100	91	58	298	307	340	3,235.29	60.26	37.25	13.75
34	32	33	317	84	76	53	233	241	264	3,088.24	44.97	27.91	10.19
32	30	31	292	77	67	51	215	225	241	2,941.18	39.52	24.82	8.86
30	28	29	273	80	75	51	193	198	222	2,794.12	33.70	20.75	7.75
28	26	27	207	58	47	29	149	160	178	2,647.06	24.65	15.88	5.89
26	24	25	143	42	40	31	101	103	112	2,500.00	15.78	9.66	3.50
24	22	23	148	36	31	23	112	117	125	2,352.94	16.47	10.32	3.68
22	20	21	101	28	24	16	73	77	85	2,205.88	10.06	6.37	2.34
20	18	19	157	37	34	24	120	123	133	2,058.82	15.44	9.50	3.42
18	16	17	139	30	27	19	109	112	120	1,911.76	13.02	8.03	2.87
16	14	15	86	28	28	15	58	58	71	1,764.71	6.40	3.84	1.57
14	12	13	69	21	17	13	48	52	56	1,617.65	4.85	3.15	1.13
12	10	11	55	10	8	8	45	47	47	1,470.59	4.14	2.59	0.86
10	8	9	61	20	19	15	41	42	46	1,323.53	3.39	2.08	0.76
8	6	7	40	10	9	7	30	31	33	1,176.47	2.21	1.37	0.49
6	4	5	40	11	11	11	29	29	29	1,029.41	1.87	1.12	0.37
4	2	3	34	7	6	6	27	28	28	882.35	1.49	0.93	0.31
2	0	1	34	3	3	3	31	31	31	735.29	1.42	0.85	0.28
0	-2	-1	26	3	3	3	23	23	23	588.24	0.85	0.51	0.17
-2	-4	-3	15	0	0	0	15	15	15	441.18	0.41	0.25	0.08
-4	-6	-5	15	1	1	1	14	14	14	294.12	0.26	0.15	0.05
-6	-8	-7	21	3	3	3	18	18	18	147.06	0.17	0.10	0.03
-8	-10	-9	2	0	0	0	2	2	2	0.00	0.00	0.00	0.00

Spillover Savings

For the supply fan VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used to calculate the spillover savings.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kW_{connected} * Hours * ESF$$

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kW_{connected} * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

For the Demand Control Ventilation, the erratum TRM Version 4.0 Section 4.4.19 Demand Control Ventilation was used to calculate the spillover electric savings.

ELECTRIC ENERGY SAVINGS

ΔkWh = Condition Space/1000 * Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Elec_Savings_Factor = value in table below based on building type and weather zone[39]

SUMMER COINCIDENT PEAK DEMAND SAVINGS

NA

Spillover savings for eliminating the secondary hot water pump operation between the temperatures of 60°F and 40°F was calculated by determining the number of hours typical hours between the two temperatures in an entire year and multiplying them by the kW demand of the hot water pumps. The following table segregates the analysis into 2 degree bins and illustrates that AHU-2's hot water pump is allowed to operate up to temperatures of 55°F:

Secondary Hot Water Pump Control Analysis

High	*Low*	*Average*	*Total Hours*	*Reduced Hours*		*kWh Savings*	
				AHU-1,3,8,9	*AHU-2*	*AHU-1,3,8,9*	*AHU-2*
66	64	65	277	277	0	126.77	0.00
64	62	63	272	272	0	124.49	0.00
62	60	61	263	263	0	120.37	0.00
60	58	59	285	285	0	130.44	0.00
58	56	57	275	275	0	125.86	0.00
56	54	55	274	274	274	125.40	31.35
54	52	53	249	249	249	113.96	28.49
52	50	51	254	254	254	116.25	29.06
50	48	49	231	231	231	105.72	26.43
48	46	47	207	207	207	94.74	23.68

[39] The electric energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

High	Low	Average	Total Hours	Reduced Hours		kWh Savings	
				AHU-1,3,8,9	AHU-2	AHU-1,3,8,9	AHU-2
46	44	45	227	227	227	103.89	25.97
44	42	43	253	253	253	115.79	28.95
42	40	41	222	222	222	101.60	25.40

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for Demand Control Ventilation

Measure	Measure Metrics				Annual Gross Therms Savings		
	Building Type	Zone	Conditioned Space (Sq. Ft.)	Savings Factor (Therm/1000 SqFt)	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Demand Control Ventilation	High School	2 (Chicago)	14,000	71	994	994	994
Total					994	994	994

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for Hot Water Valve Control

Measure	Measure Metrics			Annual Gross Therms Savings			
	# Air Handlers	GPM per Air Handler	Delta T	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
HW Valve Control	9	10	1.0	1,799			1,620
Total				1,799			1,620

Spillover

The tables shown below present the verified gross savings for measures that did not receive incentives but produced spillover savings

Annual kWh Savings for HW Pump Control

Measure	Measure Metrics		Annual Gross kWh Savings			
	# of Pumps	kW Demand	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
HW Pump Control	5	0.11				1,725
Total						1,725

Annual kWh Savings for Demand Control Ventilation

Measure	Measure Metrics				Annual Gross kWh Savings			
	Building Type	Zone	Conditioned Space (Sq. Ft.)	Savings Factor (kWh/1000 SqFt)	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
Demand Control Ventilation	High School	2 (Chicago)	14,000	316		7,980	4,424	
Total						7,980	4,424	

Annual kWh Savings for VFDs on Fans

Measure	Measure Metrics					Annual Gross kWh Savings			
	Application	Program Type	Type	HP	Building Type	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	7.5 HP	School(K-12)		5,704		
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	5 HP	School(K-12)		3,807		
Total							9,511		

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings			Lifetime Gross Savings	Spillover
		Ex Ante Therms	Ex Post Therms	Realization Rate	Ex Post Therms	Annual Therms
Standard	Demand Control Ventilation	994	994	100%	9,940	
Subtotal		994	994	100%	9,940	
Custom	HW Valve Control	1,799	1,620	90%	24,299	
Subtotal		*1,799*	*1,620*	*90%*	*24,299*	
Total		***2,793***	***2,614***	***94%***	***34,239***	

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Ex Post Peak kW Reduction	Annual kWh Savings	Annual Peak kW Reduction
Standard	Demand Control Ventilation							4,424	0.00
	Variable Speed Drives for HVAC							9,511	2.80
Subtotal		0	0		0.00	0	0.00	13,935	2.80
Custom	HW Pump Control							1,725	0.00
Subtotal								*1,725*	*0.00*
Total		***0***	***0***		***0.00***	***0***	***0.00***	***15,660***	***2.80***

The natural gas measures have a combined verified realization rate of 94%. The cause of the realization rate can be attributed to ADM calculating a lower than expected natural gas savings for the hot water valve control measure. The difference can be attributed to the ex ante analysis assuming that all of the effected air handlers had the same operation schedule. During the site visit, field staff discovered some air handlers had different operating schedules; therefore, the temperature bin analysis was adjusted to reflect the actual scheduling of the nine effected air handlers.

Spillover electric savings were realized since the electric projects didn’t receive incentives. The total annual spillover savings are 15,660 kWh and 2.8 peak kW reduction.

Name SC52

Executive Summary

Under application SC52, the customer received custom and standard incentives from the Illinois Department of Commerce for the installation of two high efficiency water heaters and HVAC controls at a middle school. The electric realization rate is 73% and the natural gas realization rate for this project is 45%.

Project Description

The customer installed (2) A.O. Smith BTH-199 one hundred gallon hot water heaters. The customer also replaced its dysfunctional DDC and pneumatic controls on an air handling unit (AHU) and a rooftop unit (RTU). The existing controls were not functional and equipment typically ran without scheduling. The new controls allow for equipment scheduling and temperature setbacks and resets.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and invoices to ensure the claimed equipment was installed and proper as-built efficiencies were being applied. As-built operational characteristics of the HVAC equipment were collected through the facility's energy management system, and site contacts were interviewed to determine the baseline operation.

Standard Incentives

For the water heaters, TRM Version 3.0, Section 4.3.1 Storage Water Heater was used.

NATURAL GAS ENERGY SAVINGS

TRM Section 4.3.1 provides a deemed savings estimated based upon the building type the new water heater is installed in. The following graphic presents the savings estimates from the section of the TRM:

Annual Therms Savings for Hot Water Heaters by Building Type

Gas, High Efficiency	Gas, Standard
The annual natural gas energy savings from this measure is a	Gas savings depend on building type and are based on measure case energy factor of 0.67 and a heating capacity of 75 MBtuh. These values are averages of qualifying units. Savings values are derived from 2008 DEER Miser, which provides MBtuh gas savings per MBtuh capacity. Savings presented here are per water heater.[41]

<table>
<tr>
<td>deemed value equaling 251[40]</td>
<td>
<table>
<tr><th>Building Type</th><th>Energy Savings (therms/unit)</th></tr>
<tr><td>Assembly</td><td>185</td></tr>
<tr><td>Education – Primary/Secondary</td><td>124</td></tr>
<tr><td>Education – Post Secondary</td><td>178</td></tr>
<tr><td>Grocery</td><td>191</td></tr>
<tr><td>Health/Medical - Hospital</td><td>297</td></tr>
<tr><td>Lodging - Hotel</td><td>228</td></tr>
<tr><td>Manufacturing - Light Industrial</td><td>140</td></tr>
<tr><td>Office – > 60,000 sq-ft</td><td>164</td></tr>
<tr><td>Office – < 60,000 sq-ft</td><td>56</td></tr>
<tr><td>Restaurant - FastFood</td><td>109</td></tr>
<tr><td>Restaurant – Sit Down</td><td>166</td></tr>
<tr><td>Retail</td><td>105</td></tr>
<tr><td>Storage</td><td>150</td></tr>
<tr><td>Multi-Family</td><td>119</td></tr>
<tr><td>Other</td><td>148</td></tr>
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Custom Incentives

Savings for the installation of the DDC controls were calculated through using an eQuest model. ADM compiled a 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 2013 NOAA weather data for the region. Using this weather file and the utility provided billing data for the

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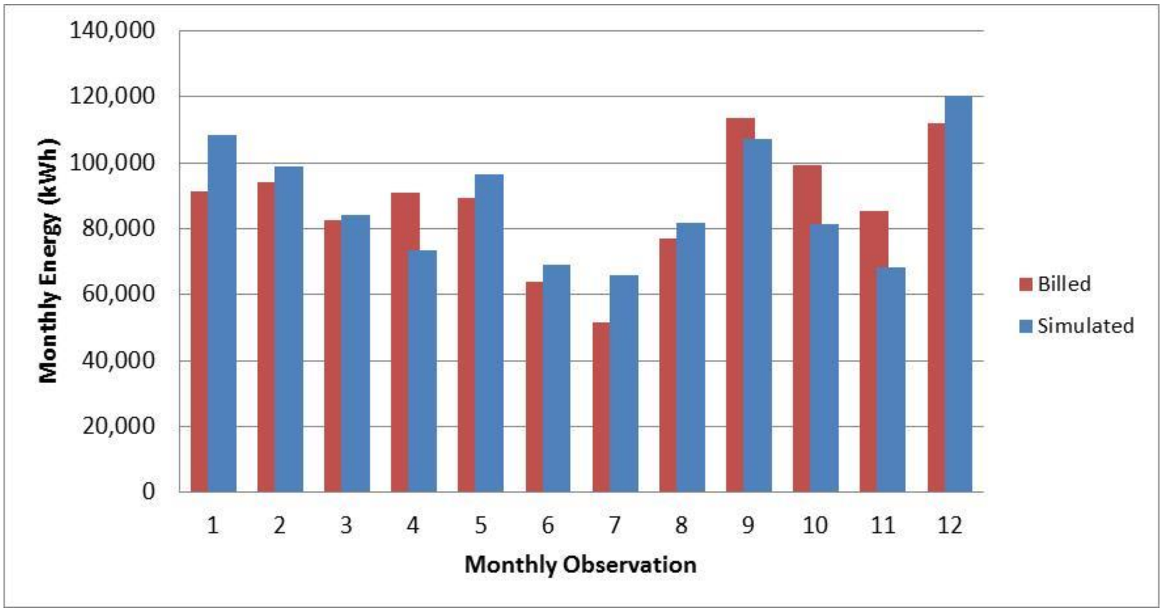
[41] Gas Storage Water Heater 0.67. Work Paper WPRSGNGDHW106. Resource Solutions Group. December 2010

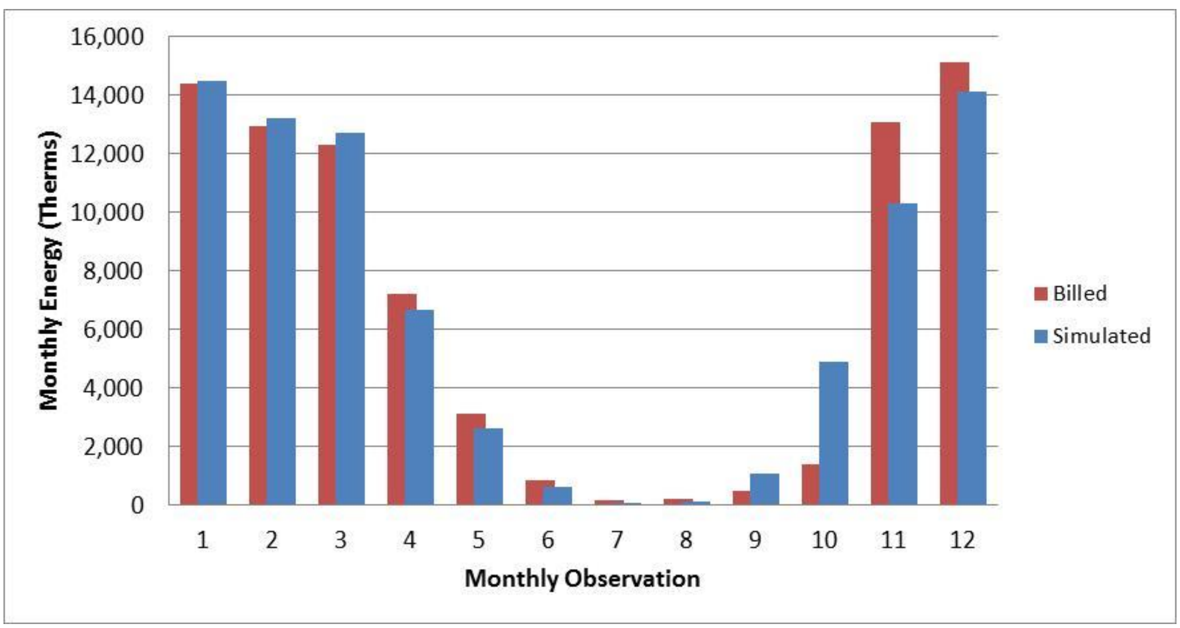
[40] Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011. These deemed values should be compared to PY evaluation and revised as necessary

project; ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2013 Monthly Electric Calibration



2013 Monthly Natural Gas Calibration



Upon completion of the calibration for the baseline eQuest model, the impacts of the installed measures were added to create an as-built model. Once the as-built model was completed, the baseline and as-built models were run using Chicago O'Hare TMY3 weather data. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Electric and Natural Gas Energy Consumption

End-Use	Baseline kWh	As-Built kWh	Annual kWh Savings	Baseline Therms	As-Built Therms	Annual Therm Savings
Lighting	394,182	394,182	0	0	0	0
Misc. Equipment	109,812	109,812	0	0	0	0
Heating	235,553	235,544	9	79,324	76,562	2,762
Cooling	265,764	223,849	41,915	0	0	0
Heat Rejection	0	0	0	0	0	0
Pumps	8,489	8,319	170	0	0	0
Fans	89,371	78,407	10,964	0	0	0
Exterior	0	0	0	0	0	0
Total	**1,103,171**	**1,050,113**	**53,058**	**79,324**	**76,562**	**2,762**

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for Storage Hot Water Heaters

Measure	Measure Metrics				Annual Gross Therms Savings	
	Program Type	Measure Type	Tank Size	Building Type	Ex Ante	TRM-Calculated Ex Post
Storage Water Heater	TOS	Gas, Standard	60 Gallon	Education – Primary/Secondary	124	124
Storage Water Heater	TOS	Gas, Standard	60 Gallon	Education – Primary/Secondary	124	124
Total					248	248

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for DDC Controls

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
DDC Controls	72,199			53,058
Total	72,199			53,058

Annual Therms Savings for DDC Controls

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
DDC Controls	6,458			2,762
Total	6,458			2,762

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	Storage Water Heater	248	248	100%	3,720
Subtotal		*248*	*248*	*100%*	*3,720*
Custom	DDC Controls	6,458	2,762	43%	41,430
Subtotal		*6,458*	*2,762*	*43%*	*41,430*
Total		***6,706***	***3,010***	***45%***	***45,150***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	DDC Controls	72,199	53,058	73%	21.67	795,870
Total		***72,199***	***53,058***	***73%***	***21.67***	***795,870***

The electric realization rate is 73%. The ex-ante analysis relies on a temperature bins to estimate savings. Within the temperature bins, it uses engineering equations to derive electric energy savings from cooling and fans. The fan equation overestimates savings as the RTU has VFDs, and the equation assumes full speed operation. The engineering equations also do not account for interactive effects within the building or equipment efficiencies. The ex-post analysis uses calibrated simulation that accounts for varying fan speeds, interactive effects, and equipment efficiencies.

The natural gas measures have a combined realization rate of 45%. The same bin analysis was performed for natural gas heating savings for the DDC controls. Another factor in the 45% realization rate that was not mentioned in the electric realization rate is the heating hours that are assumed in the ex-ante analysis. The baseline was assumed to have 5,461 heating hours, and the as-built was assumed to have 3,673 heating hours. These hours are not justified and appear to be largely overestimated.

Name SC53

Executive Summary

Under application SC53, the customer received standard incentives from the Illinois Department of Commerce for the installation of 14 high efficiency split system unitary air conditioners. The site also received custom incentives for the installation of direct digital controls (DDC) on a total of 14 unit ventilators serving classrooms. The electric realization rate is 34%, and the natural gas realization rate for this project is 75%.

Project Description

The customer installed (2) new two ton AAON high efficiency condensing units with a rated SEER of 17.3, and (12) four ton AAON high efficiency condensing units with a rated SEER of 16.2. Each of the new condensing units serve unit ventilators located in classrooms throughout the middle school. Originally, the unit ventilators operated continuously with no time-of-use controls, resulting in an annual operation of 8,760 hours. In order to minimize the annual energy consumption of the unit ventilator systems, a DDC system was installed to limit the operation of the systems based on a global schedule employed by the facility. The reduction in operating hours results in a reduction of fan, cooling, and heating energy consumption.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and verified the claimed efficiencies of the unitary air conditioners during the on-site visit. As-built operational characteristics of the unit ventilators were collected through the facility's new energy management system, and site contacts were interviewed to determine the baseline operation.

Standard Incentives

For the high efficiency packaged units, the erratum TRM Version 4.0 Section 4.4.15 Single-Package and Split System Unitary Air Conditioners was used.

ELECTRIC ENERGY SAVINGS

For units with cooling capacities less than 65 kBtu/h:

$$\Delta kWH = (kBtu/h) * [(1/SEER_{base}) – (1/SEER_{ee})] * EFLH$$

For units with cooling capacities equal to or greater than 65 kBtu/h:

$$\Delta kWH = (kBtu/h) * [(1/EER_{base}) – (1/EER_{ee})] * EFLH$$

Where:

kBtu/h = capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).

$SEER_{base}$ = Seasonal Energy Efficiency Ratio of the baseline equipment; see table

$SEER_{ee}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).

EER_{base} = Energy Efficiency Ratio of the baseline equipment; see table above for default values. Since IECC 2006 does not provide EER requirements for air-cooled air conditioners < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1

EER_{ee} = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EER_{ee} is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.

= Actual installed

EFLH = cooling equivalent full load hours; see table

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW_{SSP} = (kBtu/h * (1/EER_{base} - 1/EER_{ee})) * CF_{SSP}$$

Where:

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

Custom Incentives

Savings for the installation of the DDC controls was calculated through the use of a custom temperature bin analysis. Using TMY3 weather data for the region, the weather was segmented into two degree bins and was used to calculate the number of actual hours spent in each bin, as well as the number of hours the unit ventilators operate in each bin with the DDC controls

Using psychometric equations, the mixed air temperature and enthalpy seen by the unit ventilators were calculated for each outdoor temperature bin as a function of; outdoor temperature/enthalpy, return air temperature/enthalpy, outdoor air CFM, and return air CFM. The following equations were used to accomplish this:

$$MixAir_{Temp} = (ReturnAir_{Temp} * ((Total_{CFM}-OSA_{CFM})/Total_{CFM})) +(OSA_{Temp} * (OSA_{CFM}/Total_{CFM}))$$

Where:

$MixAir_{Temp}$ = The mixed air temperature of the return air and minimum outside air as seen by the cooling/heating coil

$ReturnAir_{Temp}$ = The return air temperature of the room as a function of the setpoint temperature of the room

$Total_{CFM}$ = The total supply CFM of the unit ventilator

OSA_{CFM} = The minimum outside air CFM of the unit ventilator

OSA_{Temp} = The average outside air temperature of a given temperature bin

$MixAir_{Enthalpy}$ = $(ReturnAir_{Enathlpy} * ((Total_{CFM}-OSA_{CFM})/Total_{CFM})) + (OSA_{Temp} * (OSA_{CFM}/Total_{CFM}))$

Where:

$MixAir_{Enthalpy}$	= The mixed air enthalpy of the return air and minimum outside air as seen by the cooling/heating coil
$ReturnAir_{Entahlpy}$	= The return air enthalpy of the room as a function of the setpoint temperature of the room
$Total_{CFM}$	= The total supply CFM of the unit ventilator
OSA_{CFM}	= The minimum outside air CFM of the unit ventilator
$OSA_{Entahlpy}$	= The average outside air enthalpy of a given temperature bin

The cooling energy seen by the unit ventilators' cooling coil for a given bin was then calculated using the following equation:

$Cooling_{Btus}$ = $4.5 * Total_{CFM} * (ReturnAir_{Enathlpy} – SupplyAir_{Entahlpy}) * Hours$

Where:

$Total_{CFM}$	= The total supply CFM of the unit ventilator
$ReturnAir_{Entahlpy}$	= The return air enthalpy of the room as a function of the setpoint temperature of the room
$SupplyAir_{Entahlpy}$	= The supply air enthalpy of the unit ventilator
Hours	= The number of hours in a given bin, either baseline or as-built

The heating energy seen by the unit ventilators' heating coil for a given bin was calculated using the following equation:

$Heating_{Btus}$ = $1.1 * Total_{CFM} * (ReturnAir_{Temp} – SupplyAir_{Temp}) * Hours$

Where:

$Total_{CFM}$	= The total supply CFM of the unit ventilator
$ReturnAir_{Temp}$	= The return air temperature of the room as a function of the setpoint temperature of the room
$SupplyAir_{Temp}$	= The supply air temperature of the unit ventilator
Hours	= The number of hours in a given bin, either baseline or as-built

Electrical kWh energy savings for the installation of the DDC controls is the combination of the cooling energy savings and the fan energy savings. The following equation was used to calculate the total kWh savings for this measure:

ΔkWH = $(\sum(CoolBtus_{Base} - CoolBtus_{Asbuilt}) / (EER * 1{,}000)) + Fan_{kW} * (Hours_{base} – Hours_{as\text{-}built})$

Where:

$CoolBtus_{Base}$	= The summation of the baseline cooling Btus for the entire year
$CoolBtus_{Asbuilt}$	= The summation of the as-built cooling Btus for the entire year

EER = The rated Energy Efficiency Ratio (EER) of the cooling system of the unit ventilator

Fan_{kW} = The kW demand of the supply fan of the unit ventilator

$Hours_{base}$ = The baseline hours of operation before the installation of the controls, 8,760

$Hours_{asbuilt}$ = The as-built hours of operation after the installation of the controls, 6,205

Natural gas Therms savings for the installation of the DDC controls was calculated using the following equation:

$$\Delta Therms = (\sum(HeatBtus_{Base} - HeatBtus_{Asbuilt}) / (Eff * 100{,}000))$$

Where:

$HeatBtus_{Base}$ = The summation of the baseline heating Btus for the entire year

$HeatBtus_{Asbuilt}$ = The summation of the as-built heating Btus for the entire year

Eff = The heating efficiency of the boiler serving the unit ventilator

The following table presents a summary of the DDC control bin analysis used to determine annual energy savings:

DDC Control Bin Analysis

Average Temp	*Average Enthalpy*	*Baseline Hours*	*As-Built Hours*	*Mixed Air Temp*	*Mixed Air Enthalpy*	*Discharge Air Temp.*	*Discharge Air Enthalpy*	*Baseline kBtus*	*As-Built kBtus*	*Cooling kWh Savings*	*Heating Therms Savings*	*Fan kWh Savings*
95	40.94	1	1	79.45	31.96	56.00	23.03	733	733	0.00	-	0.00
93	42.18	4	4	78.83	32.23	56.21	23.12	2,993	2,993	0.00	-	0.00
91	41.56	22	22	78.22	31.98	56.42	23.22	15,824	15,824	0.00	-	0.00
89	39.24	41	41	77.60	31.28	56.63	23.36	26,646	26,646	0.00	-	0.00
87	36.27	80	80	76.99	30.38	56.84	23.50	45,228	45,228	0.00	-	0.00
85	34.93	98	98	76.37	29.95	57.05	23.62	50,880	50,880	0.00	-	0.00
83	34.17	133	133	75.76	29.67	57.26	23.74	64,720	64,720	0.00	-	0.00
81	33.51	143	143	75.15	29.42	57.47	23.87	65,254	65,254	0.00	-	0.00
79	33.20	164	155	74.53	29.28	57.68	24.00	71,182	67,276	302.00	-	22.63
77	32.49	213	185	73.92	29.02	57.89	24.13	85,695	74,430	870.90	-	70.41
75	31.22	247	216	73.30	28.61	58.11	24.26	88,301	77,218	856.76	-	77.95
73	30.94	250	206	72.69	28.48	58.32	24.38	84,041	69,250	1,143.51	-	110.64
71	30.19	287	233	72.07	28.21	58.53	24.52	87,077	70,693	1,266.63	-	135.79
69	29.03	321	244	71.46	27.83	58.74	24.65	83,757	63,666	1,553.25	-	193.62
67	27.91	327	220	70.84	27.46	58.95	24.79	71,765	48,283	1,815.45	-	269.06
65	26.94	277	162	70.23	27.13	59.16	24.92	50,309	29,422	1,614.71	-	289.18

Average Temp	*Average Enthalpy*	*Baseline Hours*	*As-Built Hours*	*Mixed Air Temp*	*Mixed Air Enthalpy*	*Discharge Air Temp.*	*Discharge Air Enthalpy*	*Baseline kBtus*	*As-Built kBtus*	*Cooling kWh Savings*	*Heating Therms Savings*	*Fan kWh Savings*
63	25.70	272	147	69.61	26.72	59.37	25.05	37,369	20,196	1,327.66	-	314.33
61	24.13	263	179	69.00	26.22	59.58	25.19	22,407	15,250	553.27	-	211.23
59	22.88	285	213	68.39	25.82	59.79	25.33	11,553	8,634	225.64	-	181.05
57	22.00	275	179	67.77	25.52	60.00	25.46	1,247	812	33.66	-	241.40
55	21.00	274	176	67.16	25.18	75.00	36.86	-42,361	-27,210	-	189.39	246.43
53	19.67	249	170	66.54	24.74	76.21	37.95	-47,435	-32,385	-	188.12	198.65
51	18.83	254	161	65.93	24.46	77.41	39.09	-57,507	-36,451	-	263.19	233.86
49	17.86	231	143	65.31	24.13	78.62	40.25	-60,592	-37,510	-	288.53	221.29
47	17.01	207	139	64.70	23.83	79.83	41.42	-61,728	-41,451	-	253.47	170.99
45	16.05	227	139	64.08	23.50	81.03	42.64	-75,842	-46,441	-	367.52	221.29
43	15.32	253	161	63.47	23.25	82.24	43.93	-93,612	-59,571	-	425.51	231.34
41	14.35	222	159	62.85	22.92	83.45	45.20	-90,111	-64,539	-	319.65	158.42
39	13.64	195	136	62.24	22.68	84.66	46.58	-86,153	-60,086	-	325.83	148.36
37	12.61	272	194	61.63	22.33	85.86	47.94	-129,937	-92,676	-	465.77	196.14
35	11.91	398	284	61.01	22.08	87.07	49.34	-204,417	-145,865	-	731.89	286.67
33	11.27	317	207	60.40	21.85	88.28	50.82	-174,195	-113,749	-	755.58	276.61
31	10.60	292	198	59.78	21.59	89.48	52.26	-170,940	-115,912	-	687.86	236.37
29	9.78	273	181	59.17	21.31	90.69	53.83	-169,618	-112,458	-	714.51	231.34
27	9.17	207	134	58.55	21.08	91.90	55.34	-136,043	-88,067	-	599.71	183.57
25	8.41	143	95	57.94	20.80	93.10	56.93	-99,115	-65,846	-	415.87	120.70
23	7.63	148	101	57.32	20.54	94.31	58.65	-107,894	-73,631	-	428.30	118.19
21	6.95	101	78	56.71	20.29	95.52	60.34	-77,256	-59,663	-	219.91	57.84
19	6.34	157	97	56.09	20.07	96.72	62.18	-125,728	-77,679	-	600.61	150.88
17	5.75	139	85	55.48	19.85	97.93	64.00	-116,304	-71,121	-	564.78	135.79
15	4.98	86	62	54.87	19.57	99.14	65.83	-75,045	-54,102	-	261.79	60.35
13	4.31	69	45	54.25	19.32	100.34	67.72	-62,688	-40,883	-	272.56	60.35
11	3.85	55	34	53.64	19.15	101.55	69.78	-51,943	-32,110	-	247.91	52.81
9	3.26	61	42	53.02	18.93	102.76	71.84	-59,800	-41,173	-	232.83	47.78
7	2.67	40	25	52.41	18.71	103.97	73.97	-40,649	-25,406	-	190.54	37.72
5	2.15	40	25	51.79	18.51	105.17	76.18	-42,085	-26,303	-	197.27	37.72
3	1.53	34	20	51.18	18.29	106.38	78.55	-36,993	-21,760	-	190.40	35.20
1	0.90	34	15	50.56	18.06	107.59	80.93	-38,213	-16,859	-	266.93	47.78

Average Temp	*Average Enthalpy*	*Baseline Hours*	*As-Built Hours*	*Mixed Air Temp*	*Mixed Air Enthalpy*	*Discharge Air Temp.*	*Discharge Air Enthalpy*	*Baseline kBtus*	*As-Built kBtus*	*Cooling kWh Savings*	*Heating Therms Savings*	*Fan kWh Savings*
-1	0.40	26	20	49.95	17.86	108.79	83.20	-30,155	-23,196	-	86.99	15.09
-3	-0.18	15	6	49.33	17.63	110.00	85.51	-17,936	-7,174	-	134.52	22.63
-5	-0.56	15	3	48.72	17.47	110.00	85.50	-18,118	-3,624	-	181.18	30.18
-7	-1.15	21	8	48.10	17.24	110.00	85.29	-25,619	-9,760	-	198.24	32.69
-9	-1.75	2	1	47.49	17.01	110.00	85.22	-2,464	-1,232	-	15.40	2.51

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Unitary Air Conditioners

Measure	*Measure Metrics*									*Annual Gross kWh Savings*		
	Program Type	*Building Type*	*Equipment type*	*Subcategory or rating Condition*	*# of Units*	*New Cooling Capacity (kbtu/h)*	*SEER of Efficient Equipment*	*Zone*	*Electric Resistance Heat?*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Single-Package and Split System Unitary Air Conditioners	TOS	High School	Air conditioners, Air cooled	Split System	2	24	17.3	2 (Chicago)	FALSE	198	384	662
Single-Package and Split System Unitary Air Conditioners	TOS	High School	Air conditioners, Air cooled	Split System	12	48	16.2	2 (Chicago)	FALSE	2,383	3,658	6,310
Total										2,581	4,042	6,972

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for DDC Controls

Measure	*Measure Metrics*			*Annual Gross kWh Savings*			
	# of UVs	*Baseline Hours*	*As-Built Hours*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
DDC Controls	14	8,760	6,205	71,376			17,988
Total				71,376			17,988

Annual Therm Savings for DDC Controls

Measure	*Measure Metrics*			*Annual Gross Therms Savings*			
	# of UVs	*Baseline Hours*	*As-Built Hours*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
DDC Controls	14	8,760	6,205	14,968			11,283
Total				14,968			11,283

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	DDC Controls	14,968	11,283	75%	169,238
Total		***14,968***	***11,283***	***75%***	***169,238***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Ex Post Peak kW Reduction*
Standard	Single-Package and Split System Unitary Air Conditioners	2,581	6,972	270%	9.71	104,580	9.71
Subtotal		2,581	6,972	270%	9.71	104,580	9.71
Custom	DDC Controls	71,376	17,988	25%	0.00	269,824	0.00
Subtotal		71,376	17,988	25%	0.00	269,824	0.00
Total		***73,957***	***24,960***	***34%***	***9.71***	***374,404***	***9.71***

The 75% verified natural gas and 34% verified electric realization rate is due to the ex ante analysis using inaccurate values in their DDC bin analysis. The main differences between the ex ante analysis and ex post analysis were the assumed as-built hours of operation, the efficiency of the cooling system, and the weather file used. The ex ante analysis assumed that the new controls would reduce the hours of operation from 8,760 to 4,244 hours per year. Through interviews with site contacts and scheduling exports from the EMS system, ADM determined that the system now operates 6,205 hour per year, resulting in the ex ante analysis overestimating the reduction in hours by 1,961 hours per year. ADM also discovered that the ex ante analysis assumed that the unit ventilators had a cooling efficiency of 10.17 EER. According to the unit ventilator nameplate data, they have an EER of 12.93. The lower assumed efficiency results in more energy savings. The biggest contributor to the low realization rate is the weather data used by the ex ante analysis. ADM used TMY3 weather data for the Chicago region, and it reports a very different annual temperature distribution than the weather file used in the ex ante analysis. The ex ante weather data shows much more cooling hours for the higher temperature bins than would be normally expected. For example, the ex ante weather data shows that there are 319 hours for which the temperature is above 87^{o}F, while TMY3 data shows there are only 148. The more extreme weather data resulted in an overestimation of energy savings.

Name SC54

Executive Summary

Under application SC54, the customer received standard and custom incentives from the Illinois Department of Commerce. Standard incentives were allocated for the installation of a new high efficiency water cooled chiller, four high efficiency boilers, and a storage hot water heater. Custom incentives were allocated for the retrofit of classroom unit ventilators to a facility wide variable air volume (VAV) air side system. The overall electric realization rate is 103% and the overall natural gas realization rate for this project is 261%.

Project Description

In order to decrease the natural gas and electric consumption, four aging boilers and a water cooled chiller were replaced with new high efficiency equipment. The newly installed boilers have a rate capacity of 600,000 Btu/h each with a 94% rated efficiency. The installed 164 ton water cooled centrifugal chiller is equipped with a VFD and has a rated NPLV of 0.393 kW/ton. The customer also installed a new storage hot water heater to supply domestic hot water to the occupants.

Originally, the facility utilized individual Unit Ventilators (UVs) in spaces to provide heating and cooling. Through a SEDAC report it was recommended to eliminate the UVs and install a Variable Air Volume (VAV) system to supply conditioning to the entire school. By converting to VAV, the system is able to much more efficiently condition the facility, and it allows for additional efficient control strategies. The additional control strategies include demand control ventilation (DCV) and time-of-use scheduling. The UVs originally conditioned the school 24/7 regardless of occupancy.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the installation of the boilers, chiller, hot water heater, and the retrofit of the UV air side system to VAV. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational setpoints from the building's energy management system (EMS).

Standard Incentives

For the chiller incentives, TRM Version 3.0, Section 4.4.6 Electric Chiller was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = TONS * ((IPLV_{base}) - (IPLV_{ee})) * EFLH$$

Where:

TONS = chiller nominal cooling capacity in tons (note: 1 ton = 12,000 Btu/hr)

$IPLV_{base}$ = efficiency of baseline equipment expressed as Integrated Part Load Value(kW/ton).

$IPLV_{ee}$ = efficiency of high efficiency equipment expressed as Integrated Part Load Value (kW/ton)

EFLH = Equivalent Full Load Hours for cooling

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW_{SSP} = TONS * $((PE_{base}) – (PE_{ee}))$ * CF_{SSP}

ΔkW_{PJM} = TONS * $((PE_{base}) – (PE_{ee}))$ * CF_{PJM}

Where:

PEbase = Peak efficiency of baseline equipment expressed as Full Load (kW/ton)

PEee = Peak efficiency of high efficiency equipment expressed as Full Load (kW/ton)

= Actual installed

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

CF_{PJM} = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak

For the boiler incentives, TRM Version 3.0, Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

ΔTherms = EFLH * Capacity * $((EffRating_{actual} – EffRating_{base})/EffRating_{base})$ / 100,000

Where:

EFLH = Equivalent Full Load Hours for heating (see table)

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependent on year and boiler type. Baseline efficiency values by boiler type and capacity are found in the Definition of Baseline Equipment Section

EfficiencyRating(actual) = Efficient Boiler Efficiency Rating use actual value

For the water heaters, TRM Version 3.0, Section 4.3.1 Storage Water Heater was used.

NATURAL GAS ENERGY SAVINGS

TRM Section 4.3.1 provides a deemed savings estimated based upon the building type the new water heater is installed in. The following graphic presents the savings estimates from the section of the TRM:

Annual Therms Savings for Hot Water Heaters by Building Type

<table>
<tr><th>Gas, High Efficiency</th><th>Gas, Standard</th></tr>
<tr><td>The annual natural gas energy savings from this measure is a deemed value equaling 251[42]</td><td>Gas savings depend on building type and are based on measure case energy factor of 0.67 and a heating capacity of 75 MBtuh. These values are averages of qualifying units. Savings values are derived from 2008 DEER Miser, which provides MBtuh gas savings per MBtuh capacity. Savings presented here are per water heater.[43]
<table>
<tr><th>Building Type</th><th>Energy Savings (therms/unit)</th></tr>
<tr><td>Assembly</td><td>185</td></tr>
<tr><td>Education – Primary/Secondary</td><td>124</td></tr>
<tr><td>Education – Post Secondary</td><td>178</td></tr>
<tr><td>Grocery</td><td>191</td></tr>
<tr><td>Health/Medical - Hospital</td><td>297</td></tr>
<tr><td>Lodging - Hotel</td><td>228</td></tr>
<tr><td>Manufacturing - Light Industrial</td><td>140</td></tr>
<tr><td>Office – > 60,000 sq-ft</td><td>164</td></tr>
<tr><td>Office – < 60,000 sq-ft</td><td>56</td></tr>
<tr><td>Restaurant - FastFood</td><td>109</td></tr>
<tr><td>Restaurant – Sit Down</td><td>166</td></tr>
<tr><td>Retail</td><td>105</td></tr>
<tr><td>Storage</td><td>150</td></tr>
<tr><td>Multi-Family</td><td>119</td></tr>
<tr><td>Other</td><td>148</td></tr>
</table>
</td></tr>
</table>

Custom Incentives

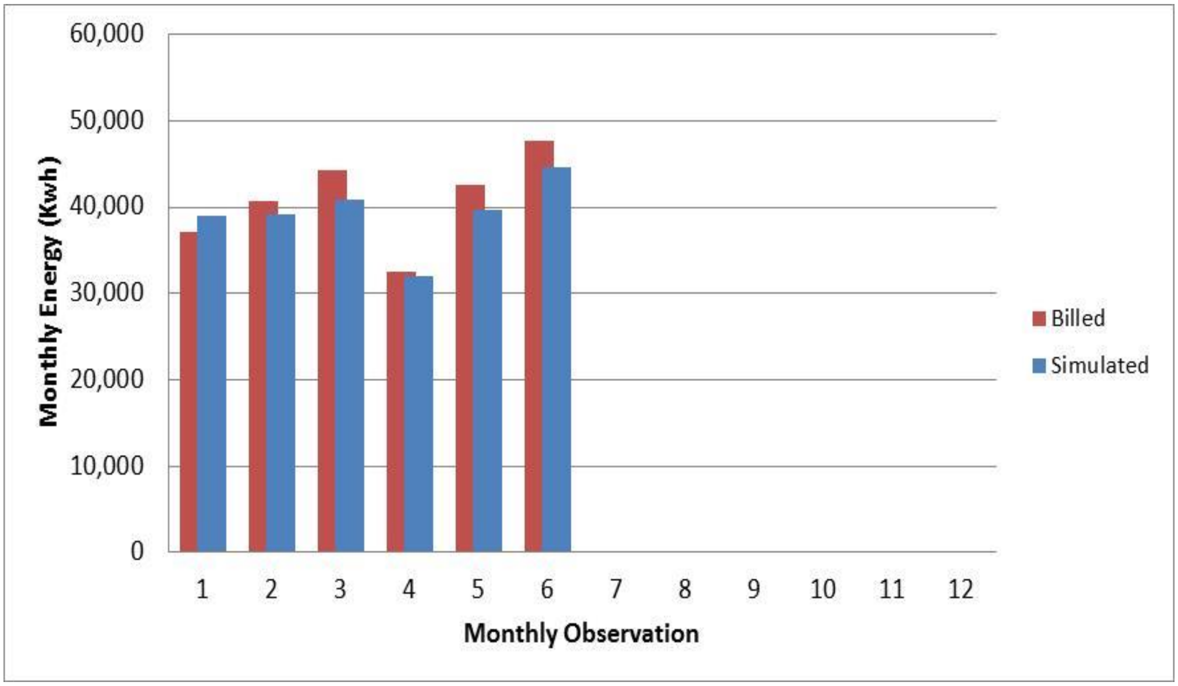
Energy savings for the retrofit of the UV air side system to VAV were calculated using an eQuest model. ADM compiled a model of the as-built facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

[42] Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011. These deemed values should be compared to PY evaluation and revised as necessary

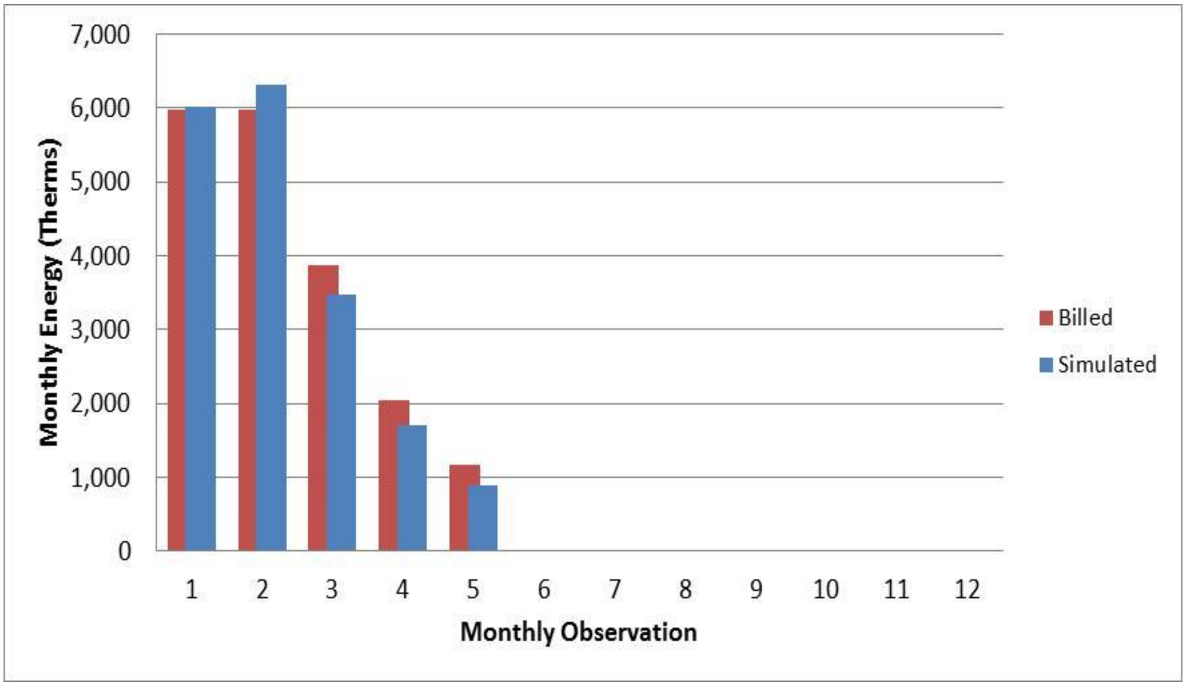
[43] Gas Storage Water Heater 0.67. Work Paper WPRSGNGDHW106. Resource Solutions Group. December 2010

Upon completion of the initial model, a custom weather file was created using 2015 NOAA weather data for the region. Using this weather file and the utility provided billing data for the school, ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2015 Monthly kWh Calibration



2015 Monthly Natural Gas Calibration



Upon completion of the calibration for the as-built eQuest model, the impacts of the installed measures were removed through the uses of parametric runs. Once the parametric runs were defined, the as-built model and parametric runs were run using Chicago O'Hare TMY3 weather data. The typical year annual savings is the difference between the two models' annual energy consumption and can be seen below:

As-Built Vs. Baseline Annual Electric and Natural Gas Energy Consumption

End-Use	Baseline kWh	As-Built kWh	Annual kWh Savings	Baseline Therms	As-Built Therms	Annual Therm Savings
Lighting	156,387	156,387	0	0	0	0
Misc. Equipment	54,583	54,583	0	0	0	0
Heating	0	0	0	43,561	20,729	22,832
Cooling	55,167	51,890	3,277	0	0	0
Heat Rejection	1,295	952	343	0	0	0
Pumps	134,674	120,170	14,504	0	0	0
Fans	88,483	55,502	32,981	0	0	0
Exterior	578	578	0	0	0	0
Total	**491,167**	**440,062**	**51,105**	**43,561**	**20,729**	**22,832**

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Water Cooled Chiller

Measure	Measure Metrics								Annual Gross kWh Savings	
	Program Type	Tons	Path followed	Equipment type	Zone	Building Type	IPLVee	EERee	Ex Ante	TRM-Calculated Ex Post
Electric Chiller	TOS	164	PATH A	Water cooled, elec. operated, centrifugal	2 (Chicago)	Elementary	0.393	0.699	6,792	11,885
Total									6,792	11,885

Annual Therms Savings for High Efficiency Boiler

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Boiler btuh*	*Building Type*	*Efficient Measure*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Boiler	TOS	600,000	Elementary	Custom	630	882
High Efficiency Boiler	TOS	600,000	Elementary	Custom	630	882
High Efficiency Boiler	TOS	600,000	Elementary	Custom	630	882
High Efficiency Boiler	TOS	600,000	Elementary	Custom	630	882
Total					2,520	3,528

Annual Therms Savings for Storage Hot Water Heater

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Measure Type*	*Tank Size*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	Gas, Standard	60 Gallon	Education – Primary/Secondary	124	124
Total					124	124

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for UV to VAV Retrofit

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
UV to VAV Retrofit	54,653			51,104
Total	54,653			51,104

Annual Therms Savings for UV to VAV Retrofit

Measure	Annual Gross Therms Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
UV to VAV Retrofit	10,526			22,832
Total	10,526			22,832

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Ex Post Peak kW Reduction	Annual kWh Savings	Annual Peak kW Reduction
Standard	Electric Chiller	6,792	11,885	175%	0.00	237,705	0.00		
Subtotal		*6,792*	*11,885*	*175%*	*0.00*	*237,705*	*0.00*		
Custom	UV to VAV Retrofit	54,653	51,104	94%	7.70	766,560	7.70		
Subtotal		*54,653*	*51,104*	*94%*	*7.70*	*766,560*	*7.70*		
Total		***61,445***	***62,989***	***103%***	***7.70***	***1,004,265***	***7.70***		

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*	*Spillover*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*	*Annual Therms*
Standard	High Efficiency Boiler	2,520	3,528	140%	70,560	
	Storage Water Heater	124	124	100%	1,860	
Subtotal		*2,644*	*3,652*	*138%*	*72,420*	
Custom	UV to VAV Retrofit	10,526	22,832	217%	342,480	
Subtotal		*10,526*	*22,832*	*217%*	*342,480*	
Total		***13,170***	***26,484***	***201%***	***414,900***	

The project has an overall electric realization rate of 103% and an overall natural gas realization rate of 201%.

