Evaluation of Illinois Energy Now Public Sector Custom, Standard, and New Construction Incentives Programs: June 2013 through May 2014

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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 and Economic Opportunity (DCEO) 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 six and natural gas program year three (EPY6/GPY3), the period from June 2013 through May 2014.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: review of program materials; on-site inspections; end-use metering; and interviews with DCEO 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 23 projects sampled for the Custom Incentives Program accounted for 35% of the expected kWh savings and the 47 projects sampled for the Standard Incentives Program accounted for 11% of the expected kWh savings. For natural gas savings, the 33 projects sampled for the Custom Incentives Program accounted for 71% of the expected therm savings and the 24 projects sampled for the Standard Incentives Program accounted for 67% 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 267 participant decision makers were surveyed about the influence of the program on their project decision-making. For the New Construction Program, seven of eight participant decision makers who completed EPY6/GPY3 projects were surveyed.
- Information for process evaluation was collected through interviews with program staff, state agency staff, local government staff, trade allies, and municipal government decision makers.

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 NC, Electric	± 8.24%
Custom/Standard NC, Natural Gas	± 8.93%

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	85
Participant Decision Maker Survey	267

The Illinois Statewide Technical Reference Manual (TRM) was used to estimate gross savings for TRM 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 were as follows:

- TRM-Calculated: Savings calculated as per Illinois's Statewide TRM version 2.
- TRM-Calculated (Errata Corrected): Savings calculated as per an erratum in version 3 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 2013 through May 2014 are summarized in Table 1-3, Table 1-4, and Table 1-5.

During this period, gross ex post electric savings total 18,664,961 kWh for the Custom Incentives Program, 94,110,595 kWh for the Standard Incentives Program, and 1,402,411 kWh for the New Construction program. The gross realization rates for electric savings from the Custom and Standard Incentives Program are 78% and 119%, respectively. For the New Construction Program, the gross realization rate is 76%.

In order to estimate free ridership in the program, survey-based techniques were applied to the data collected through a survey of decision makers. During EPY6/GPY3, net ex post electric savings total 12,692,998 kWh for the Custom Incentives Program, 79,511,435 kWh for the Standard Incentives Program, and 1,073,636 kWh for the New Construction Program. The net to gross ratio for the Custom Incentives Program is 68% and the net to gross ratio for the Standard Incentives Program is 84%. For the New Construction Program, the net to gross ratio is 77%.

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	6,444,643	6,170,854	96%	4,196,453	68%
ComEd	17,494,785	12,494,107	71%	8,496,545	68%
Total	23,939,429	18,664,961	78%	12,692,998	68%

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	18,657,883	20,868,163	17,678,843	20,736,789	17,560,381	21,383,441	115%	18,066,277	84%
ComEd	60,543,376	70,466,714	59,697,157	70,140,300	59,396,390	72,727,155	120%	61,445,159	84%
Total	79,201,259	91,334,877	77,376,000	90,877,089	76,956,771	94,110,595	119%	79,511,435	84%

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	708,736	554,018	78%	424,136	77%
ComEd	1,126,092	848,393	75%	649,500	77%
Total	1,834,828	1,402,411	76%	1,073,636	77%

The gross ex post natural gas savings for the Custom and Standard Incentives Programs and New Construction Program during the period June 2013 through May 2014 are summarized in Table 1-6, Table 1-7, and Table 1-8. For the period, gross ex post natural gas savings total 5,420,120 therms for the Custom Incentives Program, 144,686 therms for the Standard Incentives Program, and 47,640 therms for the New Construction Program. The gross realization rates for the Custom and Standard Incentives Programs are 95% and 104%, respectively. The gross realization rate for the New Construction Program is 84%.

The total net ex post natural gas savings is 4,893,051 therms for the Custom Incentives Program, 115,136 therms for the Standard Incentives Program, and 43,757 therms for the New Construction Program. The net to gross ratio for the Custom Incentives Program is 90% while the net to gross ratio for the Standard Incentives Program is 80%. For the New Construction Program, the net to gross ratio is 92%.

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	1,826,963	1,643,318	90%	1,483,516	90%
Nicor	1,066,541	1,064,189	100%	960,704	90%
North Shore	146,573	149,439	102%	134,907	90%
Peoples	2,645,671	2,563,175	97%	2,313,924	90%
Total	5,685,748	5,420,120	95%	4,893,051	90%

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 Therm Savings	Gross Realization Rate	Net Ex Post Therm Savings	Net-to-Gross Ratio
Ameren	25,577	34,780	27,671	32,959	26,228	32,959	129%	26,228	80%
Nicor	107,245	103,587	82,414	95,584	76,062	101,598	95%	80,848	80%
North Shore	3,189	4,788	3,809	4,581	3,645	4,581	144%	3,645	80%
Peoples	3,008	5,585	4,443	5,549	4,415	5,549	184%	4,415	80%
Total	139,019	148,740	118,337	138,672	110,350	144,686	104%	115,136	80%

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	10,091	10,685	106%	9,814	92%
Nicor	46,401	36,955	80%	33,942	92%
Total	56,492	47,640	84%	43,757	92%

The gross ex post peak demand reductions for the Custom and Standard Incentives Programs and New Construction Program during the period June 2013 through May 2014 are summarized in Table 1-9, Table 1-10, and Table 1-11. For the period, gross peak demand reductions total 3,947.16 kW for the Custom Incentives Program, 13,907.42 kW for the Standard Incentives Program, and 289.72 for the New Construction Program. The gross realization rate for the Standard Incentives Program is 119%.