The overall natural gas realization rate can be attributed to an underestimation of ex ante savings for the VAV retrofit. The ex ante analysis, utilized a Trane Trace simulation based on baseline conditions; however, there were not enough details provided to fully verify the analysis. The ex post analysis relies on a calibrated eQuest model for realized savings. ADM performed a quick natural gas billing data review to validate the ex post analysis. The 12 month prior to the retrofit the school consumed 59,199 therms, and in the 12 months after the retrofit consumed 30,215 therms. This results in annual reduction of 28,984 therms without weather normalization. The combined ex post natural gas savings for the project totals 26,484 and is within reason when compared to the non-normalized savings previously mentioned.

Name S-55

Executive Summary

Under project S-55, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofit project. The realization rate for this project is 94%.

Project Description

The customer performed the following retrofit:

- 2 x 2 Layin T12 with 2 x 2 2L Induction fixture
- 175 Metal Halide with 80W Induction lighting
- 400W Metal Halide with 200W Induction lighting
- 250 Metal Halide with 120W Induction lighting
- 175W Metal Halide with 200W Induction lighting
- 400W Metal Halide with 200W Induction lighting
- 400W Metal Halide with 80W Induction lighting

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.3, and 4.5.8. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*								*Annual Gross kWh Savings*		
	Qty	*Existing Wattage*	*Efficient Wattage*	*Hours (Assumed)*	*Hours (Actual)*	*In-Service Rate*	*WH Fe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*ADM Calculated Ex Post*
Misc. Commercial / Industrial Lighting	24	TRM=86 Actual=86	TRM = 31 Actual = 31	4,576	-	1.00	1.24	7,490	7,490	
Misc. Commercial / Industrial Lighting	111	TRM = 190 Actual=190	TRM = 80 Actual = 80	4,903	6,474	1.00	1.00	139,320	59,866	139,320
Misc. Commercial / Industrial Lighting	0	TRM = 460 Actual=460	TRM = 200 Actual=200	4,903	6,474	1.00	1.00	11,912	0	
Misc. Commercial / Industrial Lighting	23	TRM = 280 Actual=280	TRM = 120 Actual=120	4,903	6,474	1.00	1.00	23,824	18,043	
Misc. Commercial / Industrial Lighting	50	TRM = 460 Actual=460	TRM = 200 Actual=200	4,576	-	1.00	1.24	73,765	73,765	
Misc. Commercial / Industrial Lighting	24	TRM = 460 Actual=460	TRM = 200 Actual=200	4,576	-	1.00	1.24	35,381	35,407	
Misc. Commercial / Industrial Lighting	28	TRM = 190 Actual=190	TRM = 80 Actual = 80	4,576	-	1.00	1.24	17,464	17,477	
Total								***309,155***	***212,048***	***139,320***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided. ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	4.5.8	7,490	7,490	100%	1.27	15	112,350	N/A	N/A
	4.5.8	139,320	139,320	100%	0	15	2,089,807	N/A	N/A
	4.5.8	11,912	0	0%	0	15	0	N/A	N/A
	4.5.8	23,824	18,043	76%	0	15	270,646	N/A	N/A
	4.5.8	73,765	73,765	100%	12.52	15	1,106,477	N/A	N/A
	4.5.8	35,381	35,407	100%	6.01	15	531,109	N/A	N/A
	4.5.8	17,464	17,477	100%	2.97	15	262,150	N/A	N/A
Total		***309,155***	***291,503***	***94%***	***22.78***		***4,372,538***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The project level realization rate is 94%. Documentation for measure 3 states that the new fixtures were not installed. There is a notation that the base fixtures were removed. However, there is no current incentive provided for removal of a metal halide fixture and the incentive was for an exterior induction fixture. Adding to the slightly low realization rate is that for measure 4 the hours stated in the documentation (6,474) are much greater than the hours given in the TRM savings calculations (4,903) for an exterior fixture.

Name S56

Executive Summary

Under application S56, the customer received standard incentives from the Illinois Department of Commerce for installing 3 new hot water boiler and 21 new EnergyStar air conditioners. The electric realization rate is 104% and the natural gas realization rate is 140%.

Project Description

The customer installed (3) hot water boilers and (21) air conditioners.

Methodology for Estimating Gross Savings

Standard Incentives

ADM estimated energy savings according to the Illinois TRM Version 3.0.

High Efficiency Boilers

Savings for the boilers were calculated using Illinois TRM Version 3.0, 4.4.10 High Efficiency Boilers.

NATURAL GAS ENERGY SAVINGS

ΔTherms = EFLH * Capacity * ((EfficiencyRating(actual) - EfficiencyRating(base))/ EfficiencyRating(base) / 100,000

Where:

EFLH = Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use

Capacity = Nominal Heating Input Capacity Boiler Size (Btu/hr) for efficient unit not existing unit

EfficiencyRating(base) = Baseline Boiler Efficiency Rating, dependant on year and boiler type.

EfficiencyRating(actual) = Efficent Boiler Efficiency Rating use actual value

Savings for the air conditioners were calculated using Illinois TRM Version 3.0, 4.4.7 ENERGY STAR and CEE Tier 1 Room Air Conditioner.

ELECTRIC ENERGY SAVINGS

ΔkWh = (FLHRoomAC * Btu/H * (1/EER_{base} - 1/EER_{ee}))/1000

Where:

FLHRoomAC = Full Load Hours of room air conditioning unit

Btu/H = Size of unit

EER_{base} = Efficiency of baseline unit

= As provided in tables above

EER_{ee} = Efficiency of ENERGY STAR or CEE Tier 1 unit

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW = Btu/H * ((1/EERbase - 1/EERee))/1000) * CF

Where:

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

CF_{PJM} = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak period)

= 47.8%

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual Therms Savings for High Efficiency Boiler

Measure	*Measure Metrics*						*Annual Gross Therms Savings*		
	Program Type	*Boiler btuh*	*Base Boiler type*	*Efficient Measure*	*Zone*	*Building Type*	*Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*
High Efficiency Boiler	TOS	3,000,000	Hot Water ≥2,500,000 Btu/h	96.3%	2 (Chicago)	High School	3,026	4,222	
High Efficiency Boiler	TOS	3,000,000	Hot Water ≥2,500,000 Btu/h	96.3%	2 (Chicago)	High School	3,026	4,222	
High Efficiency Boiler	TOS	3,000,000	Hot Water ≥2,500,000 Btu/h	96.3%	2 (Chicago)	High School	3,026	4,222	
Total							*9,079*	*12,666*	

Annual Electric Savings for Room Air Conditioners

Measure	*Measure Metrics*					*Annual Gross kWh Savings*		
	Program Type	*Efficiency Standard*	*Btu/H*	*has louvers?*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
ENERGY STAR Room Air Conditioner	TOS	Energy Star	12,000	FALSE	2 (Chicago)	1,442	1,502	
Total						*1,442*	*1,502*	

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Ex Post Peak kW Reduction*
Standard	ENERGY STAR Room Air Conditioner	1,442	1,502	104%	5.40	13,518	5.40
Total		***1,442***	***1,502***	***104%***	***5.40***	***13,518***	***5.40***

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	High Efficiency Boiler	3,026	4,222	140%	84,440
	High Efficiency Boiler	3,026	4,222	140%	84,440
	High Efficiency Boiler	3,026	4,222	140%	84,440
Total		***9,079***	***12,666***	***140%***	***253,320***

The difference in realization for the electric savings is due to the ex-ante using 24,000 Btuh for the air conditioner capacity. This value was a conversion from 2 tons where 1 ton = 12,000 Btuh.

However, the air conditioner spec sheet rated the unit at 25,000 Btuh. If 24,000 Btuh was used, the realization rate would be 100%

The difference in realization for the natural gas savings is probably due to the ex-ante calculations using averaged and deemed TRM values. The ex-ante savings were taken from the database which commonly averages TRM input values. Also, a custom as-built boiler efficiency was used for the ex post calculations while the ex-ante most likely used a deemed as-built value. For example, if 90.0% and 80.0% were entered at the ex-ante and baseline efficiencies respectively, the realization rate would be 100%

Name S-57

Executive Summary

Under project S-57, the applicant received Standard Program incentives from the Illinois Department of Commerce for LED street lighting retrofit. The realization rate for this project is 133%.

Project Description

The customer retrofitted the following fixtures:

- (252) High Pressure Sodium fixtures with LED Luminaires

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	Calculation Inputs						Annual Gross kWh Savings		
	Qty	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe-IF	Ex Ante	TRM Calculated Ex Post	Errata Corrected Ex Post
LED Bulbs and Fixtures	252	TRM=361.4 Actual =303	TRM=116.8 Actual =101	4,903	TRM=0.91 Errata=1.00	1	227,121	275,018	302,217
Total							***227,121***	***275,018***	***302,217***

For measures pertaining to LED Bulbs and Fixtures (4.5.4), TRM 3.0 directs application of a flat in-service rate of 0.91. TRM 4.0 directs application of an in-service rate of 1.0 for projects that have project documentation substantiating complete installation. For this reason, an errata corrected in-service rate of 1.0 will be used for this measure if documentation verifying complete installation is available.

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Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Measure Life (yrs)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.4	227,121	302,217	133%	-	10.2	3,082,613	N/A	N/A
Total		***227,121***	***302,217***	***133%***			***3,082,613***		

*ADM calculated ex post values are used if the difference between the TRM and ADM values is greater than 100%, otherwise errata corrected values are used. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 133%. Based on algorithms in TRM 3.0 measure 4.5.4, the errata corrected ex post savings for the measure was 1,199.27 kWh per fixture, whereas the ex ante savings estimate was 901.27 kWh per fixture.

Department of Commerce incentivized these measures on the basis of reduction in connected wattage. Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

For this measure (4.5.4), the program tracking system does not record the number of actually-implemented measures; instead, the number is based on the equation [Connected Watt Reduction / 99.1 (Wattage Reduction Associated with Prototypical Measure)]. Because the reduction in wattage assumed by the tracking system for a prototypical measure (99.1) differs from the actually-occurring reduction in wattage, the tracking system contained an inaccurate estimate of the number of measures.

Name S-58

Executive Summary

Under project S-58, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting and kitchen retrofits. The natural gas realization rate for this project is 101% and the electric realization rate is 112%.

Project Description

The customer performed the following retrofits:

- (29) lamps with LED lamps
- (32) fluorescent downlights with (35) LED downlights
- Installed (1) wall mounted occupancy sensor
- Installed (20) remote mounted occupancy sensors
- Automatic door closers for walk-in freezer
- Combination oven
- Conveyor oven
- Demand controlled ventilation
- Demand controlled ventilation for kitchen exhaust hood
- Evaporative fan controls
- High efficiency ice maker
- Low flow faucet aerator
- Low flow pre rinse spray valve
- Natural gas furnace
- Variable speed drives on supply and return fans

The installed measures focused on reducing the overall HVAC energy use of the high school. In order to accomplish this, the customer installed VFDs on the supply and return fans of an air handling unit. Originally, the fans were constant speed and the addition of the VFDs will efficiently modulate air flow based on the cooling/heating demand of the space. The customer also installed new high efficiency furnaces.

In order to maximize the energy savings at the school, Demand Control Ventilation (DCV) controls were installed throughout the school. DCV saves energy by reducing the minimum outside air being supplied to the space through the use of CO2 sensors located throughout the school.

Energy savings continued into the cafeteria. Automatic door closer, kitchen exhaust hood demand controlled ventilation, evaporative fans controllers, faucet aerators, and pre rinse spray valves were all installed to reduce kitchen energy use. Also new combination ovens, a conveyor oven, and a high efficiency ice maker were installed.

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled	= total lighting load connected to the control in kilowatts
ESF	= Energy Savings Factor
WHFe	= waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd = heat factor to account for cooling demand savings

CFbaseline = Baseline Summer Peak Coincidence Factor

CFos = Retrofit Summer Peak Coincidence Factor

For the Automatic Door Closers for Walk- in Freezers, TRM Version 3.0 Section 4.6.1 Automatic Door Closer for Walk-In Closers and Freezers was used.

ELECTRIC ENERGY SAVINGS

Savings calculations are based on values from through PG&E's Workpaper PGECOREF110.1 – Auto-Closers for Main Cooler or Freezer Doors. Savings are averaged across all California climate zones and vintages[44].

Annual Savings	kWh
Walk in Cooler	943 kWh
Walk in Freezer	2307 kWh

SUMMER COINCIDENT PEAK DEMAND SAVINGS

Annual Savings	kW
Walk in Cooler	0.137 kW
Walk in Freezer	0.309 kW

For the Combination Oven, TRM Version 3.0 Section 4.2.1 Combination Oven was used.

NATURAL GAS ENERGY SAVINGS

The annual natural gas energy savings from this measure is a deemed value equaling 644 therms.[45]

For the Conveyor Oven, TRM Version 3.0 Section 4.2.4 Conveyor Oven was used.

NATURAL GAS ENERGY SAVINGS

The annual natural gas energy savings from this measure is a deemed value equaling 733 Therms[46].

For the Demand Control Ventilation, the erratum TRM Version 4.0 Section 4.4.19 Demand Control Ventilation was used.

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[44] Measure savings from ComEd TRM developed by KEMA. June 1, 2010

[45] Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011.These deemed values should be compared to PY evaluation and revised as necessary.

[46] Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011.These deemed values should be compared to PY evaluation and revised as necessary

Electric Energy Savings

ΔkWh = Condition Space/1000 * Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Elec_Savings_Factor = value in table below based on building type and weather zone[47]

Natural Gas Energy Savings

ΔTherms = Condition Space/1000 * Therm_Savings_Factor

Where:

Conditioned Space = actual square footage of conditioned space controlled by sensor

Therm _Savings_Factor = value in table below based on building type and weather zone[48]

For the Demand Controlled Ventilation for Kitchen Exhaust Hoods, TRM Version 3.0 Section 4.2.16 Kitchen Demand Ventilation Controls was used.

Electric Energy Savings

The following table provides the kWh savings

Measure Name	Annual Energy Savings Per Unit (kWh/fan)
DVC Control Retrofit	4,486
DVC Control New	4,486

Summer Coincident Peak Demand Savings

The following table provides the kW savings

Measure Name	Coincident Peak Demand Reduction (kW)
DVC Control Retrofit	0.76
DVC Control New	0.76

[47] The electric energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

[48] The natural gas energy savings was calculated using TMY3 weather data and methodology consistent with ASHRAE standards. Savings are calculated on an annual basis for each given temperature zone in Illinois. Energy savings for DCV were developed utilizing standards, inputs and approaches as set forth by ASHRAE 62.1 and 90.1, respectively. Building input parameters like square footage, equipment efficiencies and occupancy match those used in the EFLH calculations. Reference calculation found in Demand Control Ventilation 12-30-13.xls.

NATURAL GAS ENERGY SAVINGS

ΔTherms = CFM * HP* Annual Heating Load /(Eff(heat) * 100,000)

Where:

CFM = the average airflow reduction with ventilation controls per hood

= 611 cfm/HP[49]

HP = actual if known, otherwise assume 7.75 HP

Annual Heating Load = Annual heating energy required to heat fan exhaust make-up air, Btu/cfm dependent on location[50]:

Zone	Annual Heating Load, Btu/cfm
1 (Rockford)	154,000
2-(Chicago)	144,000
3 (Springfield)	132,000
4-(Belleville)	102,000
5-(Marion)	104,000

Eff(heat) = Heating Efficiency

= actual if known, otherwise assume 80%[51]

100,000 = conversion from Btu to Therm

For Evaporative Fan Controls, TRM Version 3.0 Section 4.6.6 Evaporator Fan Control was used.

ELECTRIC ENERGY SAVINGS

DEER provides savings numbers for building vintages and grocery only. The numbers above are averages of these vintages. We are assuming that this measure will be applicable for all building types

[49] PGE Workpaper, Commercial Kitchen Demand Ventilation Controls, PGECOFST116, June 1, 2009, 4,734 cfm reduction on average , with 7.75 fan horsepower on average.

[50] Food Service Technology Center Outside Air Load Calculator, http://www.fishnick.com/ventilation/oalc/oac.php, with inputs of one cfm, and hours from Commercial Kitchen Demand Ventilation Controls (Average 17.8 hours a day 4.45 am to 10.30 pm). Savings for Rockford, Chicago, and Springfield were obtained from the calculator; values for Belleview and Marion were obtained by using the average savings per HDD from the other values.

[51] Work Paper WPRRSGNGRO301 CLEAResult"Boiler Tune-Up" which cites Focus on Energy Evaluation Business Programs: Deemed Savings Manual V1.0, PA Consulting, KEMA, March 22, 2010

The following table provides the kWh savings

Northern California Climate Zones	kWh Savings Per Motor
1	480
2	476
3	479
4	475
5	477
11	476
12	476
13	476
16	483
Average	478

SUMMER COINCIDENT PEAK DEMAND SAVINGS

The following table provides the kW savings

Northern California Climate Zones	Peak kW Savings Per Motor
1	0.057
2	0.064
3	0.062
4	0.061
5	0.056
11	0.058
12	0.065
13	0.061
16	0.061
Average	0.06

For the High Efficiency Ice Maker, TRM Version 3.0 Section 4.2.10 ENERGY STAR Ice Maker was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $[(kWh_{base} – kWh_{ee}) / 100] * (DC * H) * 365.25$

Where:

kWh_{base} = maximum kWh consumption per 100 pounds of ice for the baseline equipment

= calculated as shown in the table below using the actual Harvest Rate (H) of the efficient equipment.

kWh_{ee} = maximum kWh consumption per 100 pounds of ice for the efficient equipment

= calculated as shown in the table below using the actual Harvest Rate (H) of the efficient equipment.

Ice Machine Type	kWhbase[52]	kWhee[53]
Ice Making Head (H < 450)	10.26 - 0.0086*H	9.23 - 0.0077*H
Ice Making Head (H ≥ 450)	6.89 – 0.0011*H	6.20 - 0.0010*H
Remote Condensing Unit, without remote compressor (H < 1000)	8.85 – 0.0038*H	8.05 - 0.0035*H
Remote Condensing Unit, without remote compressor (H ≥ 1000)	5.1	4.64
Remote Condensing Unit, with remote compressor (H < 934)	8.85 – 0.0038*H	8.05 - 0.0035*H
Remote Condensing Unit, with remote compressor (H ≥ 934)	5.3	4.82
Self-Contained Unit (H < 175)	18 - 0.0469*H	16.7 - 0.0436*H
Self-Contained Unit (H ≥ 175)	9.8	9.11

100 = conversion factor to convert kWhbase and kWhee into maximum kWh consumption per pound of ice.

DC = Duty Cycle of the ice machine

= 0.57[54]

H = Harvest Rate (pounds of ice made per day)

= Actual installed

365.35 = days per year

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW = ΔkWh / (HOURS * DC) * CF

[52] Baseline reflects federal standards which apply to units manufactured on or after January 1, 2010 <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div6&view=text&node=10:3.0.1.4.17.8&idno=10>.

[53] ENERGY STAR Program Requirements for Commercial Ice Machines, Partner Commitments, U.S. Environmental Protection Agency, Accessed on 7/7/10 <http://www.energystar.gov/ia/partners/product_specs/program_reqs/ice_machine_prog_req.pdf>

[54] Duty cycle varies considerably from one installation to the next. TRM assumptions from Vermont, Wisconsin, and New York vary from 40 to 57%, whereas the ENERGY STAR Commercial Ice Machine Savings Calculator < http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_Ice_Machines.xls> assumes a value of 75%. A field study of eight ice machines in California indicated an average duty cycle of 57% ("A Field Study to Characterize Water and Energy Use of Commercial Ice-Cube Machines and Quantify Saving Potential", Food Service Technology Center, December 2007). Furthermore, a report prepared by ACEEE assumed a value of 40% (Nadel, S., Packaged Commercial Refrigeration Equipment: A Briefing Report for Program Planners and Implementers, ACEEE, December 2002). The value of 57% was utilized since it appears to represent a high quality data source.

Where:

HOURS = annual operating hours

= 8766[55]

CF = 0.937

For the Low Flow Faucet Aerator, the erratum TRM Version 4.0 Section 4.3.2 Low Flow Faucet Aerators was used.

ELECTRIC ENERGY SAVINGS

Note these savings are per faucet retrofitted[56]**.**

ΔkWh = %ElectricDHW * ((GPM_base - GPM_low)/GPM_base) * Usage * EPG_electric * ISR

Where:

%ElectricDHW = proportion of water heating supplied by electric resistance heating

DHW fuel	%Electric_DHW
Electric	100%
Fossil Fuel	0%

GPM_base = Average flow rate, in gallons per minute, of the baseline faucet “as-used”

= 1.39[57] or custom based on metering studies[58] or if measured during DI:

= Measured full throttle flow * 0.83 throttling factor[59]

GPM_low = Average flow rate, in gallons per minute, of the low-flow faucet aerator “as-used”

= 0.94[60] or custom based on metering studies[61] or if measured during DI:

[55] Unit is assumed to be connected to power 24 hours per day, 365.25 days per year.

[56] This algorithm calculates the amount of energy saved per aerator by determining the fraction of water consumption savings for the upgraded fixture. Due to the distribution of water consumption by fixture type, as well as the different number of fixtures in a building, several variables must be incorporated.

[57] Email message from Maureen Hodgins, Research Manager for Water Research Foundation, to TAC/SAG, August 26, 2014

[58] Measurement should be based on actual average flow consumed over a period of time rather than a onetime spot measurement for maximum flow. Studies have shown maximum flow rates do not correspond well to average flow rate due to occupant behavior which does not always use maximum flow.

[59] 2008, Schultdt, Marc, and Debra Tachibana. Energy related Water Fixture Measurements: Securing the Baseline for Northwest Single Family Homes. 2008 ACEEE Summer Study on Energy Efficiency in Buildings. Page 1-265. www.seattle.gov/light/Conserve/Reports/paper_10.pdf

[60] Average retrofit flow rate for kitchen and bathroom faucet aerators from sources 2, 4, 5, and 7. This accounts for all throttling and differences from rated flow rates. Assumes all kitchen aerators at 2.2 gpm or less and all bathroom aerators at 1.5 gpm or less. The most comprehensive available studies did not disaggregate kitchen use from bathroom use, but instead looked at total flow and length of use for all faucets. This makes it difficult to reliably

= Rated full throttle flow * 0.95 throttling factor[62]

Usage = Estimated usage of mixed water (mixture of hot water from water heater line and cold water line) per faucet (gallons per year)

= If data is available to provide a reasonable custom estimate it should be used, if not use the following defaults (or substitute custom information in to the calculation):

Building Type	Gallons hot water per unit per day[63] (A)	Unit	Estimated % hot water from Faucets [64] (B)	Multiplier [65] (C)	Unit	Days per year (D)	Annual gallons mixed water per faucet (A*B*C*D)
Small Office	1	person	100%	10	employees per faucet	250	2,500
Large Office	1	person	100%	45	employees per faucet	250	11,250
Fast Food Rest	0.7	meal/day	50%	75	meals per faucet	365	9,581
Sit-Down Rest	2.4	meal/day	50%	36	meals per faucet	365	15,768
Retail	2	employee	100%	5	employees per faucet	365	3,650
Grocery	2	employee	100%	5	employees per faucet	365	3,650
Warehouse	2	employee	100%	5	employees per faucet	250	2,500
Elementary School	0.6	person	50%	50	students per faucet	200	3,000
Jr High/High School	1.8	person	50%	50	students per faucet	200	9,000
Health	90	patient	25%	2	Patients per faucet	365	16,425
Motel	20	room	25%	1	faucet per room	365	1,825
Hotel	14	room	25%	1	faucet per room	365	1,278
Other	1	employee	100%	20	employees per faucet	250	5,000

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separate kitchen water use from bathroom water use. It is possible that programs installing low flow aerators lower than the 2.2 gpm for kitchens and 1.5 gpm for bathrooms will see a lower overall average retrofit flow rate.

61 Measurement should be based on actual average flow consumed over a period of time rather than a onetime spot measurement for maximum flow. Studies have shown maximum flow rates do not correspond well to average flow rate due to occupant behavior which does not always use maximum flow.

62 2008, Schultdt, Marc, and Debra Tachibana. Energy related Water Fixture Measurements: Securing the Baseline for Northwest Single Family Homes. 2008 ACEEE Summer Study on Energy Efficiency in Buildings. Page 1-265. www.seattle.gov/light/Conserve/Reports/paper_10.pdf

63 Table 2-45 Chapter 49, Service Water Heating, 2007 ASHRAE Handbook, HVAC Applications.

64 Estimated based on data provided in Appendix E; “Waste Not, Want Not: The Potential for Urban Water Conservation in California”; http://www.pacinst.org/reports/urban_usage/appendix_e.pdf

65 Based on review of the Illinois plumbing code (Employees and students per faucet). Retail, grocery, warehouse and health are estimates. Meals per faucet estimated as 4 bathroom and 3 kitchen faucets and average meals per day of 250 (based on California study above) – 250/7 = 36. Fast food assumption estimated.

EPG_electric	= Energy per gallon of mixed water used by faucet (electric water heater)
	= (8.33 * 1.0 * (WaterTemp - SupplyTemp)) / (RE_electric * 3412)
	= (8.33 * 1.0 * (90 – 54.1)) / (0.98 * 3412)
	= 0.0894 kWh/gal
8.33	= Specific weight of water (lbs/gallon)
1.0	= Heat Capacity of water (btu/lb-°F)
WaterTemp	= Assumed temperature of mixed water
	= 86F for Bath, 93F for Kitchen 91F for Unknown[66]
SupplyTemp	= Assumed temperature of water entering building
	= 54.1°F [67]
RE_electric	= Recovery efficiency of electric water heater
	= 98% [68]
3412	= Converts Btu to kWh (Btu/kWh)
ISR	= In service rate of faucet aerators dependant on install method as listed in table below[69]

Selection	ISR
Direct Install - Deemed	0.95

Summer Coincident Peak Demand Savings

ΔkW = (ΔkWh / Hours) * CF

Where:

ΔkWh	= calculated value above on a per faucet basis
Hours	= Annual electric DHW recovery hours for faucet use
	= (Usage * 0.545[70])/GPH

[66] Cadmus and Opinion Dynamics Showerhead and Faucet Aerator Meter Study Memorandum dated June 2013, directed to Michigan Evaluation Working Group. If the aerator location is unknown an average of 91% should be used which is based on the assumption that 70% of household water runs through the kitchen faucet and 30% through the bathroom (0.7*93)+(0.3*86)=0.91.

[67] US DOE Building America Program. Building America Analysis Spreadsheet. For Chicago, IL http://www1.eere.energy.gov/buildings/building_america/analysis_spreadsheets.html.

[68] Electric water heaters have recovery efficiency of 98%: http://www.ahridirectory.org/ahridirectory/pages/home.aspx

[69] ComEd Energy Efficiency/ Demand Response Plan: Plan Year 2 (6/1/2009-5/31/2010) Evaluation Report: All Electric Single Family Home Energy Performance Tune-Up Program Table 3-8 http://ilsagfiles.org/SAG_files/Evaluation_Documents/ComEd/ComEd%20EPY2%20Evaluation%20Reports/ComEd_All_Electric_Single_Family_HEP_PY2_Evaluation_Report_Final.pdf

[70] 54.5% is the proportion of hot 120F water mixed with 54.1F supply water to give 90°F mixed faucet water.

= Calculate if usage is custom, if using default usage use:

Building Type	Annual Recovery Hours
Small Office	24
Large Office	109
Fast Food Rest	93
Sit-Down Rest	153
Retail	36
Grocery	36
Warehouse	24
Elementary School	29
Jr High/High School	88
Health	160
Motel	18
Hotel	12
Other	49

Where:

GPH = Gallons per hour recovery of electric water heater calculated for 85.9F temp rise (140-54.1), 98% recovery efficiency, and typical 12kW electric resistance storage tank.

= 56

CF = Coincidence Factor for electric load reduction

= Dependent on building type[71]

Building Type	Coincidence Factor
Small Office	0.0064
Large Office	0.0288
Fast Food Rest	0.0084
Sit-Down Rest	0.0184
Retail	0.0043
Grocery	0.0043
Warehouse	0.0064
Elementary School	0.0096
Jr High/High School	0.0288
Health	0.0144
Motel	0.0006
Hotel	0.0004
Other	0.0128

NATURAL GAS ENERGY SAVINGS

ΔTherms = %FossilDHW * ((GPM_base - GPM_low)/GPM_base) * Usage * EPG_gas * ISR

Where:

%FossilDHW = proportion of water heating supplied by fossil fuel heating

DHW fuel	%Fossil_DHW
Electric	0%
Fossil Fuel	100%

EPG_gas = Energy per gallon of mixed water used by faucet (gas water heater)

= (8.33 * 1.0 * (WaterTemp - SupplyTemp)) / (RE_gas * 100,000)

= 0.00446 Therm/gal

[71] Calculated as follows: Assumptions for percentage of usage during peak period (1-5pm) were made and then multiplied by 65/365 (65 being the number of days in peak period) and by the number of total annual recovery hours to give an estimate of the number of hours of recovery during peak periods. There are 260 hours in the peak period so the probability you will see savings during the peak period is calculated as the number of hours of recovery during peak divided by 260. See ‘C&I Faucet Aerator.xls’ for details.

Where:

RE_gas	= Recovery efficiency of gas water heater
`	= 67% [72]
100,000	= Converts Btus to Therms (Btu/Therm)

Other variables as defined above.

WATER IMPACT DESCRIPTIONS AND CALCULATIONS

Δgallons = ((GPM_base - GPM_low)/GPM_base) * Usage * ISR

Variables as defined above

For the low flow pre-rinse spray valves, TRM Version 3.0 Section 4.2.11 High efficiency Pre-Rinse Spray Valve was used.

NATURAL GAS ENERGY SAVINGS

ΔTherms = ΔGallons x 8.33 x 1 x (Tout - Tin) x (1/EFF) /100,000 Btu

Where (new variables only):

EFF	= Efficiency of gas water heater supplying hot water to pre-rinse spray valve
	= custom, otherwise assume 75%[73]

WATER IMPACT CALCULATION

ΔGallons	= (FLObase - FLOeff)gal/min x 60 min/hr x HOURSday x DAYSyear
FLObase	= Base case flow in gallons per minute, or custom

Time of Sale	Retrofit, Direct Install
1.6 gal/min74	1.9 gal/min75

[72] Review of AHRI Directory suggests range of recovery efficiency ratings for new Gas DHW units of 70-87%. Average of existing units is estimated at 75%. Commercial properties are more similar to MF homes than SF homes. MF hot water is often provided by a larger commercial boiler. This suggests that the average recovery efficiency is somewhere between a typical central boiler efficiency of .59 and the .75 for single family home. An average is used for this analysis by default.

[73] IECC 2012, Table C404.2, Minimum Performance of Water-Heating Equipment

[74]The baseline equipment is assumed to be 1.6 gallons per minute. The Energy Policy Act (EPAct) of 2005 sets the maximum flow rate for pre-rinse spray valves at 1.6 gallons per minute at 60 pounds per square inch of water pressure when tested in accordance with ASTM F2324-03. This performance standard went into effect January 1, 2006. www1.eere.energy.gov/femp/pdfs/spec_prerinsesprayvavles.pdf.

[75] Verification measurements taken at 195 installations showed average pre and post flowrates of 2.23 and 1.12 gallon per minute, respectively." from IMPACT AND PROCESS EVALUATION FINAL REPORT for CALIFORNIA URBAN WATER CONSERVATION COUNCIL 2004-5 PRE-RINSE SPRAY VALVE INSTALLATION PROGRAM (PHASE 2) (PG&E Program # 1198-04; SoCalGas Program 1200-04) ("CUWCC Report", Feb 2007)

FLOeff = Efficient case flow in gallons per minute or custom

Time of Sale	Retrofit, Direct Install
1.06 gal/min[76]	1.06 gal/min[77]

HOURSday = Hours per day that the pre-rinse spray valve is used at the site, custom, otherwise[78]:

Application	Hours/day
Small, quick- service restaurants	1/2
Medium-sized casual dining restaurants	1.5
Large institutional establishments with cafeteria	3

DAYSyear = Days per year pre-rinse spray valve is used at the site, custom, otherwise 312 days/yr based on assumed 6 days/wk x 52 wk/yr = 312 day/yr.

For the high efficiency furnace, TRM Version 3.0 Section 4.4.15 High Efficiency Furnace was used.

ELECTRIC ENERGY SAVINGS

ΔkWh = Heating Savings + Cooling Savings + Shoulder Season Savings

Where:

Heating Savings = Brushless DC motor or electronically commutated motor (ECM) = 418 kWh[79]

Cooling Savings = Brushless DC motor or electronically commutated motor (ECM) savings during cooling season

If air conditioning = 263 kWh

If no air conditioning = 175 kWh

[76] 1.6 gallons per minute used to be the high efficiency flow, but more efficient spray valves are available ranging down to 0.64 gallons per minute per Federal Energy Management Program which references the Food Services Technology Center web site with the added note that even more efficient models may be available since publishing the data. The average of the nozzles listed on the FSTC website is 1.06.

[77] 1.6 gallons per minute used to be the high efficiency flow, but more efficient spray valves are available ranging down to 0.64 gallons per minute per Federal Energy Management Program which references the Food Services Technology Center web site with the added note that even more efficient models may be available since publishing the data. The average of the nozzles listed on the FSTC website is 1.06.

[78] Hours primarily based on PG& E savings estimates, algorithms, sources (2005), Food Service Pre-Rinse Spray Valves with review of 2010 Ohio Technical Reference Manual and Act on Energy Business Program Technical Resource Manual Rev05.

[79] To estimate heating, cooling and shoulder season savings for Illinois, VEIC adapted results from a 2009 Focus on Energy study of BPM blower motor savings in Wisconsin. This study included effects of behavior change based on the efficiency of new motor greatly increasing the amount of people that run the fan continuously. The savings from the Wisconsin study were adjusted to account for different run hour assumptions (average values used) for Illinois. See: FOE to IL Blower Savings.xlsx.

If unknown (weighted average) = 241 kWh[80]

Shoulder Season Savings = Brushless DC motor or electronically commutated motor (ECM) savings during shoulder seasons

= 51 kWh

SUMMER COINCIDENT PEAK DEMAND SAVINGS

For units that have evaporator coils and condensing units and are cooling in the summer in addition to heating in the winter the summer coincident peak demand savings should be calculated. If the unit is not equipment with coils or condensing units, the summer peak demand savings will not apply.

$\Delta kW = (\Delta kWh/HOURS_{year}) * CF$

Where:

$HOURS_{year}$ = Actual hours per year if known, otherwise use hours from Table below for building type[81].

Building Type	Pumps and fans (h/yr)
College/University	4216
Grocery	5840
Heavy Industry	3585
Hotel/Motel	6872
Light Industry	2465
Medical	6871
Office	2301
Restaurant	4654
Retail/Service	3438
School(K-12)	2203
Warehouse	3222
Average=Miscellaneous	4103

[80] The weighted average value is based on assumption that 75% of buildings installing BPM furnace blower motors have Central AC.

[81] ComEd Trm June 1, 2010 page 139. The Office hours is based upon occupancy from the eQuest model developed for EFLH, since it was agreed the ComEd value was too low.

CF = Summer Peak Coincidence Factor for measure is provided below for different building types[82]:

Location	CF
Restaurant	0.80
Office	0.66
School (K-12)	0.22
College/University	0.56
Medical	0.75

NATURAL GAS ENERGY SAVINGS

Time of Sale:

ΔTherms = EFLH * Capacity * ((AFUE(eff) – AFUE(base)/AFUE(base))/ 100,000 Btu/Therm

Early replacement[83]:

ΔTherms for remaining life of existing unit (1st 5.5 years):

ΔTherms = EFLH * Capacity * (AFUE(eff) – AFUE(exist)/ AFUE(exist)) / 100,000 Btu/Therm

ΔTherms for remaining measure life (next 11 years):

ΔTherms = EFLH * Capacity * (AFUE(eff) - AFUE(base)/AFUE(base)) / 100,000 Btu/Therm

Where:

EFLH = Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use

Capacity = Nominal Heating Input Capacity Furnace Size (Btu/hr) for efficient unit not existing unit

= custom Furnace input capacity in Btu/hr

AFUE(exist) = Existing Furnace Annual Fuel Utilization Efficiency Rating

= Use actual AFUE rating where it is possible to measure or reasonably estimate.

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[82] Based on DEER 2008 values

[83] The two equations are provided to show how savings are determined during the initial phase of the measure (existing to efficient) and the remaining phase (new baseline to efficient). In practice, the screening tools used may either require a First Year savings (using the first equation) and then a "number of years to adjustment" and "savings adjustment" input which would be the (new base to efficient savings)/(existing to efficient savings).

If unknown, assume 64.4 AFUE%[84].

AFUE(base) = Baseline Furnace Annual Fuel Utilization Efficiency Rating, dependant on year:

AFUE(eff) = Efficent Furnace Annual Fuel Utilization Efficiency Rating.

= Actual. If Unknown, assume 95%[85]

For the supply and return fan VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $kW_{connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

[84] Average nameplate efficiencies of all Early Replacement qualifying equipment in Ameren PY3-PY4.
[85] Minimum ENERGY STAR efficiency after 2.1.2012.

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kW_{connected} * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*		
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHF e-IF*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM Errata Ex Post*
LED Lamps	Base = 29 EE = 29	TRM = 29	TRM = 9.6	4311	1	1.23	2,296	2,715	2,983
LED downlights	Base = 32 EE = 35	TRM = 59 Actual = 47.5	TRM = 32.2 Actual = 28	4311	1	1.23	962	4,526	4,974
Total								***7,241***	***7,957***

Annual kWh Savings for Lighting Controls

Measure	*Calculation Inputs*					*Annual Gross kWh Savings*	
	Qty	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Wall Mounted Lighting Control	1	0.104	4,311	0.41	0.74	226	226
Remote Mounted Lighting Control	20	4.0	4,311	0.41	0.74	8,696	8,696
Total						***8,922***	***8,922***

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for High Efficiency Ice Maker

Measure	*Measure Metrics*			*Annual Gross kWh Savings*	
	Program Type	*Harvest Rate (H) of New Equipment (lb)*	*Ice Machine type*	*Ex Ante*	*TRM-Calculated Ex Post*
ENERGY STAR Ice Maker	TOS	250	Ice Making Head (H < 450)	419	419
Total				419	419

Annual kWh Savings for Demand Control Ventilation Kitchen Exhaust Hood

Measure	*Measure Metrics*		*Annual Gross kWh Savings*	
	Measure Category	*Climate Zone*	*Ex Ante*	*TRM-Calculated Ex Post*
Kitchen Demand Ventilation Controls	DCV Control New	2 (Chicago)	4,341	4,486
Kitchen Demand Ventilation Controls	DCV Control New	2 (Chicago)	5,788	4,486
Total			10,129	8,972

Annual kWh Savings for High Efficiency Gas Furnace

Measure	*Measure Metrics*						*Annual Gross kWh Savings*	
	Program Type	*AC or No AC*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (kBTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Furnace	TOS	Air Conditioning	92%	High School	2 (Chicago)	394	1,865	732
High Efficiency Furnace	TOS	Air Conditioning	92%	High School	2 (Chicago)	800	3,787	732
Total							5,652	1,464

Annual kWh Savings for Variable Speed Drives

Measure	*Measure Metrics*						*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*HP*	*Loadshape*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	25 HP	C39 - VFD - Supply fans <10 HP	School (K-12)	15,370	18,908
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	15 HP	C40 - VFD - Return fans <10 HP	School (K-12)	9,222	11,345
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	25 HP	C39 - VFD - Supply fans <10 HP	School (K-12)	15,370	18,908
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	15 HP	C40 - VFD - Return fans <10 HP	School (K-12)	9,222	11,345
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	5 HP	C39 - VFD - Supply fans <10 HP	School (K-12)	3,074	3,782
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	7.5 HP	C39 - VFD - Supply fans <10 HP	School (K-12)	4,611	5,673
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	10 HP	C40 - VFD - Return fans <10 HP	School (K-12)	6,148	7,563
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	20 HP	C39 - VFD - Supply fans <10 HP	School (K-12)	12,296	15,127
Total							75,313	92,651

Annual kWh Savings for Demand Controlled Ventilation

Measure	*Measure Metrics*			*Annual Gross kWh Savings*		
	Building Type	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Demand Control Ventilation	High School	2 (Chicago)	13,024	7,424	7,424	4,116
Total				7,424	7,424	4,116

Annual kWh Savings for Automatic Door Closer for Walk-In Coolers and Freezers

Measure	*Measure Metrics*	*Annual Gross kWh Savings*	
	Equipment Type	*Ex Ante*	*TRM-Calculated Ex Post*
Automatic Door Closer for walk-in coolers and freezers	Walk-In Cooler	2,307	2,307
Total		2,307	2,307

Annual kWh Savings for Evaporator Fan Control

Measure	*Measure Metrics*	*Annual Gross kWh Savings*	
	Number of Motors	*Ex Ante*	*TRM-Calculated Ex Post*
Evaporator Fan Control	1	487	478
Total		487	478

Annual Therm Savings for Combination Oven

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*TRM-Calculated Ex Post*
Combination Oven	2,576	2,576
Total	2,576	2,576

Annual Therm Savings for Conveyor Oven

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*TRM-Calculated Ex Post*
Conveyor Oven	733	733
Total	733	733

Annual Therm Savings for Pre-Rinse Spray Valve

Measure	*Measure Metrics*			*Annual Gross Therms Savings*	
	Program Type	*Heating fuel*	*Application*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Pre-Rinse Spray Valve	TOS	Gas	Large institutional establishments with cafeteria	472	943
Total				472	943

Annual Therm Savings for Demand Control Ventilation Kitchen Exhaust Hood

Measure	*Measure Metrics*		*Annual Gross Therms Savings*	
	Measure Category	*Climate Zone*	*Ex Ante*	*TRM-Calculated Ex Post*
Kitchen Demand Ventilation Controls	DCV Control New	2 (Chicago)	8,248	8,249
Kitchen Demand Ventilation Controls	DCV Control New	2 (Chicago)	10,998	10,998
Total			19,246	19,247

Annual Therm Savings for Low Flow Faucet Aerators

Measure	*Measure Metrics*		*Annual Gross Therms Savings*		
	DHW Fuel	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Low Flow Faucet Aerators	Fossil Fuel	High School	66	99	99
Total			66	99	99

Annual Therm Savings for High Efficiency Gas Furnace

Measure	*Measure Metrics*						*Annual Gross Therm Savings*	
	Program Type	*AC or No AC*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (kBTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*
High Efficiency Furnace	TOS	Air Conditioning	92%	High School	2 (Chicago)	394	525	477
High Efficiency Furnace	TOS	Air Conditioning	92%	High School	2 (Chicago)	800	1,066	968
Total							1,591	1,445

Annual Therm Savings for Demand Controlled Ventilation

Measure	Measure Metrics			Annual Gross Therms Savings		
	Building Type	Zone	Conditioned Space (Sq. Ft.)	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Demand Control Ventilation	Elementary School	1 (Rockford)	13,024	925	925	925
Total				925	925	925

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Measure Life (yrs)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.4	2,296	2,983	118%	0.09	6	15,743	N/A	N/A
	4.5.10	226	226	100%	0.05	8	1,809	N/A	N/A
	4.5.10	8,696	8,696	100%	0.16	8	69,569	N/A	N/A
	4.5.4	962	4,974	470%	0.15	12	54,314	N/A	N/A
	Automatic Door Closers for Walk-In Freezers	2,307	2,307	100%	0.31		18,456	N/A	N/A
	Demand Control Ventilation	7,424	4,116	55%	0		41,160	N/A	N/A
	Demand Control Ventilation for Kitchen Exhaust Hood - New Hood	4,341	4,486	103%	0.76		67,290	N/A	N/A
	Demand Control Ventilation for Kitchen Exhaust Hood - New Hood	5,788	4,486	78%	0.76		67,290	N/A	N/A
	Natural Gas Furnace_GH1	1,865	732	39%	0.07		12,078	N/A	N/A

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
	Natural Gas Furnace_GH1	3,787	732	19%	0.07		12,078	N/A	N/A
	Evaporative Fan Controls	478	478	100%	0.06		7,648	N/A	N/A
	High-Efficiency Ice Maker_201 - 300 lbs/24hrs	419	419	100%	0.08		4,190	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	15,370	18,908	123%	5.58		283,620	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	9,222	11,345	123%	3.35		170,175	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	15,370	18,908	123%	5.58		283,620	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	9,222	11,345	123%	3.35		170,175	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	3,074	3,782	123%	1.12		56,730	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	4,611	5,673	123%	1.67		85,095	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	6,148	7,563	123%	2.23		113,445	N/A	N/A
	VSD on HVAC Fan or Pump_VS1	12,296	15,127	123%	4.47		226,905	N/A	N/A
Total		***113,902***	***127,286***	***112%***	***29.92***		***1,761,390***		

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	Combination Oven	2,576	2,576	100%	30,912
Standard	Conveyor Oven	733	733	100%	12,461
Standard	Demand Control Ventilation	925	925	100%	9,250
Standard	Demand Control Ventilation for Kitchen Exhaust Hood - New Hood	8,248	8,249	100%	123,735
Standard	Demand Control Ventilation for Kitchen Exhaust Hood - New Hood	10,998	10,998	100%	164,970
Standard	Natural Gas Furnace_GH1	525	477	91%	7,871
Standard	Natural Gas Furnace_GH1	1,066	968	91%	15,972
Standard	Low Flow Faucet Aerators - Natural Gas Water Heater	66	99	150%	891
Standard	Low Flow Pre-Rinse Spray Valve - Natural Gas Water Heater	472	943	200%	4,715
Total		***25,609***	***25,968***	***101%***	***370,777***

The electric realization rate for this project is 112%.

Based on algorithms in TRM 3.0 measure 4.5.4, the ex post savings for the first measure was 94 kWh per fixture, whereas the ex ante savings estimate was 79.1 kWh per fixture.

The ex post savings for the fourth measure was 129 kWh per fixture, whereas the ex ante savings estimate was 27.5 kWh per fixture.

Divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM explain differences between ex ante savings and ex post savings.

The realization rate for the second and third measures, 4.5.10, is 100%.

The non-lighting electric measures have a combined verified realization rate of 109%. The difference in savings can be attributed to ADM calculating higher and lower than expected electric savings for several measures.

- ADM calculated the annual electric savings for the Demand Controlled Ventilation measure through the use of the IL TRM, and so did the ex-ante analysis. However, the ex-ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0.

- ADM calculated the annual electric savings for the Demand Controlled Ventilation for Kitchen Exhaust Hood measure through the use of the IL TRM, which has a deemed savings value. However, the ex-ante calculates savings with an equation using the fan horsepower as an input.
- ADM calculated the annual electric savings for the natural gas furnace measure through the use of the IL TRM, which has a deemed savings value. However, the ex-ante likely calculates savings with an equation using the furnace capacity as an input.
- ADM calculated the annual electric savings for the variable speed drives using the IL TRM Version 3.0. The ex-ante analysis likely used an averaged electric savings factor when calculating the savings accounting for the different in savings.

The natural gas measures have a combined verified realization rate of 101%. The difference in savings can be attributed to ADM calculating higher and lower than expected gas savings for several measures.

- ADM calculated the annual gas savings for the Low Flow Faucet Aerators measure through the use of the IL TRM, and so did the ex-ante analysis. However, the ex-ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0.
- ADM calculated the annual gas savings for the Low Flow Pre Rinse Spray Valves measure through the use of the IL TRM, and so did the ex-ante analysis. However, the ex-ante analysis utilized TRM Version 3.0; while, ADM used errata corrected Version 4.0.
- ADM calculated the annual gas savings for the Pre Rinse Spray Valves measure through the use of the IL TRM, and so did the ex-ante analysis. However, the ex-ante analysis only calculated savings for 2 valves, while the 4 valves were installed.

Name SC-59

Executive Summary

Under project SC-59, the applicant received Standard and Custom Program incentives from the Illinois Department of Commerce for lighting retrofit project. The realization rate for this project is 82%.

Project Description

The customer performed the following retrofit:

- (750) High Pressure Sodium Exterior Lighting Fixtures with LED Streetlights
- Installed (750) Custom lighting controls on LED Streetlights

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.4. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Location	*Measure*	*Calculation Inputs*						*Annual Gross kWh Savings*		
		QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated*	*ADM Calculated*
									Ex Post	*Ex Post*
Exterior	LED Bulbs and Fixtures	750	TRM = 361.4 ADM = 200	TRM = 116.8 ADM = 102	4,903	1	1	438,365	899,455	360,371
								438,365	***899,455***	***360,371***

ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values.

Annual kWh Savings for Custom Lighting Controls

Location	*Measure*	*Calculation Inputs*					*Annual Gross kWh Savings*	
		QTY	*Controlled Wattage*	*Percent on*	*Hours*	*WHFe-IF*	*Ex Ante*	*ADM Calculated*
								Ex Post
Exterior	Lighting Controls	750	103	85%	2,190	1	113,332	25,130
Exterior	Lighting Controls	750	103	50%	2,190	1		83,768
							113,332	***108,898***

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Project Location*	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	Exterior	4.5.4	438,365	360,371	82%	0.00	10.2	3,675,000	N/A	N/A
Custom	Exterior	Custom	113,332	108,898	92%	0.00	8	871,182	N/A	N/A
Total			***551,697***	***469,268***	***85%***	***0.00***		***4,546,182***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate based on ADM calculated ex post for this project is 85%.

Based on algorithms in TRM 3.0 measure 4.5.4, the ex post savings for the first measure was 480.49 kWh per fixture, whereas the ex ante savings estimate was 584 kWh per fixture. The program applicant reported an incorrect base wattage on the application materials resulting in an inaccurate kWh reduction calculation.

The second measure was a custom lighting control installed on LED street lighting fixtures. The ex post savings for the second measure was 145.20 kWh per control, whereas the ex ante savings was 151 kWh per control.

Name S-61

Executive Summary

Under project S-61, the applicant received Standard Program incentives from the Illinois Department of Commerce for lighting retrofit project. The realization rate for this project is 91%.

Project Description

The customer performed the following retrofit:

- (22) exit signs with LED exit signs
- (3,077) 4’ T8 lamps with reduced wattage lamps
- (176) Occupancy sensors installed

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5.3, 4.5.5. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled = total lighting load connected to the control in kilowatts

ESF = Energy Savings Factor

WHFe = waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd = heat factor to account for cooling demand savings

CFbaseline = Baseline Summer Peak Coincidence Factor

CFos = Retrofit Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

<table>
<tr><th rowspan="3">Measure</th><th colspan="7">Calculation Inputs</th><th colspan="2">Annual Gross kWh Savings</th></tr>
<tr><th rowspan="2">QTY</th><th rowspan="2">Existing Wattage</th><th rowspan="2">Efficient Wattage</th><th rowspan="2">Hours</th><th rowspan="2">In-Service Rate</th><th rowspan="2">WHF e-IF</th><th rowspan="2">Ex Ante</th><th>TRM-Calculated</th></tr>
<tr><th>Ex Post</th></tr>
<tr><td>LED Exit Signs</td><td>22</td><td>TRM = 35
Actual= 11</td><td>TRM = 2
Actual = 2</td><td>8,766</td><td>1.00</td><td>1.25</td><td>4,981</td><td>7,955</td></tr>
<tr><td>Reduced Watt T8 Fixtures and Lamps</td><td>196</td><td>TRM = 182
Actual= 172</td><td>TRM = 94
Actual = 58</td><td>4,311</td><td>1.00</td><td>1.25</td><td rowspan="3">529,561</td><td>92,945</td></tr>
<tr><td>Reduced Watt T8 Fixtures and Lamps</td><td>864</td><td>TRM = 182
Actual = 172</td><td>TRM = 94
Actual = 89</td><td>4,311</td><td>1.00</td><td>1.25</td><td>409,717</td></tr>
<tr><td>Reduced Watt T8 Fixtures and Lamps</td><td>6</td><td>TRM = 88
Actual = 86</td><td>TRM = 49
Actual = 58</td><td>4,311</td><td>1.00</td><td>1.25</td><td>1,261</td></tr>
</table>

Measure	Calculation Inputs						Annual Gross kWh Savings	
	QTY	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe-IF	Ex Ante	TRM-Calculated Ex Post
Reduced Watt T8 Fixtures and Lamps	27	TRM=182 Actual=172	TRM = 94 Actual = 89	4,311	1.0	1.25		12,804
Total							***534,542***	***524,682***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Annual kWh Savings for Lighting Controls

Measure	Calculation Inputs					Annual Gross kWh Savings	
	Qty	kW Controlled	Hours	ESF	WHFd	Ex Ante	TRM-Calculated Ex Post
Occupancy Sensor Lighting Control	176	0.35	4,311	0.41	1.44	192,897	136,098
Total						192,897	136,098

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Measure Life (yrs)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.5	4,981	7,955	160%	0.23	16	127,282	N/A	N/A
	4.5.3	529,561	516,727	98%	30.38	15	7,750,909	N/A	N/A
	4.5.10	192,897	136,098	71%	0.35	8	1,088,786	N/A	N/A
Total		***727,439***	***660,781***	***91%***	***35.14***		***8,966,977***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 91%.

For measures incentivized under 4.5.3 and 4.5.5, divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contribute to the difference between ex ante savings and ex post savings.

Based on algorithms in TRM 3.0 measure 4.5.5, the TRM calculated ex post savings for the first measure was 162kWh per fixture, whereas the ex ante savings estimate was 226kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the second measure was 473kWh per fixture, whereas the ex ante savings estimate was 485kWh per fixture.

Based on algorithms in TRM 3.0 measure 4.5.10, the ADM corrected ex post savings for the third measure was 773kWh per fixture, whereas the ex ante savings estimate was 1,096kWh per fixture. The difference between the number of occupancy sensors installed and the number of occupancy sensors claimed on the application materials is the primary reason for the low realization rate.

Name C62

Executive Summary

Under application C62, the customer received custom incentives from the Illinois Department of Commerce for the installation of a new high efficiency steam boiler. The overall natural gas realization rate for this project is 164%.

Project Description

Originally, the steam for the campus was provided by Boilers #5 and #6. Each boiler has a steam capacity of 90,000 lbs/hr at an average efficiency of 75%. In order to improve the overall efficiency of the steam plant, a new Victory Energy boiler with a rated steam capacity of 174,600 lbs/hr and a peak efficiency of 88.5% was installed. As a result of the increased capacity of the new boiler, it is only used in the heating season as it is able to meet the steam demand of the campus without the need of Boilers #5 and #6. During summer months the boiler is not used. Boilers #5 or #6 are used to meet the reduced steam demand.

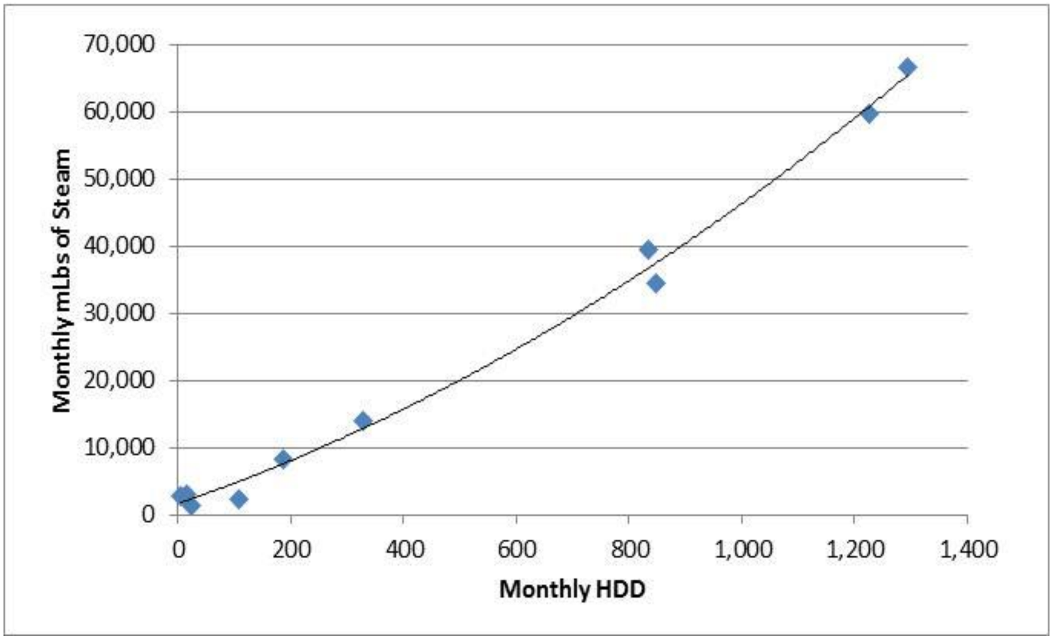
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the installation of the new boiler, and interviewed site contacts to determine how the new boiler is to be operated in conjunction with the existing boilers. ADM was provided with monthly performance data for the baseline steam plant as well as the results from the boiler efficiency test that was recently performed on the new Victory Energy steam boiler.

Custom Incentives

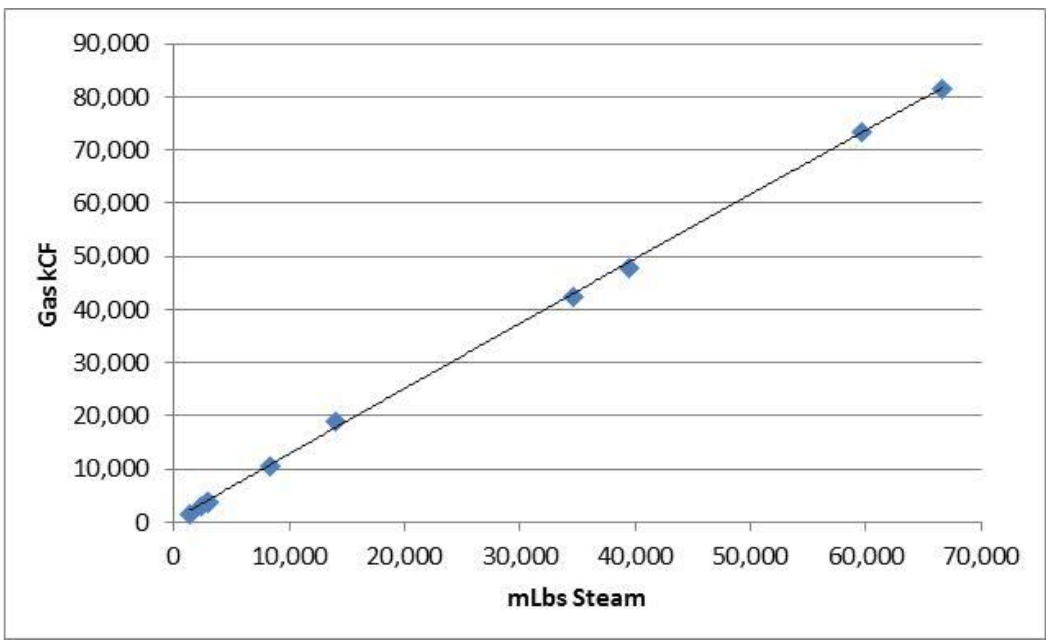
Energy savings were calculated using monthly steam plant reports and provided boiler efficiency test results. The provided monthly steam reports detailed the pounds of steam produced by each boiler, the corresponding cubic feet of natural gas consumed, average boiler efficiency, and the number of operating hours. Using corresponding weather data from the closest NOAA weather station, the total monthly steam production was correlated to heating degree days with a 65°F base temperature. The effect that heating degree days have on the total monthly steam production is illustrated in the following figure:

Monthly Steam Production Vs Heating Degree Days



ADM then compared the total monthly steam production to the total natural gas consumption of the boilers, which allowed for the calculation of a baseline efficiency curve for the steam plant. The baseline efficiency of the steam plant is illustrated in the following figure:

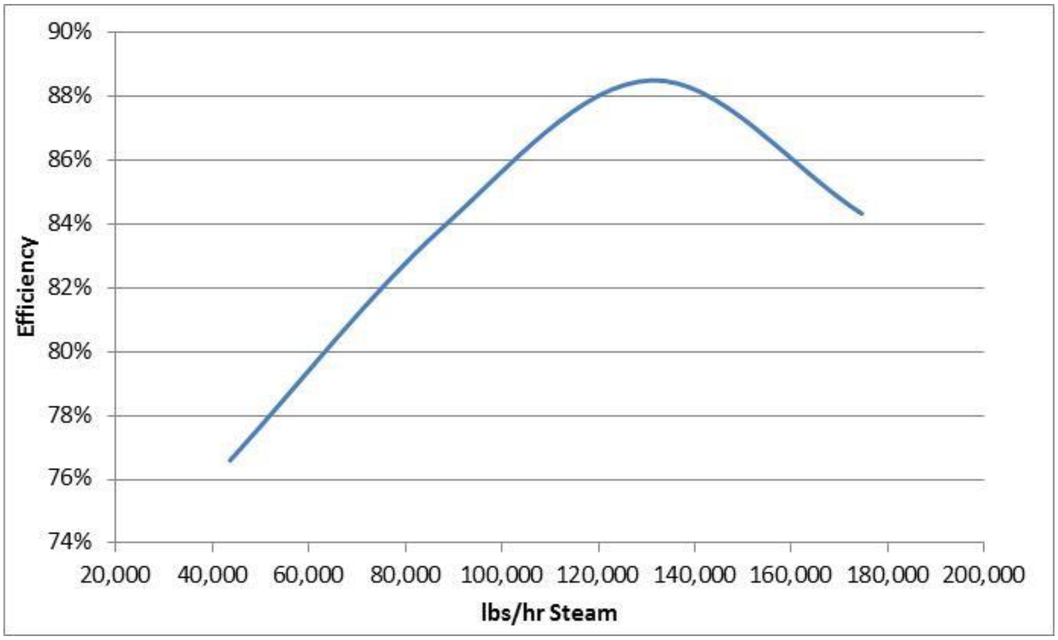
Monthly Natural Gas Consumption Vs Steam Consumption



Using TMY3 weather data for the region and the derived monthly steam production versus heating degree day curve, ADM calculated the amount of steam that would need to be produced by the plant for each month in a typical year. Once the monthly steam plant production requirements were established, the required baseline gas consumption for the plant was calculated using the aforementioned baseline steam plant efficiency curve.

The as-built natural gas consumption of the new steam boiler was calculated through the use of the provided boiler efficiency test results and the assumption that the monthly steam requirements in the heating months would be the same as the baseline case. The results of the efficiency test are illustrated in the following figure:

Victory Boiler Efficiency Curve



The annual therms savings for the installation of the new boiler is the difference between the natural gas consumption of the baseline steam plant and the as-built steam plant. The following table presents the monthly therms savings for the new boiler and the variables used to calculate the annual therms savings:

Monthly Therms Savings for High Efficiency Boiler

Month	HDD	mlbs Steam	Baseline Gas KCF	Baseline Eff.	lbs/hr Steam	As-Built Eff.	As-Built Gas KCF	Therms		
								Baseline	As-Built	Savings
1	1,342	68,886	84,394	79.8%	129,388	88.4%	76,120	843,938	761,202	82,736
2	1,011	47,052	58,113	79.1%	88,377	84.0%	54,745	581,129	547,448	33,680
3	753	32,413	40,325	78.6%	60,881	79.4%	39,922	403,254	399,218	4,036
4	394	15,558	19,677	77.3%	43,650	76.6%	19,853	196,774	198,529	-1,755
5	272	10,740	13,743	76.4%	43,650	76.6%	13,705	137,430	137,052	379
6	81	4,156	5,609	72.4%	-	-	-	-	-	-
7	3	1,795	2,686	65.3%	-	-	-	-	-	-
8	2	1,778	2,665	65.2%	-	-	-	-	-	-
9	36	2,769	3,893	69.5%	-	-	-	-	-	-
10	326	12,802	16,284	76.8%	43,650	76.6%	16,336	162,844	163,360	-516
11	534	21,621	27,125	77.9%	43,650	76.6%	27,590	271,251	275,899	-4,648
12	1,065	50,377	62,135	79.2%	94,623	85.0%	57,951	621,348	579,506	41,842
Total								3,217,968	3,062,214	155,754

It should be noted that the new boiler is not operational in the summer and shoulder months. The existing smaller boilers are used for the reduced steam requirements of the campus.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for High Efficiency Boiler

Measure	Annual Gross Therms Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
High Efficiency Boiler	95,000			155,754
Total	95,000			155,754

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	High Efficiency Boiler	95,000	155,754	164%	3,115,073
Total		***95,000***	***155,754***	***164%***	***3,115,073***

The project has an overall natural gas realization rate of 164%. Final expected savings calculations for the project were not provided, but the preliminary calculations utilized load assumptions and a number of operating hours to calculate the annual savings. ADM relied on actual month plant logs to calculate the savings as well as the actual boiler efficiency test results. The results show the as-built boiler efficiency ranging from 76.6% to a high of 84.3%. The high realization rate is most likely the result of the ex ante analysis underestimating the annual steam load of the steam plant.

Project Number S-63

Executive Summary

Under application S-63, the program participant received Standard Program incentives from the Illinois Department of Commerce for retrofitting lighting fixtures. The realization rate for this project is 112%.

Project Description

The customer retrofitted the following:

- (6) 4' 1LT12 fixtures with (6) 4'1LT8 fixtures
- (683) 4' 2LT12 fixtures with (683) 4' 2LT8 fixtures
- (374) 4' 3LT12 fixtures with (374) 4' 3LT8 fixtures
- (200) 4' 4LT12 fixtures with (200) 4' 4LT8 fixtures
- (18) T12 U-tube lamps with (18) T8 U-tube lamps

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measure 4.5. 3. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHF_d	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings of Lighting Retrofit

Measure	Calculation inputs						Annual Gross kWh Savings	
	Quantity	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe	Ex Ante	TRM-Calculated Ex Post
HP and RW T8 Fixtures and Lamps_	6	48	25	3,540	100%	1.14	211,720	635
HP and RW T8 Fixtures and Lamps_	683	82	49	3,540	100%	1.14		103,693
HP and RW T8 Fixtures and Lamps_	374	122	72	3,540	100%	1.14		75,466
HP and RW T8 Fixtures and Lamps_	200	164	94	3,540	100%	1.14		56,498
HP and RW T8 Fixtures and Lamps_	18	28	16	3,540	100%	1.14		872
Total							***211,720***	***237,163***

TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

Summary of Project-Level Gross Realized Savings

The table shown below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Measure Life (Years)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Standard	4.5.3	211,720	237,163	112%	49.37	7	1,607,886	N/A	N/A
Total		***211,720***	***237,163***	***112%***	***49.37***		***1,607,886***		

The project-level gross realization rate is 112%.

Based on algorithms in TRM version 3.0 measure 4.5.3, the TRM calculated ex post savings per fixture was 71.61kWh, whereas the ex ante savings estimate was 63.93 kWh.

Project Number SC64

Executive Summary

Under application SC64, the program participant received Standard and Custom Program incentives from the Illinois Department of Commerce for the installation of VFDs on supply/exhaust fans and for retrofitting existing laboratory fume hoods with high efficiency fume hoods. The overall electric realization rate for this project is 121%.

Project Description

The installed measures focused on reducing the overall HVAC energy use of the university. In order to accomplish this, the customer installed VFDs on the supply and exhaust fans of air handling units serving the facility. Originally, the supply fans relied on inlet guide vanes to control the air flow being supplied to the facility while the exhaust fans operated at constant speed. The customer installed the following VFDs:

- (26) 15 Hp VFDs on air handler supply fans,
- (16) 20 Hp VFDs on air handler supply fans,
- (4) 25 Hp VFDs on air handler supply fans,
- (2) 1 Hp VFDs on exhaust fans,
- (2) 3 Hp VFDs on exhaust fans,
- (2) 5 Hp VFDs on exhaust fans,
- (2) 7.5 Hp VFDs on exhaust fans,
- (7) 15 Hp VFDs on exhaust fans, and
- (2) 20 Hp VFDs on exhaust fans.

The customer also installed the following high efficiency fume hoods:

- (34) 4-foot Fume Hoods with a gross area opening of 2.70 ft^2 and minimum face velocity of 80 feet per minute,
- (11) 5-foot Fume Hoods with a gross area opening of 3.57 ft^2 and minimum face velocity of 80 feet per minute,
- (1) 6-foot Fume Hoods with a gross area opening of 4.45 ft^2 and minimum face velocity of 80 feet per minute, and
- (2) 8-foot Fume Hoods with a gross area opening of 6.20 ft^2 and minimum face velocity of 80 feet per minute.

The installation of the new fume hoods resulted in savings through reduced face velocity as compared to the existing fume hoods. The reduction in face velocity results in a decrease in exhaust fan energy consumption and HVAC cooling load. HVAC cooling load is reduced as a result of a decrease in the volume of air being exhausted from the building; thus, the amount of “Make Up” air needing to be brought back into the building to maintain pressurization is reduced.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and verified the installation of the VFDs and high efficiency laboratory fume hoods during an onsite inspection.

Standard Incentives

For the supply and return fan VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

$\Delta kWH = kW_{connected} * Hours * ESF$

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kW_{connected} * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Custom Incentives

Annual electrical savings for the new high efficiency fume hood was calculated through the use of Lawrence Berkeley National Laboratory Fume Hood Calculator[86]. The fume hood calculator compares the annual energy consumption of two user defined fume hoods while calculating the potential annual energy savings. The fume hood calculator requires users to input known details of each hood which includes the following: location, hours of operation, vertical hood opening, horizontal hood opening, face velocity, and cooling plant efficiency.

Annual energy savings for each individual hood type was calculated then multiplied by the corresponding quantity to determine the total annual energy savings for the project.

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

[86] http://fumehoodcalculator.lbl.gov/index.php

Annual kWh Savings for VFDs on Fans

Measure	Measure Metrics					Annual Gross kWh Savings			
	Qty	Application	Hours of Operation	HP	Building Type	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
Variable Speed Drives for HVAC	26	Forward Curved Inlet Guide Vanes	8,760	15 HP	College/ University		202,834		
Variable Speed Drives for HVAC	16	Forward Curved Inlet Guide Vanes	8,760	20 HP	College/ University		166,342		
Variable Speed Drives for HVAC	4	Forward Curved Inlet Guide Vanes	8,760	25 HP	College/ University		51,718		
Variable Speed Drives for HVAC	2	Constant Volume Fan	8,760	1 HP	College/ University		6,015		
Variable Speed Drives for HVAC	2	Constant Volume Fan	8,760	3 HP	College/ University		18,045		
Variable Speed Drives for HVAC	2	Constant Volume Fan	8,760	5 HP	College/ University		30,275		
Variable Speed Drives for HVAC	2	Constant Volume Fan	8,760	7.5 HP	College/ University		45,366		
Variable Speed Drives for HVAC	7	Constant Volume Fan	8,760	15 HP	College/ University		317,564		
Variable Speed Drives for HVAC	2	Constant Volume Fan	8,760	20 HP	College/ University		120,914		
Total						610,823	959,073		

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for High Efficiency Fume Hoods

Measure	Measure Metrics							Annual Gross kWh Savings			
	Qty	Horizontal "in"	Vertical "in"	Opening Area "ft²"	Min Face FPM		kWh Savings per Hood	Ex Ante	TRM-Calculated	TRM-Calculated (Errata Corrected)	ADM Calculated
					As-Built	Baseline[87]			Ex Post	Ex Post	Ex Post
4' Fume Hood	34	18.5	21	2.7	80	150	4,625				157,250
5' Fume Hood	11	24.5	21	3.6	80	150	6,125				67,375
6' Fume Hood	1	30.5	21	4.4	80	150	8,715				8,715
8' Fume Hood	2	42.5	21	6.2	80	150	10,626				21,252
Total								389,650			254,592

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Ex Post Peak kW Reduction	Annual kWh Savings	Annual Peak kW Reduction
Standard	Variable Speed Drives for HVAC	610,823	959,073	157%	55.63	14,386,095	55.63		
Subtotal		610,823	959,073	157%	55.63	14,386,095	55.63		
Custom	Fume Hoods	389,650	254,592	65%	41.78	3,818,880	41.78		
Subtotal		*389,650*	*254,592*	*65%*	*41.78*	*3,818,880*	*41.78*		
Total		***1,000,473***	***1,213,665***	***121%***	***97.41***	***18,204,975***	***97.41***		

The electric measures have a combined verified realization rate of 121%.

ADM is unable to provide a detailed explanation of the fume hood realization rate because ex ante calculations were not provided for review. Therefore, ADM is unsure of the ex ante assumptions that were used to calculate the claimed 389,650 kWh savings.

ADM was not provided the ex ante calculation for the VFDs, but ADM assumes that the high realization rate is due to the ex ante assumptions underestimating the annual hours of operation

[87] Energy-Efficient Fume Hoods (Low-Flow Fume Hoods), Lawrence Berkeley National Laboratory

for the fan. Section 4.4.17 of TRM Version 3.0 uses a default hours of operation of 4,216 for fans at a University; however, the section allows for custom hours of operation to be used if they are known. Since the facility houses laboratories that require 24/7 conditioning and ventilation, ADM opted to use 8,760 hours of operation in the ex post analysis.

Project Number C65

Executive Summary

Under application C65, the program participant received Custom Program incentives from the Illinois Department of Commerce for retrofitting existing laboratory fume hoods with high efficiency fume hoods. The electric realization rate for this project is 43%.

Project Description

The customer installed the following high efficiency fume hoods:

- (2) 4-foot Fume Hoods with a gross area opening of 2.70 ft^2 and minimum face velocity of 80 feet per minute,
- (160) 6-foot Fume Hoods with a gross area opening of 4.45 ft^2 and minimum face velocity of 80 feet per minute, and
- (6) 8-foot Fume Hoods with a gross area opening of 6.20 ft^2 and minimum face velocity of 80 feet per minute.

The installation of the new fume hoods resulted in savings through reduced face velocity as compared to the existing fume hoods. The reduction in face velocity results in a decrease in exhaust fan energy consumption and HVAC cooling load. HVAC cooling load is reduced as a result of a decrease in the volume of air being exhausted from the building; thus, the amount of "Make Up" air needing to be brought back into the building to maintain pressurization is reduced.

Methodology for Estimating Gross Savings

ADM staff reviewed project documentation and verified the installation of the high efficiency laboratory fume hoods during an onsite inspection.

Custom Incentives

Annual electrical savings for the new high efficiency fume hood was calculated through the use of Lawrence Berkeley National Laboratory Fume Hood Calculator[88]. The fume hood calculator compares the annual energy consumption of two user defined fume hoods while calculating the potential annual energy savings. The fume hood calculator requires users to input known details of each hood which includes the following: location, hours of operation, vertical hood opening, horizontal hood opening, face velocity, and cooling plant efficiency.

Annual energy savings for each individual hood type was calculated and multiplied by the corresponding quantity to determine the total annual energy savings for the project.

[88] http://fumehoodcalculator.lbl.gov/index.php

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for High Efficiency Fume Hoods

Measure	Measure Metrics							Annual Gross kWh Savings			
	Qty	Horizontal "in"	Vertical "in"	Opening Area "ft²"	Min Face FPM		kWh Savings per Hood	Ex Ante	TRM-Calculated	TRM-Calculated (Errata Corrected)	ADM Calculated
					As-Built	Baseline[89]			Ex Post	Ex Post	Ex Post
4' Fume Hood	14	18.5	21	2.7	80	150	4,625				9,250
6' Fume Hood	59	30.5	21	4.4	80	150	8,715				1,394,400
8' Fume Hood	2	42.5	21	6.2	80	150	10,626				63,756
Total								3,446,667			1,467,406

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Ex Post Peak kW Reduction	Annual kWh Savings	Annual Peak kW Reduction
Custom	Fume Hoods	3,446,667	1,467,406	43%	215.85	22,011,090	215.85		
Total		***3,446,667***	***1,467,406***	***43%***	***215.85***	***22,011,090***	***215.85***		

The electric measure has a verified realization rate of 43%. The ex post analysis uses Lawrence Berkeley National Laboratory Fume Hood Calculator. ADM determined this to be the best approach for this measure with the available information.

89 Energy-Efficient Fume Hoods (Low-Flow Fume Hoods), Lawrence Berkeley National Laboratory

Project Number	SC66

Executive Summary

Under application SC66, the program participant received Standard and Custom Program incentives from the Illinois Department of Commerce for the installation of VFDs on exhaust fans, the replacement of air filters in 38 AHUs to reduce the static pressure drop in each unit, and the recommissioning of (523) VAV boxes to provide Variable Air Volume rather than Constant Volume. The overall electric realization rate for this project is 112%.

Project Description

In order to reduce the overall HVAC fan energy use for the facility, the customer installed VFDs on the exhaust fans of air handling units serving the facility. Originally the exhaust fans were constant speed and had no capacity control. The customer installed the following VFDs:

- VSD for (1) 10 hp return fan on AHU 34
- VSDs for (5) 15 hp return fans on AHU 10, 12, 14, 22, 29
- VSDs for (2) 15 hp return fans on AHU 32, 37
- VSDs for (4) 20 hp return fans on AHU 8, 17, 27, 28
- VSD for (1) 25 hp return fan on AHU 30

The supply fans were already equipped with VFDs, however the associated AHUs were operating as constant volume fans. To further reduce fan energy use the VAV boxes were recommissioned to provide Variable Air Volume. In addition, air filters were replaced and upgraded in 38 AHUs. The existing units had 3 filters - 30% Pleat Pre-Filter, 60% VariCel M-Pak Mid-Filter, and 95% VariCel M-Pak HEPA Final Filter. The as-built units use one 90% 1" V-Bank Electronic Filter and one 95% Dynamic V8 Electronic Filter. The AHUs operate continuously, 8,760 hours per year.

Methodology for Estimating Gross Savings

ADM staff inspected project documentation and verified the installation of the VFDs, Filters, and the recommissioning of the VAV boxes.

Standard Incentives

For the supply and return fan VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kW_{connected} * Hours * ESF$$

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = kW_{connected} * DSF$

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Custom Incentives

Annual energy savings for the installation of the recommissioning of the VAV boxes was calculated through the use of a temperature bin analysis. The analysis was performed using five degree temperature bins and was informed by TMY3 weather data for the Chicago Midway weather station. This analysis calculates savings associated with reduced fan usage only and assumes that cooling and heating usage remain constant. The following table presents the calculated electric savings for the VAV recommissioning:

Annual Savings for VAV Recommissioning

Outside Air Temperature			*Outdoor Enthalpy*	*Occ. Annual Hrs*	*Fan kWh Savings*	*Fan Speed*
High	*Low*	*Average*				
105	100	102.5	39.25	4	303	100%
100	95	97.5	39.20	5	379	100%
95	90	92.5	37.98	51	3,865	100%
90	85	87.5	35.44	222	28,298	95%
85	80	82.5	33.65	511	89,543	90%
80	75	77.5	32.19	363	79,559	85%
75	70	72.5	30.46	936	242,800	80%
70	65	67.5	27.52	684	202,485	75%
65	60	62.5	23.83	681	224,167	70%
60	55	57.5	21.41	463	166,193	65%
55	50	52.5	19.41	934	360,036	60%
50	45	47.5	16.98	793	324,249	55%
45	40	42.5	15.23	733	299,716	55%
40	35	37.5	12.90	604	232,829	60%
35	30	32.5	11.13	363	130,298	65%
30	25	27.5	9.08	382	125,744	70%
25	20	22.5	7.34	309	91,473	75%
20	15	17.5	5.64	270	70,038	80%
15	10	12.5	3.98	108	23,671	85%
10	5	7.5	2.87	150	26,284	90%
5	0	2.5	1.40	90	11,472	95%
0	-5	-2.5	0.06	49	3,713	100%
-5	-10	-7.5	-1.25	22	1,667	100%
-10	-15	-12.5	-2.50	26	1,970	100%
-15	-20	-17.5	-3.57	7	530	100%
Total				8,760	2,741,284	

Energy savings for the upgrading and replacement of the air filters was calculated by the reduced fan usage associated by the reduction in static pressure as follows:

$$\Delta kW = (CFM * \Delta P)/(6355 * Fan\ Eff. * Motor\ Eff.)$$

$$\Delta kWh = \Delta kW * 8760$$

Where:

ΔkW = kW reduction due to the difference between the pre and post filter static pressure drop.

CFM = Air flow rate of the fan system, Cubic Feet Per Minute

Fan Eff = Rate efficiency of the fan

Motor Eff = Rated efficiency of the fan motor

ΔkWh = Annual kWh savings for the high efficiency filters.

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for VFDs on Fans

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Qty	*Application*	*Hours of Operation*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	10 HP	Medical	6,104	30,229
Variable Speed Drives for HVAC	5	Constant Volume Fan	8,760	15 HP	Medical	15,259	75,187
Variable Speed Drives for HVAC	2	Constant Volume Fan	8,760	15 HP	Medical	18,310	90,733
Variable Speed Drives for HVAC	4	Constant Volume Fan	8,760	20 HP	Medical	45,776	226,831
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	25 HP	Medical	48,828	241,829
Total						134,277	664,809

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for the VAV Recommissioning

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
VAV Retrofit	876,435			1,512,357
Total	876,435			1,512,357

Annual kWh Savings for the Filter Replacement and Upgrade

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Filter Retrofit	3,058,608			2,365,598
Total	3,058,608			2,365,598

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Standard	Variable Speed Drives for HVAC	134,277	664,809	495%	49.36	9,972,135
Subtotal		134,277	664,809	495%	49.36	9,972,135
Custom	Filter Upgrade	3,058,608	2,365,598	77%	270.05	3,548,397
	VAV Recommissioning	876,435	1,512,357	173%	168.71	22,685,350
Subtotal		3,935,043	3,877,995	99%	438.76	26,233,747
Total		***4,069,320***	***4,452,764***	***112%***	***488.12***	***36,205,882***

The electric measures have a combined verified realization rate of 112%.

The high electric realization rate can be attributed to the 495% realization rate for the VFD savings and the 313% realization rate for the VAV recommissioning. The 495% realization rate is for the VFD retrofit is due to the ex-ante calculations using the TRM default hours of operation and the ex-ante analysis assuming the baseline fan was Forward Curve with Discharge Dampers. Section 4.4.17 of TRM Version 3.0 uses a default hours of operation of 6,871 for fans at a medical facility; however, the section allows for custom hours of operation to be used if they are known. Since the facility requires 24/7 conditioning and ventilation, ADM opted to use 8,760 hours of operation in the ex-post analysis.

The 313% realization rate for the VAV recommissioning is due to the use of a “guaranteed savings” reduction factor of 63% applied to the electrical savings in the ex-ante calculation and not taking into consideration that the fan speed varied throughout the year. The ex-ante analysis assumed that the flow of the VAV system was constant throughout the year. In fact the analysis does have an average assumed flow for the as-built system of 85% but failed to include it in the as-built fan power calculation. ADM evaluated the VAV recommissioning using an alternate method and determined similar electric savings prior to application of the reduction factor.

The 77% realization rate for the filter upgrade and replacement can be attributed to the ex-ante analysis using the optimal static pressure drop rather than the dirty static pressure drop. When the static pressure drop of a dirty filter is averaged with the clean filter static pressure drop the total static pressure drop is similar to the manufacturers stated optimal static pressure drop. This adjustment to the total static pressure drop decreases the electric savings associated with fan power reduction.

Project Number SC67

Executive Summary

Under application SC67, the program participant received Standard and Custom Program incentives from the Illinois Department of Commerce for the installation of VFDs on supply/exhaust fans, the replacement of pneumatic controls with direct digital controls, and the conversion of (4) 100% outside air units to mixed air handling units with VAV boxes controlled by the new DDC system. The overall electric realization rate for this project is 96% and the overall natural gas realization rate is 92%.

Project Description

In order to reduce the overall HVAC fan energy usage for the facility, the customer installed VFDs on the supply and exhaust fans of air handling units serving the facility. Originally, the supply and exhaust fans were constant speed and had no capacity control, the customer installed the following VFDs:

- (1) 10 Hp VFDs on SF-1,
- (1) 5 Hp VFDs on ER-1,
- (1) 3 Hp VFDs on ER-2,
- (1) 30 Hp VFDs on ER-6,
- (1) 15 Hp VFDs on ER-7, and
- (1) 10 Hp VFDs on ER-8.

The customer also replaced the existing pneumatic temperature control system with a Direct Digital Control (DDC) system. The existing system operated 24/7 due to the inoperable control system. With the addition of the DDC system, during unoccupied hours the air handlers revert to a minimum flow schedule and the outdoor air dampers are completely closed. This results in a reduction of fan usage during unoccupied hours and a reduction of cooling energy as outside air is no longer being supplied to the space. Along with the DDC system, (4) 100% outside air units were converted to variable flow mixed air units. The existing pneumatic dual duct variable air volume (DDVAV) boxes were converted to standard VAV boxes controlled by the new DDC system.

Methodology for Estimating Gross Savings

ADM staff inspected project documentation and verified the installation of the VFDs, DDC system and the conversion of the 100% outside dual duct systems to mixed air systems with VAV boxes.

Standard Incentives

For the supply and return fan VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

ΔkWH = $kW_{connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW = $kW_{connected}$ * DSF

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

Custom Incentives

Annual energy savings for the installation of the new DDC system and the conversion of the (4) outside air units to mixed air units with VAV boxes were calculated through the use of two separate temperature bin analyses. Both analyses were performed using five degree temperature bins and where informed by TMY3 weather data for the Chicago Midway weather station. The temperature bin analyses relied on standard engineering heat transfer equations to determine the annual energy savings as a result of the reduction in outside air being supplied to the zones during occupied and non-occupied periods. The following tables present the calculated natural gas and electric savings for the VAV retrofit and the installation of the DDC system:

Annual Savings for VAV Retrofit

Outside Air Temperature			*Outdoor Enthalpy*	*Occ. Annual Hrs*	*Cooling Load (Tons-Hrs)*		*Heating Load (MBtuh)*		Fan kWh Savings	Cooling kWh Savings	Heating Therm Savings
High	*Low*	*Average*			*Baseline*	*As-Built*	*Baseline*	*As-Built*			
105	100	102.5	39.25	4	2,774	1,760	-	-	123	913	-
100	95	97.5	39.20	4	2,766	1,755	-	-	123	910	-
95	90	92.5	37.98	45	28,911	18,342	-	-	1,389	9,513	-
90	85	87.5	35.44	172	92,964	58,978	-	-	7,147	30,588	-
85	80	82.5	33.65	319	149,358	94,754	-	-	16,403	49,143	-
80	75	77.5	32.19	170	69,665	44,196	-	-	10,285	22,922	-
75	70	72.5	30.46	361	122,831	77,925	-	-	24,842	40,415	-
70	65	67.5	27.52	219	48,567	30,812	-	-	16,728	15,980	-
65	60	62.5	23.83	278	20,458	12,979	-	-	23,139	6,731	-
60	55	57.5	21.41	187	-	-	-	-	16,715	-	-
55	50	52.5	19.41	367	-	-	743,644	471,777	34,817	-	3,398
50	45	47.5	16.98	328	-	-	854,510	542,112	32,704	-	3,905
45	40	42.5	15.23	255	-	-	811,959	515,116	25,425	-	3,711
40	35	37.5	12.90	191	-	-	718,750	455,984	18,120	-	3,285
35	30	32.5	11.13	140	-	-	607,883	385,649	12,514	-	2,778
30	25	27.5	9.08	130	-	-	639,725	405,849	10,820	-	2,923
25	20	22.5	7.34	113	-	-	621,488	394,280	8,631	-	2,840
20	15	17.5	5.64	104	-	-	632,199	401,075	7,157	-	2,889
15	10	12.5	3.98	44	-	-	292,942	185,846	2,662	-	1,339
10	5	7.5	2.87	48	-	-	347,362	220,371	2,468	-	1,587
5	0	2.5	1.40	43	-	-	336,073	213,209	1,787	-	1,536
0	-5	-2.5	0.06	13	-	-	109,130	69,233	401	-	499
-5	-10	-7.5	-1.25	8	-	-	71,788	45,543	247	-	328

Outside Air Temperature			*Outdoor Enthalpy*	*Occ. Annual Hrs*	*Cooling Load (Tons-Hrs)*		*Heating Load (MBtuh)*		Fan kWh Savings	Cooling kWh Savings	Heating Therm Savings
High	*Low*	*Average*			*Baseline*	*As-Built*	*Baseline*	*As-Built*			
-10	-15	-12.5	-2.50	5	-	-	47,762	30,301	154	-	218
-15	-20	-17.5	-3.57	0	-	-	0	0	0	-	0
Total				3,548					274,804	177,114	31,236

Annual Savings for DDC Controls with Night Setback

Outside Air Temperature			*Outdoor Enthalpy*	*UnOcc. Annual Hrs*	*Cooling Load (Tons-Hrs)*		*Fan kWh Savings*	*Cooling kWh Savings*
High	Low	Average			*Baseline*	*As-Built*		
105	100	102.5	39.25	0	0	0	0	0
100	95	97.5	39.20	1	631	156	72	427
95	90	92.5	37.98	6	3,518	871	435	2,382
90	85	87.5	35.44	50	24,664	6,109	3,622	16,700
85	80	82.5	33.65	192	82,045	20,320	13,909	55,552
80	75	77.5	32.19	193	72,183	17,878	13,981	48,874
75	70	72.5	30.46	575	178,558	44,224	41,654	120,900
70	65	67.5	27.52	465	94,116	23,310	33,686	63,725
65	60	62.5	23.83	403	27,066	6,704	29,194	18,326
60	55	57.5	21.41	276	-	-	19,994	-
55	50	52.5	19.41	567	-	-	41,075	-
50	45	47.5	16.98	465	-	-	33,686	-
45	40	42.5	15.23	478	-	-	34,627	-
40	35	37.5	12.90	413	-	-	29,919	-
35	30	32.5	11.13	223	-	-	16,155	-
30	25	27.5	9.08	252	-	-	18,255	-
25	20	22.5	7.34	196	-	-	14,199	-
20	15	17.5	5.64	166	-	-	12,025	-
15	10	12.5	3.98	64	-	-	4,636	-
10	5	7.5	2.87	102	-	-	7,389	-
5	0	2.5	1.40	47	-	-	3,405	-
0	-5	-2.5	0.06	36	-	-	2,608	-
-5	-10	-7.5	-1.25	14	-	-	1,014	-
-10	-15	-12.5	-2.50	21	-	-	1,521	-
-15	-20	-17.5	-3.57	7	-	-	507	-

Outside Air Temperature			*Outdoor Enthalpy*	*UnOcc. Annual Hrs*	*Cooling Load (Tons-Hrs)*		*Fan kWh Savings*	*Cooling kWh Savings*
High	Low	Average			*Baseline*	*As-Built*		
Total				5,212			377,568	326,887

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for VFDs on Fans

Measure	*Measure Metrics*					*Annual Gross kWh Savings*	
	Qty	*Application*	*Hours of Operation*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	10 HP	College/ University	6,103	30,229
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	5 HP	College/ University	3,052	15,138
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	3 HP	College/ University	1,831	9,022
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	30 HP	College/ University	18,310	90,225
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	15 HP	College/ University	9,155	45,366
Variable Speed Drives for HVAC	1	Constant Volume Fan	8,760	10 HP	College/ University	6,103	30,229
Total						44,555	220,209

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for the VAV Retrofit

Measure	*Annual Gross Therms Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
VAV Retrofit	33,936			31,236
Total	33,936			31,236

Annual kWh Savings for the VAV Retrofit

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
VAV Retrofit	464,178			451,919
Total	464,178			451,919

Annual kWh Savings for DDC Controls

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
DDC Controls	929,853			704,455
Total	929,853			704,455

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh
Standard	Variable Speed Drives for HVAC	44,555	220,209	494%	16.35	3,303,135
Subtotal		44,555	220,209	494%	16.35	3,303,135
Custom	DDC Controls	929,853	704,455	76%	0.00	10,566,831
	VAV Retrofit	464,178	451,919	97%	258.73	6,778,778
Subtotal		*1,394,031*	*1,156,374*	*83%*	*258.73*	*17,345,609*
Total		***1,438,586***	***1,376,583***	***96%***	***275.08***	***20,648,744***

Verified Natural Gas Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings			Lifetime Gross Savings
		Ex Ante Therms	Ex Post Therms	Realization Rate	Ex Post Therms
Custom	VAV Retrofit	33,936	31,236	92%	624,718
Total		***33,936***	***31,236***	***92%***	***624,718***

The electric measures have a combined verified realization rate of 96% and the natural gas measures have a combined verified realization rate of 92%

The 96% electric realization rate can be attributed to the ex-ante analysis double counting the VFD savings in the DDC Control measures for the fans that received standard savings for the installation of the VFDs. This resulted in an overestimation of the electric savings for the installation of the DDC controls. However, it should be noted that the savings for the VFDS was taken into consideration in the standard calculation and the 494% realization rate is due to the ex-ante calculations using the default hours of operation from the TRM. Section 4.4.17 of TRM Version 3.0 uses a default hours of operation of 4,216 for fans at a University; however, the section allows for custom hours of operation to be used if they are known. Since the facility requires 24/7 conditioning and ventilation, ADM opted to use 8,760 hours of operation in the ex-post analysis. The ex ante analysis also used a more efficient baseline control strategy.

The 92% natural gas realization rate can be attributed to the ex-ante analysis using a different weather file in their analysis. ADM utilized TMY3 weather data for Chicago Midway in the ex-post temperature bin analysis.

Project Number SC68

Executive Summary

Under application SC68, the program participant received Standard and Custom Program incentives from the Department of Commerce for the installation of VFDs on chilled water and condenser water pumps, the replacement of two centrifugal chillers with two variable speed centrifugal chillers, the optimization of chiller plant control strategies and operation, and the installation of boiler stack economizing heat exchanger system to preheat boiler feed water and domestic hot water. The overall electric realization rate for this project is 139% and the overall natural gas realization rate is 46%.