The net peak demand reductions total 2,567.57 kW for the Custom Incentives Program, 10,170.64 kW for the Standard Incentives Program, and 230.17 kW for the New Construction Program. The net to gross ratio for the Standard Incentives Program is 73%.

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	-	1,002.88		652.35	65%
ComEd	-	2,944.29		1,915.21	65%
Total	-	3,947.16		2,567.57	65%

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 kW Savings	Gross Realization Rate	Net Ex Post kW Savings	Net-to-Gross Ratio
Ameren	2,625.87	2,437.75	1,801.49	2,437.63	1,801.39	2,629.84	100%	1,923.23	73%
ComEd	9,031.78	10,289.03	7,603.55	10,288.57	7,603.20	11,277.59	125%	8,247.41	73%
Total	11,657.65	12,726.78	9,405.04	12,726.20	9,404.59	13,907.42	119%	10,170.64	73%

Table 1-11 Summary of Peak kW Reductions for New Construction Program

Utility	Ex Ante kW Savings	Gross Ex Post kW Savings	Gross Realization Rate	Net Ex Post kW Savings	Net-to-Gross Ratio
Ameren	-	108.27		86.01	79%
ComEd	-	181.45		144.15	79%
Total	-	289.72		230.17	79%

The following presents a selection of key findings from EPY6/GPY3:

- **Combined Gross Realized Savings Decreased from Prior Program Year**: In comparison to last year, the realized gross electric and natural gas savings for all three programs combined decreased. The lower activity was due to decreased Custom and New Construction Incentives Program savings. Realized gross savings for the Standard Incentives Program increased from EPY5/GPY2.
- **DCEO and Partners Working to Provide a Clear, More Consistent Brand:** DCEO's partners have adopted the Illinois Energy Now branding. The intent is to provide a clear message to the market and to communicate to public entities the partnership with the incentive programs. The Smart Energy Design Assistance Center (SEDAC) plans to host a support call center for program participants.
- **Multiple New Initiatives Launched:** DCEO launched several new initiatives during the program year including: The Clean Water Energy Efficiency Initiative directing participants to leverage funding provided by the Illinois EPA and the Illinois Clean Energy Community Foundation to implement high efficiency aeration systems, a pilot project for data centers, and a bonus incentive for large custom gas projects that exceeded 50,000 therms to increase natural gas savings.
- **Database Improvements are needed to Track New Construction Projects and Meet Accounting Requirements:** Improvements need to be made to the database because it was found to be insufficient for tracking the early phases of new construction projects, and does not accurately report annual program expenditures.

Key findings from interviews with staff in the state buildings sector and a review of state policy pertaining to energy efficiency in state government are summarized below.

- **There are State Policies in place to Encourage Energy Efficiency in State Buildings, but Budget Policy Limits Implementation Potential:** There are several state policies that encourage or require the state to adopt energy conservation measures in existing and new facilities. However, reductions in state agency appropriations and the under-funding of capital budgets present significant constraints on resources available for the implementation of energy saving measures.
- **Decision Making and Approval Processes are Complex:** The approval processes for energy efficiency projects is complicated and it may involve either staff from the agency that is primarily using the building or CMS staff, depending on which agency has primary responsibility for the building. In addition, larger capital improvement projects require additional approval by the Capital Development Board (CDP). The multiple decision makers and organizations involved in the process likely create challenges for program outreach and

for trade allies seeking to develop business opportunities by encouraging energy efficiency improvements in state buildings. Trade allies noted that there were many parties involved in making decisions about equipment purchasing for state buildings and approval processes were slow.

- **Agencies Lack Budget Line Item for Incentive Projects to Participation:** Some agencies do not have a line item in their budgets for incentive dollars from DCEO. Incentives for these agencies are funneled into the general fund rather than funding the agency directly. This likely reduces the efficacy of incentives for encouraging energy efficiency projects. One large agency has developed a solution that uses funds for managing cash flow to finance projects. Other agencies may be able to replicate this strategy.
- **Funding Constraints Create Multiple Barriers:** The lack of state funds for capital improvements and agency facilities disincentives the replacement of old equipment, or equipment that is not operating optimally. Because of the lack of capital funds, most capital improvements are approved only to make emergency repair. Energy saving options may not be fully considered in these cases because short time frames to identify energy efficient equipment options and to apply for grant opportunities. Complicating this, many state facilities have older equipment that is more expensive to replace than newer equipment more commonly found in private sector buildings.

  Some state government entities such as state universities and the Department of Military Affairs have access to non-state funds that are available to pay for energy efficiency improvements. The availability of these funds likely contributes to the higher level of participation by state universities.
- **New Construction Program Time Requirements and Lack of Incentives for Incorporating Design Features Limit Participation:** Allowing projects to span multiple grant years may improve new construction program activity. Additionally, either providing incentives to designers or more fully leveraging SEDAC design assistance to incorporate efficiency may encourage additional projects.
- **Support Services Provided by ERC and SEDAC are Valued:** Staff of several state agencies stated services provided by ERC and SEDAC are valued for developing energy saving projects.

Key findings from decision makers from local government agencies in the Chicago metropolitan area collected through interviews and surveys are summarized below.

- **Local Government Decision Making and Approval Processes are Complex:** Decision making about energy efficiency projects involves multiple decision makers, as is typical of public sector organizations. Interview respondents reported that facility management staff typically initiates projects, but projects require review from other managers and approval by the governing board for the municipality, the city council, and/or the mayor. This can complicate program outreach efforts because it increases the complexity and timeline of the approval process. Most municipalities have specific contracting requirements, which may affect project implementation timelines.