Project Description

In order to reduce the overall chiller plant pumping energy usage for the facility, the customer installed VFDs on the primary chilled water pumps and the condenser chilled water pumps. Originally, the pumps were constant speed and ran when specified chillers sequenced on or off. The customer installed the following VFDs:

- (3) 200 Hp VFDs on Primary Chilled Water Pumps,
- (3) 100 Hp VFDs on Condenser Water Pumps,

The customer also installed two new variable speed centrifugal chillers and performed chiller plant control system optimization. Additionally, during chiller plant optimization, the secondary pumping system was audited and adjusted for reduced flow with variable speed pumping. Chilled water coil control valves were changed from 3-way to 2-way and much of the old flow balancing restrictions were removed. This also included removal of bypass piping between various chilled water loops in the system. Furthermore, a boiler exhaust stack economizer heat exchanger was installed to pre-heat boiler feed water and facility domestic hot water.

Methodology for Estimating Gross Savings

ADM staff inspected project documentation and verified the installation of the VFDs, new chillers and the installation of the boiler stack economizer heat exchanger system.

Standard Incentives

For the condenser and chilled water pump VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used to calculate the TRM based savings; however, due to the system configuration ADM opted to include the VFD savings analysis in the custom analysis for the chillers and chiller plant optimization discussed in the following Custom Incentives section of the report. The final reason is due to VFDs being installed on condenser water pumps which have no provisions for their calculation in the Illinois TRM.

Standard & Custom Incentives

Annual natural gas energy savings for the installation of the boiler stack economizer heat exchanger were calculated using a billing regression. The regression is calculated using gas therm usage and heating degree days in Chicago for a period between April 2013 and March 2015. The linear regression coefficients were calculated pre and post ECM installation in April of 2015. Annual savings were calculated by using Chicago TMY3 weather data heating degree days. The heat recovery had a well-defined impact as observed in the bills and in the performance indicators of the regression with pre and post r-squared values greater than 0.95.

$$Therms = m * HDD + b$$

Where:

Therms	= Monthly natural gas consumed by the facility
m	=Slope of linear fit trendline
b	=Intercept of linear fit trendline
HDD	=Heating Degree Days (65 degree F balance point)

The following table presents the derived coefficients for the pre- and post-retrofit regressions:

Monthly Natural Gas Pre/Post Regression Coefficients

Coefficient	*Pre*	*Post*
m	184.83	182.73
b	201,002	190,193
R^2	0.96	0.97

The following table illustrates the comparison of the billed monthly Therm consumption to that predicted by the aforementioned regressions:

Monthly Billed vs. Regressed Natural Gas Consumption

Annual electric energy savings for the new VSD chillers and chiller plant optimization were calculated using energy savings for the proposed measures calculated through a DEER prototypical hospital eQUEST model using Chicago TMY3 weather data. The savings output by the DEER model were scaled with existing facility electric billing data to estimate the project specific energy savings. This project has multiple electric savings components, some standard measures and some custom measures, all of which are inter-related. Analysis of ex-ante savings estimation for custom measures shows double counting of energy savings related to variable speed drives for chilled water and condenser water pumps. ADM removed the savings attributed to VFDs installed on pumps and used a custom calculation to calculate savings for variable speed condenser water and primary chilled water pumping loops. These savings were calculated using the same DEER prototypical hospital model and scaled to facility billing data.

Normally savings for the condenser and chilled water pump VFDs would be calculated with the Illinois TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC; however, due to the system configuration ADM opted to include the VFD savings analysis in the custom analysis for the chillers and chiller plant optimization This was also due to VFDs being installed on the condenser water pumps which have no provisions for their calculation in the Illinois TRM.

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for VFDs on Pumps

Measure	*Measure Metrics*					*Annual Gross kWh Savings*			
	Qty	*Application*	*Hours of Operation*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Variable Speed Drives for HVAC	3	Chilled Water Pump	8,760	200 HP	Medical	295,705	1,142,880		340,133
Variable Speed Drives for HVAC	3	Condenser Water Pump	8,760	100 HP	Medical	147,853	-		108,032
Total						443,558	1,142,880		448,165

Annual kWh Savings for New VSD Chillers

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
New VSD Chillers	63,224			579,633
Total	63,224			579,633

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual Therms Savings for the Boiler Stack HX Economizer

Measure	Annual Gross Therms Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
Boiler Stack HX Economizer	308,908			141,927
Total	308,908			141,927

Annual kWh Savings for the Chiller Plant Optimization

Measure	Annual Gross kWh Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
Chiller Plant Optimization	834,517			834,517
Total	834,517			834,517

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Ex Post Peak kW Reduction
Standard	Variable Speed Drives for HVAC	443,558	448,165	101%	281.05	6,653,370	281.05
	New VSD Chillers	63,224	579,633	917%	131.54	11,592,660	131.54
Subtotal		506,782	1,027,798	203%	412.59	18,246,030	412.59
Custom	Chiller Plant Optimization	834,517	834,517	100%	0.00	12,517,755	0.00
Subtotal		834,517	834,517	100%	0.00	12,517,755	0.00
Total		***1,341,298***	***1,862,315***	***139%***	***412.59***	***30,763,785***	***412.59***

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	Boiler Stack Economizer Heat Exchanger	308,908	141,927	46%	2,128,905
Total		***308,908***	***141,927***	***46%***	***2,128,905***

The electric measures have a combined verified realization rate of 139% and the natural gas measures have a combined verified realization rate of 46%

The 139% electric realization rate can be attributed to the ex-ante analysis under estimating energy savings from the new chiller installation. The difference in savings can be attributed to the ex-ante analysis using TRM based calculations; however, the TRM does not allow for savings calculations when the chillers are in a multi-chiller configuration. This is what lead ADM to using a custom analysis and thus determine a different savings value.

The 46% natural gas realization rate can be attributed to the ex-ante analysis over estimating the amount of reclaimed heat being utilized. Ex-ante savings were overestimated because they calculated maximum heat recovery possible for all boilers running at full load for all 8760 hours and just applied a "savings guarantee factor" of 57%. The ex-ante savings analysis thought the 57% adjustment factor would account for load availability, downtown, etc, as described in the provided calculation document. This was not a good approximation and resulted in savings being over-estimated. The billing analysis clearly shows excellent correlation with heating degree days and natural gas usage. The billing data shows actual usage pre and post ECM installation which accurately represents savings attained by the measure. Billing regression analysis shows less gas savings which can be attributed to the heating loads not being able to utilize as large of a percentage of waste heat as the ex-ante analysis estimated.

Name C69A

Executive Summary

Under application C69A, the customer received custom incentives from the Illinois Department of Commerce for the retro commissioning of 15 buildings. The electric realization rate is 120%.

Project Description

The customer performed retro commissioning on 15 buildings, which included the following measures:

- Removal on inefficient chillers, and piping to chiller plant
- Fume hood controls
- Replacement of control valves
- Installing variable frequency drives on air handler fans
- Calibrating temperature sensors
- Capping ventilation to spaces not utilized
- Replacing pneumatic controls with DDC (digital)
- Programming occupied and unoccupied schedules in BMS
- Install occupancy sensors to control VAV boxes
- Capping roof vents
- Air balancing supply and exhaust
- Replace outdoor air dampers stuck open
- Calibrate room thermostats

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the effectiveness of the RCx measures by reviewing the operation of each building. Mechanical rooms in each building were reviewed for new digital controls on air handlers, new control valves and installation of variable frequency drives on electric motors. Also, the modulation of the equipment to new occupied/unoccupied schedules was reviewed in the building control systems. Trend data was collected for verification.

ADM calculated the annual energy savings for the installed measures through the use of a monthly pre/post trending data regression. The regression compared the monthly trending data to the local weather in an effort to determine the effects that weather has on the cooling system/heating system for both the pre and post conditions. The monthly data consisted of electric sub meters and chilled water meters. The data had varying durations between meter readings, so the data was normalized to one month. The chilled water metered energy was converted to kWh based on the physical plant chiller trend data. The derived regressions had an average R^2 of 0.79 for the 15 buildings. Two of the buildings were aggregated together due to interactions with shared electric and chilled water.

From the regression the following equation was derived and used to calculate the monthly energy consumption for the pre and post configurations:

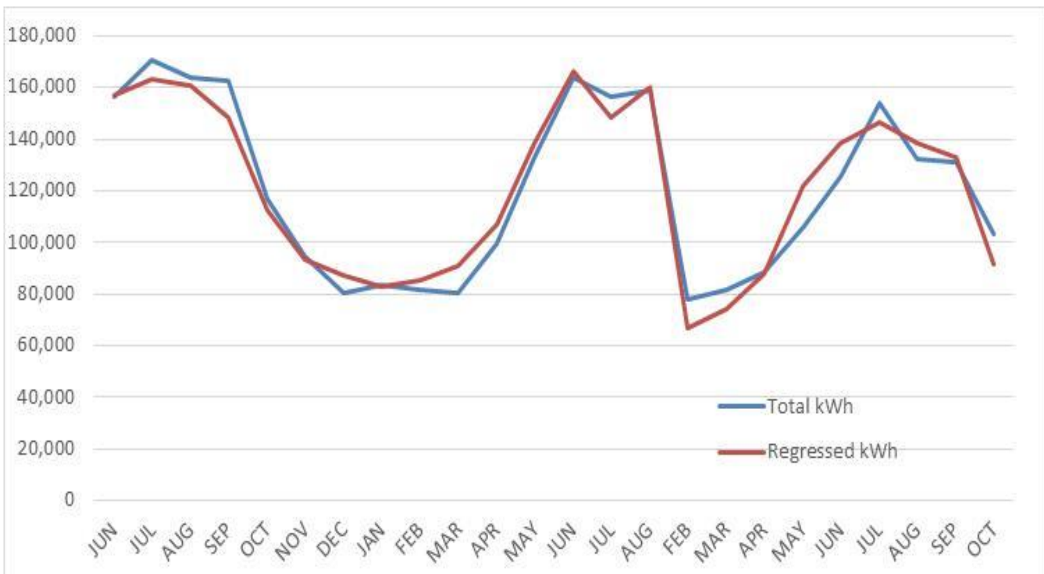
$$kWh_{Monthly} = (b \times CDD + c \ \times HDD + d \ \times \ Post + Intercept) - \ (b \ \times \ CDD + c \ \times HDD + d \ \ \times Pre + Intercept)$$

Where:

$kWh_{Monthly}$	*= Monthly kWh consumption*
CDD	*= Number of Cooling Degree Days for the month*
HDD	*= Number of Heating Degree Days for the month*
Pre_Post	*= Binary value for pre/post monthly period (0=Pre, 1=Post)*
b	*=coefficient for cooling degree days*
c	*=coefficient for heating degree days*
d	*=coefficient for Pre/Post flag*

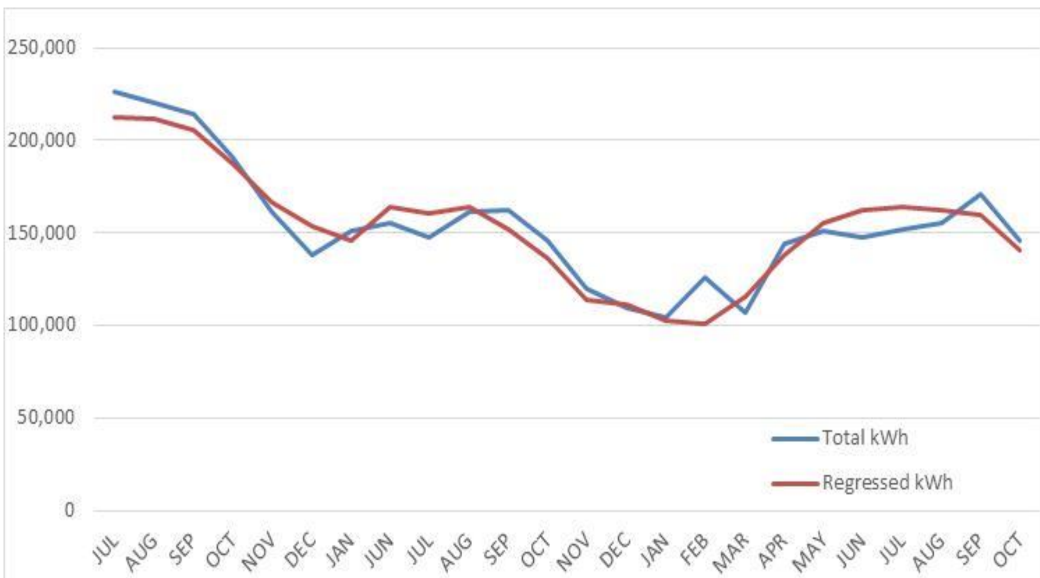
The following graphs compare the monthly metered kWh to the kWh calculated through the use of the derived equation:

Building 1: Trended Vs. Regressed Monthly kWh



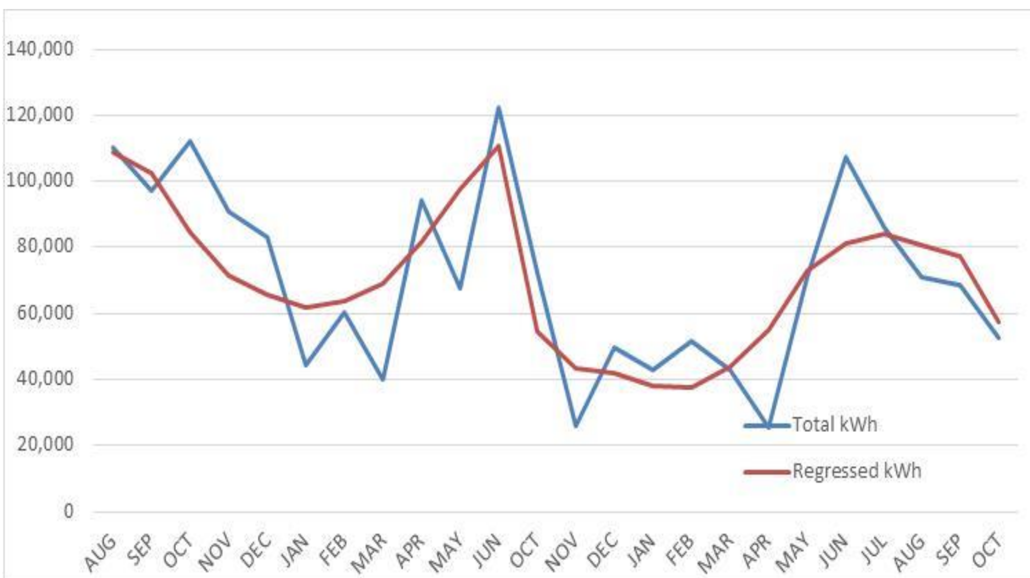
Building 2: Trended Vs. Regressed Monthly kWh

Building 3: Trended Vs. Regressed Monthly kWh

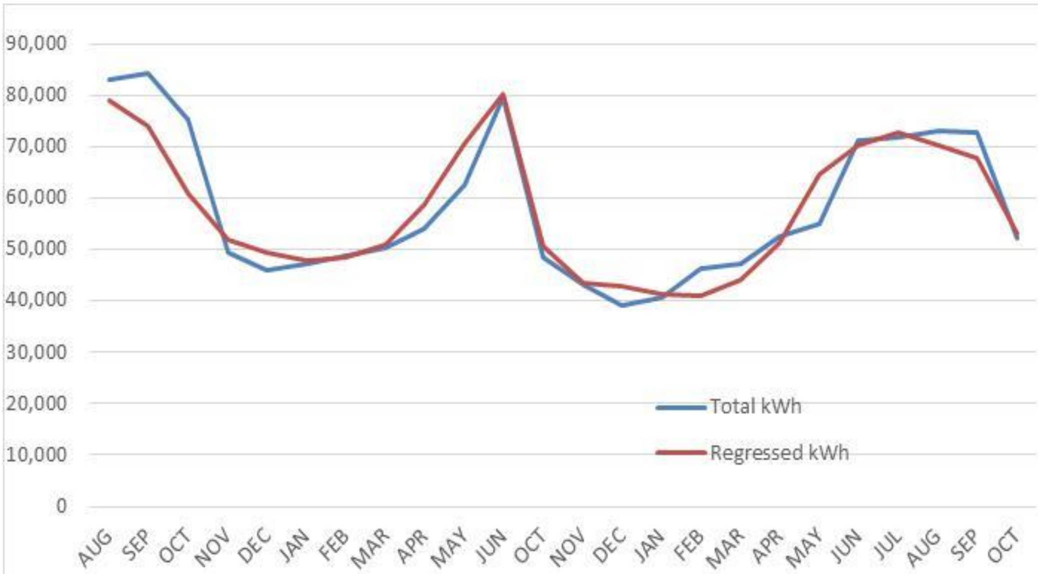


Building 4: Trended Vs. Regressed Monthly kWh

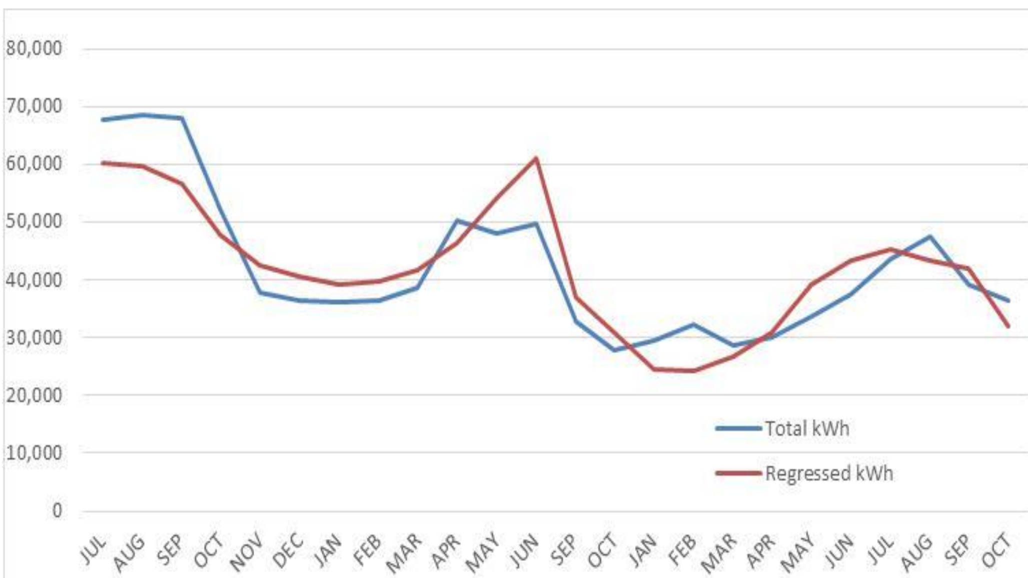
Building 5: Trended Vs. Regressed Monthly kWh



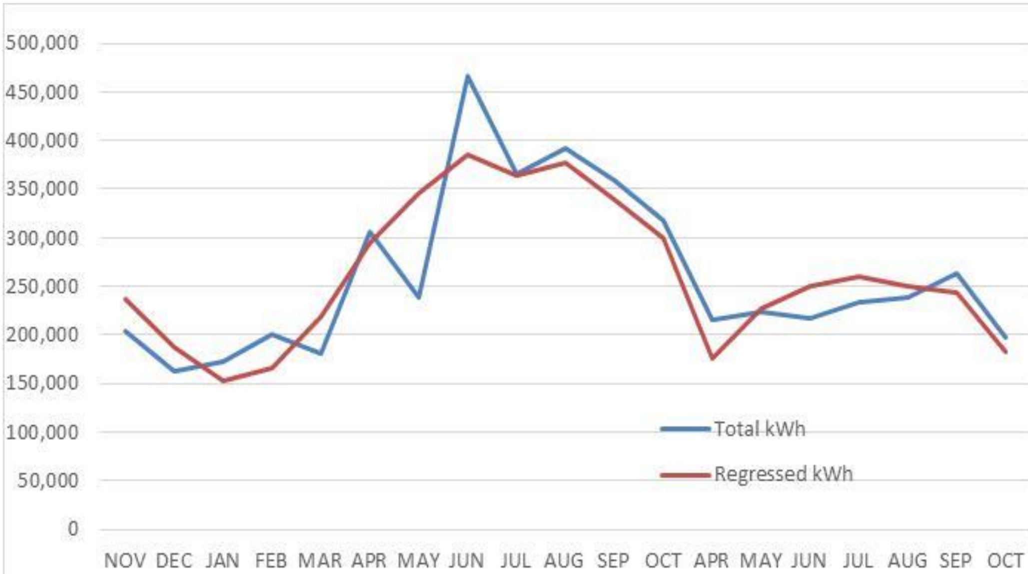
Building 6: Trended Vs. Regressed Monthly kWh



Building 7: Trended Vs. Regressed Monthly kWh



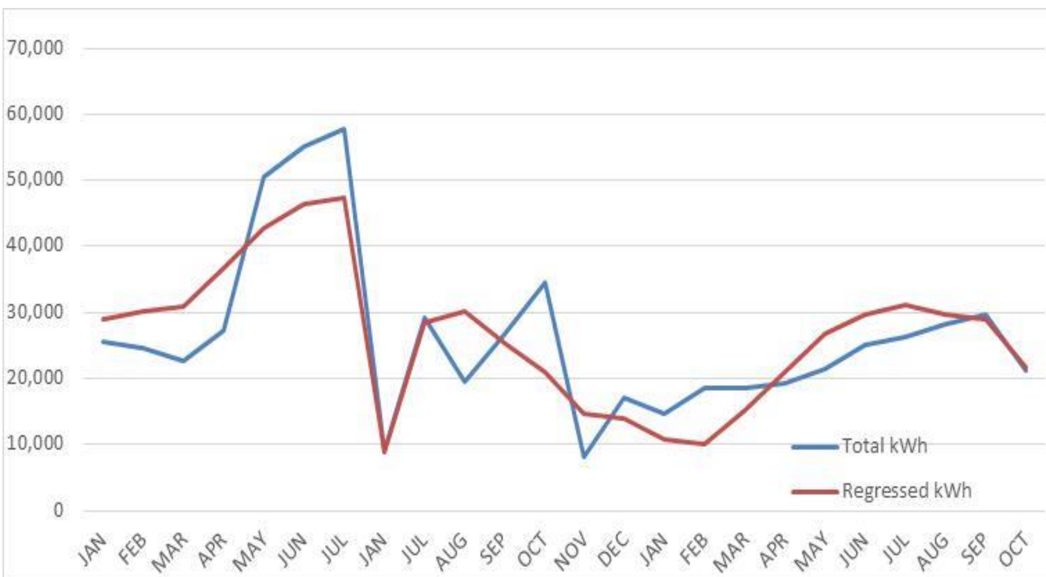
Building 8: Trended Vs. Regressed Monthly kWh



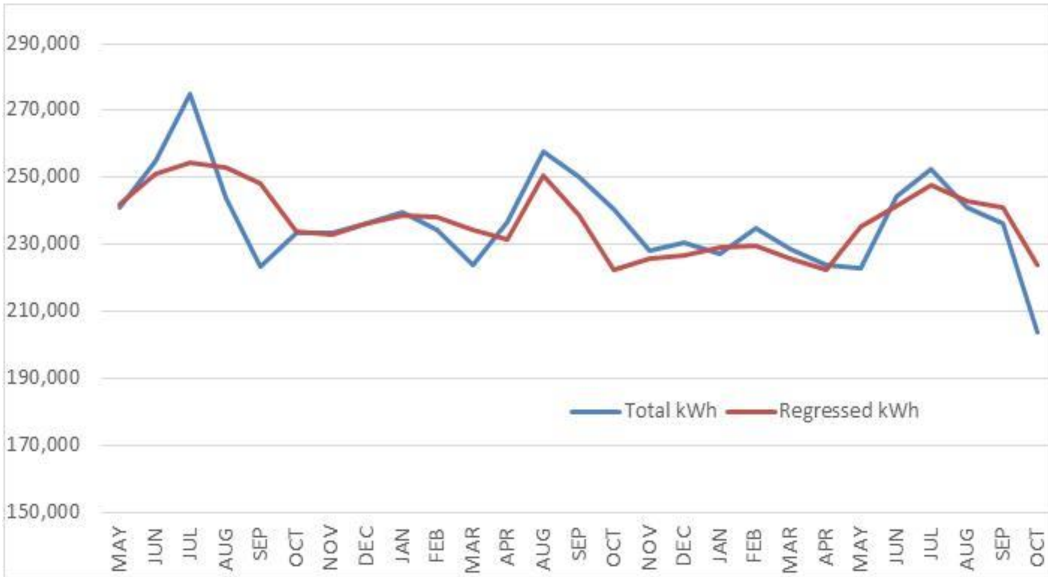
Building 9: Trended Vs. Regressed Monthly kWh

Building 10 & 11: Trended Vs. Regressed Monthly kWh

Building 12: Trended Vs. Regressed Monthly kWh



Building 13: Trended Vs. Regressed Monthly kWh



Building 14: Trended Vs. Regressed Monthly kWh

Building 15: Trended Vs. Regressed Monthly kWh

Measure-level Gross Savings Results

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for Retro Commissioning

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*	*ADM Calculated Ex Post*
Building 1	296,910			221,357
Building 2	612,439			582,154
Building 3	424,188			313,156
Building 4	401,458			457,761
Building 5	272,494			318,511
Building 6	129,994			90,817
Building 7	730,561			185,312
Building 8	174,577			1,485,636
Building 9	135,388			144,158
Building 10 & 11	441,200			262,559
Building 12	124,997			200,621
Building 13	313,905			96,740

Measure	Annual Gross kWh Savings			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Building 14	161,030			281,326
Building 15	836,776			1,429,374
Total RCx	5,055,917			6,069,210

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*
Custom	RCx	5,055,917	6,069,210	120%	692.83
Total		5,055,917	6,069,210	120%	***692.83***

The electric realization rate is 120%. The ex-ante estimated savings were based on the square feet of the buildings retro-commissioned multiplied by an energy savings factor based on historical projects. There was one building that significantly exceeded the ex-ante savings. The scope of work included removal of inefficient chillers and piping to the chilled water loop from the physical plant, and complete conversion of pneumatic controls to DDC (digital) controls, along with the installation of variable frequency drives.

Name S-69B

Executive Summary

Under project S-69B, the applicant received Standard Program incentives from Illinois Department of Commerce for lighting retrofit project. The realization rate for this project is 75%.

Project Description

The customer performed the following retrofit across 39 project sites:

- (2801) 4' T8 lamps with reduced watt 4' T8 lamps
- (30) 3' T8 lamps with reduced watt 3' T8 lamps
- (29) 2' T8 lamps with reduced watt 2' T8 lamps
- (50) 8' T8 lamps with reduced watt 8' T8 lamps
- (33) 4' T12 Lamps removed (delamped)
- (18) U-Shaped T12 to U-Shaped T8
- (94) Exterior LED fixture retrofit
- (218) LED Exit Sign retrofit
- (91) Bi-Level Occupancy Sensor Lighting controls added to exterior fixtures

Methodology for Estimating Gross Savings.

ADM staff inspected project documentation pertaining to the lighting retrofit.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2, 4.5.3, 4.5.4, 4.5.5, and 4.5.13. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Annual kWh Savings for Lighting Retrofit

Location	*Measure*	*Calculation Inputs*						*Annual Gross kWh Savings*	
		QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*
69-A	Reduced Watt T8	122	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	28,766	16,247
	Reduced Watt T8	56	TRM = 164 ADM = 168	TRM = 94 ADM = 96	3,540	1	1.14		15,820
	Reduced Watt T8	8	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	1,534	1,065
	Reduced Watt T8	8	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		1,065
69-B	LED Exit Sign	7	TRM = 23	TRM = 2	8,766	N/A	1.14	1,469	1,469
69-C	LED Exit Sign	33	TRM = 23	TRM = 2	8,766	N/A	1.14	6,925	6,925
69-D	LED Exit Sign	31	TRM = 23	TRM = 2	8,766	N/A	1.14	6,506	6,506
69-E	LED Exit Sign	11	TRM = 23	TRM = 2	8,766	N/A	1.14	2,308	2,308
69-F	LED Exit Sign	65	TRM = 23	TRM = 2	8,766	N/A	1.14	13,641	13,641
69-G	LED Exit Sign	71	TRM = 23	TRM = 2	8,766	N/A	1.14	16,789	14,900
69-H	Delamping	10	TRM =33.7 ADM = 42	TRM = 0 ADM = 0	3,540	1	1	1,090	1,193
	Reduced Watt T8	118	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1	15,701	13,785
	Reduced Watt T8	11	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1		2,726
69-I	Delamping	7	TRM =33.7 ADM = 42	TRM = 0 ADM = 0	3,540	1	1	870	835
	Reduced	2	TRM = 40	TRM = 25	3,540	1	1.14	10,100	121

Location	*Measure*	*Calculation Inputs*						*Annual Gross kWh Savings*	
		QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated Ex Post*
	Watt T8		ADM = 42	ADM = 25					
	Reduced Watt T8	2	TRM = 122 ADM = 126	TRM = 72 ADM = 73	3,540	1	1.14		404
	Reduced Watt T8	25	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		3,329
	Reduced Watt T8	25	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		7,062
69-J	Reduced Watt T8	1	TRM = 40 ADM = 42	TRM = 25 ADM = 25	3,540	1	1.14	11,954	61
	Reduced Watt T8	41	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		5,460
	Reduced Watt T8	26	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		7,345
69-K	Reduced Watt T8	36	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	9,205	4,794
	Reduced Watt T8	18	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		5,085
69-L	Reduced Watt T8	9	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	3,963	1,199
	Reduced Watt T8	11	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		3,107
69-M	Reduced Watt T8	80	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	10,484	10,654
	Reduced Watt T8	1	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		282
	Reduced Watt T8	30	TRM = 48 ADM = 63	TRM = 25 ADM = 36	3,540	1	1.14	2,876	2,785
69-N	Reduced Watt T8	1	TRM = 40 ADM = 42	TRM = 25 ADM = 25	3,540	1	1.14	6,201	61
	Reduced Watt T8	48	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		6,392
69-O	Reduced Watt T8	4	TRM = 40 ADM = 42	TRM = 25 ADM = 25	3,540	1	1.14	13,296	242
	Reduced Watt T8	102	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		13,584
69-P	Reduced Watt T8	55	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	7,032	7,325
69-Q	Reduced Watt T8	20	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	2,557	2,663
69-R	Reduced Watt T8	16	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	2,046	2,131
	Reduced Watt T8	2	TRM = 122 ADM =237	TRM = 72 ADM =185	3,540	1	1.14	8,407	404
	Reduced Watt T8	27	TRM = 122 ADM =237	TRM = 72 ADM =185	3,540	1	1.14		5,448
	Reduced Watt T8	1	TRM = 182 ADM =474	TRM = 94 ADM =370	3,540	1	1.14		355
69-S	Reduced Watt T8	1	TRM = 40 ADM = 42	TRM = 25 ADM = 25	3,540	1	1.14	959	61
	Reduced Watt T8	7	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		932
69-T	Delamping	16	TRM =33.7 ADM = 42	TRM = 0 ADM = 0	3,540	1	1	1,745	1,909

Location	*Measure*	*Calculation Inputs*						*Annual Gross kWh Savings*	
		QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHFe-IF*	*Ex Ante*	*TRM-Calculated* / *Ex Post*
	Reduced Watt T8	8	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1	1,009	935
	Reduced Watt T8	1	TRM = 139 ADM =133	TRM = 94 ADM = 98	3,540	1	1		159
	Reduced Watt T8	7	TRM = 122 ADM =237	TRM = 72 ADM =185	3,540	1	1	1,665	1,239
69-U	Reduced Watt T8	49	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1	8,808	7,399
69-V	Reduced Watt T8	6	TRM = 164 ADM =168	TRM = 94 ADM = 96	4,576	1	1	6,831	1,922
	Reduced Watt T8	26	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1		3,926
69-W	Reduced Watt T8	19	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,746	1	1.16	5,058	3,452
	Reduced Watt T8	5	TRM = 164 ADM =168	TRM = 94 ADM = 96	4,746	1	1.16		1,927
69-X	Reduced Watt T8	12	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1	5,573	1,812
	Reduced Watt T8	1	TRM = 139 ADM =133	TRM = 94 ADM = 98	4,576	1	1		206
	Reduced Watt T8	9	TRM = 164 ADM =168	TRM = 94 ADM = 96	4,576	1	1		2,883
	Reduced Watt T8	2	TRM = 122 ADM =237	TRM = 72 ADM =185	4,576	1	1	4,957	458
	Reduced Watt T8	11	TRM = 122 ADM =237	TRM = 72 ADM =185	4,576	1	1		2,517
69-Y	Reduced Watt T8	2	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1	449	302
	Reduced Watt T8	1	TRM = 40 ADM = 42	TRM = 25 ADM = 25	4,576	1	1		69
69-Z	Reduced Watt T8	20	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14	5,881	5,650
	Reduced Watt T8	6	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		799
69-AA	Reduced Watt T8	30	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	7,927	3,995
	Reduced Watt T8	16	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		4,520
69-BB	Reduced Watt T8	13	TRM = 122 ADM =126	TRM = 72 ADM = 73	3,540	1	1.14	5,306	2,623
	Reduced Watt T8	11	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		3,107
69-CC	Reduced Watt T8	3	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1	15,639	453
	Reduced Watt T8	42	TRM = 164 ADM =168	TRM = 94 ADM = 96	4,576	1	1		13,453
69-DD	Reduced Watt T8	3	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1	15,639	453
	Reduced Watt T8	42	TRM = 164 ADM =168	TRM = 94 ADM = 96	4,576	1	1		13,453
69-EE	Reduced Watt T8	54	TRM = 164 ADM =168	TRM = 94 ADM = 96	4,576	1	1	19,414	17,297
69-FF	Reduced	15	TRM = 82	TRM = 49	4,576	1	1	2,696	2,265

Location	Measure	Calculation Inputs						Annual Gross kWh Savings	
		QTY	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe-IF	Ex Ante	TRM-Calculated Ex Post
	Watt T8		ADM = 84	ADM = 48					
69-GG	Reduced Watt T8	8	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1	1,438	1,208
69-HH	Reduced Watt T8	772	TRM = 40 ADM = 42	TRM = 25 ADM = 25	3,540	1	1.14	49,925	46,732
	Reduced Watt T8	5	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		666
69-II	Reduced Watt T8	37	TRM = 40 ADM = 42	TRM = 25 ADM = 25	3,540	1	1.14	63,860	2,240
	Reduced Watt T8	393	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		52,338
	Reduced Watt T8	44	TRM = 164 ADM =168	TRM = 94 ADM = 96	3,540	1	1.14		12,430
	Reduced Watt T8	1	TRM = 40 ADM = 42	TRM = 25 ADM = 24	3,540	1	1.14	64	61
69-JJ	Reduced Watt T8	45	TRM = 40 ADM = 42	TRM = 25 ADM = 25	4,576	1	1.24	23,998	3,830
	Reduced Watt T8	111	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1.24		20,785
	Reduced Watt T8	7	TRM = 32 ADM = 21	TRM = 25 ADM = 13	4,576	1	1.24	404	278
	Reduced Watt T8	1	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1.24		187
69-KK	Reduced Watt T8	29	TRM = 40 ADM = 42	TRM = 25 ADM = 25	4,576	1	1.24	17,527	2,468
	Reduced Watt T8	84	TRM = 82 ADM = 84	TRM = 49 ADM = 48	4,576	1	1.24		15,729
69-LL	Reduced Watt T8	32	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14	4,539	4,262
	Reduced Watt T8	7	TRM = 40 ADM = 42	TRM = 25 ADM = 25	3,540	1	1.14		424
	Reduced Watt T8	2	TRM = 57 ADM = 63	TRM = 25 ADM = 37	3,540	1	1.14	1,406	258
	Reduced Watt T8	9	TRM = 82 ADM = 84	TRM = 49 ADM = 48	3,540	1	1.14		1,199
	Reduced Watt T8	10	TRM = 40 ADM = 42	TRM = 25 ADM = 24	3,540	1	1.14		605
69-MM	Occupancy Controlled Bi-Level Lighting Fixtures*	N/A	N/A	N/A	N/A	N/A	N/A	172,415	0
	LED Bulb & Fixtures	40	TRM=361.4 ADM = 455	TRM=116.8 ADM = 105	4,903	1	1	58,980	47,971
	LED Bulb & Fixtures	21	TRM=361.4 ADM = 215	TRM=116.8 ADM = 138	4,903	1	1		25,185
	LED Bulb & Fixtures	19	TRM = 0 ADM = 0	TRM=116.8 ADM = 91	4,903	1	1		(10,881)
	LED Bulb & Fixtures	14	TRM = 0 ADM = 0	TRM = 18.6 ADM = 29	4,903	1	1		(1,277)
								687,832	***515,651***

ADM savings is calculated based on actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours rather than TRM assumed values. TRM 3.0 stipulates an ISR of 1.0 for measure HP & RW T8 Fixtures and Lamps (4.5.3) if documentation supporting complete installation is provided.

*Ex post savings value for this measure is zero. Applicant erroneously claimed an incentive for bi-level fixtures rather than occupancy sensors. As there is no measure for exterior occupancy sensors in the Illinois TRM version 3.0, the ex post value is 0.

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	*Project Location*	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
Standard	69-A	4.5.3	28,766	32,067	111%	6.67	15	243,710	N/A	N/A
		4.5.3	1,534	2,131	139%	0.44	15	15,981	N/A	N/A
	69-B	4.5.5	1,469	1,469	100%	0.12	16	23,504	N/A	N/A
	69-C	4.5.5	6,925	6,925	100%	0.58	16	110,805	N/A	N/A
	69-D	4.5.5	6,506	6,506	100%	0.55	16	104,090	N/A	N/A
	69-E	4.5.5	2,308	2,308	100%	0.19	16	36,935	N/A	N/A
	69-F	4.5.5	13,641	13,641	100%	1.15	16	218,252	N/A	N/A
	69-G	4.5.5	16,789	14,900	89%	1.25	16	238,399	N/A	N/A
	69-H	4.5.2	1,090	1,193	109%	0.34	11	13,123	N/A	N/A
		4.5.3	15,701	16,511	105%	4.66	15	206,771	N/A	N/A
	69-I	4.5.2	870	835	96%	0.24	11	9,186	N/A	N/A
		4.5.3	10,100	10,916	108%	2.27	15	1,816	N/A	N/A
	69-J	4.5.3	11,954	12,865	108%	2.68	15	908	N/A	N/A
	69-K	4.5.3	9,205	9,879	107%	2.06	15	71,914	N/A	N/A
	69-L	4.5.3	3,963	4,306	109%	0.9	15	17,979	N/A	N/A
	69-M	4.5.3	10,484	10,936	104%	2.28	15	159,810	N/A	N/A
		4.5.3	2,876	2,785	97%	0.58	15	41,768	N/A	N/A
	69-N	4.5.3	6,201	6,453	104%	1.34	15	908	N/A	N/A
	69-O	4.5.3	13,296	13,826	104%	2.88	15	3,632	N/A	N/A

Incentive Type	Project Location	Measure Category	Annual Gross Savings				Lifetime Gross Savings		Spillover	
			Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Measure Life (yrs)	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
	69-P	4.5.3	7,032	7,325	104%	1.52	15	109,869	N/A	N/A
	69-Q	4.5.3	2,557	2,663	104%	0.55	15	39,952	N/A	N/A
	69-R	4.5.3	2,046	2,131	104%	0.44	15	31,962	N/A	N/A
		4.5.3	8,407	6,207	74%	1.29	15	6,053	N/A	N/A
	69-S	4.5.3	959	993	104%	0.21	15	908	N/A	N/A
	69-T	4.5.2	1,745	1,909	109%	0.54	11	20,996	N/A	N/A
		4.5.3	1,009	1,094	108%	0.31	15	14,018	N/A	N/A
		4.5.3	1,665	1,239	74%	0.35	15	18,585	N/A	N/A
	69-U	4.5.3	8,808	7,399	84%	1.07	15	110,991	N/A	N/A
	69-V	4.5.3	6,831	5,848	86%	0.84	15	28,829	N/A	N/A
	69-W	4.5.3	5,058	5,379	106%	0.8	15	51,778	N/A	N/A
	69-X	4.5.3	5,573	4,901	88%	0.71	15	27,181	N/A	N/A
		4.5.3	4,957	2,974	60%	0.43	15	6,864	N/A	N/A
	69-Y	4.5.3	449	371	83%	0.05	15	4,530	N/A	N/A
	69-Z	4.5.3	5,881	6,449	110%	1.34	15	84,748	N/A	N/A
	69-AA	4.5.3	7,927	8,515	107%	1.77	15	59,929	N/A	N/A
	69-BB	4.5.3	5,306	5,731	108%	1.19	15	39,347	N/A	N/A
	69-CC	4.5.3	15,639	13,906	89%	2.01	15	6,795	N/A	N/A
	69-DD	4.5.3	15,639	13,906	89%	2.01	15	6,795	N/A	N/A
	69-EE	4.5.3	19,414	17,297	89%	2.12	15	259,459	N/A	N/A
	69-FF	4.5.3	2,696	2,265	84%	0.33	15	33,977	N/A	N/A
	69-GG	4.5.3	1,438	1,208	84%	0.17	15	18,121	N/A	N/A
	69-HH	4.5.3	49,925	47,398	95%	9.87	15	700,984	N/A	N/A
	69-II	4.5.3	63,860	67,007	105%	13.95	15	33,596	N/A	N/A
		4.5.3	64	61	95%	0.01	15	908	N/A	N/A
	69-JJ	4.5.3	23,998	24,615	103%	4.18	15	57,452	N/A	N/A

Incentive Type	*Project Location*	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*		*Spillover*	
			Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Measure Life (yrs)*	*Ex Post kWh*	*Annual kWh Savings*	*Annual Peak kW Reduction*
		4.5.3	404	465	115%	0.08	15	4,171	N/A	N/A
	69-KK	4.5.3	17,527	18,197	104%	3.09	15	37,024	N/A	N/A
	69-LL	4.5.3	4,539	4,685	103%	0.98	15	63,924	N/A	N/A
		4.5.3	1,406	2,062	147%	0.43	15	3,874	N/A	N/A
	69-MM	4.5.13	172,415	0	0%	0	N/A	0	N/A	N/A
		4.5.4	58,980	60,998	103%	0	15	719,564	N/A	N/A
Total			***687,832***	***515,651***	***75%***	***83.816***		***7,764,772***		

*ADM calculated savings use factors for actual efficient watts, actual or TRM adjusted baseline watts, actual quantities and verified hours. The ADM savings is used when the TRM savings factors did not align with the installed equipment. TRM calculated ex post values are used if errata corrected values are not applicable.

The realization rate for this project is 75%.

In order to calculate an accurate kWh savings value, the analysis is calculated using TRM assumed values closest to the wattages of the actual fixtures. Differences between this wattage and the assumed wattages used to calculate kWh savings account for some variation in the realization rates for this project.

Site-specific issues resulting in the low project realization rate are discussed below.

Site 69-A included two measures. The first measure, 4ft T12 to T8 (4.5.3) had a realization rate of 111%. The second measure, 2ft T12 to T8 (4.5.3) had a realization rate of 139%. The 111 E. Green Street application materials combined both 2’ T8 and 2’ U-shaped T8 in the same line item. U-Shaped 2’ 2LT8 fixtures were incorrectly incentivized as 2’ 2LT8 resulting in a high realization rate.

Sites 69-B, 69-C, 69-D, 69-E, and 69-F included one measure each. The measure LED Exit Signs (4.5.5) had a realization rate of 100% at each location.

Site 69-G included one measure. The measure LED Exit Signs (4.5.5) had a realization rate of 89%. The 69-G site was incentivized for retrofitting 80 existing exit signs with LED exit signs. However, only 71 exit signs were retrofitted. This difference in quantity resulted in a low realization rate.

Site 69-H included two measures. The first measure, 4ft Fluorescent Lamp Delamping (4.5.2) had a realization rate of 109%. The second measure, 4ft T12 to T8 (4.5.3) had a realization rate of 105%. For measure 4.5.2, the difference between the actual and TRM assumed wattage for the baseline lamps accounts for the high realization rate.

Site 69-I included two measures. The first measure, 4ft Fluorescent Lamp Delamping (4.5.2) had a realization rate of 96%. The second measure, 4ft T12 to T8 (4.5.3) had a realization rate of 108%. For measure 4.5.2, the difference between the actual and TRM assumed wattage for the baseline lamps accounts for the high realization rate. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-J included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 108%. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-K included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 107%. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-L included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 109%. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-M included two measures. The first measure, 4ft T12 to T8 (4.5.3) had a realization rate of 104%. The second measure, 3ft T12 to T8 (4.5.3) had a realization rate of 97%.

Site 69-N included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 104%.

Site 69-O included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 104%.

Site 69-P included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 104%.

Site 69-Q included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 104%.

Site 69-R included two measures. The first measure, 4ft T12 to T8 (4.5.3) had a realization rate of 104%. The second measure, 8ft T12 to T8 (4.5.3) had a realization rate of 74%. For measures incentivized under 4.5.3 8’ lamps the assumed wattage used to calculate kWh was not the closest to the actual wattage. The difference accounts for the low realization rate for this measure.

Site 69-S included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 104%.

Site 69-T included three measures. The first measure, 4ft Fluorescent Lamp Delamp (4.5.2) had a realization rate of 109%. The second measure, 4ft T12 to T8 (4.5.3) had a realization rate of 108%. The third measure, 8ft T12 to T8 (4.5.3) had a realization rate of 74%. For measures incentivized under 4.5.3 8' lamps the assumed wattage used to calculate kWh was not the closest to the actual wattage. The difference accounts for the low realization rate for this measure. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings. For measure 4.5.2, the difference between the actual and TRM assumed wattage for the baseline lamps accounts for the high realization rate.

Site 69-U included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 84%. This site was incentivized as a miscellaneous cooled building. However, according to a previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-V included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 86%. This site was incentivized as a miscellaneous cooled building. However, according to a previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-W included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 106%. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-X included two measures. The first measure, 4ft T12 to T8 (4.5.3), had a realization rate of 88%. The second measure, 8ft T12 to T8 (4.5.3) had a realization rate of 60%. This site was incentivized as a miscellaneous cooled building. However, according to a previous site visit the building is uncooled. This resulted in a low realization rate. For measures incentivized under 4.5.3 8' lamps the assumed wattage used to calculate kWh was not the closest to the actual wattage. The difference accounts for the low realization rate for this measure.

Site 69-Y included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 83%. This site was incentivized as a miscellaneous cooled building. However, according to a previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-Z included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 110%. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-AA included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 107%. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-BB included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 108%. The high realization rate for measure 4.5.3 is due to differences between the assumed fixture wattage closest to the actual fixture wattage, and the assumed wattages used to calculate kWh savings.

Site 69-CC included one measure. The measure 4ft T12 to T8(4.5.3) had a realization rate of 89%. This site was incentivized as a miscellaneous cooled building. However, according to a previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-DD included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 89%. This site was incentivized as a miscellaneous cooled building. However, according to a previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-EE included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 89%. This site was incentivized as a miscellaneous cooled building. However, according to a previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-FF included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 84%. This site was incentivized as a miscellaneous cooled building. However, according to previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-GG included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 84%. This site was incentivized as a miscellaneous cooled building. However, according to previous site visit the building is uncooled. This resulted in a low realization rate.

Site 69-HH included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 95%.

Site Evans Hall (13443) included two measures. The first measure, 4ft T12 to T8 (4.5.3), had a realization rate of 105%. The second measure, 2ft T12 to T8 (4.5.3) had a realization rate of 95%.

Site 69-JJ included two measures. The first measure, 4ft T12 to T8 (4.5.3), had a realization rate of 103%. The second measure, 2ft T12 to T8 (4.5.3), had a realization rate of 115%. The Student Staff Apt application materials combined both 2’ T8 and 2’ U-shaped T8 in the same line item. U-Shaped 2’ 2LT8 fixtures were incentivized as 2’ 2LT8 resulting in a high realization rate.

Site 69-KK included one measure. The measure 4ft T12 to T8 (4.5.3) had a realization rate of 104%.

Site 69-LL included two measures. The first measure, 4ft T12 to T8 (4.5.3) had a realization rate of 103%. The second measure, 2ft T12 to T8 (4.5.3) had a realization rate of 147%. The Sherman Hall application materials combined both 2’ T8 and 2’ U-shaped T8 in the same line item. U-Shaped 2’ 2LT8 fixtures were incentivized as 2’ 2LT8 resulting in a high realization rate. The kWh calculation for measure 4.5.3 was not based on the TRM assumed wattage closest to the actual wattage. This resulted in a high realization rate

Site 69-MM included two measures. The first measure, Occupancy Controlled Bi-Level Lighting Fixtures (4.5.13), had a realization rate of 0%. The second measure, Retrofit Exterior LED fixture (4.5.4), had a realization rate of 103%. 69-MM was listed as miscellaneous in the database and in the application materials. The correct classification is exterior. The total LED fixtures listed in the application and database for 69-MM does not match the actually installed LED fixture totals. The applicant for project site 69-MM erroneously applied for an incentive for Occupancy Controlled Bi-Level Lighting Fixtures. This measure only applies to bi-level lighting fixtures that are on 24 hours a day. The applicant did not install this type of equipment, and should not have received a rebate. The realization rate for this measure was 0%.

Name SC-70

Executive Summary

Under project SC-70, the applicant received Custom and Standard Program incentives from the Illinois Department of Commerce for a lighting and HVAC retrofit project. The realization rates for this project are 81% for the electric measures and 83% for the natural gas measures.

Project Description

The customer performed the following retrofit:

- (54) Exit Signs with LED Exit Signs
- (604) 4' T12 lamps with (716) 4' T8 Lamps
- Installed (40) wall mounted occupancy sensors
- (2) Lochinvar commercial condensing water heaters
- (2) Daikin centrifugal chillers
- (5) Fulton Vantage condensing hot water boilers
- (7) VFDs on return fans (RF 2-6, 9, & 12)
- (10) VFDs on supply fans (SF 1-9 & 12)
- (2) VFDs on cooling tower fans (CTFs)
- (2) VFDs on condenser water pumps (CWPs)
- (3) VFDs on dual temperature water pumps (DTWPs)
- (6) Daikin 12 ton rooftop units (RTUs 1-5, 9, & 10)
- (1) Daikin 7.5 ton rooftop unit

Methodology for Estimating Gross Savings

ADM staff inspected project documentation pertaining to the lighting and HVAC retrofits.

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.3, 4.5.5, and 4.5.10. Algorithms pertaining to savings calculations are presented below.

Standard Incentives

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$ = input wattage of the existing system

$Watts_{EE}$ = new input wattage of EE fixture

WHF_e = waste heat factor to account for cooling energy savings

ISR = In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd = waste heat factor to account for cooling demand savings

CF = Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled = total lighting load connected to the control in kilowatts

ESF = Energy Savings Factor

WHFe = waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd = heat factor to account for cooling demand savings

CFbaseline = Baseline Summer Peak Coincidence Factor

CFos = Retrofit Summer Peak Coincidence Factor

For the supply and return fan and dual temperature water pump VFDs, TRM Version 3.0 Section 4.4.17 Variable Speed Drives for HVAC was used. Algorithms pertaining to savings calculations are presented below:

ELECTRIC ENERGY SAVINGS FOR VSD

ΔkWH = $kW_{Connected}$* Hours * ESF

Where:

$kW_{Connected}$ = kW of equipment is calculated using motor efficiency.

(HP * .746 kw/hp* load factor)/motor efficiency

Motors are assumed to have a load factor of 80% for calculating KW if actual values cannot be determined, custom load factor may be applied if known. Actual motor efficiency shall be used to calculate KW. If not known a default value of 93% shall be used.

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type. When available, actual hours should be used.

ESF = Energy savings factor varies by VFD application.

Application	ESF
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

SUMMER COINCIDENT PEAK DEMAND SAVINGS FOR VSD

ΔkW = $kW_{Connected}$ * DSF

Where:

DSF = Demand Savings Factor varies by VFD application. Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

Application	DSF
Hot Water Pump	0
Chilled Water Pump	0.299
Constant Volume Fan	0.348
Air Foil/inlet Guide Vanes	0.13
Forward Curved Fan, with discharge dampers	0.136
Forward Curved Inlet Guide Vanes	0.03
Custom Process	custom

For the high efficiency package units, the erratum TRM Version 4.0 Section 4.4.15 Single-Package and Split System Unitary Air Conditioners was used.

ELECTRIC ENERGY SAVINGS

For units with cooling capacities less than 65 kBtu/h:

ΔkWH = (kBtu/h) * [(1/$SEER_{base}$) – (1/$SEER_{ee}$)] * EFLH

For units with cooling capacities equal to or greater than 65 kBtu/h:

ΔkWH = (kBtu/h) * [(1/EER_{base}) – (1/EER_{ee})] * EFLH

Where:

kBtu/h = capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).

$SEER_{base}$ = Seasonal Energy Efficiency Ratio of the baseline equipment; see table

$SEER_{ee}$ = Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).

EER_{base} = Energy Efficiency Ratio of the baseline equipment; see table above for default values. Since IECC 2006 does not provide EER requirements for air-cooled air conditioners < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1

EER_{ee} = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EER_{ee} is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.

= Actual installed

EFLH = cooling equivalent full load hours; see table

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW_{SSP} = (kBtu/h * (1/EER_{base} - 1/EER_{ee})) * CF_{SSP}

Where:

CF_{SSP} = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3%

For the condensing hot water heaters, TRM Version 3.0 Section 4.3.5 Tankless Water Heater was used.

NATURAL GAS SAVINGS

ΔTherms=[[Wgal x 8.33 x 1 x (Tout - Tin) x [(1/Eff base) - (1/Eff ee)]]/100,000] +[[(SL x 8,766)/Eff base]] / 100,000 Btu/Therms]

Where:

Wgal = Annual water use for equipment in gallons

= custom, otherwise assume 21,915 gallons [90]

8.33 lbm/gal = weight in pounds of one gallon of water

1 Btu/lbm°F = Specific heat of water: 1 Btu/lbm/°F

8,766 hr/yr = hours a year

Tout = Unmixed Outlet Water Temperature

= custom, otherwise assume 130 degree F[91]

Tin = Inlet Water Temperature

= custom, otherwise assume 54.1 degree F[92]

Eff base = Rated efficiency of baseline water heater expressed as Energy Factor (EF) or Thermal Efficiency (Et); see table below[93]

Input Btuh of existing, tanked water heater	Eff base	Units
Size: ≤ 75,000 Btu/h	0.67 - 0.0019*Tank Volume	Energy Factor
Size: >75,000 Btu/h and ≤ 155,000 Btu/h	80%	Thermal Efficiency
Size: >155,000 Btu/h	80%	Thermal Efficiency

Where Tank Volume = custom input, if unknown assume 60 gallons for Size: ≤ 75,000 Btu/h

Please note: Units in base case must match units in efficient case. If Energy Factor used in base case, Energy Factor to be used in efficient case. If Themal Efficiency is used in base case, Thermal Efficiency must be used in efficient case.

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[90] 21,915 gallons is an estimate of 60 gal/day for 365.25 days/yr. If building type is known, reference 2007 ASHRAE Handbook HVAC Applications p. 49.14 Table 7 Hot Water Demands and Use for Various Types of Buildings to help estimate hot water consumption.

[91] Based on 2010 Ohio Techical Reference Manual and NAHB Research Center, (2002) Performance Comparison of Residential hot Water Systems. Prepared for National Renewable Energy Laboratory, Golden, Colorado.

[92] August 31, 2011 Memo of Savings for Hot Water Savings Measures to Nicor Gas from Navigant states that 54.1°F was calculated from the weighted average of monthly water mains temperatures reported in the 2010 Building America Benchmark Study for Chicago-Waukegan, Illinois.

[93] IECC 2012, Table C404.2, Minimum Performance of Water-Heating Equipment

Eff ee = Rated efficiency of efficient water heater expressed as Energy Factor (EF) or Thermal Efficiency (Eff t)

= custom input, if unknown assume 0.84[94]

SL = Stand-by Loss in Base Case Btu/hr

= custom input based on formula in table below, if unknown assume unit size in table below[95]

Input Btu/h of new, tankless water heater	Standby Loss (SL)
Size: ≤ 75,000 Btu/h	0
Size: >75,000 Btu/h	(Input rating/800)+(110*√Tank Volume))

Where:

Tank Volume = custom input, if unknown assume, 60 gallons for <75,000 Btu/hr, 75 gallons for >75,000 Btu/h and ≤ 155,000 Btu/h and 150 for Size >155,000 Btu/h

Input Value = nameplate Btu/hr rating of water heater

Custom Incentives

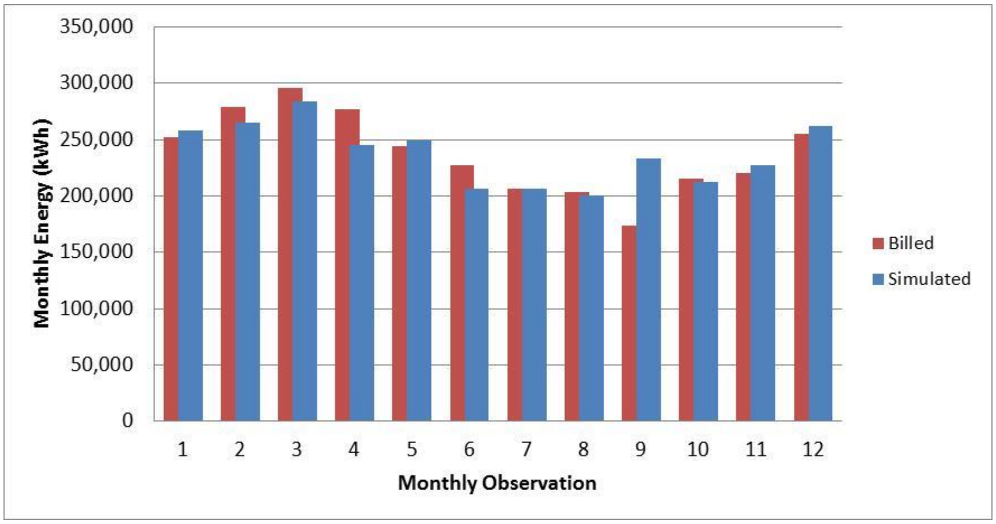
Energy savings for the custom measures were calculated using an eQuest model. ADM compiled a model of the baseline facility using the details and construction documents collected during the on-site M&V visit and from the project documentation.

Upon completion of the initial model, a custom weather file was created using 2013 NOAA weather data for the region. Using this weather file and the utility provided billing data for the school; ADM ensured that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

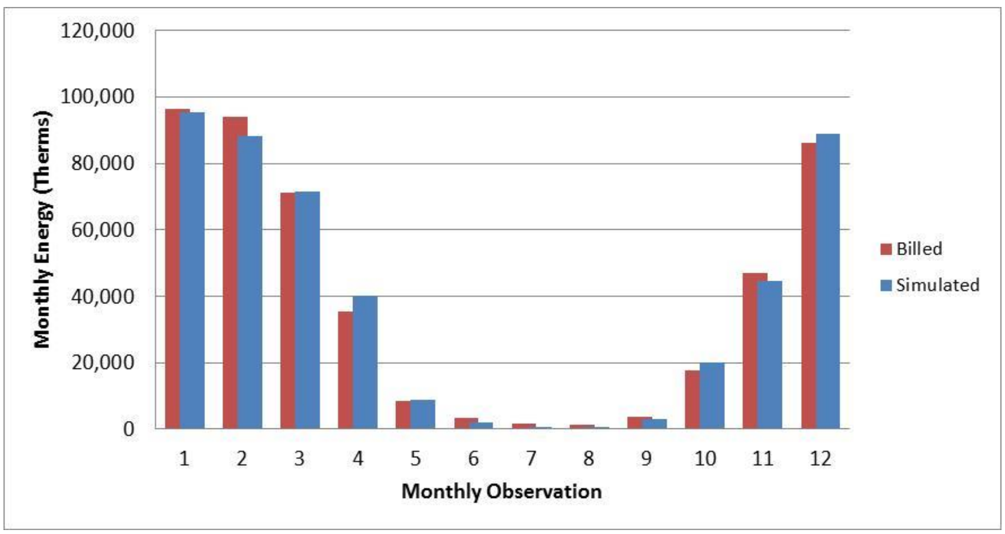
[94] Specifications of energy efficient tankless water heater. Reference Consortium for Energy Efficiency (CEE) which maintains a list of high efficiency tankless water heaters which currently have Energy Factors up to .96. Ameren currently requires minimum .82 energy factor.

[95] Stand-by loss is provided 2012 International Energy Conservation Code (IECC2012), Table C404.2, Minimum Performance of Water-Heating Equipment

2013 Monthly kWh Calibration



2013 Monthly Natural Gas 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 run using Chicago Midway TMY3 weather data. The realized energy savings are the differences between the baseline and as-built models' energy usages.

Measure-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit, along with the numeric values of inputs to the savings calculation equation.

Standard Incentives

Annual kWh Savings for Lighting Retrofit

Measure	*Calculation Inputs*						*Annual Gross kWh Savings*	
	QTY	*Existing Wattage*	*Efficient Wattage*	*Hours*	*In-Service Rate*	*WHF e-IF*	*Ex Ante*	*TRM-Calculated Ex Post*
LED Exit Signs	Base = 54 EE = 54	TRM = 23 Actual = 23	TRM = 2 Actual = 5	TRM = 8,766 Actual = 8,766	1	1.23	12,227	12,227
LED Lamps and Fixtures	Base = 145 EE = 189	TRM = 82 Actual = 83	TRM = 49 Actual = 59	TRM = 4,311 Actual = 4,311	1	1.23	293,962	33,072
LED Lamps and Fixtures	Base = 411 EE = 459	TRM = 164 Actual = 162	TRM = 94 Actual = 59	TRM = 4,311 Actual = 4,311	1	1.23		170,370
LED Lamps and Fixtures	Base = 28 EE = 53	TRM = 182 Actual = 207	TRM = 94 Actual = 59	TRM = 4,311 Actual = 4,311	1	1.23		24,731
LED Lamps and Fixtures	Base = 20 EE = 15	TRM = 147 Actual = 144	TRM = 72 Actual = 89	TRM = 4,311 Actual = 4,311	1	1.23		5,965
Total							***306,189***	***246,366***

Annual kWh Savings for Lighting Controls

Measure	*Calculation Inputs*					*Annual Gross kWh Savings*	
	Qty	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Occupancy Sensor Lighting Control	40	50,734	4,311	0.41	1.23	110,298	110,298
Total						***110,298***	***110,298***

Annual kWh Savings for VFDs on Supply/Return Fans and Pumps

Measure	Measure Metrics					Annual Gross kWh Savings	
	Application	Program Type	Type	HP	Building Type	Ex Ante	TRM-Calculated Ex Post
Variable Speed Drives for HVAC	Air Foil/inlet Guide Vanes	TOS	HVAC	56.5	School(K-12)	18,252	18,132
Variable Speed Drives for HVAC	Air Foil/inlet Guide Vanes	TOS	HVAC	205.5	School(K-12)	123,644	65,947
Variable Speed Drives for HVAC	Dual Temp Water Pump	TOS	HVAC	225	School(K-12)	138,329	153,317
Total						280,225	237,396

Annual kWh Savings for High Efficiency HVAC Units

Measure	Measure Metrics							Annual Gross kWh Savings		
	Program Type	Building Type	Equipment type	Subcategory or rating Condition	New Cooling Capacity (kbtu/h)	SEER of Efficient Equipment	Zone	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Single-Package and Split System Unitary Air Conditioners	TOS	High School	Air conditioners, Air cooled	Single Package	144	13.31	2 (Chicago)	18,906	3,593	6,197
Single-Package and Split System Unitary Air Conditioners	TOS	High School	Air conditioners, Air cooled	Single Package	90	13.86	2 (Chicago)	2,302	434	749
Total								21,208	4,027	6,946

Annual kWh Savings for Chillers

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
Chillers	48,491			63,640
Total	48,491			63,640

Annual kWh Savings for VFDs on Condenser Water Pumps and Cooling Towers

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
CWP VFDs	41,157			547
CT VFDs	15,228			5,380
Total	56,385			5,927

Annual Therms Savings for Tankless Water Heaters

Measure	*Measure Metrics*				*Annual Gross Therm Savings*		
	Fuel Type	*Program Type*	*Output (Gpm) at delta T 70*	*Existing Input rating (btu/h)*	*Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*
Tankless Water Heater	*Gas*	*TOS*	*36*	*1,300,000*	*248*	*668*	
Total					248	668	

Custom Incentives

Annual Therms Savings for High Efficiency Boilers

Measure	Annual Gross Therms Savings			
	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post	ADM Calculated Ex Post
Boilers	45,968			37,609
Total	45,968			37,609

Summary of Project-Level Gross Realized Savings

The table below presents the realized gross energy savings of the lighting retrofit.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh
Standard	Single-Package and Split System Unitary Air Conditioners	21,208	6,946	33%	2.26	104,192
	Variable Speed Drives for HVAC	280,225	237,396	85%	65.03	3,560,938
	4.5.5	12,227	12,227	100%	0.10	195,632
	4.5.3	293,962	234,139	80%	3.78	3,512,078
	4.5.10	110,298	110,298	100%	5.13	1,102,976
	Chillers	48,491	63,640	131%	26.50	969,820
	CWP VFDs	41,157	547	1%	0.27	617,355
	CT VFDs	15,228	5,380	35%	2.57	228,420
Total		***822,796***	***670,573***	***81%***	***105.65***	***10,291,411***

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	Tankless Water Heater	248	668	269%	6,679
Subtotal		*248*	668	269%	6,679
Custom	Boilers	45,968	37,609	82%	752,180
Subtotal		*45,968*	37,609	82%	752,180
Total		***46,216***	***38,277***	***83%***	***758,859***

The electric measures have a combined realization rate of 81%. The combined natural gas realization rate is 83%.

The realization for the first measure (4.5.5) is 100%.

Based on algorithms in TRM 3.0 measure 4.5.3, the ex post savings for the second measure was 327 kWh per fixture, whereas the ex ante savings estimate was 411kWh per fixture.

Several factors resulted in the low realization rate for this measure. The difference between the base and efficient quantities, and the divergence between the number of watts of actually-implemented measures and the wattage of the prototypical measure identified in the TRM contribute to the difference between ex ante savings and ex post savings.

The realization rate for the third measure (4.5.10) is 100%.

The realization rate for the high efficiency HVAC units is 33%. The installed unit efficiencies were only slightly higher than the baseline.

The realization rate for the standard VFDs is 85%. The energy savings factor and hours used in the ex ante estimate are likely an average of building types.

The ex ante used standard TRM calculations for the chillers. Multiple chiller applications that serve the same cooling loop cannot be evaluated using the TRM. The 131% realization rate is the result of those calculations not accounting for the interactive effects and actual building operations.

The realization rate for the condenser water pump VFDs is 1%. The ex ante used standard TRM calculations. Condenser water pump VFDs are considered a custom measure. Standard calculations don’t have energy savings factors for condenser water pumps.

The realization rate for the cooling tower fan VFDs is 35%. The ex ante used standard TRM calculations. Cooling tower VFDs are considered a custom measure. Standard calculations don’t have energy savings factors for cooling tower fans.

The realization rate for the condensing hot water heaters is 269%. The installed water heaters were tankless. The ex ante estimate assumed storage water heaters.

The realization rate for the boilers is 82%. The ex ante used TRM calculations for the custom incentives. Five (5) new boilers replaced (4) old boilers. Since this isn't a direct replacement of boilers, ADM used a custom analysis. ADM did perform TRM calculations for the boilers as a way to triangulate savings, and the results were 35,429 therms saved (77% realization rate).

Name NC71

Executive Summary

Under application NC71, the customer received custom incentives from the Illinois Department of Commerce for above-code new construction. The realization rate for this project is 100%.

Project Description

During the construction and planning phase of the new building, the customer opted to build above ASHRAE 90.1-2007 minimum standards, which was the governing code during the time of the permit application process. The table below provides a summary of the code requirements and as-built construction details for the new building:

ASHRAE 90.1 2007 Vs As-Built Construction Details

Parameter	*ASHRAE 90.1 2007*	*As-Built*
Roof U-Factor	U-0.048	U-0.043
Exterior Wall U-Factor	U-0.090	U-0.033
Windows U-Factor	U-0.55	U-0.45
Windows SHGC	SHGC-0.40	SHGC-0.32
Lighting (LPD)	1.0 W/sf	0.70 W/sf
Cooling Efficiency	Existing plant	Existing plant plus heat recovery chiller
Heating Efficiency	Existing plant	Existing plant plus heat recovery chiller

**Note: Additional chilled and hot water are supplied from the campus central plant.

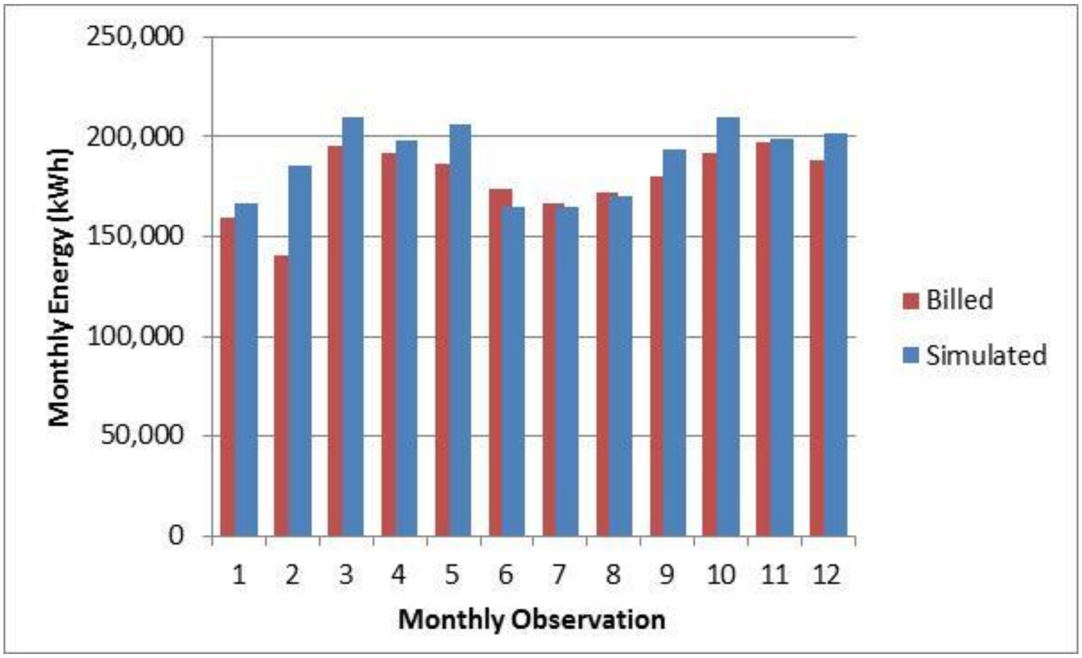
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the above-code measures. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational setpoints from the building’s energy management system.

Custom Incentives

Energy savings were calculated using a Trane Trace model. ADM reviewed the provided model of the as-built facility which used site specific details summarized in the SEDAC report. Upon completion of the review of the provided model, a custom weather file was created using NOAA weather data for the Champaign area. A monthly energy profile was created using the custom weather file and sub metered electrical billing data. ADM ensured that the model's energy load shape matched that of the bills. The results of this comparison can be seen below:

Monthly kWh Comparison



Upon verification of the calibrated as-built Trane Trace model, the baseline model with ASHRAE 90.1 2007 minimum standards was reviewed. Once the baseline model was verified, the baseline and as-built models were compared. The typical year annual savings is the difference between the two models' annual consumption.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for Above Code Construction

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
LEED New Construction	2,069,024	-	-	2,069,024
Total	2,069,024	-	-	2,069,024

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project:

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings			Lifetime Gross Savings
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post kWh
Custom	LEED New Construction	2,069,024	2,069,024	100%	31,035,360[96]
Total		***2,069,024***	***2,069,024***	***100%***	***31,035,360***

The project has an overall electric realization rate of 100%. ADM verified the provided Trane Trace model and concluded that it accurately represents the building in both the as-built and baseline configurations.

[96] The lifetime savings were calculated by multiplying typical first year savings by the expected useful life of 15 years. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls

Name NC72

Executive Summary

Under application NC72, the customer received custom incentives from the Illinois Department of Commerce for above-code construction of a new 170,298 ft^2 dormitory building. The electrical realization rate for this project is 100% and the natural gas realization rate for this project is 100%.

Project Description

During the construction and planning phase of the new dormitory building, the customer opted to build above ASHRAE 90.1-2007 minimum standards, which was the governing code during the time of the permit application process. The table below provides a summary of the code requirements and as-built construction details for the new dormitory building:

ASHRAE 90.1 2007 Vs As-Built Construction Details

Parameter	*ASHRAE 90.1 2007*	*As-Built*
Roof U-Factor	U-0.048	U-0.031
Exterior Wall U-Factor	U-0.090	U-0.048
Windows U-Factor	U-0.55	U-0.35
Windows SHGC	SHGC-0.40	SHGC-0.38
Lighting (LPD)	1.0 W/sf	0.60 W/sf for dormitory
		0.75 W/sf for corridor
Cooling Efficiency	Existing plant	Existing plant plus heat recovery chillers
Heating Efficiency	Existing plant	Existing plant plus heat recovery chillers

**Note: Additional chilled and hot water are supplied from the campus central plant.

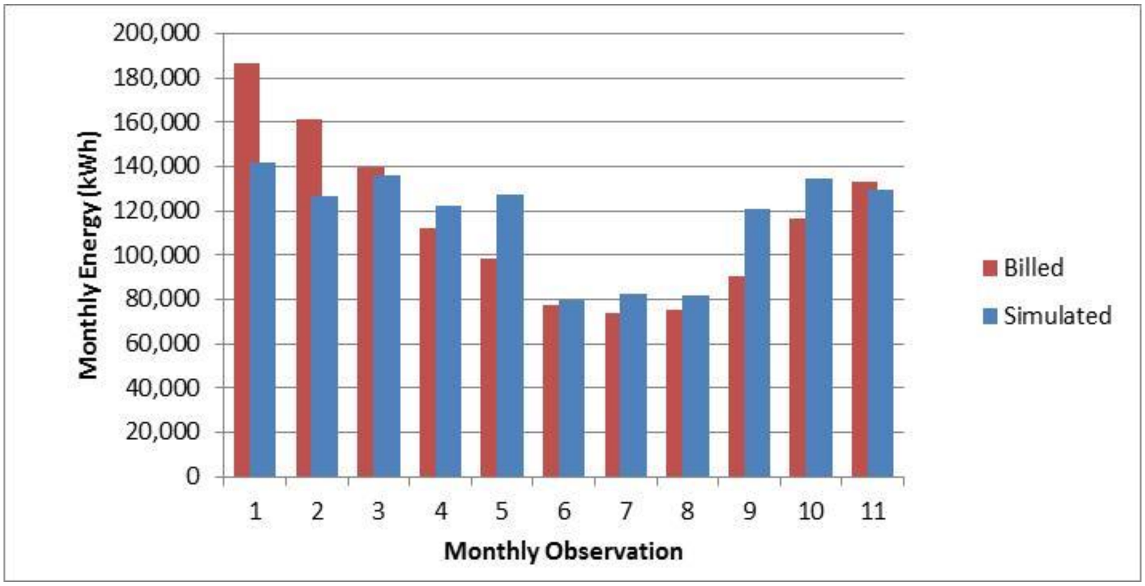
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the above-code measures. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts regarding typical facility operation and collected HVAC operational setpoints from the building's energy management system.

Custom Incentives

Energy savings were calculated using a Trane Trace model of the dormitory. ADM reviewed the provided model of the as-built facility which used site specific details and constructions summarized in the SEDAC LEED report. Upon completion of the review of the provided model, a custom weather file was created using NOAA weather data for the Champaign area. Using this weather file and sub metered electrical billing data for the facility; a monthly energy profile was created. ADM ensured that the model's energy load shape matched that of the bills. The results of this comparison can be seen below:

Monthly kWh Comparison



Upon verification of the calibration of the as-built Trane Trace model, the baseline model with ASHRAE 90.1 2007 minimum standards was reviewed. Once the baseline model was verified, the baseline and as-built models were compared. The typical year annual savings is the difference between the two models' annual consumption when ran using TMY3 weather data for the region.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for Above Code Construction

Measure	*Annual Gross kWh Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
LEED New Construction	1,274,900	-	-	1,274,900
Total	1,274,900	-	-	1,274,900

Annual Therms Savings for Above Code Construction

Measure	*Annual Gross Therm Savings*			
	Ex Ante	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
LEED New Construction	20,503	-	-	20,503
Total	20,503	-	-	20,503

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post kWh*
Custom	LEED New Construction	1,274,900	1,274,900	100%	19,123,500[97]
Total		***1,274,900***	1,274,900	***100%***	***19,123,500***

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	LEED New Construction	20,503	20,503	100%	307,545[98]
Total		***20,503***	***20,503***	***100%***	***307,545***

97 The lifetime savings were calculated by multiplying typical first year savings by the expected useful life of 15 years. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls

98 The lifetime savings were calculated by multiplying typical first year savings by the expected useful life of 15 years. California DEER Effective Useful Life worksheets: EUL_Summary_10-1-08.xls

The project has an overall electric realization rate of 100% and an overall natural gas realization rate of 100%. ADM verified the provided Trane Trace model and concluded that it accurately represented the building in both the as-built and baseline configurations.

Name SC73

Executive Summary

Under application SC73, the applicant received standard and custom incentives from the Illinois Department of Commerce for installing lighting and kitchen retrofits. The electric realization rate is 99% and the natural gas realization rate is 100%.

Project Description

The customer installed (1) 49 cubic ft. solid door freezer, (1) 49 cubic ft. solid door refrigerator, (1) 23 cubic ft. solid door refrigerator, (1) full-size hot food holding cabinet, (1) door-type dishwasher, (2) stacked convection ovens, (2) tanked water heaters, and demand control ventilation for (1) 5 HP exhaust hood fan and (1) 3 HP makeup air fan.

As part of the lighting retrofit, the customer installed the following:

- (8) Exit Signs with LED Exit Signs
- (2) Halogen lamps with 4’ T8 Lamps
- (24) 4’ T8 lamps delamped
- Installed (1) wall mounted occupancy sensor

Methodology for Estimating Gross Savings

Standard Incentives

ADM estimated energy savings according to the Illinois TRM Version 3.0.

Savings for the freezer were calculated using Section 4.2.2 Commercial Solid and Glass Door Refrigerators & Freezers.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = (kWhbase – kWhee) * 365.25$$

Where:

kWhbase = baseline maximum daily energy consumption in kWh

= calculated using actual chilled or frozen compartment volume (V) of the efficient unit as shown in the table below.

Type	kWhbase
Solid Door Refrigerator	0.10 * V + 2.04
Glass Door	0.12 * V +

Type	kWhbase
Refrigerator	3.34
Solid Door Freezer	0.40 * V + 1.38
Glass Door Freezer	0.75 * V + 4.10

kWhee = efficient maximum daily energy consumption in kWh

= calculated using actual chilled or frozen compartment volume (V) of the efficient unit as shown in the table below.

Type	Refrigerator kWhee	Freezer kWhee
Solid Door		
0 < V < 15	≤ 0.089V + 1.411	≤ 0.250V + 1.250
15 ≤ V < 30	≤ 0.037V + 2.200	≤ 0.400V – 1.000
30 ≤ V < 50	≤ 0.056V + 1.635	≤ 0.163V + 6.125
V ≥ 50	≤ 0.060V + 1.416	≤ 0.158V + 6.333
Glass Door		
0 < V < 15	≤ 0.118V + 1.382	≤ 0.607V + 0.893
15 ≤ V < 30	≤ 0.140V + 1.050	≤ 0.733V – 1.000
30 ≤ V < 50	≤ 0.088V + 2.625	≤ 0.250V + 13.500
V ≥ 50	≤ 0.110V + 1.500	≤ 0.450V + 3.500

V = the chilled or frozen compartment volume (ft^3) (as defined in the Association of Home Appliance Manufacturers Standard HRF1–1979)

= Actual installed

365.25 = days per year

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = \Delta kWh / HOURS * CF$

Where:

HOURS = equipment is assumed to operate continuously, 24 hours per day, 365.25 days per year.
= 8766
CF = Summer Peak Coincidence Factor for measure
= 0.937

Savings for the hot food holding cabinet were calculated using Section 4.2.9 ENERGY STAR Hot Food Holding Cabinet.

ELECTRIC ENERGY SAVINGS

Deemed values are provided in the table below:

Cabinet Size	Savings (kWh)
Full Size HFHC	9308
¾ Size HFHC	3942
½ Size HFHC	2628

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW = \Delta kWh/Hours * CF$

Where:

Hours = Hours/day *Days

Summer Peak Coincidence Factor is provided below for different building types:

Location	CF
Fast Food Limited Menu	0.32
Fast Food Expanded Menu	0.41
Pizza	0.46
Full Service Limited Menu	0.51
Full Service Expanded Menu	0.36
Cafeteria	0.36

Savings for the Energy Star Dishwasher were calculated using Section 4.2.6 ENERGY STAR Dishwasher.

ENERGY SAVINGS

ENERGY STAR dishwashers save energy in three categories, building water heating, booster water heating and idle energy. Building water heating and booster water heating could be either electric or natural gas. These deemed values are presented in a table format. Savings for natural gas building and electric booster water are shown in the table below.

Dishwasher type		kWh	Therms
Low Temp	Under Counter	0	56
	Door Type	0	562
	Single Tank Conventional	0	527
	Multi Tank Conventional	0	809
High Temp	Under Counter	2717	220
	Door Type	5269	441
	Single Tank Conventional	8110	515
	Multi Tank Conventional	12419	1007

Savings for the convection ovens were calculated using Section 4.2.5 ENERGY STAR Convection Oven.

NATURAL GAS ENERGY SAVINGS

Use deemed value of 306 therms.

Savings for the water heaters were calculated using Section 4.3.1 Storage Water Heater.

NATURAL GAS ENERGY SAVINGS

<table>
<tr><th>Gas, High Efficiency</th><th>Gas, Standard</th></tr>
<tr><td>The annual natural gas energy savings from this measure is a deemed value</td><td>Gas savings depend on building type and are based on measure case energy factor of 0.67 and a heating capacity of 75 MBtu/hr. These values are averages of qualifying units. Savings values are derived from 2008 DEER Miser, which provides MBtu/hr gas savings per MBtu/hr capacity. Savings presented here are per water heater.<table><tr><th>Building Type</th><th>Energy Savings (therms/unit)</th></tr></table></td></tr>
</table>

Gas, High Efficiency	Gas, Standard
equaling 251	

Assembly	185
Education – Primary/Secondary	124
Education – Post Secondary	178
Grocery	191
Health/Medical - Hospital	297
Lodging - Hotel	228
Manufacturing - Light Industrial	140
Office – > 60,000 sq-ft	164
Office – < 60,000 sq-ft	56
Restaurant - FastFood	109
Restaurant – Sit Down	166
Retail	105
Storage	150
Multi-Family	119
Other	148

Savings for the demand control ventilation were calculated using Section 4.2.16 Kitchen Demand Ventilation Controls.

ELECTRIC ENERGY SAVINGS

The following table provides the kWh savings:

Measure Name	Annual Energy Savings Per Unit (kWh/fan)
DVC Control Retrofit	4,486
DVC Control New	4,486

SUMMER COINCIDENT PEAK DEMAND SAVINGS

The following table provides the kW savings:

Measure Name	Coincident Peak Demand Reduction (kW)
DVC Control Retrofit	0.76
DVC Control New	0.76

NATURAL GAS ENERGY SAVINGS

ΔTherms = CFM * HP* Annual Heating Load /(Eff(heat) * 100,000)

Where:

CFM = the average airflow reduction with ventilation controls per hood

= 611 cfm/HP

HP = actual if known, otherwise assume 7.75 HP

Annual Heating Load = Annual heating energy required to heat fan exhaust make-up air, Btu/cfm dependent on location:

Zone	Annual Heating Load, Btu/cfm
1 (Rockford)	154,000
2-(Chicago)	144,000
3 (Springfield)	132,000
4-(Belleville)	102,000
5-(Marion)	104,000

Eff(heat) = Heating Efficiency

= actual if known, otherwise assume 80%

100,000 = conversion from Btu to Therm

Energy savings for the lighting retrofit were calculated according to the Illinois TRM 3.0, measures 4.5.2, 4.5.5, and 4.5.8. Algorithms pertaining to savings calculations are presented below.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ Hours * WHF_e * ISR$$

where

$Watts_{base}$	= input wattage of the existing system
$Watts_{EE}$	= new input wattage of EE fixture
WHF_e	= waste heat factor to account for cooling energy savings
ISR	= In service rate = % of units rebated that get installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1000}\right) * \ WHF_d * CF * ISR$$

Where:

WHFd	= waste heat factor to account for cooling demand savings
CF	= Summer Peak Coincidence Factor

For the lighting controls, TRM section 4.5.10 was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = kWcontrolled * \ Hours * ESF * \ WHF_e$$

Where:

kWcontroled	= total lighting load connected to the control in kilowatts
ESF	= Energy Savings Factor
WHFe	= waste heat factor to account for cooling energy savings

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kWh = kWcontrolled * \ WHF_d * (CFbaseline - CFos)$$

Where:

WHFd	= Waste heat factor to account for cooling demand savings
CFbaseline	= Baseline Summer Peak Coincidence Factor
CFos	= Retrofit Summer Peak Coincidence Factor

Custom Incentives

Savings for the refrigerators were calculated using Section 4.2.2 Commercial Solid and Glass Door Refrigerators & Freezers of the Illinois TRM Version 3.0.

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = (kWhbase - kWhee) * 365.25$$

Where:

kWhbase = baseline maximum daily energy consumption in kWh

= calculated using actual chilled or frozen compartment volume (V) of the efficient unit as shown in the table below.

Type	kWhbase
Solid Door Refrigerator	0.10 * V + 2.04
Glass Door Refrigerator	0.12 * V + 3.34
Solid Door Freezer	0.40 * V + 1.38
Glass Door Freezer	0.75 * V + 4.10

kWhee = efficient maximum daily energy consumption in kWh

= calculated using actual chilled or frozen compartment volume (V) of the efficient unit as shown in the table below.

Type	Refrigerator kWhee	Freezer kWhee
Solid Door		
$0 < V < 15$	$\leq 0.089V + 1.411$	$\leq 0.250V + 1.250$
$15 \leq V < 30$	$\leq 0.037V + 2.200$	$\leq 0.400V - 1.000$
$30 \leq V < 50$	$\leq 0.056V + 1.635$	$\leq 0.163V + 6.125$
$V \geq 50$	$\leq 0.060V + 1.416$	$\leq 0.158V + 6.333$
Glass Door		
$0 < V < 15$	$\leq 0.118V + 1.382$	$\leq 0.607V + 0.893$
$15 \leq V < 30$	$\leq 0.140V + 1.050$	$\leq 0.733V - 1.000$
$30 \leq V < 50$	$\leq 0.088V + 2.625$	$\leq 0.250V + 13.500$
$V \geq 50$	$\leq 0.110V + 1.500$	$\leq 0.450V + 3.500$

V = the chilled or frozen compartment volume (ft^3) (as defined in the Association of Home Appliance Manufacturers Standard HRF1–1979)

= Actual installed

365.25 = days per year

SUMMER COINCIDENT PEAK DEMAND SAVINGS

ΔkW = ΔkWh / HOURS * CF

Where:

HOURS = equipment is assumed to operate continuously, 24 hours per day, 365.25 days per year.

= 8766

CF = Summer Peak Coincidence Factor for measure

= 0.937

Measure-level Gross Savings Results

Standard Incentives

The tables shown below present the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Commercial Solid Door Freezers

Measure	Measure Metrics		Annual Gross kWh Savings	
	Cubic Feet	Door Type	Ex Ante	TRM-Calculated Ex Post
ENERGY STAR Solid Door Freezer	49	Solid	2,840	2,509
Total			2,840	2,509

Annual kWh Savings for ENERGY STAR Hot Food Holding Cabinets

Measure	Measure Metrics		Annual Gross kWh Savings	
	Size	Quantity	Ex Ante	TRM-Calculated Ex Post
ENERGY STAR Hot Food Holding Cabinet	Full Size	1	9,314	9,308
Total			9,314	9,308

Annual Therms Savings for ENERGY STAR Dishwasher

Measure	Measure Metrics		Annual Gross Therms Savings	
	Type	Temp	Ex Ante	TRM-Calculated Ex Post
ENERGY STAR Dishwasher	Door	Low Temp	562	562
Total			562	562

Annual kWh Savings for ENERGY STAR Convection Ovens

Measure	*Measure Metrics*		*Annual Gross kWh Savings*	
	Deemed Savings per Unit	*Quantity*	*Ex Ante*	*TRM-Calculated Ex Post*
ENERGY STAR Convection Oven	306	2	609	612
Total			609	612

Annual Therms Savings for Storage Water Heaters

Measure	*Measure Metrics*			*Annual Gross Therms Savings*	
	Thermal Efficiency	*Quantity*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	81%	2	Education – Primary/Secondary	248	248
Total				248	248

Annual kWh Savings for Kitchen Demand Ventilation Controls

Measure	*Measure Metrics*		*Annual Gross kWh Savings*	
	Measure Category	*Climate Zone*	*Ex Ante*	*TRM-Calculated Ex Post*
Demand Control Ventilation for Kitchen	DCV Control New	2 (Chicago)	2,894	4,486
Demand Control Ventilation for Kitchen	DCV Control New	2 (Chicago)	1,737	4,486
Total			4,631	8,972

Annual Therms Savings for Kitchen Demand Ventilation Controls

Measure	Measure Metrics		Annual Gross Therms Savings	
	Measure Category	Climate Zone	Ex Ante	TRM-Calculated Ex Post
Demand Control Ventilation for Kitchen	DCV Control New	2 (Chicago)	5,499	5,499
Demand Control Ventilation for Kitchen	DCV Control New	2 (Chicago)	3,299	3,299
Total			8,798	8,798

Annual kWh Savings for Lighting Retrofit

Measure	Calculation Inputs						Annual Gross kWh Savings	
	QTY	Existing Wattage	Efficient Wattage	Hours	In-Service Rate	WHFe-IF	Ex Ante	TRM-Calculated Ex Post
LED Exit Signs	8	TRM = 23	TRM = 2	8,766	1	1.23	1,811	1,811
Fluorescent Delamping	24	TRM = 19.4 Actual=29.5	TRM = 0 Actual = 0	4,311	1	1.23	5,287	2,469
Halogen to T8	2	Actual = 90	Actual = 88	4,311	1	1.23		21
Total							7,098	4,301

Annual kWh Savings for Lighting Controls

Measure	Calculation Inputs					Annual Gross kWh Savings	
	Qty	kW Controlled	Hours	ESF	WHFd	Ex Ante	TRM-Calculated Ex Post
Occupancy Sensor Lighting Control	1	0.088	4,311	0.41	0.74	191	191
Total						191	191

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for Commercial Solid Door Refrigerators

Measure	*Measure Metrics*		*Annual Gross kWh Savings*			
	Cubic Feet	*Door Type*	*Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*	*ADM Calculated* *Ex Post*
ENERGY STAR Solid Door Refrigerator	49	Solid	2,012	935		
ENERGY STAR Solid Door Refrigerator	23	Solid	945	471		
Total			2,957	1,406		

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Standard	ENERGY STAR Solid Door Freezer	2,840	2,509	88%	0.27	30,108
Standard	ENERGY STAR Hot Food Holding Cabinet	9,314	9,308	100%	0.38	111,696
Standard	Demand Control Ventilation for Kitchen	2,894	4,486	155%	0.76	67,290
Standard	Demand Control Ventilation for Kitchen	1,737	4,486	258%	0.76	67,290
Standard	4.5.5	1,811	1,811	100%	0.03	28,982
Standard	4.5.2/4.5.8	5,287	2,490	47%	0.08	27,157
Standard	Occupancy Sensors	191	191	100%	0.00	318
Subtotal		*24,074*	*25,281*	*105%*	*2.28*	*332,841*
Custom	ENERGY STAR Solid Door Refrigerator	2,012	935	46%	0.10	11,220
Custom	ENERGY STAR Solid Door Refrigerator	945	471	50%	0.05	5,652
Subtotal		*2,957*	*1,406*	*48%*	*0.15*	*16,872*
Total		***27,031***	***26,687***	***99%***	***2.43***	***349,713***

Verified Natural Gas Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	Demand Control Ventilation for Kitchen	5,499	5,499	100%	82,485
Standard	Demand Control Ventilation for Kitchen	3,299	3,299	100%	49,491
Standard	ENERGY STAR Dishwasher	562	562	100%	8,430
Standard	ENERGY STAR Convection Oven	609	612	100%	7,344
Standard	Storage Water Heater	248	248	100%	3,720
Total		***10,217***	***10,220***	***100%***	***151,470***

The overall electric realization rate is 99%, and the natural gas realization rate is 100%.

For the solid door freezer, it is unclear why the realization rate is low. The same freezer volume was used in the ex ante calculation and in the ex post calculation.

For the kitchen demand control ventilation, the realization rate is high because the ex ante calculation determines savings based on controlled motor size, whereas the Illinois TRM applies a deemed savings per fan.

For the solid door refrigerators, the realization is low because the ex ante calculation applied incorrect TRM formulas for energy efficient unit energy consumption. The applicable formula is determined by the volume of the unit. The ex ante calculation made an attempt at using the applicable formula for baseline unit consumption, but had an error in the execution of the calculation, resulting in a higher baseline consumption value.

The incentive given for 4.5.2/4.5.8 was based on new T8 Fixtures and Lamps (4.5.3), however the correct measure to be used is fluorescent delamping (4.5.2), and miscellaneous commercial lighting (4.5.8). The program participant will be given credit for this installation under measures 4.5.2 and 4.5.8. Based on algorithms in TRM 3.0 measures 4.5.2 and 4.5.8, the ex post savings for the second measure was 103 kWh per fixture, whereas the ex ante savings estimate for the second measure was 203.35 kWh per fixture

Project Number C74

Executive Summary

Under application C74, the program participant received Custom Program incentives from the Illinois Department of Commerce for retrofitting existing laboratory fume hoods with high efficiency fume hoods. The electric realization rate for this project is 40%.

Project Description

The customer installed the following high efficiency fume hoods:

- (14) 4-foot Fume Hoods with a gross area opening of 2.70 ft^2 and minimum face velocity of 80 feet per minute,
- (66) 5-foot Fume Hoods with a gross area opening of 3.57 ft^2 and minimum face velocity of 80 feet per minute,
- (59) 6-foot Fume Hoods with a gross area opening of 4.45 ft^2 and minimum face velocity of 80 feet per minute, and
- (2) 8-foot Fume Hoods with a gross area opening of 6.20 ft^2 and minimum face velocity of 80 feet per minute.