- **Barriers to Natural Gas Projects:** Three barriers to natural gas projects were identified: natural gas incentives cover a smaller share of equipment cost than incentives for electricity efficiency projects; organizations have already planned electricity efficiency projects; and there is less awareness of natural gas incentives. These factors explain why meeting natural gas efficiency goals has been more challenging than meeting electricity efficiency goals, but do not explain why DCEO has had greater difficulty reaching its natural gas saving goals in the Nicor service territory.
- **Opportunities to Improve Awareness and Understanding of Programs:** DCEO may be able to improve outreach efforts by targeting associations such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association. The facility management staff who often initiate energy saving projects are members of these organizations. There may also be opportunities to develop a clear presentation of how to complete an incentive project that would better inform municipalities of the process.
- **Franchise Agreements may have Moderate Impact on Completion of Incentive Projects:** Program staff has noted that franchise agreements that cover all or a portion of municipality energy costs may limit program activity. Interview and survey responses suggest that these agreements may have a moderate impact on program participation. Most survey respondents report that they have franchise agreements that cover all or part of the cost of electricity (78%) and natural gas service (69%). However, none indicated that these arrangements made it much more difficult to get projects approved and only 22% indicated that it made it somewhat more difficult. One interview respondent indicated that not having utility costs made getting approval for energy efficiency projects more difficult. The effect of these agreements may be greater than respondents stated. Respondents may be reluctant to report that the agreements reduce their motivation to complete energy saving projects that could result in environmental benefits and reduce municipal energy costs being passed on to residents.
- **Incentive Dollars May Not be Returned to Budgets used to Finance Projects:** Nearly one-half of respondents (48%) reported that the incentive funds for energy efficiency projects would not be returned to the department or budget that financed the project. As such, some organizations may not implement energy efficient equipment because the incremental costs are not recouped.
- **DCEO Sponsored Audits and Project Reviews are Highly Valued:** Interview respondents valued audits and project reviews performed by SEDAC and the 360 Energy Group. These services provided a credible source of information on energy saving improvements, assisted

with the development of projects, and provided clear equipment specifications used to develop bid requests.

The following recommendations are offered for improving the DCEO public sector programs.

- **Consider Outreach to Additional Associations:** Outreach efforts to groups such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association may be effective at reaching municipal facility staff who often initiate energy efficiency projects.
- **Continue to Leverage Audits and Project Reviews as Gateway to Program Participation:** Energy assessments and project reviews appear to be an effective means of assisting public entities with developing energy saving projects. Program staff should continue to leverage these services and target non-participating organizations to encourage participation in the incentive programs. Moreover, specifically targeting utility service territories where the programs are underperforming may improve goal attainment.
- **Explore Financing Mechanisms for Government Agencies:** Incentive payments are often not returned to the state agency budget used to pay for the improvement. Program staff should explore models developed by other state agencies for funding energy efficiency improvements in the absence of a budget line for accepting incentives can be applied elsewhere. DCEO should leverage its position on the Energy Efficiency Committee to press for the implementation of budget line items for state agencies to receive incentives mandated by Executive Order 7 of 2009.

  Similar budget issues may limit the effectiveness of the incentives for local government agencies. Staff should also consider implementing a utility bill credit process to fund efficiency projects for other public sector entities.
- **Opportunity to Improve Consistency of Program Information and Relevance:** Program staff reported that their partners were adopting consistent use of the Energy Now Brand to communicate that the DCEO energy efficiency incentives and technical services are part of a single program. SEDAC will be hosting a call center that will be the main telephone contact for program participants. These developments are moving the DCEO programs to a more consolidated presence. However, additional improvements are possible. For example, program information can be found separately on the DCEO, SEDAC, and ERC websites. Creating a single site that is used by DCEO and its partners to present information that is organized effectively may encourage program participation and help establish the DCEO programs a resource for energy efficiency. For example, the information could be presented by target market (e.g., state agencies, municipalities, parks departments), by facility type

(e.g., waste water treatment facilities, correctional facilities, or public pools), by equipment type (e.g., lighting equipment, kitchen equipment), or by some combination of these options.

- **Monitor Effectiveness of Sweet Deal Bonus:** Although program activity spiked around the two deadlines for the sweet deal bonus (October 31st and February 14th), it is unclear if these bonus incentives influenced additional projects or shifted their timeline to earlier in the program year. It is important to note that for both the Standard and Custom Programs, the majority of savings occurred after the sweet deal timeline had passed.
- **Consider Specialized Training to Trade Allies to help them Navigate Public Sector Approval Processes:** Trade allies reported issues developing projects at state agencies involving complex decision-making processes and slow approval processes. These issues are also found in other public sector entities. Staff may be able to provide guidance to trade allies on navigating decision-making processes at public sector organizations to make the process more transparent and facilitate their ability to sell projects.

2 Introduction

This section presents a description of the three programs that Illinois Department of Commerce and Economic Opportunity (DCEO) offers to public sector entities: 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 six and natural gas program year three (EPY6/GPY3), the period from June 2013 through May 2014.

2.1 Description of Programs

The Custom and Standard Incentives Programs and the New Construction Program offered by DCEO 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

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 EPY6/GPY3, 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.

Two bonus incentive opportunities were offered during the program year under both programs: The “Sweet Deal Bonus”, and the High Impact Natural Gas Efficiency bonus. The “Sweet Deal Bonus” offered a 10% bonus for projects completed by October 31st, 2013 and a 5% bonus for projects completed by February 14th, 2014. The High Impact Natural Gas Efficiency (HINGE) bonus offered incentives of $4.00 per therm saved for projects that saved between 50,000 and 100,000 therms, and $5.00 per therm saved for projects that saved more than 100,000 therms. Up to 90% of the project cost was eligible under either incentive. To receive the HINGE bonus, applications for pre-approvals were required by September 30th, 2013 and the project must have been completed by May 31st, 2014.

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. 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.

Expected electric savings are shown in Table 2-1 by utility for the Custom and Standard Incentives Programs. There were 179 Custom Incentives Program projects during the period from June 2013 through May 2014 that were expected to provide savings of 23,939,429 kWh. Additionally, there were 923 Standard Incentives Program projects during the period June 2013 through May 2014 that were expected to provide savings of 79,201,259 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	6,444,643	18,657,883
ComEd	17,494,785	60,543,376
Total	23,939,429	79,201,259

Expected natural gas savings are shown in Table 2-2 by utility for the Custom and Standard Incentives Programs. There were 211 Custom Incentives Program projects during the period June 2013 through May 2014, which were expected to provide a total savings of 5,685,748 therms. The 106 Standard Incentives Program projects during the same period were expected to provide a total savings of 139,019 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	1,826,963	25,577
Nicor	1,066,541	107,256
North Shore	146,573	3,189
Peoples	2,645,671	3,008
Total	5,685,748	139,019

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

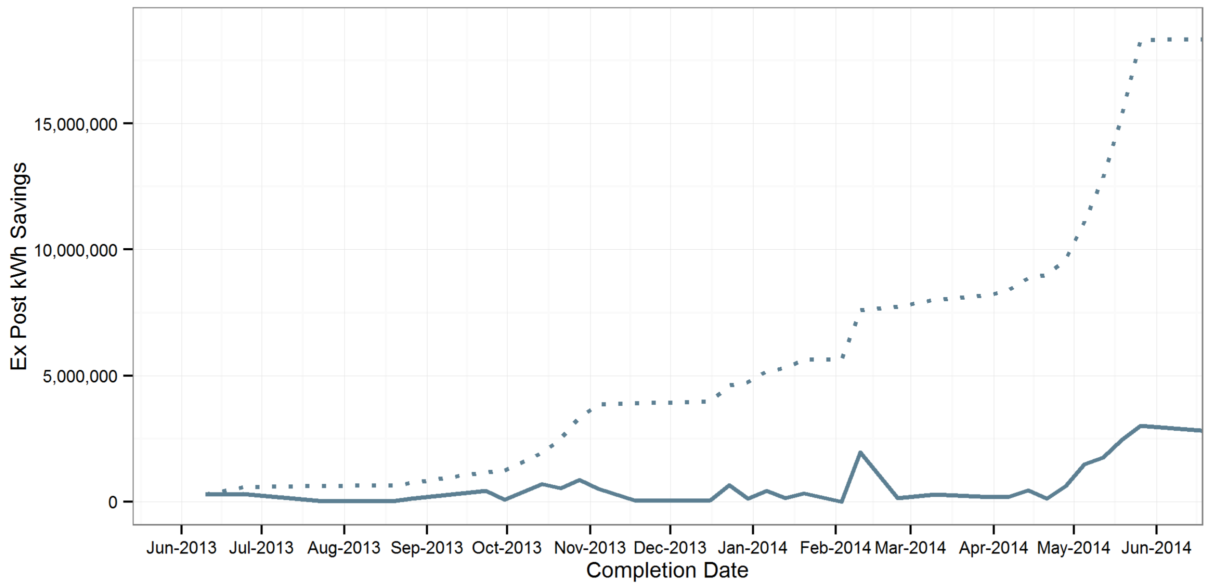

Figure 2-1 Custom Incentives Program Cumulative Ex Post kWh Savings by Date of Application Submission

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

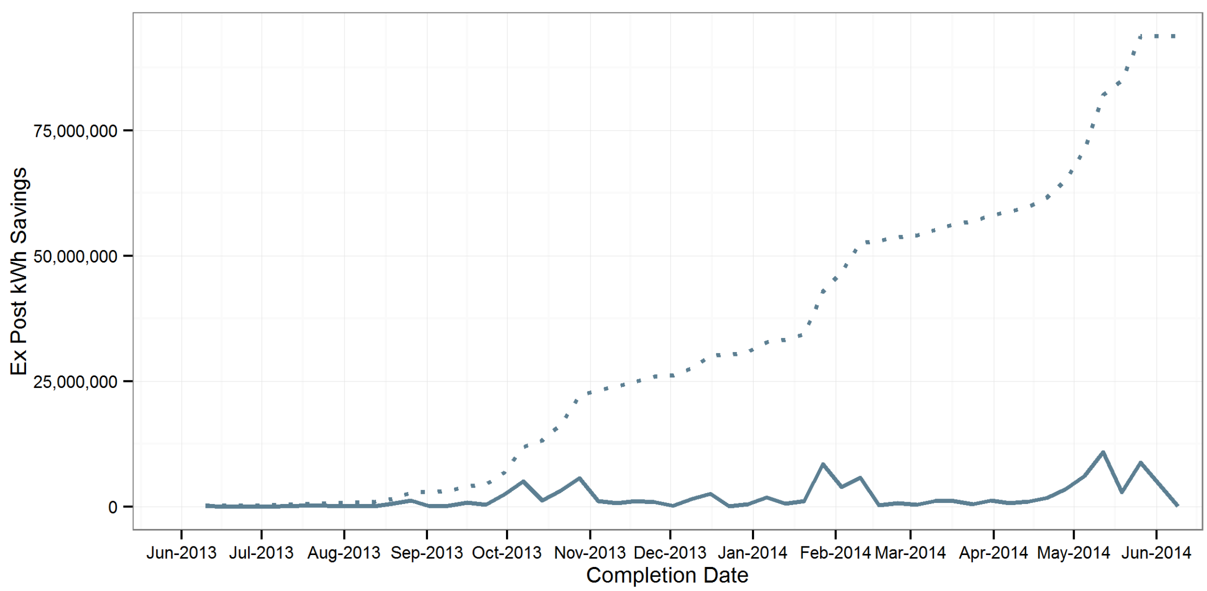

Figure 2-2 Standard Incentives Program Cumulative Ex Post kWh Savings by Date of Application Submission