The installation of the new fume hoods resulted in savings through the reduced face velocity as compared to the existing fume hoods. The reduction in face velocity results in a decrease in exhaust fan energy consumption as well as HVAC cooling load. HVAC cooling load is reduced as a result of a decrease in the volume of air being exhausted from the building; thus, the amount of “Make Up” air needed to be brought back into the building was reduced to maintain pressurization.

Methodology for Estimating Gross Savings

ADM staff inspected project documentation and verified the installation of the high efficiency laboratory fume hoods during an onsite inspection.

Custom Incentives

Annual electrical savings for the new high efficiency fume hood was calculated through the use of Lawrence Berkeley National Laboratory Fume Hood Calculator[99]. The fume hood calculator compares the annual energy consumption of two user defined fume hoods while calculating the potential annual energy savings. The fume hood calculator requires users to input known details of each hood which includes the following: location, hours of operation, vertical hood opening, horizontal hood opening, face velocity, and cooling plant efficiency.

[99] http://fumehoodcalculator.lbl.gov/index.php

Annual energy savings for each individual hood type was calculated and multiplied by the corresponding quantity to determine the total annual energy savings for the project.

Measure-level Gross Savings Results

Custom Incentives

The tables shown below present the verified gross savings for measures that received custom incentives.

Annual kWh Savings for High Efficiency Fume Hoods

Measure	Measure Metrics							Annual Gross kWh Savings			
	Qty	Horizontal "in"	Vertical "in"	Opening Area "ft²"	Min Face FPM		kWh Savings per Hood	Ex Ante	TRM-Calculated	TRM-Calculated (Errata Corrected)	ADM Calculated
					As-Built	Baseline[100]			Ex Post	Ex Post	Ex Post
4' Fume Hood	14	18.5	21	2.7	80	150	4,625				64,750
5' Fume Hood	66	24.5	21	3.6	80	150	6,125				404,250
6' Fume Hood	59	30.5	21	4.4	80	150	8,715				514,185
8' Fume Hood	2	42.5	21	6.2	80	150	10,626				21,252
Total								2,526,666			1,004,437

Project-level Gross Savings Results

The tables shown below present the verified gross savings for this project.

Verified Electric Savings/Realization Rates

Incentive Type	Measure Category	Annual Gross Savings				Lifetime Gross Savings	Spillover	
		Ex Ante kWh	Ex Post kWh	Realization Rate	Ex Post Peak kW Reduction	Ex Post kWh	Annual kWh Savings	Annual Peak kW Reduction
Custom	Fume Hoods	2,526,666	1,004,437	40%	158.48	15,066,555		
Total		***2,526,666***	***1,004,437***	***40%***	***158.48***	***15,066,555***		

The electric measure has a verified realization rate of 40%. The ex post analysis uses Lawrence Berkeley National Laboratory Fume Hood Calculator. ADM determined this to be the best approach for this measure with the available information.

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[100] Energy-Efficient Fume Hoods (Low-Flow Fume Hoods), Lawrence Berkeley National Laboratory

7. Appendix B: Custom and Standard Incentives Participant Survey

SCREENING

1. Hello. May I please speak with <CONTACT>?

   Hello. My name is _____and I am calling on behalf of the Illinois Department of Commerce & Economic Opportunity.

   We are conducting a study on behalf of the Department of Commerce to help them improve their programs.

   According to our records, you participated in the Department of Commerce's Illinois Energy Now Program, through which you received a rebate or incentive for an energy efficiency project located at <ADDRESS>.

   We would like you to answer some questions about your decision making regarding your experience with the program. Do you have a few minutes to speak with me?
   [IF NEEDED: INTERVIEW SHOULD TAKE APPROXIMATELY 15 MINUTES]
   1 (Yes)
   2 (Not available at this time: SCHEDULE CALL BACK)
   3 (Not familiar with project [ASK TO BE REFERRED TO SOMEONE WHO IS FAMILIAR])

2. I was told you're the person who is most knowledgeable about this project. Is this correct?
   1 (Yes)
   2 (No) [ASK TO BE REFERRED TO SOMEONE WHO IS THE MOST KNOWLDEABLE AND CONTACT THAT PERSON]

BACKGROUND

3. To begin, can you tell me 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)
   97 (Other)
   98 (Don't know)
   99 (Refused)

4. How did you first learn about the incentives for energy saving improvements provided through the <PROGRAM>?
   1 (At a Department of Commerce Trade Ally Rally)
   2 (The program website)
   3 (Through an internet search)
   4 (From a Department of Commerce Program representative)
   5 (From a friend or colleague)
   6 (A presentation at a conference or workshop)
   7 (The Department of Commerce Illinois Energy Now Newsletter)
   8 (From a professional group or association that you are a member of)
   9 (From a Trade Ally/contractor/equipment vendor/energy consultant)
   97 (Other)
   98 (Don't know)
   99 (Refused)

VENDOR/CONRACTOR INFORMATION BATTERY

5. I would like to get some information on the vendors or contractors that may have helped you <IMPLEMENT> the <ENDUSE>. Did you work with a contractor or vendor that helped you decide to <IMPLEMENT> the <END USE>?
   1 Yes
   2 No
   98 (Don't know)
   99 (Refused)

ASK Q6 IF [Q5=1]

6. Did the vendor or contractor encourage you to participate in the <PROGRAM>?
   1 Yes
   2 No
   98 (Don't know)
   99 (Refused)

ASK Q7 IF [Q5=1]

7. Did you also use a DESIGN or CONSULTING engineer?
   1 Yes
   2 No
   98 (Don't know)
   99 (Refused)

8. Did <ADMINSTAFF> assist you with the project that you implemented through the <ADMINISTRATOR>'s <PROGRAM>?
   1 Yes
   2 No

98 (Don’t know)
99 (Refused)

ENERGY EFFICIENCY BUDGETING

9. In the last year, did your budget include specific funding for improvements to energy efficiency?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

PROJECT BACKGROUND

I’d now like to ask a few questions about the <ENDUSE> you <IMPLEMENTED> through the program.

10. Did you have plans to implement the <ENDUSE> that you implemented through the program before deciding to participate in the <PROGRAM>?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q11 IF [Q10 = 2]

11. Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that you DID NOT have plans to implement the <ENDUSE>?
[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q12 IF [Q11 < 10]

12. Is there an individual within your organization that might know more about whether or not your organization had plans to implement the <ENDUSE> before deciding to participate in the <PROGRAM>?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q13 IF [Q12 = 1]

13. May I have contact information for that individual? [OBTAIN CONTACT INFORMATION FOR INDIVIDUAL]
[RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q14 IF [Q10 = 1]

14. Did the plans you had before deciding to participate in the program specify the specific <ENDUSE> you were going to implement?
1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q15 IF [Q14 = 2]
15. Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that your plans DID NOT specify which specific <ENDUSE> you were going to implement?
[RECORD 0 to 10]
98 (Don't know)
99 (Refused)

ASK Q16 IF [Q15 < 10]
16. Is there an individual within your organization that might know more about whether or not your organization's plans specified the specific <ENDUSE> you were going to implement?
1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q17 IF [Q16 = 1]
17. May I have contact information for that individual? [OBTAIN CONTACT INFORMATION FOR INDIVIDUAL]
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q18 IF [Q10 = 1] AND [NTG = E]
18. In as much detail as possible, can you tell me more about the nature of the plans to implement <ENDUSE>, including efficiency levels, proposed equipment options, timelines, etc.?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q19 IF [Q10 = 1]
19. Without the program incentive, did your organization have the funds available to implement the same <ENDUSE> that you implemented through the program?
1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q20 IF [Q19 =2]

20. Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that your organization DID NOT have the funds available to implement the same <ENDUSE> before deciding to participate in the <PROGRAM>?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q21 IF [Q20 < 10]

21. Is there an individual within your organization that might know more about whether or not your organization had the funds available to implement the <ENDUSE> before deciding to participate in the <PROGRAM>?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q22 IF [Q21 = 1]

22. May I have contact information for that individual? [OBTAIN CONTACT INFORMATION FOR INDIVIDUAL]

[RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

23. Using a scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely," how likely is it that your organization could have funded this project without the program’s financial assistance?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q11 [IF <ENER_EQUIP> = 1]

24. Did the new <ENDUSE> that you installed through the program replace existing equipment, was it added to control or work directly with existing equipment, or was it new additional standalone equipment?

1 Replaced existing equipment
2 Added to control or work directly with existing equipment
3 New additional standalone equipment
00 (Other) [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

25. In deciding to do a project of this type, there are usually a number of reasons why it may be undertaken. In your own words, can you tell me why this project was implemented? IF NEEDED: Were there any other reasons? MULTIPLE RESPONSE. UP TO THREE.

1 (To replace old or outdated equipment)
2 (As part of a planned remodeling, build-out, or expansion)
3 (To gain more control over how the equipment was used)
4 (The maintenance downtime and associated expenses for the old equipment were too high)
5 (Had process problems and were seeking a solution)
6 (To improve equipment performance)
7 (To improve the product quality)
8 (To comply with codes set by regulatory agencies)
9 (To comply with organizational policies regarding regular/normal maintenance/replacement policy)
10 (To get a rebate from the program)
11 (To protect the environment)
12 (To reduce energy costs)
13 (To reduce energy use/power outages)
14)To update to the latest technology)
00 (Other) [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q26 IF [Q24=1]

26. Which of the following statements best describes the performance and operating condition of the equipment you replaced through the <PROGRAM ADMINISTRATOR>’s <PROGRAM>?

01 Existing equipment was fully functional, and without significant issues
02 Existing equipment was fully functioning, but with significant issues
03 Existing equipment had failed or did not function.
04 Existing equipment was obsolete
05 Existing equipment was fully functioning with minor issues
00 (Other) [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

NET-TO-GROSS BATTERY

ASK Q27 IF [Q24 = 1 OR Q24 = 3 OR Q24 =98 OR Q24 =99]

27. When did you first learn about the < PROGRAM ADMINISTRATOR >’s <PROGRAM>? Was it BEFORE or AFTER you finalized the specifications of your <ENDUSE> project, including the efficiency level and the scope of the project.

1 Before
2 After
98 (Don't know)
99 (Refused)

ASK Q28 IF [<ENER_EQUIP>= 0 OR Q24 = 2]

28. When did you first learn about the < PROGRAM ADMINISTRATOR >’s <PROGRAM>? Was it BEFORE or AFTER you finalized the specifications of your <ENDUSE> project, including the scope of the project.

1 Before
2 After
98 (Don't know)
99 (Refused)

Now I would like you to think about the action you might have taken with regard to the <ENDUSE> if the <PROGRAM ADMINISTRATOR> program had not been available.

29. Using a scale from 0 to 10, where 0 is “Not at all likely” and 10 is “Extremely likely”, if the <PROGRAM ADMINISTRATOR>’s program had not been available, what is the likelihood that you would have implemented the exact same project?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

30. Using a scale where 0 is “Not at all likely” and 10 is “Extremely likely”, if the program had not been available, what is the likelihood that you would have implemented the exact same project within 12 months of when you actually implemented it?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

31. Without the program, when do you think you would have implemented the <ENDUSE> project? Would you say…

1 At the same time the <ENDUSE> was actually <IMPLEMENTED >
2 After the time the <ENDUSE> was actually <IMPLEMENTED>
3 Never
98 (Don’t know)
99 (Refused)

ASK Q32 IF [Q30=2]

32. How much later would you have <IMPLEMENTED> the <ENDUSE> without the program? Would you say that you would have done it in…

1 0 to 6 months
2 7 months to 1 year
3 more than 1 year up to 2 years
4 more than 2 years up to 3 years
5 more than 3 years up to 4 years
6 Over 4 years
98 (Don’t know)
99 (Refused)

ASK Q33 IF [[Q30=2] AND [Q32<> 98,99]]

33. Why do you think you would have <IMPLEMENTED > the <ENDUSE2> in <Q32 RESPONSE>?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

34. Next, I'm going to ask you to rate the impact of various factors that might have affected your decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>.

Please rate the impact each had on your decision using a scale where a score of "0" means that the factor had no impact on the decision to implement the <ENDUSE>, and a score of "10" means that the factor had DECISIVE impact on the decision to the implement the <ENDUSE>.
[RECORD 0 to 10]
96 Not Applicable
98 (Don't know)
99 (Refused)
[If needed: Please rate the impact of [FACTOR] in your decision to <IMPLEMENT> the <ENDUSE>.]

ASK Q35 IF [Q24=1]
35. The impact of the age or condition of the existing equipment

36. The impact of the availability of the <PROGRAM> incentive

ASK Q37 IF [Q36=8,9,10]
37. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know);
99 (Refused)

ASK Q38 IF [<TECH_ASSIST>=1]
38. The impact of technical assistance you received from program staff

ASK Q39 IF [Q38=8,9,10] AND [NTG=E]
39. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q40 IF [Q5=1]
40. The impact of a recommendation from an equipment vendor or contractor that helped you with the choice of the <ENDUSE>

41. The impact of previous experience with implementing <ENDUSE>

42. The impact of a recommendation from <PROGRAM ADMINISTRATOR> program staff

ASK Q43 IF [NTG=E] AND [Q42=8,9,10]
43. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

44. The impact of information from <PROGRAM ADMINISTRATOR> marketing materials

ASK Q45 IF [NTG=E] AND [Q44=8,9,10]
45. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q46 IF [Q7=1]
46. The impact of a recommendation from a design or consulting engineer

47. The impact of standard practice in your organization

48. The impact of an endorsement or recommendation by <ADMINSTAFF>

ASK Q49 IF [NTG=E] AND [Q48=8, 9, 10]
49. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

50. The impact of organizational policy or guidelines

51. Were there any other factors we haven't discussed that that might have affected your decision to <IMPLEMENT> the <ENDUSE>?
00 [RECORD VERBATIM]
96 Nothing else influential
98 (Don't know)
99 (Refused)

ASK Q52 IF [Q51=00]
52. Using the same 0 to 10 scale, please rate the impact of this factor in your decision to <IMPLEMENT> the <ENDUSE> at this time?
[RECORD 0 to 10]
98 (Don't know)
99 (Refused)

53. [READ IF ANY OF Q35, Q40, Q41, Q46, Q47, Q50, Q51=8,9,10]

You just assigned the following factors a score of 8 or higher:

[READ ONLY ITEMS FOR WHICH RESPONDENT GAVE A RATING OF 8 OR HIGHER]

Q36 Availability of the program incentive
Q38 Technical assistance from program staff
Q40 Equipment Vendor or contractor recommendation
Q41 Previous experience with this measure
Q42 <PROGRAM ADMINISTRATOR> program staff recommendation
Q44 <PROGRAM ADMINISTRATOR> marketing materials
Q46 Recommendation from a design or consulting engineer
Q47 Standard practice in your organization
Q48 Endorsement or recommendation by <ADMINSTAFF>
Q50 Organizational policy or guidelines
Q51 Other factor

54. If you were given a TOTAL of 100 points that reflect the importance in your decision to <IMPLEMENT> the <ENDUSE> and you had to divide those 100 points between: 1) the program and 2) other factors, how many points would you give to the importance of the PROGRAM?

[RECORD 0 to 100]
98 (Don’t know)
99 (Refused)
[CALCULATE VARIABLE <OTHERPTS> AS 100 MINUS Q54 RESPONSE; IF Q54=98, 99, SET OTHERPTS=BLANK]

55. And how many points would you give to the other factors?

[RECORD 0 to 100]
98 (Don’t know)
99 (Refused)
[Note: The response should be <OTHERPTS> because both numbers should equal 100. If response does not equal <OTHERPTS>, ask Q56]

ASK Q56 IF [Q55<><OTHERPTS>]

56. The last question asked you to divide a TOTAL of 100 points between the program and other factors. You just noted that you would give <Q54 RESPONSE> points to the program. Does that mean you would give <OTHERPTS> points to the other factors?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

GO BACK TO Q54 IF [Q56=2] AND READ [OK LET ME ASK YOU THE QUESTION AGAIN]

CONSISTENCY CHECK ON PROGRAM INFLUENCE/PROGRAM COMPONENTS

ASK Q57 IF [Q54 >70] AND [Q36<3] AND [Q38<3] AND [Q42<3] AND [Q44<3] AND [Q48<3]

57. You just scored the impact of the program on your decision to implement the <ENDUSE> with <Q54 RESPONSE> out of 100 possible points. You ALSO gave relatively lower scoring to the impact of individual elements of the program experience.

ASK Q58 IF [Q54 <30] AND [[Q36>7] OR [Q38>7] OR [Q42>7] OR [Q44>7] OR [Q48>7]

58. You just scored the impact of the program on your decision to implement the <ENDUSE> with <Q54 RESPONSE> out of 100 possible points. You ALSO gave relatively higher scoring to the impact of individual elements of the program experience.

ASK Q59 IF [[Q54 >70] AND [Q36<3] AND [Q38<3] AND [Q42<3] AND [Q44<3] AND [Q48<3]] OR [[Q54 <30] AND [Q36>7]]

59. You scored the impact of THE AVAILABILITY OF THE PROGRAM INCENTIVE on your decision to implement the <ENDUSE> with <Q36 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q54 RESPONSE> out of 100 possible points. Why is the impact of THE AVAILABILITY OF THE PROGRAM INCENTIVE different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q60 IF [[Q54 >70] AND [Q36<3] AND [Q38<3] AND [Q42<3] AND [Q44<3] AND [Q48<3]] OR [[Q54 <30] AND [Q38>7]]

60. You scored the impact of the program TECHNICAL ASSISTANCE on your decision to implement the <ENDUSE> with <Q38 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q54 RESPONSE> out of 100 possible points. Why is the impact of the program TECHNICAL ASSISTANCE different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q61 IF [[Q54 >70] AND [Q36<3] AND [Q38<3] AND [Q42<3] AND [Q44<3] AND [Q48<3]] OR [[Q54 <30] AND [Q42>7]]

61. You scored the impact of THE RECOMMENDATION FROM <PROGRAM ADMINISTRATOR> <PROGRAM> STAFF PERSON on your decision to implement the <ENDUSE> with <Q42 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q54 RESPONSE> out of 100 possible points. Why is the impact of the THE RECOMMENDATION FROM <PROGRAM ADMINISTRATOR> STAFF PERSON different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q62 [IF Q54 >70] AND [Q36<3] AND [Q38<3] AND [Q42<3] AND [Q44<3] AND [Q48<3]] OR [[Q54 <30] AND [Q44>7]]

62. You scored the impact of the THE INFORMATION from <PROGRAM ADMINISTRATOR>'s MARKETING MATERIALS on your decision to implement the <ENDUSE> with <Q44 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q54 > out of 100 possible points. Why is the impact of the THE INFORMATION from <PROGRAM ADMINISTRATOR>'s MARKETING MATERIALS different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q63 IF [[Q54 >70] AND [Q36<3] AND [Q38<3] AND [Q42<3] AND [Q44<3] AND [Q48<3] OR [[Q54 <30] AND [Q48>7]]

63. You scored the impact of the THE ENDORSEMENT or RECOMMENDATION by <ADMINSTAFF> on your decision to implement the <ENDUSE> with <Q48 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q54 RESPONSE> out of 100 possible points. Why is the impact of the THE ENDORSEMENT or RECOMMENDATION by <ADMINSTAFF> different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

PROGRAM COMPONENTS (INCENTIVE)/NO PROGRAM CONSISTENCY CHECK

ASK Q64 IF [[Q36=8,9,10] AND [Q29=8,9,10]] OR [[Q36=0,1,2] AND [Q29=0,1,2]]

64. You scored the impact of the program incentive on your decision to implement the <ENDUSE> with <Q36 RESPONSE> out of 10 possible points. You ALSO scored the likelihood of <IMPLEMENTING> exact same project without the incentive with <Q29 RESPONSE> out of 10 possible points. Can you please explain the role the incentive played in your decision to <IMPLEMENT> this <ENDUSE>?

00 Record VERBATIM
98 (Don't know)
99 (Refused)

ASK Q65 IF [[Q36=8,9,10] AND [Q29=8,9,10]] OR [[Q36=0,1,2] AND [Q29=0,1,2]]

65. Would you like to change your score of <Q36 RESPONSE> out of 10 possible points on the impact of the program incentive or change your score of <Q29 RESPONSE> out of 10 possible points on the likelihood of <IMPLEMENTING> the exact same project without the incentive? You may change one score, both scores, or neither score. How would you like to proceed?

1 Change impact of incentive score
2 Change likelihood of <IMPLEMENTING> the exact same project without the program score
3 Change both

4 Change neither
98 (Don’t know)
99 (Refused)

ASK Q66 IF [Q65=1,3]

66. Please rate the impact of the PROGRAM incentive using a scale where a score of “0” means that the PROGRAM incentive had no impact on the decision to implement the energy efficiency project, and a score of “10” means that the PROGRAM incentive had DECISIVE impact on the decision to the implement the energy efficiency project.

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q67 IF [Q65=2,3]

67. Using a scale from 0 to 10, where 0 is “Not at all likely” and 10 is “Extremely likely”, if the <PROGRAM ADMINISTRATOR>’s efficiency program had not been available, what is the likelihood that you would have <IMPLEMENTED> the exact same project?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

TIMING OF PROJECT DECISION / LEVEL OF PROGRAM ATTRIBUTION CONSISTENCY CHECK

ASK Q68 IF [[Q54 > 70 OR Q36 > 7 OR Q38 > 7 OR Q42 > 7 OR Q48> 7 OR Q44> 7]] AND [Q27 = 2 OR Q28 = 2]]

68. In response to an earlier question, you noted that you learned about the program AFTER you finalized the specifications of your <ENDUSE> project. Based on some of your other responses, it sounded like the program was important in your decision to install the high efficiency equipment. I want to check to see if I am misunderstanding your answers or if the questions may have been unclear. Will you explain the role the incentive program played in either your selection of the efficiency level of the installed equipment or the scope of the project?

00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q69 IF [Q40 > 7 AND [Q27= 2 OR Q28 = 2]]

69. Earlier you stated that a recommendation from an equipment vendor or contractor was important to your decision to implement the <ENDUSE>. You also stated that you learned about the program after you decided to complete the project. Can you please explain the role the vendor or contractor played in your decision to implement the <ENDUSE>?

00 [RECORD VERBATIM]
98 (Don’t know)

99 (Refused)

PAYBACK BATTERY

70. Please rate the impact of PAYBACK ON THE INVESTMENT using a scale where a score of “0” means that the PAYBACK ON THE INVESTMENT had no impact on the decision to implement the energy efficiency project, and a score of “10” means that the PAYBACK ON THE INVESTMENT had DECISIVE impact on the decision to the implement the energy efficiency project.

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q71 IF [Q70=7,8,9,10]

71. I’d like to find out more about the payback criteria <ORGANIZATION> uses for its investments and how it might have applied to the decision to <IMPLEMENT> the <ENDUSE>.

    What is the payback cut-off point <ORGANIZATION> uses before deciding to complete a project like this one?

[DO NOT READ. Prompt if necessary: in years and months.]
1 0 to 6 months
2 7 months to 1 year
3 more than 1 year up to 2 years
4 more than 2 years up to 3 years
5 more than 3 years up to 5 years
6 Over 5 years
98 (Don’t know)
99 (Refused)

ASK Q72 IF [Q70=7,8,9,10]

72. Does your organization always implement projects that meet the required payback cut-off point?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q73 IF [Q70=7,8,9,10] AND [Q72=2] AND [NTG=E]

73. Why doesn’t your organization always implement projects that meet the required financial cut-off point?

00 [RECORD VERBATIM]
98 (Don’t know)

99 (Refused)

ASK Q74 IF [Q70=7,8,9,10]

74. Did you review payback calculations for the <ENDUSE> project with and without the <PROGRAM> incentive?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q75 IF [Q70=7,8,9,10]

75. Did the program incentive play an important role in moving your project within the acceptable payback cutoff point?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ORGANIZATIONAL/CORPORATE POLICY BATTERY

ASK Q76 IF [Q50=7,8,9,10]

76. Does your organization have an environmental policy or sustainability plan to reduce environmental emissions or energy use? Some examples would be to "buy green" or use sustainable approaches to business investments.

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q77 IF [Q50=7,8,9,10] AND [Q76=1] AND [NTG = E]

77. What specific policy affected your decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>?

00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q78 IF [Q50=7,8,9,10] AND [Q76=1]

78. Prior to participating in the <PROGRAM ADMINISTRATOR>’s <PROGRAM>, had that policy caused you to <IMPLEMENT> <ENDUSE> at this or another facility without a program incentive?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q79 IF [Q50=7,8,9,10]

79. Does <ORGANIZATION> have the financial ability to implement its policy?
1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q80 IF [[Q50=7,8,9,10] AND [Q78=1] AND [Q76=1] AND [NTG = E]]

80. Regarding the decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>, I want to make sure I fully understand the impact of this policy as compared with the impact of the program. Can you please elaborate on that?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

STANDARD PRACTICE BATTERY

ASK Q81 IF [Q47>6]

81. In an earlier question, you rated the importance of STANDARD PRACTICE in your organization very highly in your decision making. Could you please rate the importance of the PROGRAM, relative to this standard practice, in affecting your decision to <IMPLEMENT> the <ENDUSE>? Would you say the program was much more important, somewhat more important, equally important, somewhat less important, or much less important than your organization's standard practice?
1 Much more important
2 Somewhat more important
3 Equally important
4 Somewhat less important
5 Much less important
98 (Don't know)
99 (Refused)

ASK Q82 IF [[Q47=7,8,9,10] AND [NTG = E]]

82. Approximately, how long has use of <ENDUSE> been standard practice in your organization?
M [00 Record Number of Months; 98 (Don't know), 99 (Refused)]
Y [00 Record Number of Years; 98 (Don't know), 99 (Refused)]

ASK Q83 IF [Q47=7,8,9,10]

83. Does <ORGANIZATION> ever deviate from the standard practice?
1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q84 IF [Q47=7,8,9,10] AND [Q83=1] AND [NTG = E]

84. Please describe the conditions under which <ORGANIZATION> deviates from this standard
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q85 IF [Q47=7,8,9,10] AND [NTG = E]
85. How did this standard practice affect your decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q86 IF [Q47=7,8,9,10]
86. Could you please rate the importance of the <PROGRAM> as compared with this standard organization practice in affecting your decision to <IMPLEMENT> the <ENDUSE>. Would you say the <PROGRAM> was…
1 Much more important
2 Somewhat more important
3 Equally important
4 Somewhat less important
5 Much less important
98 (Don't know)
99 (Refused)

ASK Q87 IF [Q47=7,8,9,10] AND [NTG = E]
87. What group or trade organization, if any, do you look to establish standard practice for your organization?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q88 IF [Q47=7,8,9,10] AND [NTG = E]
88. How do you and other public sector organizations receive information on updates to standard practice?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ADDITIONAL PROJECTS

ASK Q89 IF [MSAME=1]
89. Our records show that <ORGANIZATION> also received an incentive from <PROGRAM ADMINISTRATOR>'s <PROGRAM> for <NSAME> other <ENDUSE> projects. Was it a single decision to complete all of those <ENDUSE> projects for which

you received an incentive from the program or did each project go through its own decision process?

1 Single Decision
2 Each project went through its own decision process
00 (Other) [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q90 IF [FSAME=1]

90. Our records show that <ORGANIZATION> also received an incentive from<PROGRAM ADMINISTRATOR>’s <PROGRAM> for a <FDESC> project at <ADDRESS>. Was the decision making process for that project the same as for the <ENDUSE> project we have been talking about?

1 Same decision making process
2 Different decision making process
00 (Other) [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

SPILLOVER MODULE

Thank you for discussing the new <ENDUSE> that you <IMPLEMENTED> through the <PROGRAM>. Next, I would like to discuss any energy efficiency equipment you might have installed or other energy efficiency measures you might have undertaken OUTSIDE of the program.

91. Since your participation in the <PROGRAM>, did you implement any ADDITIONAL energy efficiency measures at this facility or at your other facilities within <UTILITIES>’s service territory that did NOT receive incentives through <PROGRAM ADMINISTRATOR>?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q92 IF [Q91=1]

92. What was the first measure that you implemented? IF RESPONSE IS GENERAL, E.G., “LIGHTING EQUIPMENT”, PROBE FOR SPECIFIC MEASURE. PROBE FROM LIST, IF NECESSARY.

1 Lighting: T8 lamps
2 Lighting: T5 lamps
3 Lighting: Highbay Fixture Replacement
4 Lighting: CFLs
5 Lighting: Controls / Occupancy sensors
6 Lighting: LED lamps

7 Cooling: Unitary/Split Air Conditioning System
8 Cooling: Room air conditioners
9 Cooling: Variable Frequency Drives VFD/VSD on HVAC Motors
10 Motors: Efficient motors
11 Refrigeration: Strip curtains
12 Refrigeration: Anti-sweat controls
13 Refrigeration: EC motor for WALK-IN cooler/freezer
14 Refrigeration: EC motor for REACH-IN cooler/freezer
00 (Other) [RECORD VERBATIM]
96 (Didn’t implement any measures)
98 (Don't know)
99 (Refused)

ASK Q93 IF [Q92<>96,98,99] AND [Q91=1]

93. What was the second measure? IF RESPONSE IS GENERAL, E.G., “LIGHTING EQUIPMENT”, PROBE FOR SPECIFIC MEASURE. PROBE FROM LIST, IF NECESSARY.

1 Lighting: T8 lamps
2 Lighting: T5 lamps
3 Lighting: Highbay Fixture Replacement
4 Lighting: CFLs
5 Lighting: Controls / Occupancy sensors
6 Lighting: LED lamps
7 Cooling: Unitary/Split Air Conditioning System
8 Cooling: Room air conditioners
9 Cooling: Variable Frequency Drives VFD/VSD on HVAC Motors
10 Motors: Efficient motors
11 Refrigeration: Strip curtains
12 Refrigeration: Anti-sweat controls
13 Refrigeration: EC motor for WALK-IN cooler/freezer
14 Refrigeration: EC motor for REACH-IN cooler/freezer
00 (Other) [RECORD VERBATIM]
96 (Didn’t implement any measures)
98 (Don't know)
99 (Refused

ASK Q94 IF [Q93<>96,98,99] AND [Q92<>96,98,99] AND [Q91=1]

94. What was the third measure? IF RESPONSE IS GENERAL, E.G., “LIGHTING EQUIPMENT”, PROBE FOR SPECIFIC MEASURE. PROBE FROM LIST, IF NECESSARY.

1 Lighting: T8 lamps
2 Lighting: T5 lamps
3 Lighting: Highbay Fixture Replacement
4 Lighting: CFLs
5 Lighting: Controls / Occupancy sensors
6 Lighting: LED lamps

7 Cooling: Unitary/Split Air Conditioning System
8 Cooling: Room air conditioners
9 Cooling: Variable Frequency Drives VFD/VSD on HVAC Motors
10 Motors: Efficient motors
11 Refrigeration: Strip curtains
12 Refrigeration: Anti-sweat controls
13 Refrigeration: EC motor for WALK-IN cooler/freezer
14 Refrigeration: EC motor for REACH-IN cooler/freezer
00 (Other) [RECORD VERBATIM]
96 (Didn’t implement any measures)
98 (Don't know)
99 (Refused

ASK Q95 IF [Q92<>96,98,99] AND [Q91=1]

95. I have a few questions about the FIRST measure that you implemented. If needed, read back measure: <Q92 RESPONSE> [OPEN END]
a. Please describe the SIZE, TYPE, and OTHER ATTRIBUTES of this measure.
b. Please describe the EFFICIENCY of this measure.
c. How many of this measure did you implement?

ASK Q96 IF [Q92<>96,98,99] AND [Q91=1]

96. Was this measure specifically recommended by a program related audit, report or program technical specialist?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q97 IF [Q92<>96,98,99] AND [Q91=1]

97. How important was your experience in the <PROGRAM> in your decision to implement this Measure, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?
[RECORD 0 TO 10]
98 (Don’t know)
99 (Refused)

ASK Q98 IF [Q97<>98, 99] AND [Q92<>96,98,99] AND [Q91=1]

98. Can you explain how your experience with the <PROGRAM> influenced your decision to install this additional high efficiency measure?
00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q99 IF [Q92<>96,98,99] AND [Q91=1]

99. If you had not participated in the <PROGRAM>, how likely is it that your organization would still have implemented this measure, using a 0 to 10, scale where 0 means you

definitely WOULD NOT have implemented this measure and 10 means you definitely WOULD have implemented this measure?

[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

CONSISTENCY CHECK ON PROGRAM IMPORTANCE RATING VS. NO PROGRAM RATING MEASURE 1

ASK Q100 IF [[Q97=0,1,2,3] AND [Q99=0,1,2,3] AND [Q92<>96,98,99] AND [Q91=1]] OR [[IF [Q97=8,9,10] AND [Q99=8,9,10] AND [Q92<>96,98,99] AND [Q91=1]]

100. You scored the importance of your program experience to your decision to implement this measure with <Q1) RESPONSE > out of 10 possible points. You ALSO scored the likelihood of implementing this measure if your organization had not participated in the program with <Q2) RESPONSE> out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q101 IF [Q92<>96,98,99] AND [Q91=1]

101. Can you briefly explain why you decided to install this energy efficiency measure on your own, rather than going through the <PROGRAM>?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q102 IF [Q93<>96,98,99] AND [Q91=1]

102. I have a few questions about the SECOND measure that you implemented. If needed, read back measure: <Q93 RESPONSE> [OPEN END]

a. Please describe the SIZE, TYPE, and OTHER ATTRIBUTES of this measure.
b. Please describe the EFFICIENCY of this measure.
c. How many of this measure did you implement?

ASK Q103 IF [Q93<>96,98,99] AND [Q91=1]

103. Was this measure specifically recommended by a program related audit, report or program technical specialist?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q104 IF [Q93<>96,98,99] AND [Q91=1]

104. How important was your experience in the <PROGRAM> in your decision to implement this Measure, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?
[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

ASK Q105 IF [Q104<>98, 99] AND [Q93<>96,98,99] AND [Q91=1]
105. Can you explain how your experience with the <PROGRAM> influenced your decision to install this additional high efficiency measure?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q106 IF [Q93<>96,98,99] AND [Q91=1]
106. If you had not participated in the <PROGRAM>, how likely is it that your organization would still have implemented this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have implemented this measure and 10 means you definitely WOULD have implemented this measure?
[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

CONSISTENCY CHECK ON PROGRAM IMPORTANCE RATING VS. NO PROGRAM RATING MEASURE 2

ASK Q107 IF [[Q104=0,1,2,3] AND [Q106=0,1,2,3] AND [Q93<>96,98,99] AND [Q91=1]] OR [[IF [Q104=8,9,10] AND [Q106=8,9,10] AND [Q93<>96,98,99] AND [Q91=1]]
107. You scored the importance of your program experience to your decision to implement this measure with <Q104 RESPONSE > out of 10 possible points. You ALSO scored the likelihood of implementing this measure if your organization had not participated in the program with <Q106 RESPONSE> out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q108 IF [Q92<>96,98,99] AND [Q91=1]
108. Can you briefly explain why you decided to install this energy efficiency measure on your own, rather than going through the <PROGRAM>?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q109 IF [Q94<>96,98,99] AND [Q91=1]

109. I have a few questions about the THIRD measure that you implemented. If needed, read back measure: <SP3 RESPONSE> [OPEN END]
   a. Please describe the SIZE, TYPE, and OTHER ATTRIBUTES of this measure.
   b. Please describe the EFFICIENCY of this measure.
   c. How many of this measure did you implement?

ASK Q110 IF [Q94<>96,98,99] AND [Q91=1]

110. Was this measure specifically recommended by a program related audit, report or program technical specialist?
   1 Yes
   2 No
   98 (Don't know)
   99 (Refused)

ASK Q111 IF [Q94<>96,98,99] AND [Q91=1]

111. How important was your experience in the <PROGRAM> in your decision to implement this Measure, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?
   [RECORD 0 TO 10]
   98 (Don't know)
   99 (Refused)

ASK Q112 IF [Q111<>98, 99] AND [Q94<>96,98,99] AND [Q91=1]

112. Can you explain how your experience with the <PROGRAM> influenced your decision to install this additional high efficiency measure?
   00 [RECORD VERBATIM]
   98 (Don't know)
   99 (Refused)

ASK Q113 IF [Q94<>96,98,99] AND [Q91=1]

113. If you had not participated in the <PROGRAM>, how likely is it that your organization would still have implemented this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have implemented this measure and 10 means you definitely WOULD have implemented this measure?
   [RECORD 0 TO 10]
   98 (Don't know)
   99 (Refused)

CONSISTENCY CHECK ON PROGRAM IMPORTANCE RATING VS. NO PROGRAM RATING MEASURE 3

ASK Q114 IF [[Q111=0,1,2,3] AND [Q113=0,1,2,3] AND [Q94<>96,98,99] AND [Q91=1]] OR [[IF [Q111=8,9,10] AND [Q113=8,9,10] AND [Q94<>96,98,99] AND [Q91=1]]

114. You scored the importance of your program experience to your decision to implement this measure with <Q111 RESPONSE > out of 10 possible points. You ALSO scored the likelihood of implementing this measure if your organization had not

participated in the program with <Q113 RESPONSE> out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

ASK Q109 IF [Q115 <>96,98,99] AND [Q91=1]

115. Can you briefly explain why you decided to install this energy efficiency measure on your own, rather than going through the <PROGRAM>?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

PROCESS BATTERY

DISPLAY IF [NTG=B] Now I have just a few more questions about your experience with the program participation process.

ASK Q116 IF [NTG=B]

116. Did you work on completing the application for the program including gathering required documentation?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q117 IF [NTG=B]

117. Did anyone else help complete the application? MULTIPLE RESPONSE UP TO TWO

1 Another member of your company
2 A contractor
3 An equipment vendor
4 A designer or architect
5 Someone else (Please specify)
98 (Don't know)
99 (Refused)

ASK Q118 IF [Q116=1]

118. Thinking back to the application process, please rate the clarity of information on how to complete the application using a scale where 0 means "not at all clear" and 10 means "completely clear".

[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

ASK Q119 IF [Q118 < 8]

119. What information needs to be clarified?

ASK Q120 IF [Q116=1]

120. Did you have a clear sense of who you could go to for assistance with the application process?
1 Yes
2 No
98 (Don’t know)
99 Refused

ASK Q121 IF [NTG=B]

121. The next questions are about program staff that you may have contacted during the completion of your project. Program staff are anyone that reviewed your application, conducted site visits, determined your incentive amount, or processed your incentive check. Program staff are not anyone hired by you

In the course of completing this project, did you contact any program staff with questions or concerns about your project?
1 Yes
2 No
98 Don’t know
99 Refused

ASK Q122 IF [NTG=B]

122. Using a scale of 0 to 10 where 0 means "very dissatisfied" and 10 means "very satisfied", please rate your satisfaction with the following: how dissatisfied or satisfied you are with how long it took program staff to address your questions or concerns.
[Record 0-10]
98 Don’t know
99 Refused

a. [ASK IF Q121=1] how long it took program staff to address your questions or concerns
b. [ASK IF Q121=1] how thoroughly program staff addressed your question or concern
c. the steps you had to take to get through the program
d. the amount of time it took to get your rebate or incentive
e. the range of equipment that qualifies for incentives
f. the program overall

ASK Q123 [IF ANY Q122 < 4]

123. Please describe the ways in which you were dissatisfied with the aspects of the program you mentioned.

ASK Q124 IF [NTG=B]

124. Do you have any suggestions for how <PROGRAM ADMINISTRATOR> could improve its Energy Efficiency programs?

ASK Q124 IF [NTG=B]

125. What do you think are the best ways to communicate information about the <PROGRAM ADMINISTRATOR> programs to organizations like yours? [MULTISELECT UP TO 3 RESPONSES]

1 (E-mail)
2 (Telephone)
3 (Presentations at events or contractors)
4 (Trade allies/Vendors/Contractors)
5 (Direct mailings)
6 (Website updates)
7 (Other (Please specify))
98 (Don't know)
99 (Refused)

126. What type facility is the facility located at [Facility]?

1 (Airport)
2 (Community College)
3 (Correctional Facility)
4 (K-12 School)
5 (Public Library)
6 (Medical Facility)
7 (Municipal Facility)
8 (Park District Facility)
9 (Police or Fire Station)
10 (Public Works Facility)
11 (State University)
12 (Wastewater Treatment Facility)
13 (Other (Please specify))
98 (Don't know)
99 (Refused)

127. Does [Organization] rent, own and occupy, or own and rent to someone else the facility at this location?

1 Rent
2 Own and occupy
3 Own and rent to someone else
98 (Don’t know)
99 (Refused)

128. Does your organization pay the full cost of the natural gas bill for the facility located at [Location]?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

129. Does your organization pay the full cost of the electric bill for the facility located at [Location]?

1 Yes
2 No
98 (Don't know)
99 (Refused)

8. Appendix C: Custom and Standard Participant Survey Responses

As part of the evaluation work effort, a survey was made of a sample of decision makers for facilities that received incentives from the Custom and Standard Incentives Programs. The survey provided the information used in Chapter 4 to estimate free ridership for projects in the Custom and Standard Incentives Programs. However, the survey also provided more general information pertaining to the making of decisions to improve energy efficiency by program participants.

Each participant was interviewed using the survey instrument provided in Appendix B. The interviews were conducted by telephone or internet. During the interview, a participant was asked questions about (1) his or her general decision making regarding purchasing and installing energy efficient equipment, (2) his or her knowledge of and satisfaction with the program, and (3) the influence that the program had on his or her decision to install energy efficiency measures (e.g., lighting measures, HVAC measures,).

The following tabulations summarize participant survey responses. Two columns of data are presented. The first column presents the number of survey respondents (n). The second column presents the percentage of survey respondents.