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

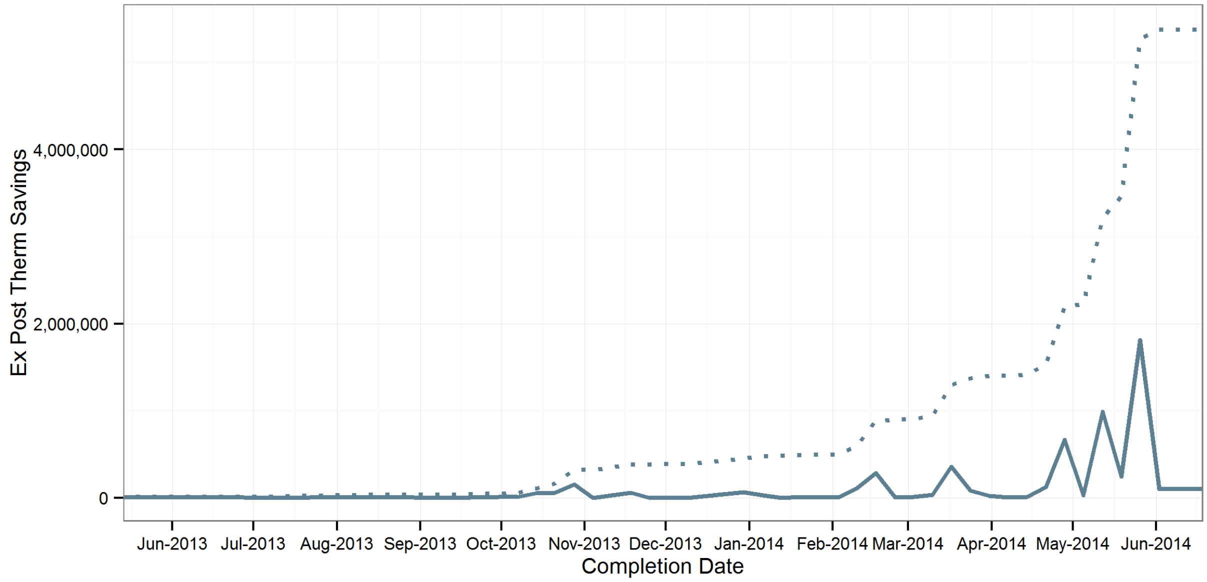

Figure 2-3 Custom Incentives Program Cumulative Ex Post Therm Savings by Date of Application Submission

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

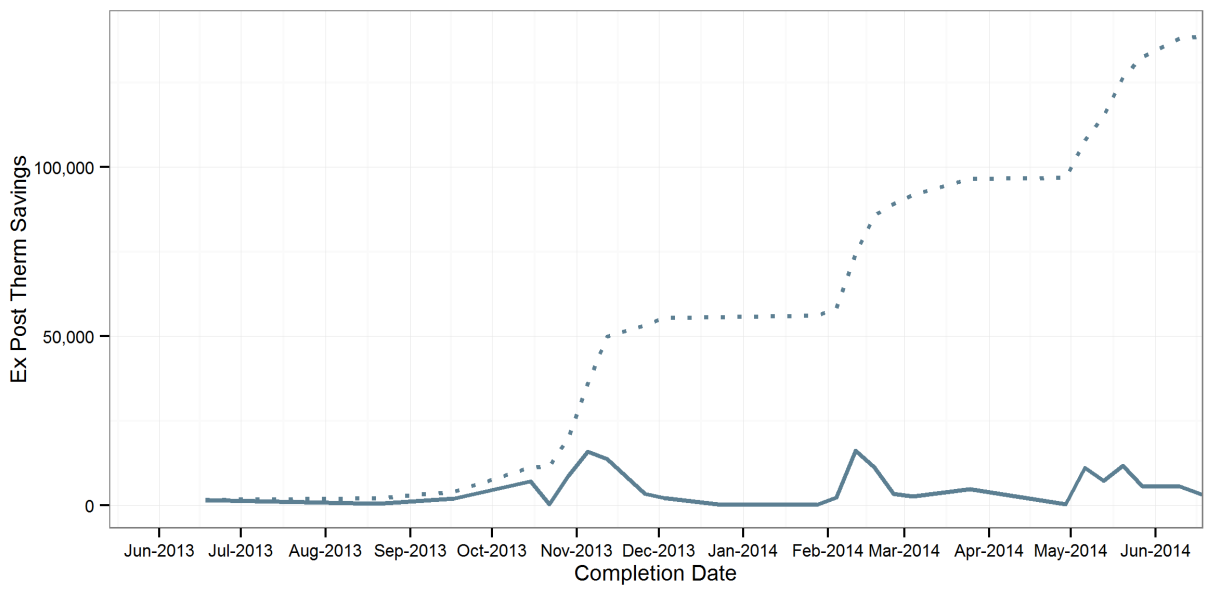

Figure 2-4 Standard Incentives Program Cumulative Ex Post Therm Savings by Date of Application Submission

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 conservation 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 EPY6/GPY3 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. Lighting incentives are based on lighting density (i.e., watts per square foot); envelope measures are based or R-values per square foot; mechanical measures are based on equipment efficiency, type, and size; water heating measures are based on equipment type; and various kitchen measures are set on a per unit basis.

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 2013 through May 2014. These projects were expected to provide savings of 1,834,828 kWh.

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

Utility	*Ex Ante kWh Savings*
Ameren	708,736
ComEd	1,126,092
Total	1,834,828

There were seven projects completed through the New Construction program that received natural gas incentives during the period June 2013 through May 2014. These projects were expected to provide savings of 56,492 therms.

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

Utility	*Ex Ante Therm Savings*
Ameren	10,091
Nicor	46,401
Total	56,492

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 2013 through May 2014 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) was used to estimate gross savings for TRM 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 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.
- Interviews and surveys of participating and non-participating local government decision makers in the Chicago metropolitan area were conducted to gather information on possible barriers to energy efficiency and participating in the program.
- Interviews were conducted with key state agency staff from the Department of Central Management Services (CMS), the Capital Development Board (CDB), and staff members from a large state agency active in the program. These interviews provided information on challenges the program faces in encouraging energy efficiency projects with the targeted market sector.
- Surveys of registered trade allies were conducted to provide insight on customer awareness of the incentive programs, the application process, and to provide suggestions for improving the programs.

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 2013 through May 2014 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.
- Chapter 6 presents evaluation conclusions and recommendations for 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: Survey Instrument for Custom Standard 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 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: Survey Instrument for New Construction 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 Survey Responses presents the results from a survey of decision makers for participants that received incentives under the New Construction Program.
- Appendix F: Survey Instrument for Municipal Non Participant provides a copy of the questionnaire used for municipal government decision makers.
- Appendix G: Municipal Survey Responses presents the results from a survey of municipal government decision makers.
- Appendix H: Trade Ally Survey Instrument provides a copy of the questionnaire used for the survey of members of the trade ally network.
- Appendix I: Trade Ally Survey Responses presents the results of the survey of trade allies.

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 2013 through May 2014. 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 period June 2013 through May 2014. Samples were drawn for both electric and natural gas savings achieved through the programs.[1]

Data obtained from DCEO showed that during the period June 2013 through May 2014, there were 190 Custom Incentives Program projects that were expected to provide total electric savings of 25,774,257 kWh annually. During the same period there were 1,386 Standard Incentives Program projects, which were expected to provide total electric savings of 79,201,153 kWh annually.

Inspection of data on kWh savings for individual projects obtained from DCEO 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 Programs. Estimation of electric savings for Custom and Standard Incentives 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 Program sample is ±14.1% at 90% confidence, while the actual precision of the Standard Incentives Program sample is ±9.92% at 90% confidence.

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

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

Table 3-2 shows the number of projects and expected kWh savings of the Standard 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)	29,075 <	29,076 – 116,266	116,267 – 239,812	239,813 – 879,413	879,414 – 2,398,102	
Number of projects	114	30	16	27	3	190
Total kWh savings	762,082	1,925,018	2,639,653	14,435,326	6,012,178	25,774,257
Average kWh Savings	6,685	64,167	164,978	534,642	2,004,059	135,654
Standard deviation of kWh savings	7,513	27,857	32,340	172,049	488,460	309,681
Coefficient of variation	1.12	0.43	0.20	0.32	0.24	2.28
Final design sample	8	6	2	4	3	23

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)	29,960 <	29,961 – 119,628	119,629 – 278,438	278,439 – 869,500	869,501 – 3,111,382	
Number of projects	857	359	121	47	2	1,386
Total kWh savings	9,591,377	21,777,855	21,963,097	21,492,107	4,376,823	79,201,259
Average kWh Savings	11,192	60,663	181,513	457,279	2,188,412	57,144
Standard deviation of kWh savings	8,051	24,667	44,944	171,383	1,305,277	131,270
Coefficient of variation	0.72	0.41	0.25	0.37	0.60	2.30
Final design sample	19	11	8	8	1	47

As shown in Table 3-3, the sample projects account for approximately 35% of the Custom Incentives Program’s expected kWh savings, and, as shown in Table 3-4, the Standard Incentives Program’s sample projects account for approximately 11% 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	6,012,178	6,012,178	100%
4	2,328,559	14,435,326	16%
3	347,274	2,639,653	13%
2	415,321	1,925,018	16%
1	119,015	762,082	16%
Total	9,222,347	25,774,257	35%

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	3,111,382	4,376,823	71%
4	3,319,745	21,492,107	15%
3	1,479,684	21,963,097	7%
2	715,862	21,777,855	3%
1	141,030	9,591,377	1%
Total	8,767,703	79,201,259	11%

Data obtained from DCEO showed that during the period June 2013 through May 2014, there were 256 Custom Incentives Program projects that were expected to provide natural gas savings of 5,742,240 therms. During the same period, there were 97 Standard Incentives Program projects that were expected to provide natural gas savings of 139,019 therms.

Inspection of data on therm savings for individual projects obtained from DCEO 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 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 Program sample is ±9.02% at 90% confidence, while the actual precision of the Standard Incentives Program sample is ±9.96% at 90% confidence.