	Response	*(n=159)*	*Percent of Respondents*
What is your job title or role?	Facilities Manager	35	22%
	Energy Manager	6	4%
	Other facilities management/maintenance position	1	1%
	Chief Financial Officer	2	1%
	Other financial/administrative position	12	8%
	Proprietor/Owner	1	1%
	President/CEO	3	2%
	Manager	17	11%
	Mayor	8	5%
	Fire Chief	6	4%
	Director/Superintendent	65	41%
	Engineer	3	2%
	Other	0	0%
	Don't Know	0	0%
	Refused	0	0%

	Response	*(n=159)*	*Percent of Respondents*
How did you first learn about the incentives for energy saving improvements provided through the program?	From a retro-commissioning service provider	22	14%
	At a Department of Commerce Trade Ally Rally	1	1%
	The program website	8	5%
	Through an internet search	11	7%
	From a Department of Commerce Program representative	29	18%
	From a friend or colleague	20	13%
	A presentation at a conference or workshop	41	26%
	The Department of Commerce Illinois Energy Now Newsletter	2	1%
	From a professional group or association that you are a member of	4	3%
	Illinois Green Economy Network	1	1%
	From a board member	2	1%
	Metropolitan Mayors Caucus	2	1%
	Previous participation	2	1%
	Other	12	8%
	Don't know	2	1%

	Response	*(n=159)*	*Percent of Respondents*
Did you work with a contractor or vendor that helped you decide to implement the energy efficient equipment?	Yes	123	77%
	No	34	21%
	Don't know	2	1%
	Refused	0	0%

	Response	*(n=123)*	*Percent of Respondents*
Did the vendor or contractor encourage you to participate in the program	Yes	88	72%
	No	31	25%
	Don't know	4	3%
	Refused	0	0%

	Response	*(n=123)*	*Percent of Respondents*
Did you also use a DESIGN or CONSULTING engineer?	Yes	48	39%
	No	74	60%
	Don't know	0	0%
	Refused	1	1%

	Response	*(n=159)*	*Percent of Respondents*
Did the design or consulting engineer assist you with the project that you implemented through the program?	Yes	23	14%
	No	120	75%
	Don't know	16	10%
	Refused	0	0%

In the last year, did your budget include specific funding for improvements to energy efficiency?	*Response*	*(n=159)*	*Percent of Respondents*
	Yes	97	61%
	No	56	35%
	Don't know	6	4%
	Refused	0	0%

Did you have plans to implement the project that you implemented through the program before deciding to participate in the program?	*Response*	*(n=158)*	*Percent of Respondents*
	Yes	77	49%
	No	78	49%
	Don't know	3	2%
	Refused	0	0%

How certain are you that you DID NOT have plans to implement the project?	*Response*	*(n=78)*	*Percent of Respondents*
	0 - Not at all certain	5	6%
	1	1	1%
	2	4	5%
	3	1	1%
	4	3	4%
	5	7	9%
	6	2	3%
	7	3	4%
	8	12	15%
	9	5	6%
	10 - Extremely certain	32	41%
	Don't know	3	4%
	Refused	0	0%

Is there an individual within your organization that might know more about whether or not your organization had plans to implement the [question("value"), id="8"] before deciding to participate in the [question("value"), id="3"]?	*Response*	*(n=43)*	*Percent of Respondents*
	Yes	2	5%
	No	41	95%
	Don't know	0	0%
	Refused	0	0%

Did the plans you had before deciding to participate in the program specify the specific equipment you were going to implement?	*Response*	*(n=77)*	*Percent of Respondents*
	Yes	35	45%
	No	40	52%
	Don't know	2	3%
	Refused	0	0%

	Response	*(n=40)*	*Percent of Respondents*
How certain are you that your plans DID NOT specify which specific equipment you were going to implement?	0 - Not at all likely	1	3%
	1	1	3%
	2	0	0%
	3	0	0%
	4	2	5%
	5	4	10%
	6	0	0%
	7	1	3%
	8	5	13%
	9	2	5%
	10 - Extremely likely	23	58%
	Don't know	1	3%
	Refused	0	0%

	Response	*(n=16)*	*Percent of Respondents*
Is there an individual within your organization that might know more about whether or not your organization's plans specified the specific equipment you were going to implement?	Yes	0	0%
	No	16	100%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=78)*	*Percent of Respondents*
Without the program incentive, did your organization have the funds available to implement the same project that you implemented through the program?	Yes	40	51%
	No	37	47%
	Don't know	1	1%
	Refused	0	0%

	Response	*(n=37)*	*Percent of Respondents*
How certain are you that your organization DID NOT have the funds available to implement the same project before deciding to participate in the program?	0 - Not at all certain	0	0%
	1	0	0%
	2	0	0%
	3	1	3%
	4	0	0%
	5	3	8%
	6	1	3%
	7	0	0%
	8	7	19%
	9	6	16%
	10 - Extremely certain	18	49%
	Don't know	1	3%
	Refused	0	0%

Is there an individual within your organization that might know more about whether or not your organization had the funds available to implement the project before deciding to participate in the program?	*Response*	*(n=18)*	*Percent of Respondents*
	Yes	1	6%
	No	17	94%
	Don't know	0	0%
	Refused	0	0%

How likely is it that your organization could have funded this project without the program's financial assistance?	*Response*	*(n=159)*	*Percent of Respondents*
	0 - Not at all likely	30	19%
	1	10	6%
	2	12	8%
	3	2	1%
	4	8	5%
	5	19	12%
	6	12	8%
	7	8	5%
	8	17	11%
	9	3	2%
	10 - Extremely likely	33	21%
	Don't know	5	3%
	Refused	0	0%

Did the new equipment that you installed through the program replace existing equipment, add to existing equipment, or was it new additional standalone equipment?	*Response*	*(n=138)*	*Percent of Respondents*
	Replaced existing equipment	125	91%
	Added to control or work directly with existing equipment	7	5%
	New additional standalone equipment	5	4%
	Other	0	0%
	Don't know	1	1%
	Refused	0	0%

	Response	*(n=159)*	*Percent of Respondents*
In deciding to do a project of this type, there are usually a number of reasons why it may be undertaken. In your own words, can you tell me why this project was implemented? [MULTIPLE RESPONSE. UP TO THREE.]	To replace old or outdated equipment	97	61%
	As part of a planned remodeling, build-out, or expansion	1	1%
	To gain more control over how the equipment was used	8	5%
	The maintenance downtime and associated expenses for the old equipment were too high	22	14%
	Had process problems and were seeking a solution	5	3%
	To improve equipment performance	23	14%
	To improve the product quality	12	8%
	To comply with codes set by regulatory agencies	0	0%
	To comply with organizational policies regarding regular/normal maintenance/replacement policy	0	0%
	To get a rebate from the program	20	13%
	To protect the environment	2	1%
	To reduce energy costs	94	59%
	To reduce energy use/power outages	37	23%
	To update to the latest technology	15	9%
	Other	10	6%
	Don’t know	0	0%
	Refused	0	0%

	Response	*(n=124)*	*Percent of Respondents*
Which of the following statements best describes the performance and operating condition of the equipment you replaced through the utility’s program?	Existing equipment was fully functional, and without significant issues	20	16%
	Existing equipment was fully functioning, but with significant issues	34	27%
	Existing equipment had failed or did not function	10	8%
	Existing equipment was obsolete	21	17%
	Existing equipment was fully functioning with minor issues	31	25%
	Other	7	6%
	Don't know	1	1%
	Refused	0	0%

	Response	*(n=131)*	*Percent of Respondents*
When did you first learn about the utility's program? Was it BEFORE or AFTER you finalized the specifications of your project (including the efficiency level and the scope of the project)?	Before	110	84%
	After	16	12%
	Don't know	5	4%
	Refused	0	0%

	Response	*(n=159)*	*Percent of Respondents*
If the utility's program had not been available, what is the likelihood that you would have implemented the exact same project?	0 - Not at all likely	41	26%
	1	10	6%
	2	16	10%
	3	15	9%
	4	11	7%
	5	18	11%
	6	7	4%
	7	10	6%
	8	12	8%
	9	4	3%
	10 - Extremely likely	14	9%
	Don't know	1	1%
	Refused	0	0%

	Response	*(n=159)*	*Percent of Respondents*
If the program had not been available, what is the likelihood that you would have implemented the exact same project within 12 months of when you actually implemented it?	0 - Not at all likely	50	31%
	1	11	7%
	2	20	13%
	3	12	8%
	4	9	6%
	5	16	10%
	6	7	4%
	7	6	4%
	8	9	6%
	9	4	3%
	10 - Extremely likely	13	8%
	Don't know	2	1%
	Refused	0	0%

	Response	*(n=159)*	*Percent of Respondents*
Without the program, when do you think you would have implemented the project?	At the same time	32	20%
	After	71	45%
	Never	39	25%
	Don't know	17	11%
	Refused	0	0%

	Response	*(n=71)*	*Percent of Respondents*
How much later would you have implemented the project without the program?	0 to 6 months	1	1%
	7 months to 1 year	9	13%
	more than 1 year up to 2 years	15	21%
	more than 2 years up to 3 years	13	18%
	more than 3 years up to 4 years	7	10%
	Over 4 years	23	32%
	Don’t know	3	4%
	Refused	0	0%

	Response	*(n=125)*	*Percent of Respondents*
The impact of the age or condition of the existing equipment?	0 - No Impact	3	2%
	1	1	1%
	2	0	0%
	3	1	1%
	4	6	5%
	5	21	17%
	6	5	4%
	7	6	5%
	8	26	21%
	9	13	10%
	10 - Decisive impact	42	34%
	Don't know	0	0%
	Not Applicable	1	1%

	Response	*(n=159)*	*Percent of Respondents*
The impact of the availability of the program incentive	0 - No Impact	8	5%
	1	1	1%
	2	1	1%
	3	2	1%
	4	1	1%
	5	13	8%
	6	7	4%
	7	13	8%
	8	24	15%
	9	16	10%
	10 - Decisive impact	73	46%
	Don't know	0	0%
	Not Applicable	0	0%

	Response	*(n=159)*	*Percent of Respondents*
The impact of technical assistance you received from program staff	0 - No Impact	24	15%
	1	6	4%
	2	7	4%
	3	4	3%
	4	4	3%
	5	22	14%
	6	6	4%
	7	9	6%
	8	19	12%
	9	6	4%
	10 - Decisive impact	23	14%
	Don't know	1	1%
	Not Applicable	28	18%

	Response	*(n=122)*	*Percent of Respondents*
The impact of a recommendation from an equipment vendor or contractor that helped you with the choice of the equipment used	0 - No Impact	5	4%
	1	0	0%
	2	1	1%
	3	4	3%
	4	1	1%
	5	7	6%
	6	3	2%
	7	15	12%
	8	38	31%
	9	7	6%
	10 - Decisive impact	32	26%
	Don't know	3	2%
	Not Applicable	6	5%

	Response	*(n=158)*	*Percent of Respondents*
The impact of previous experience with implementing energy efficient equipment	0 - No Impact	29	18%
	1	3	2%
	2	7	4%
	3	3	2%
	4	3	2%
	5	15	9%
	6	7	4%
	7	9	6%
	8	24	15%
	9	4	3%
	10 - Decisive impact	15	9%
	Don't know	3	2%
	Not Applicable	36	23%

	Response	*(n=158)*	*Percent of Respondents*
The impact of a recommendation from program staff	0 - No Impact	36	23%
	1	6	4%
	2	9	6%
	3	1	1%
	4	5	3%
	5	16	10%
	6	3	2%
	7	10	6%
	8	13	8%
	9	5	3%
	10 - Decisive impact	15	9%
	Don't know	5	3%
	Not Applicable	34	22%

	Response	*(n=158)*	*Percent of Respondents*
The impact of information from program marketing materials	0 - No Impact	34	22%
	1	4	3%
	2	9	6%
	3	3	2%
	4	4	3%
	5	21	13%
	6	11	7%
	7	14	9%
	8	10	6%
	9	5	3%
	10 - Decisive impact	11	7%
	Don't know	3	2%
	Not Applicable	29	18%

	Response	*(n=48)*	*Percent of Respondents*
The impact of a recommendation from a design or consulting engineer	0 - No Impact	3	6%
	1	0	0%
	2	0	0%
	3	0	0%
	4	1	2%
	5	4	8%
	6	3	6%
	7	8	17%
	8	7	15%
	9	11	23%
	10 - Decisive impact	6	13%
	Don't know	1	2%
	Not Applicable	4	8%

The impact of standard practice	*Response*	*(n=158)*	*Percent of*

in your organization			*Respondents*
	0 - No Impact	14	9%
	1	1	1%
	2	8	5%
	3	6	4%
	4	4	3%
	5	27	17%
	6	7	4%
	7	17	11%
	8	27	17%
	9	7	4%
	10 - Decisive impact	18	11%
	Don't know	4	3%
	Not Applicable	18	11%

The impact of an endorsement or recommendation by utility staff	*Response*	*(n=158)*	*Percent of Respondents*
	0 - No Impact	44	28%
	1	8	5%
	2	5	3%
	3	1	1%
	4	4	3%
	5	10	6%
	6	4	3%
	7	10	6%
	8	9	6%
	9	6	4%
	10 - Decisive impact	9	6%
	Don't know	7	4%
	Not Applicable	41	26%

The impact of organizational policy or guidelines	*Response*	*(n=158)*	*Percent of Respondents*
	0 - No Impact	25	16%
	1	3	2%
	2	8	5%
	3	7	4%
	4	2	1%
	5	19	12%
	6	8	5%
	7	24	15%
	8	15	9%
	9	5	3%
	10 - Decisive impact	13	8%
	Don't know	3	2%
	Not Applicable	26	16%

If you were given a TOTAL of 100 points that reflect the	*Response*	*(n=159)*	*Percent of Respondents*

importance in your decision to implement the measure and you had to divide those 100 points between: 1) the program and 2) other factors, how many points would you give to the importance of the PROGRAM?	Less than 20	8	5%
	20 to 40	12	8%
	40 to 60	23	14%
	60 to 80	42	26%
	more than 80	74	47%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=159)*	*Percent of Respondents*
And how many points would you give to the other factors?	Less than 20	40	25%
	20 to 40	64	40%
	40 to 60	28	18%
	60 to 80	16	10%
	more than 80	11	7%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=5)*	*Percent of Respondents*
The last question asked you to divide a TOTAL of 100 points between the program and other factors. You just noted that you would give [question("value"), id="105"] points to the program. Does that mean you would give [question("value"), id="116"] points to the other factors?	Yes	4	80%
	No	1	20%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=159)*	*Percent of Respondents*
Please rate the impact that PAYBACK ON THE INVESTMENT had on the decision to the implement the energy efficiency project.	0 - No Impact	2	1%
	1	1	1%
	2	4	3%
	3	2	1%
	4	5	3%
	5	16	10%
	6	7	4%
	7	14	9%
	8	30	19%
	9	15	9%
	10 - Decisive impact	60	38%
	Don't know	3	2%
	Refused	0	0%

	Response	*(n=119)*	*Percent of Respondents*
What is the payback cut-off point your organization uses before deciding to complete a project like this one?	0 to 6 months	0	0%
	7 months to 1 year	6	5%
	more than 1 year up to 2 years	9	8%
	more than 2 years up to 3 years	16	13%
	more than 3 years up to 5 years	27	23%
	Over 5 years	24	20%
	Don't know	37	31%
	Refused	0	0%

	Response	*(n=119)*	*Percent of Respondents*
Does your organization always implement projects that meet the required payback cut-off point?	Yes	33	28%
	No	57	48%
	Don't know	28	24%
	Refused	1	1%

	Response	*(n=118)*	*Percent of Respondents*
Did you review payback calculations for the project with and without the program incentive?	Yes	65	55%
	No	45	38%
	Don't know	8	7%
	Refused	0	0%

	Response	*(n=118)*	*Percent of Respondents*
Did the program incentive play an important role in moving your project within the acceptable payback cutoff point?	Yes	99	84%
	No	10	8%
	Don't know	9	8%
	Refused	0	0%

	Response	*(n=56)*	*Percent of Respondents*
Does your organization have an environmental policy or sustainability plan to reduce environmental emissions or energy use?	Yes	36	64%
	No	18	32%
	Don't know	2	4%
	Refused	0	0%

	Response	*(n=36)*	*Percent of Respondents*
Prior to participating in the utility's program, had that policy caused you to implement energy efficient projects at this or another facility without a program incentive?	Yes	17	47%
	No	18	50%
	Don't know	1	3%
	Refused	0	0%

Does your organization have the financial ability to implement its policy?	*Response*	*(n=56)*	*Percent of Respondents*
	Yes	29	52%
	No	22	39%
	Don't know	5	9%
	Refused	0	0%

Could you please rate the importance of the PROGRAM, relative to STANDARD PRACTICE, in affecting your decision to implement the project?	*Response*	*(n=68)*	*Percent of Respondents*
	Much more important	11	16%
	Somewhat more important	17	25%
	Equally important	35	51%
	Somewhat less important	3	4%
	Much less important	1	1%
	Don't know	1	1%
	Refused	0	0%

Does your organization ever deviate from the standard practice?	*Response*	*(n=68)*	*Percent of Respondents*
	Yes	19	28%
	No	38	56%
	Don't know	11	16%
	Refused	0	0%

Could you please rate the importance of the program as compared with standard organization practice in affecting your decision to implement the project?	*Response*	*(n=68)*	*Percent of Respondents*
	Much more important	13	19%
	Somewhat more important	12	18%
	Equally important	33	49%
	Somewhat less important	7	10%
	Much less important	1	1%
	Don't know	2	3%
	Refused	0	0%

Our records show that your organization also received an incentive from the utility's program for other project(s). Was it a single decision to complete those projects for which you received an incentive from the program or did each project go through its own decision process?	*Response*	*(n=33)*	*Percent of Respondents*
	Single Decision	15	45%
	Each project went through its own decision process	16	48%
	Other	2	6%
	Don't know	0	0%
	Refused	0	0%

Our records show that your organization also received an incentive from the utility's program for a different energy efficiency project. Was the decision making process for that project the same as for the project we have been talking about?	*Response*	*(n=26)*	*Percent of Respondents*
	Same decision making process	24	92%
	Different decision making process	2	8%
	Other	0	0%
	Don't know	0	0%
	Refused	0	0%

Since your participation in the program, did you implement any ADDITIONAL energy efficiency measures at this facility or at your other facilities within the utilitiy's service territory that did NOT receive incentives through the program?	*Response*	*(n=158)*	*Percent of Respondents*
	Yes	58	37%
	No	93	59%
	Don't know	6	4%
	Refused	1	1%

Did you work on completing the application for the program including gathering required documentation?	*Response*	*(n=152)*	*Percent of Respondents*
	Yes	117	77%
	No	35	23%
	Don't know	0	0%
	Refused	0	0%

Did anyone else help complete the application? [MULTIPLE RESPONSE, UP TO TWO]	*Response*	*(n=118)*	*Percent of Respondents*
	Another member of your company	19	12%
	A contractor	34	21%
	An equipment vendor	38	24%
	A designer or architect	14	9%
	360 energy group	13	8%
	Consultant	5	3%
	Engineer	5	3%
	Department of Commerce Staff	3	2%
	Someone else (Please specify)	23	14%
	Don't know	16	10%
	Refused	1	1%

	Response	*(n=117)*	*Percent of Respondents*
Thinking back to the application process, please rate the clarity of information on how to complete the application.	0 - Not at all clear	1	1%
	1	0	0%
	2	2	2%
	3	1	1%
	4	3	3%
	5	5	4%
	6	9	8%
	7	20	17%
	8	28	24%
	9	15	13%
	10 - Completely clear	26	22%
	Don't know	7	6%
	Refused	0	0%

	Response	*(n=117)*	*Percent of Respondents*
Did you have a clear sense of who you could go to for assistance with the application process?	Yes	108	92%
	No	8	7%
	Don't know	1	1%
	Refused	0	0%

	Response	*(n=152)*	*Percent of Respondents*
In the course of completing this project, did you contact any program staff with questions or concerns about your project?	Yes	59	39%
	No	84	55%
	Don't know	9	6%
	Refused	0	0%

	Response	*(n=59)*	*Percent of Respondents*
How satisfied are you with how thoroughly program staff addressed your question or concern?	0 - Very dissatisfied	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	2	3%
	6	0	0%
	7	6	10%
	8	8	14%
	9	11	19%
	10 - Very satisfied	31	53%
	Don't know	1	2%
	Refused	0	0%

	Response	*(n=59)*	*Percent of Respondents*
How satisfied are you with how long it took program staff to address your questions or concerns	0 - Very dissatisfied	0	0%
	1	0	0%
	2	0	0%
	3	1	2%
	4	1	2%
	5	2	3%
	6	0	0%
	7	8	14%
	8	8	14%
	9	14	24%
	10 - Very satisfied	25	42%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=152)*	*Percent of Respondents*
How satisfied are you with the steps you had to take to get through the program	0 - Very dissatisfied	1	1%
	1	0	0%
	2	3	2%
	3	3	2%
	4	1	1%
	5	7	5%
	6	6	4%
	7	17	11%
	8	38	25%
	9	22	14%
	10 - Very satisfied	47	31%
	Don't know	7	5%
	Refused	0	0%

	Response	*(n=152)*	*Percent of Respondents*
How satisfied are you with the amount of time it took to get your rebate or incentive	0 - Very dissatisfied	4	3%
	1	1	1%
	2	2	1%
	3	4	3%
	4	3	2%
	5	11	7%
	6	12	8%
	7	15	10%
	8	33	22%
	9	14	9%
	10 - Very satisfied	45	30%
	Don't know	8	5%
	Refused	0	0%

	Response	*(n=150)*	*Percent of Respondents*
How satisfied are you with the range of equipment that qualifies for incentives	0 - Very dissatisfied	1	1%
	1	0	0%
	2	0	0%
	3	2	1%
	4	1	1%
	5	9	6%
	6	7	5%
	7	22	15%
	8	34	23%
	9	14	9%
	10 - Very satisfied	37	25%
	Don't know	23	15%
	Refused	0	0%

	Response	*(n=152)*	*Percent of Respondents*
How satisfied are you with the program overall	0 - Very dissatisfied	0	0%
	1	0	0%
	2	1	1%
	3	0	0%
	4	0	0%
	5	3	2%
	6	2	1%
	7	5	3%
	8	27	18%
	9	40	26%
	10 - Very satisfied	74	49%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=142)*	*Percent of Respondents*
What do you think are the best ways to communicate information about the programs to organizations like yours? [MULTI SELECT UP TO 3 RESPONSES]	E-mail	79	50%
	Telephone	7	4%
	Presentations at events or contractors	32	20%
	Trade allies/Vendors/Contractors	22	14%
	Direct mailings	33	21%
	Website updates	15	9%
	Through professional organizations / regional planning groups	9	6%
	Utility bill message / insert	3	2%
	Other (Please Specify)	27	17%
	Don't know	5	3%
	Refused	0	0%

	Response	*(n=158)*	*Percent of Respondents*
What type facility is the facility located at address?	Airport	2	1%
	Community College	5	3%
	Correctional Facility	2	1%
	K-12 School	42	27%
	Public Library	7	4%
	Medical Facility	1	1%
	Municipal Facility	24	15%
	Park District Facility	20	13%
	Police or Fire Station	14	9%
	Public Works Facility	4	3%
	State University	5	3%
	Wastewater Treatment Facility	14	9%
	Community Center	2	1%
	Courthouse	2	1%
	Garage	3	2%
	Street Lighting	3	2%
	911 Facility	1	1%
	Other	7	4%
	Don't know	0	0%

	Response	*(n=157)*	*Percent of Respondents*
Does your organization rent, own and occupy, or own and rent to someone else the facility at this location?	Rent	0	0%
	Own and occupy	148	94%
	Own and rent to someone else	6	4%
	Don't know	3	2%
	Refused	0	0%

	Response	*(n=158)*	*Percent of Respondents*
Does your organization pay the full cost of the natural gas bill for the facility?	Yes	138	87%
	No	13	8%
	Don't know	6	4%
	Refused	1	1%

	Response	*(n=158)*	*Percent of Respondents*
Does your organization pay the full cost of the electric bill for the facility?	Yes	145	92%
	No	9	6%
	Don't know	3	2%
	Refused	1	1%

9. Appendix D: New Construction Participant Survey

SCREENING

1. Hello. May I please speak with <CONTACT>?

   Hello. My name is _____and I am calling on behalf of the Illinois Department of Commerce & Economic Opportunity.

   We are conducting a study on behalf of the Department of Commerce to help them improve their programs.

   According to our records, you participated in the Department of Commerce's Illinois Energy Now Program, through which you received a rebate or incentive for an energy efficient new construction project located at <ADDRESS>.

   We would like you to answer some questions about your decision making regarding your experience with the program. Do you have a few minutes to speak with me?
   [IF NEEDED: INTERVIEW SHOULD TAKE APPROXIMATELY 15 MINUTES]
   1 (Yes)
   2 (Not available at this time: SCHEDULE CALL BACK)
   3 (Not familiar with project [ASK TO BE REFERRED TO SOMEONE WHO IS FAMILIAR])

2. I was told you're the person who is most knowledgeable about this project. Is this correct?

1 (Yes)
2 (No) [ASK TO BE REFERRED TO SOMEONE WHO IS THE MOST KNOWLDEABLE AND CONTACT THAT PERSON]

BACKGROUND

3. To begin, can you tell me 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)
97 (Other)
98 (Don't know)
99 (Refused)

4. How did you first learn about the incentives for energy efficient new construction provided through the <PROGRAM>?

1 (At a Department of Commerce Trade Ally Rally)
2 (The program website)
3 (Through an internet search)
4 (From a Department of Commerce Program representative)
5 (From the Smart Energy Design Assistance Center (SEDAC))
6 (From a friend or colleague)
7 (A presentation at a conference or workshop)
8 (The Department of Commerce Illinois Energy Now Newsletter)
9 (From a professional group or association that you are a member of)
10 (From a Trade Ally/contractor/equipment vendor/energy consultant)
97 (Other)
98 (Don't know)
99 (Refused)

CONRACTOR/DESIGNER/ARCHITECT INFORMATION BATTERY

5. Did you work with a designer or architect that helped you incorporate energy efficient equipment or design features in the new construction project completed at <ADDRESS>?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q6 IF [Q5=1]

6. Did the designer or architect encourage you to participate in the <PROGRAM>?

1 Yes
2 No
98 (Don't know)
99 (Refused)

7. Did you work with a general contractor that helped you decide to incorporate the energy efficient equipment or design features?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q8 IF [Q7=1]

8. Did the general contractor you worked with encourage you to participate in the <PROGRAM>?

1 Yes
2 No
98 (Don't know)
99 (Refused)

9. Did you work with a design or consulting engineer that helped you decide to incorporate the energy efficient equipment or design features?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q10 IF [Q9=1]

10. Did the design or consulting engineer you worked with encourage you to participate in the <PROGRAM>?

1 Yes
2 No
98 (Don't know)
99 (Refused)

11. Did you receive design assistance through the Smart Energy Design Assistance Center when planning this project?

1 Yes
2 No
98 (Don't know)

99 (Refused)

PROJECT BACKGROUND

I’d now like to ask a few questions about the <ENDUSE> you <IMPLEMENTED> through the program as part of this new construction project.

READ Q12 IF [Q11 = 1]

12. For the remainder of the survey, please consider any design assistance that you received through the Smart Energy Design Assistance Center as part of the program.

13. Did you have plans to implement the <ENDUSE> that you implemented through the program before deciding to participate in the <PROGRAM>?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q14 IF [Q13 = 2]

14. Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that you DID NOT have plans to implement the <ENDUSE>?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q15 IF [Q14 < 10]

15. Is there an individual within your organization that might know more about whether or not your organization had plans to implement the <ENDUSE> before deciding to participate in the <PROGRAM>?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q16 IF [Q15 = 1]

16. May I have contact information for that individual? [OBTAIN CONTACT INFORMATION FOR INDIVIDUAL]

[RECORD VERBATIM]

98 (Don’t know)

99 (Refused)

ASK Q17 IF [Q13 = 1]

17. Did the plans you had before deciding to participate in the program specify the specific <ENDUSE> you were going to implement?

1 Yes

2 No

98 (Don’t know)

99 (Refused)

ASK Q18 IF [Q17 = 2]

18. Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that your plans DID NOT specify which specific <ENDUSE> you were going to implement?

[RECORD 0 to 10]

98 (Don’t know)

99 (Refused)

ASK Q19 IF [Q18 < 10]

19. Is there an individual within your organization that might know more about whether or not your organization's plans specified the specific <ENDUSE> you were going to implement?

1 Yes

2 No

98 (Don’t know)

99 (Refused)

ASK Q20 IF [Q19 = 1]

20. May I have contact information for that individual? [OBTAIN CONTACT INFORMATION FOR INDIVIDUAL]

[RECORD VERBATIM]

98 (Don’t know)
99 (Refused)

ASK Q21 IF [Q13 = 1] AND [NTG = E]

21. In as much detail as possible, can you tell me more about the nature of the plans to implement <ENDUSE>, including efficiency levels, proposed equipment options, timelines, etc.?

[RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q22 IF [Q13 = 1]

22. Without the program incentive, did your organization have the funds available to implement the same <ENDUSE> that you implemented through the program?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q23 IF [Q22 =2]

23. Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that your organization DID NOT have the funds available to implement the same <ENDUSE> before deciding to participate in the <PROGRAM>?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q24 IF [Q23 < 10]

24. Is there an individual within your organization that might know more about whether or not your organization had the funds available to implement the <ENDUSE> before deciding to participate in the <PROGRAM>?

1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q25 IF [Q24 = 1]

25. May I have contact information for that individual? [OBTAIN CONTACT INFORMATION FOR INDIVIDUAL]

[RECORD VERBATIM]

98 (Don’t know)
99 (Refused)

26. Using a scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely," how likely is it that your organization could have funded the energy efficient equipment or design features incorporated in this new construction project without the program’s financial assistance?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

27. There are usually a number of reasons for incorporating energy efficient design features or equipment in a new construction project. In your own words, can you tell me why you decided to incorporate the energy efficient design features or equipment into this project? IF NEEDED: Were there any other reasons? MULTIPLE RESPONSE. UP TO THREE.

1 (To gain more control over how the equipment was used)
2 (The reduce maintenance costs)
3 (To comply with codes set by regulatory agencies)
4 (To comply with organizational policies regarding new construction)
5 (To get a rebate from the program)
6 (To protect the environment)
7 (To reduce energy costs)
8 (To reduce energy use/power outages)
9 (To update to the latest technology)
00 (Other) [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

NET-TO-GROSS BATTERY

28. When did you first learn about the <PROGRAM ADMINISTRATOR>’s <PROGRAM>? Was it BEFORE or AFTER you finalized the specifications for the <ENDUSE>, including the efficiency level and the scope of the energy efficiency aspects of the project.

1 Before
2 After

98 (Don't know)
99 (Refused)

Now I would like you to think about the action you might have taken with regard to the <ENDUSE> if the <PROGRAM ADMINISTRATOR> program had not been available.

29. Using a scale from 0 to 10, where 0 is “Not at all likely” and 10 is “Extremely likely”, if the <PROGRAM ADMINISTRATOR>’s program had not been available, what is the likelihood that you would have <IMPLEMENTED> the exact same [ENDUSE] in this new construction project?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

30. Next, I’m going to ask you to rate the impact of various factors that might have affected your decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>.

    Please rate the impact each had on your decision using a scale where a score of “0” means that the factor had no impact on the decision to implement the <ENDUSE>, and a score of “10” means that the factor had DECISIVE impact on the decision to the implement the <ENDUSE>.

[RECORD 0 to 10]
96 Not Applicable
98 (Don’t know)
99 (Refused)

[If needed: Please rate the impact of [FACTOR] in your decision to <IMPLEMENT> the <ENDUSE>.]

31. The impact of the availability of the <PROGRAM> incentive

ASK Q32 IF [Q31=8,9,10]

32. Why do you give it this rating?

[RECORD VERBATIM]
98 (Don’t know);
99 (Refused)

ASK Q33 IF [Q11 = 1]

33. The impact of the design assistance you received through the Smart Energy Design Assistance Center

ASK Q34 IF [Q33=8,9,10] AND [NTG=E]

34. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q35 IF [Q7=1]

35. The impact of a recommendation from a general contractor
36. The impact of a recommendation from a designer or architect
37. The impact of previous experience with implementing <ENDUSE>
38. The impact of a recommendation from <PROGRAM ADMINISTRATOR> program staff

ASK Q39 IF [NTG=E] AND [Q38=8,9,10]

39. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

40. The impact of information from <PROGRAM ADMINISTRATOR> marketing materials

ASK Q41 IF [NTG=E] AND [Q40=8,9,10]

41. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q42 IF [Q9=1]

42. The impact of a recommendation from a design or consulting engineer
43. The impact of standard practice in your organization

ASK Q44 IF [NTG=E] AND [Q43=8, 9, 10]

44. Why do you give it this rating?
[RECORD VERBATIM]
98 (Don't know)
99 (Refused)

45. The impact of organizational policy or guidelines

46. Were there any other factors we haven't discussed that that might have affected your decision to <IMPLEMENT> the <ENDUSE>?

00 [RECORD VERBATIM]
96 Nothing else influential
98 (Don't know)
99 (Refused)

ASK Q47 IF [Q46=00]

47. Using the same 0 to 10 scale, please rate the impact of this factor in your decision to <IMPLEMENT> the <ENDUSE> at this time?

[RECORD 0 to 10]
98 (Don't know)
99 (Refused)

48. [READ IF ANY OF Q31, Q33, Q35, Q36, Q37, Q38, Q40, Q42, Q43, Q45, Q46 =8,9,10]

You just assigned the following factors a score of 8 or higher:

[READ ONLY ITEMS FOR WHICH RESPONDENT GAVE A RATING OF 8 OR HIGHER]

Q31 Availability of the <PROGRAM> incentive

Q33 Design assistance you received through the Smart Energy Design Assistance Center

Q35 Recommendation from a general contractor

Q36 Recommendation from a designer or architect

Q37 Previous experience with implementing <ENDUSE>

Q38 Recommendation from <PROGRAM ADMINISTRATOR> program staff

Q40 Information from <PROGRAM ADMINISTRATOR> marketing materials

Q42 Recommendation from a design or consulting engineer

Q43 Standard practice in your organization

Q45 Organizational policy or guidelines

Q46 <OTHER FACTOR>

49. If you were given a TOTAL of 100 points that reflect the importance in your decision to <IMPLEMENT> the <ENDUSE> and you had to divide those 100 points between: 1) the program and 2) other factors, how many points would you give to the importance of the PROGRAM?

[RECORD 0 to 100]

98 (Don't know)

99 (Refused)

[CALCULATE VARIABLE <OTHERPTS> AS 100 MINUS Q49 RESPONSE; IF Q49=98, 99, SET OTHERPTS=BLANK]

50. And how many points would you give to the other factors?

[RECORD 0 to 100]

98 (Don't know)

99 (Refused)

[Note: The response should be <OTHERPTS> because both numbers should equal 100. If response does not equal <OTHERPTS>, ask Q51]

ASK Q51 IF [Q50<><OTHERPTS>]

51. The last question asked you to divide a TOTAL of 100 points between the program and other factors. You just noted that you would give <Q49 RESPONSE> points to the program. Does that mean you would give <OTHERPTS> points to the other factors?

1 Yes

2 No

98 (Don't know)

99 (Refused)

GO BACK TO Q49 IF [Q51=2] AND READ [OK LET ME ASK YOU THE QUESTION AGAIN]

CONSISTENCY CHECK ON PROGRAM INFLUENCE/PROGRAM COMPONENTS

READ Q52 IF [Q49 >70] AND [Q31<3] AND [Q33<3] AND [Q38<3] AND [Q40<3]

52. You just scored the impact of the program on your decision to implement the <ENDUSE> with <Q49 RESPONSE> out of 100 possible points. You ALSO gave relatively lower scoring to the impact of individual elements of the program experience.

ASK Q53 IF [Q49 <30] AND [[Q31>7] OR [Q33>7] OR [Q38>7] OR [Q40>7]]

53. You just scored the impact of the program on your decision to implement the <ENDUSE> with <Q49 RESPONSE> out of 100 possible points. You ALSO gave relatively higher scoring to the impact of individual elements of the program experience.

ASK Q54 IF [[Q49 >70] AND [Q31<3] AND [Q33<3] AND [Q38<3] AND [Q40<3]] OR

[[Q49 <30] AND [Q31>7]]

54. You scored the impact of THE AVAILABILITY OF THE PROGRAM INCENTIVE on your decision to implement the <ENDUSE> with <Q31 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q49 RESPONSE> out of 100 possible points. Why is the impact of THE AVAILABILITY OF THE PROGRAM INCENTIVE different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q55 IF [[Q49 >70] AND [Q31<3] AND [Q33<3] AND [Q38<3] AND [Q40<3]] OR

[[Q49 <30] AND [Q33>7]]

55. You scored the impact of the program THE DESIGN ASSISTANCE YOU RECEIVED THROUGH THE SMART ENERGY DESIGN ASSISTANCE CENTER on your decision to implement the <ENDUSE> with <Q33 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q49 RESPONSE> out of 100 possible points. Why is the impact of the program THE DESIGN ASSISTANCE YOU RECEIVED THROUGH THE SMART ENERGY DESIGN ASSISTANCE CENTER different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q56 IF [[Q49 >70] AND [Q31<3] AND [Q33<3] AND [Q38<3] AND [Q40<3]] OR

[[Q49 <30] AND [Q38>7]]

56. You scored the impact of THE RECOMMENDATION FROM <PROGRAM ADMINISTRATOR> <PROGRAM> STAFF PERSON on your decision to implement the <ENDUSE> with <Q38 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q49 RESPONSE> out of 100 possible points. Why is the impact of the THE RECOMMENDATION FROM <PROGRAM ADMINISTRATOR> STAFF PERSON different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q57 [IF Q49 >70] AND [Q31<3] AND [Q33<3] AND [Q38<3] AND [Q40<3]] OR

[[Q49 <30] AND [Q40>7]]

57. You scored the impact of the THE INFORMATION from <PROGRAM ADMINISTRATOR>'s MARKETING MATERIALS on your decision to implement the <ENDUSE> with <Q40 RESPONSE> out of 10 possible points, and scored the impact of the program overall with <Q49 > out of 100 possible points. Why is the impact of the THE INFORMATION from <PROGRAM ADMINISTRATOR>'s MARKETING MATERIALS different than the impact of the program overall?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

PROGRAM COMPONENTS (INCENTIVE)/NO PROGRAM CONSISTENCY CHECK

ASK Q58 IF [[Q31=8,9,10] AND [Q29=8,9,10]] OR [[Q31=0,1,2] AND [Q29=0,1,2]]

58. You scored the impact of the program incentive on your decision to implement the <ENDUSE> with <Q31 RESPONSE> out of 10 possible points. You ALSO scored the likelihood of <IMPLEMENTING> the exact same project without the incentive with <Q29 RESPONSE> out of 10 possible points. Can you please explain the role the incentive played in your decision to <IMPLEMENT> this <ENDUSE>?

00 Record VERBATIM
98 (Don't know)
99 (Refused)

ASK Q59 IF [[Q31=8,9,10] AND [Q29=8,9,10]] OR [[Q31=0,1,2] AND [Q29=0,1,2]]

59. Would you like to change your score of <Q31 RESPONSE> out of 10 possible points on the impact of the program incentive or change your score of <Q29 RESPONSE> out of 10 possible points on the likelihood of <IMPLEMENTING> the exact same project without the incentive? You may change one score, both scores, or neither score. How would you like to proceed?
DO NOT READ

1 Change impact of incentive score
2 Change likelihood of <IMPLEMENTING> the exact same project without the program score
3 Change both
4 Change neither
98 (Don't know)
99 (Refused)

ASK Q60 IF [Q59=1,3]

60. Please rate the impact of the PROGRAM incentive using a scale where a score of “0” means that the PROGRAM incentive had no impact on the decision to implement the energy efficiency project, and a score of “10” means that the PROGRAM incentive had DECISIVE impact on the decision to the implement the energy efficiency project.

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

ASK Q61 IF [Q59=2,3]

61. Using a scale from 0 to 10, where 0 is “Not at all likely” and 10 is “Extremely likely”, if the <PROGRAM ADMINISTRATOR>’s efficiency program had not been available, what is the likelihood that you would have <IMPLEMENTED> the exact same project?

[RECORD 0 to 10]
98 (Don’t know)
99 (Refused)

TIMING OF PROJECT DECISION / LEVEL OF PROGRAM ATTRIBUTION CONSISTENCY CHECK

ASK Q62 IF [[Q49 > 70 OR Q31 > 7 OR Q33 > 7 OR Q38 > 7 OR > 7 OR Q40> 7]] AND [Q28 = 2]

62. In response to an earlier question, you noted that you learned about the program AFTER you finalized the specifications of your <ENDUSE> project. Based on some of your other responses, it sounded like the program was important in your decision to install the high efficiency equipment. I want to check to see if I am misunderstanding your answers or if the questions may have been unclear. Will you explain the role the incentive program played in either your selection of the efficiency level of the installed equipment or the scope of the project?

00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q63 IF [Q35 > 7 AND [Q28= 2]

63. Earlier you stated that a recommendation from a general contractor was important to your decision to implement the <ENDUSE>. You also stated that you learned about the program after you decided to complete the project. Can you please explain the role the general contractor played in your decision to implement the <ENDUSE>?

00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q63 IF [Q36 > 7 AND [Q28= 2]

64. Earlier you stated that a recommendation from a designer or architect was important to your decision to implement the <ENDUSE>. You also stated that you learned about the program after you decided to complete the project. Can you please explain the role the designer or architect played in your decision to implement the <ENDUSE>?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q63 IF [Q42 > 7 AND [Q28= 2]

65. Earlier you stated that a recommendation from a design or consulting engineer was important to your decision to implement the <ENDUSE>. You also stated that you learned about the program after you decided to complete the project. Can you please explain the role the design or consulting engineer played in your decision to implement the <ENDUSE>?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

PAYBACK BATTERY

66. Please rate the impact of PAYBACK ON THE INVESTMENT using a scale where a score of "0" means that the PAYBACK ON THE INVESTMENT had no impact on the decision to implement the energy efficient design features or equipment and a score of "10" means that the PAYBACK ON THE INVESTMENT had DECISIVE impact on the decision to the implement the energy efficient design features or equipment.

[RECORD 0 to 10]
98 (Don't know)
99 (Refused)

ASK Q67 IF [Q66=7,8,9,10]

67. I'd like to find out more about the payback criteria <ORGANIZATION> uses for its investments and how it might have applied to the decision to <IMPLEMENT> the <ENDUSE>.

What is the payback cut-off point <ORGANIZATION> uses before deciding to complete a project like this one?

[DO NOT READ. Prompt if necessary: in years and months.]

1 0 to 6 months

2 7 months to 1 year
3 more than 1 year up to 2 years
4 more than 2 years up to 3 years
5 more than 3 years up to 5 years
6 Over 5 years
98 (Don’t know)
99 (Refused)

ASK Q68 IF [Q66=7,8,9,10]

68. Does your organization always implement projects that meet the required payback cut-off point?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q69 IF [Q66=7,8,9,10] AND [Q68=2] AND [NTG=E]

69. Why doesn’t your organization always implement projects that meet the required financial cut-off point?
00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q70 IF [Q66=7,8,9,10]

70. Did you review payback calculations for the <ENDUSE> project with and without the <PROGRAM> incentive?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q71 IF [Q66=7,8,9,10]

71. Did the program incentive play an important role in moving your project within the acceptable payback cutoff point?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ORGANIZATIONAL/CORPORATE POLICY BATTERY

ASK Q72 IF [Q45=7,8,9,10]

72. Does your organization have an environmental policy or sustainability plan to reduce environmental emissions or energy use? Some examples would be to "buy green" or use sustainable approaches to business investments.

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q73 IF [Q45=7,8,9,10] AND [Q72=1] AND [NTG = E]

73. What specific policy affected your decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q74 IF [Q45=7,8,9,10] AND [Q72=1]

74. Prior to participating in the <PROGRAM ADMINISTRATOR>'s <PROGRAM>, had that policy caused you to <IMPLEMENT> <ENDUSE> at another facility without a program incentive?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q75 IF [Q45=7,8,9,10]

75. Does <ORGANIZATION> have the financial ability to implement its policy?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q76 IF [[Q45=7,8,9,10] AND [Q74=1] AND [Q72=1] AND [NTG = E]]

76. Regarding the decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>, I want to make sure I fully understand the impact of this policy as compared with the impact of the program. Can you please elaborate on that?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

STANDARD PRACTICE BATTERY

ASK Q77 IF [Q43>6]

77. In an earlier question, you rated the importance of STANDARD PRACTICE in your organization very highly in your decision making. Could you please rate the importance of the PROGRAM, relative to this standard practice, in affecting your decision to <IMPLEMENT> the <ENDUSE>? Would you say the program was much more important, somewhat more important, equally important, somewhat less important, or much less important than your organization's standard practice?

1 Much more important
2 Somewhat more important
3 Equally important
4 Somewhat less important
5 Much less important
98 (Don't know)
99 (Refused)

ASK Q78 IF [[Q43=7,8,9,10] AND [NTG = E]]

78. Approximately, how long has use of <ENDUSE> been standard practice in your organization?

M [00 Record Number of Months; 98 (Don't know), 99 (Refused)]
Y [00 Record Number of Years; 98 (Don't know), 99 (Refused)]

ASK Q79 IF [Q43=7,8,9,10]

79. Does <ORGANIZATION> ever deviate from the standard practice?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q80 IF [Q43=7,8,9,10] AND [Q79=1] AND [NTG = E]

80. Please describe the conditions under which <ORGANIZATION> deviates from this standard

00 [RECORD VERBATIM]
98 (Don't know)

99 (Refused)

ASK Q81 IF [Q43=7,8,9,10] AND [NTG = E]

81. How did this standard practice affect your decision to <IMPLEMENT> the <ENDUSE> through the <PROGRAM>?
00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q82 IF [Q43=7,8,9,10]

82. Could you please rate the importance of the <PROGRAM> as compared with this standard organization practice in affecting your decision to <IMPLEMENT> the <ENDUSE>. Would you say the <PROGRAM> was…
1 Much more important
2 Somewhat more important
3 Equally important
4 Somewhat less important
5 Much less important
98 (Don’t know)
99 (Refused)

ASK Q83 IF [Q43=7,8,9,10] AND [NTG = E]

83. What group or trade organization, if any, do you look to establish standard practice for your organization?
00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ASK Q84 IF [Q43=7,8,9,10] AND [NTG = E]

84. How do you and other public sector organizations receive information on updates to standard practice?
00 [RECORD VERBATIM]
98 (Don’t know)
99 (Refused)

ADDITIONAL PROJECTS

ASK Q85 IF [MSAME=1]

85. Our records show that <ORGANIZATION> also received an incentive from <PROGRAM ADMINISTRATOR>'s <PROGRAM> for implementing energy efficient equipment or design features in <NSAME> other new construction projects. Was it a single decision to complete all of these new construction projects for which you received an incentive from the program or did each project go through its own decision process?

1 Single Decision
2 Each project went through its own decision process
00 (Other) [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q86 IF [FSAME=1]

86. Our records show that <ORGANIZATION> also received an incentive from<PROGRAM ADMINISTRATOR>'s <PROGRAM> for including <FDESC> in this new construction project. Was the decision making process for that aspect of the project the same as for the <ENDUSE> we have been talking about?

1 Same decision making process
2 Different decision making process
00 (Other) [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

SPILLOVER MODULE

Thank you for discussing the new <ENDUSE> that you <IMPLEMENTED> through the <PROGRAM>. Next, I would like to discuss any energy efficiency equipment you might have installed or other energy efficiency measures you might have undertaken OUTSIDE of the program.

87. Since your participation in the <PROGRAM>, did you implement any ADDITIONAL energy efficiency measures at this facility or at your other facilities within <UTILITIES>'s service territory that did NOT receive incentives through <PROGRAM ADMINISTRATOR>?

1 Yes

2 No
98 (Don’t know)
99 (Refused)

ASK Q88 IF [Q87=1]

88. What was the first measure that you implemented? IF RESPONSE IS GENERAL, E.G., “LIGHTING EQUIPMENT”, PROBE FOR SPECIFIC MEASURE. PROBE FROM LIST, IF NECESSARY.

1 Lighting: T8 lamps
2 Lighting: T5 lamps
3 Lighting: Highbay Fixture Replacement
4 Lighting: CFLs
5 Lighting: Controls / Occupancy sensors
6 Lighting: LED lamps
7 Cooling: Unitary/Split Air Conditioning System
8 Cooling: Room air conditioners
9 Cooling: Variable Frequency Drives VFD/VSD on HVAC Motors
10 Motors: Efficient motors
11 Refrigeration: Strip curtains
12 Refrigeration: Anti-sweat controls
13 Refrigeration: EC motor for WALK-IN cooler/freezer
14 Refrigeration: EC motor for REACH-IN cooler/freezer
00 (Other) [RECORD VERBATIM]
96 (Didn’t implement any measures)
98 (Don't know)
99 (Refused)

ASK Q89 IF [Q88<>96,98,99] AND [Q87=1]

89. What was the second measure? IF RESPONSE IS GENERAL, E.G., “LIGHTING EQUIPMENT”, PROBE FOR SPECIFIC MEASURE. PROBE FROM LIST, IF NECESSARY.

1 Lighting: T8 lamps
2 Lighting: T5 lamps
3 Lighting: Highbay Fixture Replacement
4 Lighting: CFLs
5 Lighting: Controls / Occupancy sensors
6 Lighting: LED lamps
7 Cooling: Unitary/Split Air Conditioning System

8 Cooling: Room air conditioners
9 Cooling: Variable Frequency Drives VFD/VSD on HVAC Motors
10 Motors: Efficient motors
11 Refrigeration: Strip curtains
12 Refrigeration: Anti-sweat controls
13 Refrigeration: EC motor for WALK-IN cooler/freezer
14 Refrigeration: EC motor for REACH-IN cooler/freezer
00 (Other) [RECORD VERBATIM]
96 (Didn’t implement any measures)
98 (Don't know)
99 (Refused)

ASK Q90 IF [Q89<>96,98,99] AND [Q88<>96,98,99] AND [Q87=1]

90. What was the third measure? IF RESPONSE IS GENERAL, E.G., “LIGHTING EQUIPMENT”, PROBE FOR SPECIFIC MEASURE. PROBE FROM LIST, IF NECESSARY.

1 Lighting: T8 lamps
2 Lighting: T5 lamps
3 Lighting: Highbay Fixture Replacement
4 Lighting: CFLs
5 Lighting: Controls / Occupancy sensors
6 Lighting: LED lamps
7 Cooling: Unitary/Split Air Conditioning System
8 Cooling: Room air conditioners
9 Cooling: Variable Frequency Drives VFD/VSD on HVAC Motors
10 Motors: Efficient motors
11 Refrigeration: Strip curtains
12 Refrigeration: Anti-sweat controls
13 Refrigeration: EC motor for WALK-IN cooler/freezer
14 Refrigeration: EC motor for REACH-IN cooler/freezer
00 (Other) [RECORD VERBATIM]
96 (Didn’t implement any measures)
98 (Don't know)
99 (Refused)

ASK Q91 IF [Q88<>96,98,99] AND [Q87=1]

91. I have a few questions about the FIRST measure that you implemented. If needed, read back measure: <Q88 RESPONSE> [OPEN END]

a. Please describe the SIZE, TYPE, and OTHER ATTRIBUTES of this measure.
b. Please describe the EFFICIENCY of this measure.
c. How many of this measure did you implement?

ASK Q92 IF [Q88<>96,98,99] AND [Q87=1]

92. Was this measure specifically recommended by a program related audit, report or program technical specialist?
1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q93 IF [Q88<>96,98,99] AND [Q87=1]

93. How important was your experience in the <PROGRAM> in your decision to implement this Measure, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?
[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

ASK Q94 IF [Q93<>98, 99] AND [Q88<>96,98,99] AND [Q87=1]

94. Can you explain how your experience with the <PROGRAM> influenced your decision to install this additional high efficiency measure?
00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q95 IF [Q88<>96,98,99] AND [Q87=1]

95. If you had not participated in the <PROGRAM>, how likely is it that your organization would still have implemented this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have implemented this measure and 10 means you definitely WOULD have implemented this measure?
[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

CONSISTENCY CHECK ON PROGRAM IMPORTANCE RATING VS. NO PROGRAM RATING MEASURE 1

ASK Q96 IF [[Q93=0,1,2,3] AND [Q95=0,1,2,3] AND [Q88<>96,98,99] AND [Q87=1]]

OR [[IF [Q93=8,9,10] AND [Q95=8,9,10] AND [Q88<>96,98,99] AND [Q87=1]]

96. You scored the importance of your program experience to your decision to implement this measure with <Q93 RESPONSE > out of 10 possible points. You ALSO scored the likelihood of implementing this measure if your organization had not participated in the

program with <Q95 RESPONSE> out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

00 [RECORD VERBATIM]

98 (Don't know)

99 (Refused)

ASK Q97 IF [Q88<>96,98,99] AND [Q87=1]

97. Can you briefly explain why you decided to install this energy efficiency measure on your own, rather than going through the <PROGRAM>?