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

Table 3-6 shows the number of projects and expected therm savings of the Standard 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*	*Totals*
Strata boundaries (Therm)	20,640 <	20,641 – 101,058	101,059 – 859,063	
Number of projects	216	32	8	256
Total therm savings	820,810	1,497,756	3,423,673	5,742,240
Average therm savings	3,800	46,805	427,959	22,431
Standard deviation of therm savings	4,864	21,945	292,207	89,164
Coefficient of variation	1.28	0.47	0.68	3.93
Final design sample	15	10	8	33

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

	Stratum 1	*Stratum 2*	*Stratum 3*	*Totals*
Strata boundaries (therm)	1,133 <	1,134 – 5,760	5,761 – 24,651	
Number of projects	75	17	5	97
Total therm savings	26,845	49,091	63,082	139,019
Average therm savings	358	2,888	12,616	1,433
Standard deviation of therm savings	304	1,274	6,859	3,177
Coefficient of variation	0.85	0.44	0.54	2.22
Final design sample	11	8	5	24

As shown in Table 3-7 the sample projects account for approximately 71% of the Custom Incentives Program’s expected therm savings, and as shown in Table 3-8, the sample projects account for approximately 67% 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*
3	3,423,673	3,423,673	100%
2	524,953	1,497,756	35%
1	101,824	820,810	12%
Total	4,050,450	5,742,240	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*
3	63,114	63,082	100%
2	27,875	49,091	57%
1	2,169	26,845	8%
Total	93,158	139,019	67%

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 DCEO 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 DCEO 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, 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 energy conserving 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 (TOU) 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 kW reduction was calculated for projects that are part of the sample for measurement and verification. In order to calculate total achieved peak kW savings, the total realized peak kW savings for the sampled projects of a stratum were factored by the ratio of total expected kWh savings to sample expected kWh savings.

Peak Period Demand Savings 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:

$$\text{Peak Capacity Savings} = kW_{before} - kW_{after}$$

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 these 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 an 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:

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

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

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

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

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

where kW_{ave} = Volts x $Amps_{ave}$ x Power Factor 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. 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. Data on the efficiencies of high efficiency motors installed under the program should be available from program records. In some cases, the efficiencies of the replaced motors may also be noted in DCEO's program records. Care must be taken using nameplate efficiency ratings of replaced motors, unless the company maintains good documentation of their equipment. If a motor has been rewound it may not operate as originally rated. However, if the efficiencies of the old motors are not directly available, the efficiency values can be imputed by using published data on average efficiency values for motors of given horsepower. 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

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

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

real motors that have the same full load efficiencies are used for determining part load efficiencies.

Like 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 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

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

frequency of the electric power supplied to the motor. The factors that make a motor load a suitable application for a VFD are (1) variable speed requirements and (2) 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 approach to determining savings from installation of VFDs involves (1) making one-time measurements of voltage, current, and power factor of the VFD/motor and (2) 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 in order 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; 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 due to the energy efficiency measures installed within each compressed air system. The AirMaster+ 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, etc. 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) was used to estimate gross savings for TRM 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 2.
- TRM-Calculated (Errata Corrected): Savings calculated as per an erratum in version 3 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 kWh savings, peak kW reductions, and gross 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 energy 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 Program during the period June 2013 through May 2014 are summarized by sampling stratum in Table 3-10. Overall, the gross ex post savings of 20,067,372 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	6,012,178	3,636,445	60%
4	14,435,326	10,832,425	75%
3	2,639,653	2,913,078	110%
2	1,925,018	1,676,862	87%
1	762,082	1,008,561	132%
Total	25,774,257	20,067,372	78%

The gross ex post kWh savings for the Standard Incentives Program for the period June 2013 through May 2014 is summarized in Table 3-11. Overall, the gross ex post savings of 94,110,595 kWh were equal to 119% 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	4,376,823	3,253,873	3,253,873	3,253,873	74%
4	21,492,107	27,796,950	27,796,950	28,500,159	133%
3	21,963,097	18,841,550	18,841,550	21,371,847	97%
2	21,777,855	24,038,285	23,580,497	23,580,497	108%
1	9,591,377	17,404,219	17,404,219	17,404,219	181%
Total	79,201,259	91,334,877	90,877,089	94,110,595	119%

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*
C-24	2,398,102	2,445,183	102%
C-8	2,156,525	233,196	11%
C-19	1,457,551	958,066	66%
C-2	790,412	295,508	37%
C-29	680,519	940,058	138%
C-26	545,800	327,291	60%
C-21	177,000	197,961	112%
C-13	170,274	185,285	109%
C-1	116,266	118,112	102%
C-4	59,698	15,732	26%
C-3	41,114	12,096	29%
C-5	36,375	69,472	191%
C-27	31,472	46,514	148%
C-4	30,324	12,684	42%
C-14	24,731	41,388	167%
C-4	20,956	16,470	79%
C-11	17,698	3,155	18%
C-20	14,296	12,643	88%
C-6	9,455	9,119	96%
C-15	2,800	3,173	113%
C-12	1,878	975	52%
All Non-Sample Projects	15,156,183	12,720,880	84%
Total	23,939,429	18,664,961	78%