00 [RECORD VERBATIM]

98 (Don't know)

99 (Refused)

ASK Q98 IF [Q89<>96,98,99] AND [Q87=1]

98. I have a few questions about the SECOND measure that you implemented. If needed, read back measure: <Q89 RESPONSE> [OPEN END]

a. Please describe the SIZE, TYPE, and OTHER ATTRIBUTES of this measure.

b. Please describe the EFFICIENCY of this measure.

c. How many of this measure did you implement?

ASK Q99 IF [Q89<>96,98,99] AND [Q87=1]

99. Was this measure specifically recommended by a program related audit, report or program technical specialist?

1 Yes

2 No

98 (Don't know)

99 (Refused)

ASK Q100 IF [Q89<>96,98,99] AND [Q87=1]

100. How important was your experience in the <PROGRAM> in your decision to implement this Measure, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?

[RECORD 0 TO 10]

98 (Don't know)

99 (Refused)

ASK Q101 IF [Q100<>98, 99] AND [Q89<>96,98,99] AND [Q87=1]

101. Can you explain how your experience with the <PROGRAM> influenced your decision to install this additional high efficiency measure?

00 [RECORD VERBATIM]

98 (Don't know)

99 (Refused)

ASK Q102 IF [Q89<>96,98,99] AND [Q87=1]

102. If you had not participated in the <PROGRAM>, how likely is it that your organization would still have implemented this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have implemented this measure and 10 means you definitely WOULD have implemented this measure?

[RECORD 0 TO 10]

98 (Don't know)

99 (Refused)

CONSISTENCY CHECK ON PROGRAM IMPORTANCE RATING VS. NO PROGRAM RATING MEASURE 2

ASK Q103 IF [[Q100=0,1,2,3] AND [Q102=0,1,2,3] AND [Q89<>96,98,99] AND [Q87=1]]

OR [[IF [Q100=8,9,10] AND [Q102=8,9,10] AND [Q89<>96,98,99] AND [Q87=1]]

103. You scored the importance of your program experience to your decision to implement this measure with <Q100 RESPONSE > out of 10 possible points. You ALSO scored the likelihood of implementing this measure if your organization had not participated in the program with <Q102 RESPONSE> out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

00 [RECORD VERBATIM]

98 (Don't know)

99 (Refused)

ASK Q104 IF [Q88<>96,98,99] AND [Q87=1]

104. Can you briefly explain why you decided to install this energy efficiency measure on your own, rather than going through the <PROGRAM>?

00 [RECORD VERBATIM]

98 (Don't know)

99 (Refused)

ASK Q105 IF [Q90<>96,98,99] AND [Q87=1]

105. I have a few questions about the THIRD measure that you implemented. If needed, read back measure: <SP3 RESPONSE> [OPEN END]

a. Please describe the SIZE, TYPE, and OTHER ATTRIBUTES of this measure.
b. Please describe the EFFICIENCY of this measure.
c. How many of this measure did you implement?

ASK Q106 IF [Q90<>96,98,99] AND [Q87=1]

106. Was this measure specifically recommended by a program related audit, report or program technical specialist?

1 Yes
2 No
98 (Don't know)
99 (Refused)

ASK Q107 IF [Q90<>96,98,99] AND [Q87=1]

107. How important was your experience in the <PROGRAM> in your decision to implement this Measure, using a scale of 0 to 10, where 0 is not at all important and 10 is extremely important?

[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

ASK Q108 IF [Q107<>98, 99] AND [Q90<>96,98,99] AND [Q87=1]

108. Can you explain how your experience with the <PROGRAM> influenced your decision to install this additional high efficiency measure?

00 [RECORD VERBATIM]
98 (Don't know)
99 (Refused)

ASK Q109 IF [Q90<>96,98,99] AND [Q87=1]

109. If you had not participated in the <PROGRAM>, how likely is it that your organization would still have implemented this measure, using a 0 to 10, scale where 0 means you definitely WOULD NOT have implemented this measure and 10 means you definitely WOULD have implemented this measure?

[RECORD 0 TO 10]
98 (Don't know)
99 (Refused)

CONSISTENCY CHECK ON PROGRAM IMPORTANCE RATING VS. NO PROGRAM RATING MEASURE 3

ASK Q110 IF [[Q107=0,1,2,3] AND [Q109=0,1,2,3] AND [Q90<>96,98,99] AND [Q87=1]]

OR [[IF [Q107=8,9,10] AND [Q109=8,9,10] AND [Q90<>96,98,99] AND [Q87=1]]

110. You scored the importance of your program experience to your decision to implement this measure with <Q107 RESPONSE > out of 10 possible points. You ALSO scored the likelihood of implementing this measure if your organization had not participated in the program with <Q109 RESPONSE> out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

ASK Q111 IF [Q89 <>96,98,99] AND [Q87=1]

111. Can you briefly explain why you decided to install this energy efficiency measure on your own, rather than going through the <PROGRAM>?

00 [RECORD VERBATIM]

98 (Don’t know)

99 (Refused)

PROCESS BATTERY

DISPLAY IF [NTG=B] Now I have just a few more questions about your experience with the program participation process.

ASK Q112 IF [NTG=B]

112. Did you work on completing the application for the program including gathering required documentation?

1 Yes

2 No

98 (Don't know)

99 (Refused)

ASK Q113 IF [NTG=B]

113. Did anyone else help complete the application? MULTIPLE RESPONSE UP TO TWO

1 Another member of your company

2 A contractor

3 An equipment vendor

4 A designer or architect

5 Someone else (Please specify)
98 (Don't know)
99 (Refused)

ASK Q114 IF [Q112=1]

114. Thinking back to the application process, please rate the clarity of information on how to complete the application using a scale where 0 means "not at all clear" and 10 means "completely clear".
[RECORD 0 TO 10]
98 (Don’t know)
99 (Refused)

ASK Q115 IF [Q114 < 8]

115. What information needs to be clarified?

ASK Q116 IF [Q112=1]

116. Did you have a clear sense of who you could go to for assistance with the application process?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q117 IF [NTG=B]

117. The next questions are about program staff that you may have contacted during the completion of your project. Program staff are anyone that reviewed your application, conducted site visits, determined your incentive amount, or processed your incentive check. Program staff are not anyone hired by you

In the course of completing this project, did you contact any program staff with questions or concerns about your project?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

ASK Q118 IF [NTG=B]
118. Using a scale of 0 to 10 where 0 means "very dissatisfied" and 10 means "very satisfied", please rate your satisfaction with the following:
[Record 0-10]
98 Don’t know

99 Refused

a. [ASK IF Q117=1] how long it took program staff to address your questions or concerns
b. [ASK IF Q117=1] how thoroughly program staff addressed your question or concern
c. the steps you had to take to get through the program
d. the amount of time it took to get your rebate or incentive
e. the range of equipment that qualifies for incentives
f. the program overall

ASK Q119 [IF ANY Q118 < 4]

119. Please describe the ways in which you were dissatisfied with the aspects of the program you mentioned.

ASK Q120 IF [NTG=B]

120. Do you have any suggestions for how <PROGRAM ADMINISTRATOR> could improve its Energy Efficiency programs?

ASK Q120 IF [NTG=B]

121. What do you think are the best ways to communicate information about the <PROGRAM ADMINISTRATOR> programs to organizations like yours? [MULTISELECT UP TO 3 RESPONSES]

1 (E-mail)

2 (Telephone)

3 (Presentations at events or contractors)

4 (Trade allies/Vendors/Contractors)

5 (Direct mailings)

6 (Website updates)

7 (Other (Please specify))

98 (Don't know)

99 (Refused)

122. What type of facility is located at [Facility]?

1 (Airport)

2 (Community College)

3 (Correctional Facility)

4 (K-12 School)

5 (Public Library)

6 (Medical Facility)
7 (Municipal Facility)
8 (Park District Facility)
9 (Police or Fire Station)
10 (Public Works Facility)
11 (State University)
12 (Wastewater Treatment Facility)
13 (Other (Please specify))
98 (Don't know)
99 (Refused)

123. Does [Organization] rent, own and occupy, or own and rent to someone else the facility at this location?
1 Rent
2 Own and occupy
3 Own and rent to someone else
98 (Don’t know)
99 (Refused)

124. Does your organization pay the full cost of the natural gas bill for the facility located at [Location]?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

125. Does your organization pay the full cost of the electric bill for the facility located at [Location]?
1 Yes
2 No
98 (Don’t know)
99 (Refused)

10. Appendix E: New Construction Participant Survey Responses

As part of the evaluation work effort, a survey was made of a sample of decision makers for facilities that received incentives from the New Construction Program. The survey provided the information used in Chapter 4 to estimate free ridership for projects in the New Construction Program. However, the survey also provided more general information pertaining to the making of decisions to improve energy efficiency by program participants.

Each participant was interviewed using the survey instrument provided in Appendix D. The interviews were conducted by telephone. During the interview, a participant was asked questions about (1) his or her general decision making regarding the decision to incorporate beyond-code efficiency improvements in the construction project, (2) his or her knowledge of and satisfaction with the program, and (3) the influence that the program had on his or her decision to implement the beyond-code efficiency improvements.

The following tabulations summarize participant survey responses. Two columns of data are presented. The first column presents the number of survey respondents (*n*). The second column presents the percentage of survey respondents.

	Response	*(n=7)*	*Percent of Respondents*
To begin, can you tell me your job title or role?	Facilities Manager	2	29%
	Energy Manager	1	14%
	Other facilities management/maintenance position	1	14%
	Chief Financial Officer	0	0%
	Other financial/administrative position	0	0%
	Proprietor/Owner	0	0%
	President/CEO	0	0%
	Manager	3	43%
	Other	0	0%
	Don’t know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
How did you first learn about the incentives for energy efficient new construction provided through the program?	Published material	1	14%
	Architect	1	14%
	Construction manager	1	14%
	Internal resources	1	14%
	The program website	1	14%
	Experience with other DOC Programs	1	14%
	Don’t know	1	14%

	Response	*(n=7)*	*Percent of Respondents*
Did you work with a designer or architect that helped you incorporate energy efficient equipment or design features in the new construction project completed at your location?	Yes	6	86%
	No	1	14%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=6)*	*Percent of Respondents*
Did the designer or architect encourage you to participate in the program?	Yes	3	50%
	No	3	50%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
Did you work with a general contractor that helped you decide to incorporate the energy efficient equipment or design features?	Yes	4	57%
	No	3	43%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
Did the general contractor you worked with encourage you to participate in the program?	Yes	1	25%
	No	3	75%
	Don't know	0	0%
	Refused	0	0%

Did you work with a design or consulting engineer that helped you decide to incorporate the energy efficient equipment or design features?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	3	43%
	No	4	57%
	Don't know	0	0%
	Refused	0	0%

Did the design or consulting engineer you worked with encourage you to participate in the program?	*Response*	*(n=3)*	*Percent of Respondents*
	Yes	1	33%
	No	2	67%
	Don't know	0	0%
	Refused	0	0%

Did you receive design assistance through the Smart Energy Design Assistance Center when planning this project?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	3	43%
	No	4	57%
	Don't know	0	0%
	Refused	0	0%

Did you have plans to implement the project that you implemented through the program before deciding to participate in the program?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	6	86%
	No	0	0%
	Don't know	1	14%
	Refused	0	0%

Did the plans you had before deciding to participate in the program specify the specific energy efficient equipment you were going to implement?	*Response*	*(n=6)*	*Percent of Respondents*
	Yes	2	33%
	No	3	50%
	Don't know	1	17%
	Refused	0	0%

	Response	*(n=3)*	*Percent of Respondents*
Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that your plans DID NOT specify which specific energy efficient equipment you were going to implement?	0 - Not at all certain	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	0	0%
	8	2	67%
	9	1	33%
	10 - Extremely certain	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=6)*	*Percent of Respondents*
Without the program incentive, did your organization have the funds available to implement the same project that you implemented through the program?	Yes	3	50%
	No	2	33%
	Don't know	1	17%
	Refused	0	0%

	Response	*(n=2)*	*Percent of Respondents*
Using a scale from 0 to 10, where 0 is "Not at all certain" and 10 is "Extremely certain," how certain are you that your organization DID NOT have the funds available to implement the same project before deciding to participate in the program?	0 - Not at all certain	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	1	50%
	7	0	0%
	8	0	0%
	9	0	0%
	10 - Extremely certain	1	50%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of*
Using a scale from			

0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely," how likely is it that your organization could have funded the energy efficient equipment or design features incorporated in this new construction project without the program's financial assistance?			*Respondents*
	0 - Not at all likely	0	0%
	1	1	14%
	2	0	0%
	3	0	0%
	4	1	14%
	5	1	14%
	6	0	0%
	7	1	14%
	8	0	0%
	9	0	0%
	10 - Extremely likely	3	43%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
In deciding to do a project of this type, there are usually a number of reasons why it may be undertaken. In your own words, can you tell me why this retro-commissioning project was implemented?	To gain more control over how the equipment was used	0	0%
	The reduce maintenance costs	1	14%
	To comply with codes set by regulatory agencies	0	0%
	To comply with organizational policies regarding new construction	0	0%
	To get a rebate from the program	0	0%
	To protect the environment	2	29%
	To reduce energy costs	4	57%
	To reduce energy use/power outages	3	43%
	To update to the latest technology	1	14%
	Other	2	29%
	Don’t know	0	0%
	Refused	0	0%

When did you first learn about the utility's program? Was it BEFORE or AFTER you finalized the specifications for the energy efficiency equipment, including the efficiency level and the scope of the energy efficiency aspects of the project?	*Response*	*(n=7)*	*Percent of Respondents*
	Before	3	43%
	After	2	29%
	Don't know	2	29%
	Refused	0	0%

Using a scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely", if the utility's program had not been available, what is the likelihood that you would have implemented the exact same energy efficient equipment in this new construction project?	*Response*	*(n=7)*	*Percent of Respondents*
	0 - Not at all likely	0	0%
	1	1	14%
	2	0	0%
	3	0	0%
	4	0	0%
	5	2	29%
	6	0	0%
	7	0	0%
	8	1	14%
	9	0	0%
	10 - Extremely likely	3	43%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
The impact of the availability of the program incentive	0 - No impact	0	0%
	1	1	14%
	2	0	0%
	3	0	0%
	4	0	0%
	5	3	43%
	6	1	14%
	7	0	0%
	8	1	14%
	9	0	0%
	10 - Decisive impact	1	14%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=3)*	*Percent of Respondents*
The impact of the design assistance you received through the Smart Energy Design Assistance Center	0 - No impact	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	0	0%
	8	2	67%
	9	1	33%
	10 - Decisive impact	0	0%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
The impact of a recommendation from a general contractor	0 - No impact	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	0	0%
	8	1	25%
	9	0	0%
	10 - Decisive impact	1	25%
	Not applicable	2	50%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=6)*	*Percent of Respondents*
The impact of a recommendation from a designer or architect	0 - No impact	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	0	0%
	8	2	33%
	9	1	17%
	10 - Decisive impact	1	17%
	Not applicable	2	33%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
The impact of previous experience with implementing similar energy efficient equipment	0 - No impact	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	1	14%
	6	0	0%
	7	2	29%
	8	1	14%
	9	1	14%
	10 - Decisive impact	1	14%
	Not applicable	1	14%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
The impact of a recommendation from program staff	0 - No impact	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	1	14%
	6	0	0%
	7	1	14%
	8	0	0%
	9	0	0%
	10 - Decisive impact	1	14%
	Not applicable	4	57%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
The impact of information from program marketing materials	0 - No impact	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	1	14%
	6	1	14%
	7	0	0%
	8	1	14%
	9	2	29%
	10 - Decisive impact	0	0%
	Not applicable	1	14%
	Don't know	1	14%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
The impact of standard practice in your organization	0 - No impact	0	0%
	1	0	0%
	2	1	14%
	3	0	0%
	4	0	0%
	5	1	14%
	6	0	0%
	7	0	0%
	8	1	14%
	9	1	14%
	10 - Decisive impact	2	29%
	Not applicable	0	0%
	Don't know	1	14%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
The impact of organizational policy or guidelines	0 - No impact	0	0%
	1	1	14%
	2	0	0%
	3	0	0%
	4	0	0%
	5	1	14%
	6	0	0%
	7	1	14%
	8	1	14%
	9	2	29%
	10 - Decisive impact	1	14%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
If you were given a TOTAL of 100 points that reflect the importance in your decision to implement the energy efficient equipment and you had to divide those 100 points between: 1) the program and 2) other factors, how many points would you give to the importance of the PROGRAM?	Less than 20	1	14%
	20 to 40	3	43%
	40 to 60	0	0%
	60 to 80	2	29%
	more than 80	1	14%
	Don’t know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
And how many points would you give to the other factors?	Less than 20	0	0%
	20 to 40	3	43%
	40 to 60	0	0%
	60 to 80	2	29%
	more than 80	2	29%
	Don’t know	0	0%
	Refused	0	0%

Please rate the impact of PAYBACK ON THE INVESTMENT using a scale where a score of "0" means that the PAYBACK ON THE INVESTMENT had no impact on the decision to implement the energy efficient design features or equipment, and a score of "10" means that the PAYBACK ON THE INVESTMENT had DECISIVE impact on the decision to the implement the energy efficient design features or equipment.	*Response*	*(n=7)*	*Percent of Respondents*
	0 - No impact	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	3	43%
	6	0	0%
	7	1	14%
	8	2	29%
	9	0	0%
	10 - Decisive impact	1	14%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

I'd like to find out more about the payback criteria your organization uses for its investments and how it might have applied to the decision to implement the energy efficient equipment. What is the payback cut-off point your organization uses before deciding to complete a project like this one?	*Response*	*(n=4)*	*Percent of Respondents*
	0 to 6 months	0	0%
	7 months to 1 year	0	0%
	More than 1 year up to 2 years	0	0%
	More than 2 years up to 3 years	1	25%
	More than 3 years up to 5 years	3	75%
	Over 5 years	0	0%
	Don't know	0	0%
	Refused	0	0%

Does your organization always implement projects that meet the required payback cut-off point?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	1	25%
	No	3	75%
	Don't know	0	0%
	Refused	0	0%

Did you review payback calculations for the project with and without the program incentive?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	3	75%
	No	1	25%
	Don't know	0	0%
	Refused	0	0%

Did the program incentive play an important role in moving your project within the acceptable payback cutoff point?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	3	75%
	No	1	25%
	Don't know	0	0%
	Refused	0	0%

Does your organization have an environmental policy or sustainability plan to reduce environmental emissions or energy use? Some examples would be to "buy green" or use sustainable approaches to business investments.	*Response*	*(n=5)*	*Percent of Respondents*
	Yes	5	100%
	No	0	0%
	Don't know	0	0%
	Refused	0	0%

Prior to participating in the program, had that policy caused you to implement energy efficient equipment at another facility without a program incentive?	*Response*	*(n=5)*	*Percent of Respondents*
	Yes	3	60%
	No	0	0%
	Don't know	2	40%
	Refused	0	0%

	Response	*(n=5)*	*Percent of Respondents*
Does your organization have the financial ability to implement its policy?	Yes	5	100%
	No	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
In an earlier question, you rated the importance of STANDARD PRACTICE in your organization very highly in your decision making. Could you please rate the importance of the PROGRAM, relative to this standard practice, in affecting your decision to implement the energy efficient equipment? Would you say the program was much more important, somewhat more important, equally important, somewhat less important, or much less important than your organization's standard practice?	Much more important	1	25%
	Somewhat more important	0	0%
	Equally important	1	25%
	Somewhat less important	1	25%
	Much less important	0	0%
	Don't know	1	25%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
Does your organization ever deviate from the standard practice?	Yes	0	0%
	No	2	50%
	Don't know	2	50%
	Refused	0	0%

Could you please rate the importance of the program as compared with this standard organization practice in affecting your decision to implement the energy efficient equipment. Would you say the program was…	*Response*	*(n=4)*	*Percent of Respondents*
	Much more important	0	0%
	Somewhat more important	1	25%
	Equally important	2	50%
	Somewhat less important	1	25%
	Much less important	0	0%
	Don't know	0	0%
	Refused	0	0%

Our records show that your organization also received an incentive from utility's program for including energy efficient equipment in this new construction project. Was the decision making process for that aspect of the project the same as for the project we have been talking about?	*Response*	*(n=5)*	*Percent of Respondents*
	Same decision making process	4	80%
	Different decision making process	1	20%
	Other	0	0%
	Don't know	0	0%
	Refused	0	0%

Since your participation in the program, did you implement any ADDITIONAL energy efficiency measures at this facility or at your other facilities within utility's service territory that did NOT receive incentives through the program?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	3	43%
	No	3	43%
	Don't know	1	14%
	Refused	0	0%

Did you work on completing the application for the program including gathering required documentation?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	2	50%
	No	2	50%
	Don't know	0	0%
	Refused	0	0%

Did anyone else help complete the application?	*Response*	*(n=4)*	*Percent of Respondents*
	Another member of your company	1	25%
	A contractor	0	0%
	An equipment vendor	0	0%
	A designer or architect	2	50%
	Someone else	1	25%
	Don't know	0	0%
	Refused	0	0%

Thinking back to the application process, please rate the clarity of information on how to complete the application using a scale where 0 means "not at all clear" and 10 means "completely clear".	*Response*	*(n=2)*	*Percent of Respondents*
	0 - Not at all clear	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	0	0%
	8	2	100%
	9	0	0%
	10 - Completely clear	0	0%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

Did you have a clear sense of who you could go to for assistance with the application process?	*Response*	*(n=2)*	*Percent of Respondents*
	Yes	2	100%
	No	0	0%
	Don't know	0	0%
	Refused	0	0%

In the course of completing this project, did you contact any program staff with questions or concerns about your project?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	0	0%
	No	4	100%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
The steps you had to take to get through the program	0 - Very dissatisfied	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	1	25%
	7	0	0%
	8	3	75%
	9	0	0%
	10 - Very satisfied	0	0%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
The amount of time it took to get your rebate or incentive	0 - Very dissatisfied	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	1	25%
	7	1	25%
	8	2	50%
	9	0	0%
	10 - Very satisfied	0	0%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
The range of equipment that qualifies for incentives	0 - Very dissatisfied	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	2	50%
	8	0	0%
	9	2	50%
	10 - Very satisfied	0	0%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
The program overall	0 - Very dissatisfied	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	1	25%
	8	2	50%
	9	0	0%
	10 - Very satisfied	1	25%
	Not applicable	0	0%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=4)*	*Percent of Respondents*
What do you think are the best ways to communicate information about the programs to organizations like yours?	E-mail	2	50%
	Telephone	0	0%
	Presentations at events or contractors	0	0%
	Trade allies/Vendors/Contractors	1	25%
	Direct mailings	0	0%
	Website updates	0	0%
	Other	2	50%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
What type of facility is located at your location?	Airport	0	0%
	Community College	2	29%
	Correctional Facility	0	0%
	K-12 School	0	0%
	Public Library	0	0%
	Medical Facility	0	0%
	Municipal Facility	0	0%
	Park District Facility	0	0%
	Police or Fire Station	0	0%
	Public Works Facility	0	0%
	State University	1	14%
	Wastewater Treatment Facility	0	0%
	Other	4	57%
	Don't know	0	0%
	Refused	0	0%

	Response	*(n=7)*	*Percent of Respondents*
Does your organization rent, own and occupy, or own and rent to someone else the facility at this location?	Rent	0	0%
	Own and occupy	7	100%
	Own and rent to someone else	0	0%
	Don’t know	0	0%
	Refused	0	0%

Question	*Response*	*(n=7)*	*Percent of Respondents*
Does your organization pay the full cost of the natural gas bill for the facility?	Yes	7	100%
	No	0	0%
	Don't know	0	0%
	Refused	0	0%

Question	*Response*	*(n=7)*	*Percent of Respondents*
Does your organization pay the full cost of the electric bill for the facility?	Yes	7	100%
	No	0	0%
	Don't know	0	0%
	Refused	0	0%

11. Appendix F: Free Ridership Analysis

This appendix presents additional analysis of the data collected on free ridership that pertains to the free ridership methodology employed in the calculation of net savings for the Custom Incentives, Standard Incentives, and New Construction Programs. ADM estimated free ridership for the Custom Incentives and Standard Incentive Programs using the Core Non-Residential Free Ridership Protocol presented in the Illinois Statewide Technical Reference Manual (TRM) Version 5.0, Vol. 4 (p.28). This protocol presents two options for calculating the Program Components Score and three options for accounting for the deferment of free ridership (Timing Options). Free ridership for the New Construction Program was also estimated using the Core Non-Residential Protocol, however, none of the approaches for accounting for deferred free ridership were applied because it is unlikely that the program would have accelerated the timing of the project. Consequently, there are only the two options for calculating the Program Components Score.

Additionally, guided by Illinois Commerce Commission direction that, with respect to a determination regarding free ridership, the person or entity in question should have actual energy efficiency plans before they are to be considered to be free riders, ADM developed an Energy Efficiency Plans Score and incorporated it into the algorithm for calculation of participant free ridership.[101]

Accounting for the two Program Component Score options, the three Timing Options, and the inclusion/exclusion of the Energy Efficiency Plans Score, there are a total of 12 free ridership scores presented below for the Custom Incentives and Standard Incentive Programs and four scores for the New Construction Program.

<u>Alternative Program Component Score Options</u>

The two approaches for calculating the Program Components Score are defined as follows:

(1) Program Components Score (Option 1) is equal to:

1 - ([*Maximum Program Factor Score*]/10).

(2) Program Components Score (Option 2) is equal to:

([*Maximum Program Factor Score*] / ([*Maximum Program Factor Score*]+[*Maximum Non-Program Factor Score*])).

<u>Alternative Timing Options</u>

[101] See docket 11-0593 Final Order: https://www.icc.illinois.gov/downloads/public/edocket/371251.pdf

The three *timing options* that may account for the deferment of free ridership in the overall free ridership score are as follows:

(1) For Timing Option 1, a timing adjustment factor is equal to:

1 - (*Number of Months Expedited* - 6)/42

Under Timing Option 1, the timing adjustment factor is multiplied with the No Program Score, which is then averaged with the Program Influence Score and the Program Components Score.

(2) For Timing Option 2, a timing adjustment factor is equal to:

1 - ((*Number of Months Expedited* - 6)/42)*((10 - *Likelihood of Implementing within One Year*)/10)

Under Timing Option 2, the average of the No Program Score, Program Influence Score, and the Program Components Score are multiplied by the timing adjustment factor.

(3) For Timing Option 3, a timing score is equal to:

Likelihood of Implementing within One Year/10

Under Timing Option 3, the timing score is averaged with the No Program Score to calculate a Counterfactual Score. Overall free ridership is calculated by taking the average of the Program Components Score and the Program Influence Score, and then taking the average of the result and the Counterfactual Score.

Energy Efficiency Plans Score

The construction of the Energy Efficiency Plans Score is described in Chapter 4. Table F-1 summarizes the share of respondents that met the criteria indicating that they had prior plans. As shown, 59% of respondents met the two criteria that indicated that they did not have plans to complete the project prior to participation and another 12% met the criteria indicating they did not have funds for the project.

Table F-1 Summary of Responses to Plans Module

Prior Plans Indicator	*Percent of Respondents*
Did not have plans prior to deciding to participate	31%
Plans did not specify measure	19%
Did not have funds to implement measures	19%
Met any of the plans criteria	59%

All scores are reported in terms of free ridership, meaning that higher scores are indicative of higher levels of free ridership.

Table F-2 through Table F-9 present the free ridership scores for each program weighted by kWh savings, kW reductions, and therm savings, respectively.

Table F-2 Summary of Free Ridership Scoring Options and Free Ridership for the Custom Incentives Program (Weighted by kWh Savings)

Program Components Score Option	*Free Ridership Algorithm Timing Option*	*Included Component Scores*						*FR With Plans Score*	*FR Without Plans Score*
		Program Influence	*Adjusted No Program Score*	*No Program Score*	*Counter-factual Score*	*Program Components 1*	*Program Components 2*		
1	1	Yes	Yes	No	No	Yes	No	0.18	0.24
	2	Yes	No	Yes	No	Yes	No	0.18	0.21
	3	Yes	No	No	Yes	Yes	No	0.20	0.29
2	1	Yes	Yes	No	No	No	Yes	0.22	0.37
	2	Yes	No	Yes	No	No	Yes	0.21	0.26
	3	Yes	No	No	Yes	No	Yes	0.25	0.42

Table F-3 Summary of Free Ridership Scoring Options and Free Ridership for the Standard Incentives Program (Weighted by kWh Savings)

Program Components Score Option	Free Ridership Algorithm Timing Option	Included Component Scores						FR With Plans Score	FR Without Plans Score
		Program Influence	Adjusted No Program Score	No Program Score	Counter-factual Score	Program Components 1	Program Components 2		
1	1	Yes	Yes	No	No	Yes	No	0.11	0.18
	2	Yes	No	Yes	No	Yes	No	0.10	0.14
	3	Yes	No	No	Yes	Yes	No	0.13	0.22
2	1	Yes	Yes	No	No	No	Yes	0.16	0.30
	2	Yes	No	Yes	No	No	Yes	0.13	0.20
	3	Yes	No	No	Yes	No	Yes	0.17	0.32

Table F-4 Summary of Free Ridership Scoring Options and Free Ridership for the New Construction Program (Weighted by kWh Savings)

Program Components Score Option	Included Component Scores				FR With Plans Score	FR Without Plans Score
	Program Influence	No Program Score	Program Components 1	Program Components 2		
1	Yes	Yes	Yes	No	0.39	0.71
2	Yes	Yes	No	Yes	0.42	0.76

Table F-5 Summary of Free Ridership Scoring Options and Free Ridership for the Custom Incentives Program (Weighted by kW Reductions)

Program Components Score Option	Free Ridership Algorithm Timing Option	Included Component Scores						FR With Plans Score	FR Without Plans Score
		Program Influence	Adjusted No Program Score	No Program Score	Counter-factual Score	Program Components 1	Program Components 2		
1	1	Yes	Yes	No	No	Yes	No	0.06	0.28
	2	Yes	No	Yes	No	Yes	No	0.06	0.09
	3	Yes	No	No	Yes	Yes	No	0.06	0.27
2	1	Yes	Yes	No	No	No	Yes	0.07	0.41
	2	Yes	No	Yes	No	No	Yes	0.06	0.10
	3	Yes	No	No	Yes	No	Yes	0.07	0.30

Table F-6 Summary of Free Ridership Scoring Options and Free Ridership for the Standard Incentives Program (Weighted by kW Reductions)

Program Components Score Option	Free Ridership Algorithm Timing Option	Included Component Scores						FR With Plans Score	FR Without Plans Score
		Program Influence	Adjusted No Program Score	No Program Score	Counter-factual Score	Program Components 1	Program Components 2		
1	1	Yes	Yes	No	No	Yes	No	0.48	0.55
	2	Yes	No	Yes	No	Yes	No	0.48	0.54
	3	Yes	No	No	Yes	Yes	No	0.50	0.59
2	1	Yes	Yes	No	No	No	Yes	0.52	0.63
	2	Yes	No	Yes	No	No	Yes	0.51	0.61
	3	Yes	No	No	Yes	No	Yes	0.55	0.67

There were no peak demand reductions for the New Construction Program.

Table F-7 Summary of Free Ridership Scoring Options and Free Ridership for the Custom Incentives Program (Weighted by Therm Savings)

Program Components Score Option	Free Ridership Algorithm Timing Option	Included Component Scores						FR With Plans Score	FR Without Plans Score
		Program Influence	Adjusted No Program Score	No Program Score	Counter-factual Score	Program Components 1	Program Components 2		
1	1	Yes	Yes	No	No	Yes	No	0.16	0.28
	2	Yes	No	Yes	No	Yes	No	0.16	0.26
	3	Yes	No	No	Yes	Yes	No	0.17	0.31
2	1	Yes	Yes	No	No	No	Yes	0.18	0.41
	2	Yes	No	Yes	No	No	Yes	0.18	0.35
	3	Yes	No	No	Yes	No	Yes	0.20	0.40

Table F-8 Summary of Free Ridership Scoring Options and Free Ridership for the Standard Incentives Program (Weighted by Therm Savings)

Program Components Score Option	Free Ridership Algorithm Timing Option	Included Component Scores						FR With Plans Score	FR Without Plans Score
		Program Influence	Adjusted No Program Score	No Program Score	Counter-factual Score	Program Components 1	Program Components 2		
1	1	Yes	Yes	No	No	Yes	No	0.48	0.55
	2	Yes	No	Yes	No	Yes	No	0.48	0.54
	3	Yes	No	No	Yes	Yes	No	0.50	0.59
2	1	Yes	Yes	No	No	No	Yes	0.52	0.63
	2	Yes	No	Yes	No	No	Yes	0.51	0.61
	3	Yes	No	No	Yes	No	Yes	0.55	0.67

Table F-9 Summary of Free Ridership Scoring Options and Free Ridership for the New Construction Program (Weighted by Therm Savings)

Program Components Score Option	*Included Component Scores*				*FR With Plans Score*	*FR Without Plans Score*
	Program Influence	*No Program Score*	*Program Components 1*	*Program Components 2*		
1	Yes	Yes	Yes	No	0.33	0.35
2	Yes	Yes	No	Yes	0.44	0.47

Choice of Program Components Score

All material in this section is based on results from Custom Incentives Program and Standard Incentives Program participants. New Construction participant responses are not included because of differences in the questions used and wording of questions. Additionally, the small number of responses to this survey limits the value of a separate in-depth analysis.

ADM opted to reference Program Components Score (Option 1) in the calculation of free ridership. As shown in Table F-10, the average Program Components Score (Option 1) was more consistent with the other free ridership component scores calculated than the average Program Components Score (Option 2). Additionally, as presented below, the results of the analysis of the measurement characteristics of the scores are more favorable for Program Components Score (Option 1). More importantly, the inclusion of Program Components Score (Option 2) along with the Program Influence Score would be to incorporate two measurements of *relative* program influence, and to omit any measurement of *absolute* program influence.

For comparison purposes, Table F-10 presents score characteristics of the two Program Components scores and the other free ridership component scores. As shown, the inclusion of the highest rated non-program component score in the calculation in the denominator of the Program Components Score (Option 2) score greatly increases the level of free ridership implied by the Program Components Score.

Table F-10 Free Ridership Component Score Characteristics

Free Ridership Component Score	*Average*	*Min*	*Max*	*Standard Deviation*
Program Components Score (Option 1)	0.15	0	1	0.23
Program Components Score (Option 2)	0.47	0	1	0.18
Program Influence Score	0.32	0	1	0.25
Adjusted No Program Score	0.28	0	1	0.35
No Program Score	0.38	0	1	0.33
Counterfactual Score	0.35	0	1	0.32

Table F-11 displays the item-total correlations for the free ridership scores. The results below show that Program Components Score (Option 1) has a stronger relationship with the total free ridership score than the Program Components Score (Option 2).

Table F-11 Item-Total Correlations for Program Components Score Options

Score	*Program Components (Option 1)*	*Program Components (Option 2)*
Program Components	0.80	0.50
No Program	0.86	0.88
Program Influence	0.73	0.67

Table F-12 displays the internal consistency estimates of the reliability of the scores for the two options for calculating the Program Components Score. As shown, the internal consistency estimates suggest moderately higher reliability of the scores for the Program Components Score (Option 1) than for Program Components Score (Option 2).

Table F-12 Internal Consistency Estimates of Score Reliability for Program Components Score Options

Included Score	*Alpha (Standardized Scores)*
Program Components Score (Option 1)	0.79
Program Components Score (Option 2)	0.67

A factor analysis was performed with the scores for the two program components score options.[102] The results for the analysis using Program Components Score (Option 1) are displayed in Table F-13 and the results for Program Components Score (Option 2) are displayed

[102] Maximum likelihood estimation was used to estimate a single factor model. Because there are three items for the measurement model, the model is just-identified. Consequently, model parameters such as factor loadings and uniquenesses can be estimated but the fit of the single factor model or comparisons of alternative specifications cannot be made.

in Table F-14. The tables display the factor loadings and the uniquenesses associate with each score. The loadings reflect the relationship between the score and the common factor and the uniqunenesses are an estimate of the variance not associated with the common factor. As shown, the results indicate that the Program Components Score (Option 1) is more strongly related to the common factor than Program Components Score (Option 2).

Table F-13 Factor Analysis of Free Ridership Scores for Program Components 1

Scores	*Factor Loadings*	*Uniquenesses*
Program Components	0.82	0.33
No Program Score	0.68	0.53
Program Influence	0.73	0.47

Table F-14 Factor Analysis of Free Ridership Scores for Program Components 2

Scores	*Factor Loadings*	*Uniquenesses*
Program Components	0.50	0.75
No Program Score	0.76	0.42
Program Influence	0.65	0.57

Choice of Deferred Free Ridership Algorithm

As discussed above, the non-residential protocol allows for three options for accounting for the deferment of free ridership. A key difference between the options is whether or not respondent-provided information on the impact of the program of timing of implementation is used to adjust, or is averaged with, the No Program Score alone, or if it is used to adjust the average of all included free ridership scoring components.

ADM referenced the algorithm that adjusts the average of all included free ridership scoring components (Timing Option 2) for the effect of the program on timing of implementation. Responses to questions regarding program importance and the likelihood of implementing a project in the absence of the program are appropriately adjusted to account for respondent data regarding the impact of the program on expediting implementation of projects. As discussed below, none of the three options clearly performed better or worse than the other options in terms of measurement characteristics. However, graphical analysis of the relationship between respondent reports of the number of months the project was accelerated and the Program Influence Scores and the No Program Score suggest a lack of a clear relationship. The lack of relationship implies that the impact of the program on project timing is not necessarily a factor considered by participants when responding to questions of program influence or the likelihood of the program occurring in the absence of the program.

Table F-15 presents item- total correlations. The differences in the item-total correlations for the alternative specifications of the No Program Score as calculated under the three timing Options are negligible.

Table F-15 Item-Total Correlations for Timing Options

Score	*Option 1*	*Option 2*	*Option 3*
Program Components	0.83	0.80	0.77
Program Influence	0.82	0.73	0.76
No Program Specifications	0.88	0.86	0.94

Table F-16 presents the internal consistency estimates of the free ridership scores as calculated under the three timing options. Again, the differences between the alternative specifications are negligible.

Table F-16 Internal Consistency Estimates of Score Reliability for Timing Options

Algorithm	*Alpha (Standardized Scores)*
Option 1	0.80
Option 2	0.79
Option 3	0.80

Table F-17, Table F-18, and Table F-19 present the factor analysis results for the free ridership scores for each of the three timing options. Again, the results for the three options do not clearly indicate that one option has superior measurement characteristics than another.

Table F-17 Factor Analysis of Free Ridership Scores for Timing Option 1

Scores	*Factor Loadings*	*Uniquenesses*
Program Components	0.80	0.36
Program Influence	0.75	0.44
Adjusted No Program	0.73	0.46

Table F-18 Factor Analysis of Free Ridership Scores for Timing Option 2

Scores	*Factor Loadings*	*Uniquenesses*
Program Components	0.82	0.33
Program Influence	0.73	0.47
No Program	0.68	0.53

Table F-19 Factor Analysis of Free Ridership Scores for Timing Option 3

Scores	*Factor Loadings*	*Uniquenesses*
Program Components	0.80	0.36
Program Influence	0.75	0.44
Counterfactual Score	0.72	0.48

Figure F-1 and Figure F-2 display the relationships between the number of months the project was expedited, as reported by the respondent, and the Program Influence Scores and the Unadjusted No Program Score. As shown, respondents reported varying levels of free ridership as implied by the No Program and Program Influence Scores, in relation to the number of months they repotted the project was expedited.

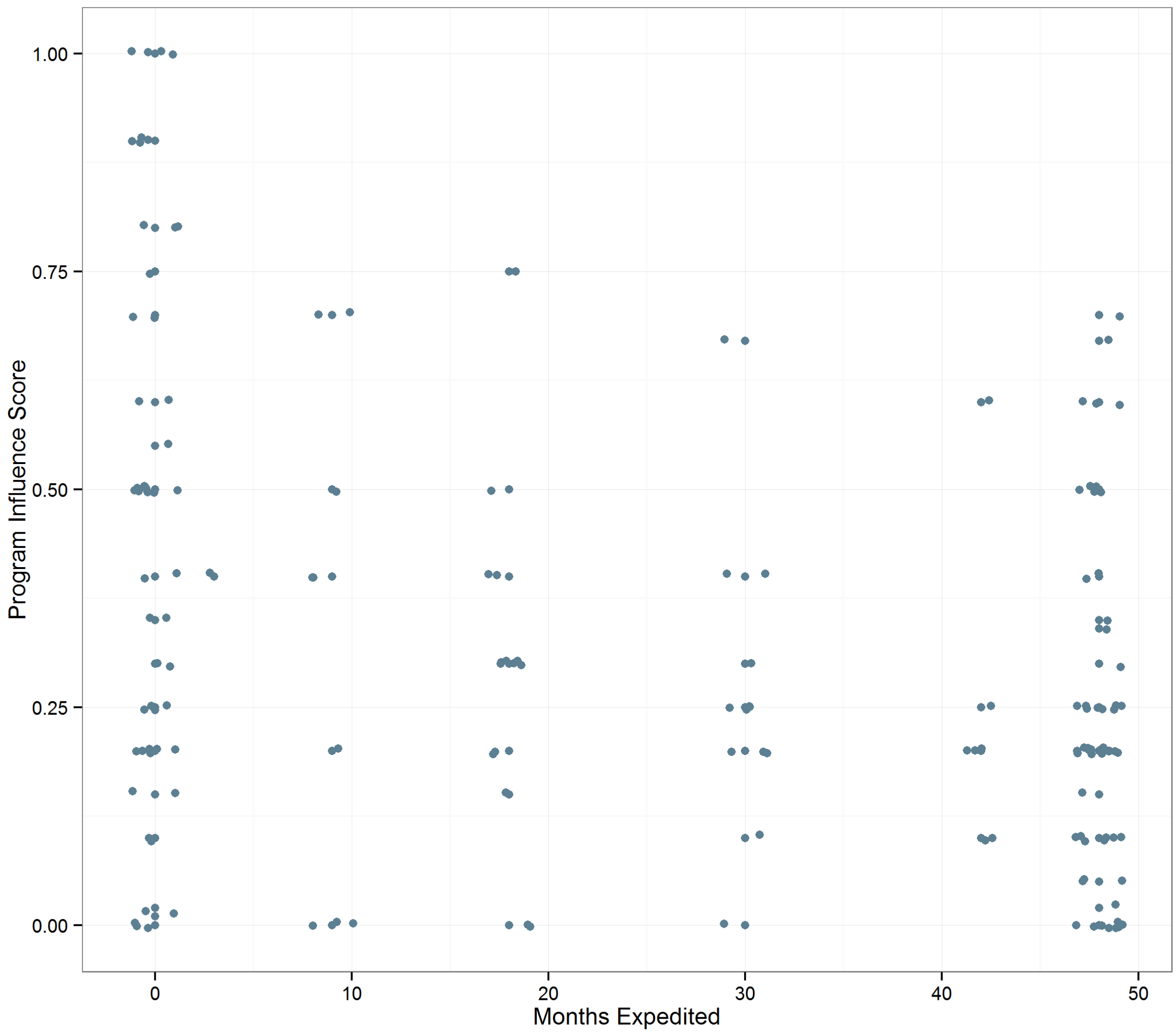

Figure F-1 Relationship between the Number of Months Expedited and the Program Influence Score

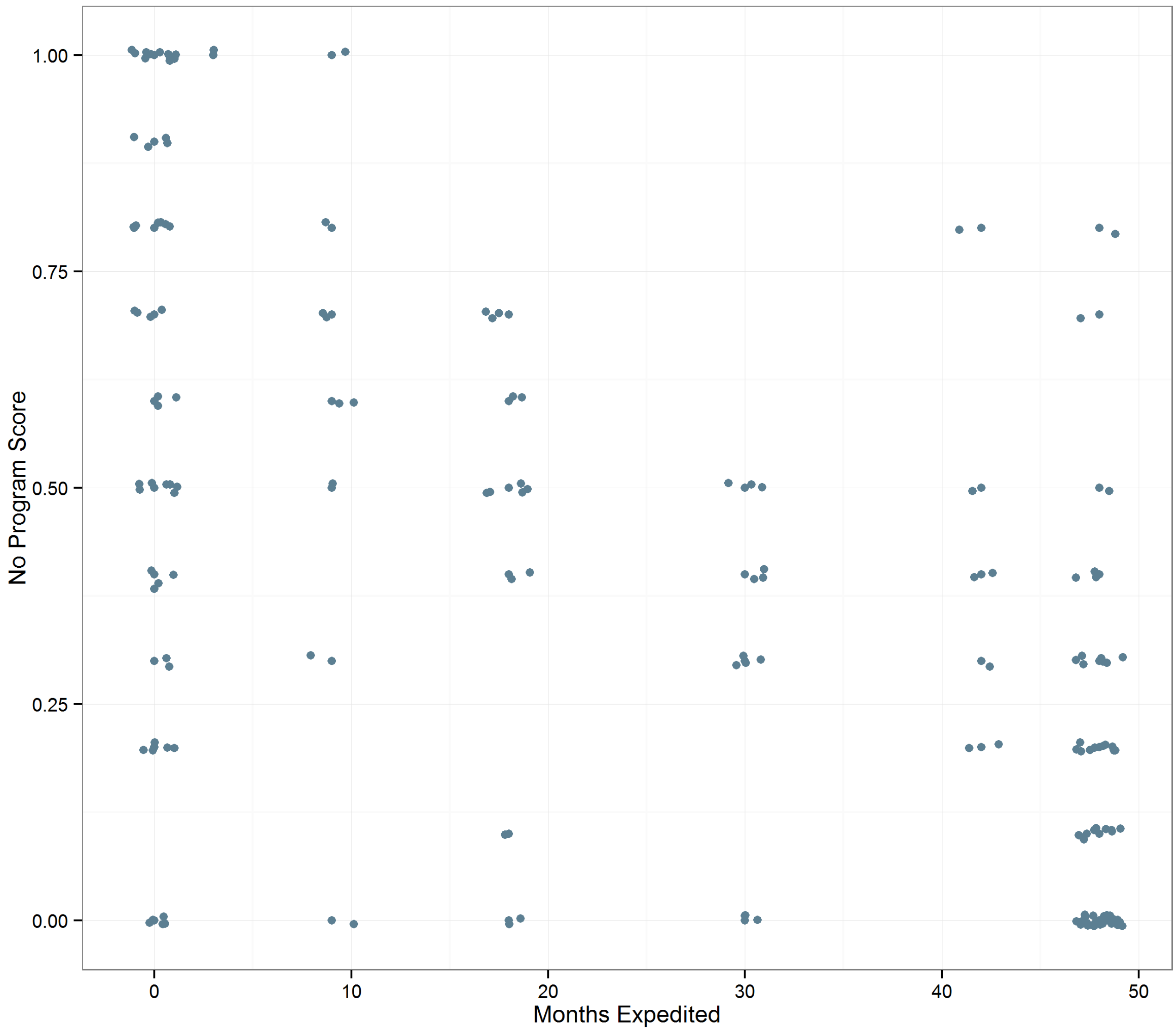

Figure F-2 Relationship between Number of Months Expedited and the No Program Score