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
		Gross Ex Post kWh Savings	Gross Ex Post kWh Savings	Gross Ex Post kWh Savings	
S-37	3,111,382	2,313,103	2,313,103	2,313,103	74%
S-44	863,788	2,093,642	2,093,642	2,093,642	242%
S-38	548,070	518,689	518,689	518,689	95%
S-33	397,967	398,239	398,239	398,239	100%
S-18	355,639	366,454	366,454	366,454	103%
S-34	303,212	296,847	296,847	296,847	98%
S-31	284,973	286,638	286,638	286,638	101%
S-30	283,952	285,610	285,610	285,610	101%
S-1	282,144	47,494	47,494	156,114	55%
S-26	275,326	139,850	139,850	304,310	111%
S-43	244,511	254,765	254,765	254,765	104%
S-5	205,826	232,646	232,646	232,646	113%
S-3	189,277	71,289	71,289	71,289	38%
S-18	158,810	166,859	166,859	166,859	105%
S-42	144,065	129,216	129,216	135,345	94%
S-13	138,329	103,266	103,266	103,266	75%
S-25	123,540	172,379	172,379	172,379	140%
S-32	117,855	92,614	92,614	92,614	79%
S-25	96,841	110,216	110,216	110,216	114%
S-20	79,001	94,683	94,683	94,683	120%
S-35	71,350	58,069	58,069	58,069	81%
S-17	68,959	86,744	71,696	71,696	104%
S-2	66,824	61,084	61,084	61,084	91%
S-15	50,523	49,981	49,981	49,981	99%
S-8	49,092	60,565	60,565	60,565	123%
S-39	48,309	67,199	67,199	67,199	139%
S-9	34,959	66,967	66,967	66,967	192%
S-12	32,149	42,043	42,043	42,043	131%
S-25	26,779	38,066	38,066	38,066	142%
S-27	13,218	14,702	14,702	14,702	111%
S-18	13,197	13,197	13,197	13,197	100%
S-41	11,232	52,673	52,673	52,673	469%
S-45	9,222	10,279	10,279	10,279	111%
S-7	9,066	15,424	15,424	15,424	170%
S-8	8,308	11,399	11,399	11,399	137%
S-12	7,962	8479	8479	8479	106%
S-15	6,848	6,838	6,838	6,838	100%
S-15	6,848	6,838	6,838	6,838	100%
S-23	6,455	7,973	7,973	7,973	124%
S-16	5,877	35,931	35,931	35,931	611%
S-11	4,756	8,800	8,800	8,800	185%

Project ID	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	
S-4	3,513	7,973	7,973	7,973	227%
S-40	2,411	6,982	6,982	6,982	290%
S-36	2,307	2,307	2,307	2,307	100%
S-24	1,222	5,462	5,462	5,462	447%
S-22	993	997	997	997	100%
S-6	816	1,441	1,441	1,441	177%
All Non-Sample Projects	70,433,556	82,411,965	81,969,225	84,923,522	121%
Total	79,201,259	91,334,877	90,877,089	94,110,595	119%

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
N-4	311,828	184,519	59%
N-1	27,201	70,585	259%
All Non-Sample Projects	1,495,799	1,147,307	77%
Total	1,834,828	1,402,411	76%

Table 3-15 summarizes the gross ex post therm savings for the Custom Incentives Program for the period June 2013 through May 2014. Overall, the gross ex post savings of 5,467,760 therms were equal to 95% 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
3	3,423,673	3,180,155	93%
2	1,497,756	1,418,439	95%
1	820,810	869,166	106%
Total	5,742,240	5,467,760	95%

Table 3-16 summarizes the gross ex post therm savings for the Standard Incentives Program for the period June 2013 through May 2014. Overall, the gross ex post savings of 139,355 therms were equal to 100% 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	63,082	37,564	33,460	39,474	63%
2	49,091	66,999	61,382	61,382	125%
1	26,845	44,177	43,830	43,830	163%
Total	139,019	148,740	138,672	144,686	104%

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*
C-17	859,063	1,030,286	120%
C-23	854,379	319,100	37%
C-17	531,035	136,802	26%
C-22	396,843	735,070	185%
C-16	233,175	294,512	126%
C-24	198,562	235,509	119%
C-28	185,013	285,381	154%
C-25	165,603	143,495	87%
C-32	100,698	96,644	96%
C-18	78,000	51,557	66%
C-19	70,547	89,884	127%
C-31	59,911	54,009	90%
C-27	56,588	54,694	97%
C-30	52,491	49,654	95%
C-17	31,059	32,958	106%
C-21	28,497	23,356	82%
C-26	25,855	23,722	92%
C-13	21,307	20,675	97%
C-17	17,131	11,153	65%
C-14	10,835	10,174	94%
C-9	10,416	1,703	16%
C-17	10,348	13,944	135%
C-1	6,754	21,420	317%
C-4	5,000	1,348	27%
C-3	3,966	1,008	25%
C-10	3,330	11,281	339%
C-11	894	3,098	346%
C-6	818	845	103%
C-20	652	647	99%
C-15	350	398	114%
C-12	235	10,058	4280%
All Non-Sample Projects	1,666,393	1,655,736	99%
Total	5,685,748	5,420,120	95%

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*	
S-29	24,651	17,435	15,244	15,244	62%
S-46	11,200	0	0	3,906	35%
S-10	9,920	0	0	2,108	21%
S-1	9,850	10,298	9,122	9,122	93%
S-14	7,493	9,831	9,094	9,094	121%
S-35	4,449	7,149	6,817	6,817	153%
S-17	4,200	6,596	5,670	5,670	135%
S-27	4,200	3,500	3,228	3,228	77%
S-43	4,035	6,579	6,053	6,053	150%
S-45	3,360	4,541	4,200	4,200	125%
S-11	2,832	4,114	3,804	3,804	134%
S-19	2,781	2,800	2,520	2,520	91%
S-38	2,018	2,764	2,562	2,562	127%
S-12	472	541	541	541	115%
S-4	358	376	361	361	101%
S-25	305	306	306	306	100%
S-42	248	248	248	248	100%
S-6	239	531	514	514	215%
S-28	224	1,004	1,004	1,004	448%
S-3	178	251	251	251	141%
S-21	124	251	251	251	202%
S-5	12	52	52	52	433%
S-8	7	7	10	10	147%
S-8	2	2	3	3	170%
All Non-Sample Projects	45,861	69,563	66,817	66,817	146%
Total	139,019	148,740	138,672	144,686	104%

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*
N-4	15,575	14,323	92%
N-1	15,520	6,424	41%
All Non-Sample Projects	25,397	26,893	106%
Total	56,492	47,640	84%

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 energy savings against the expected energy 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 energy savings against the expected energy 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.

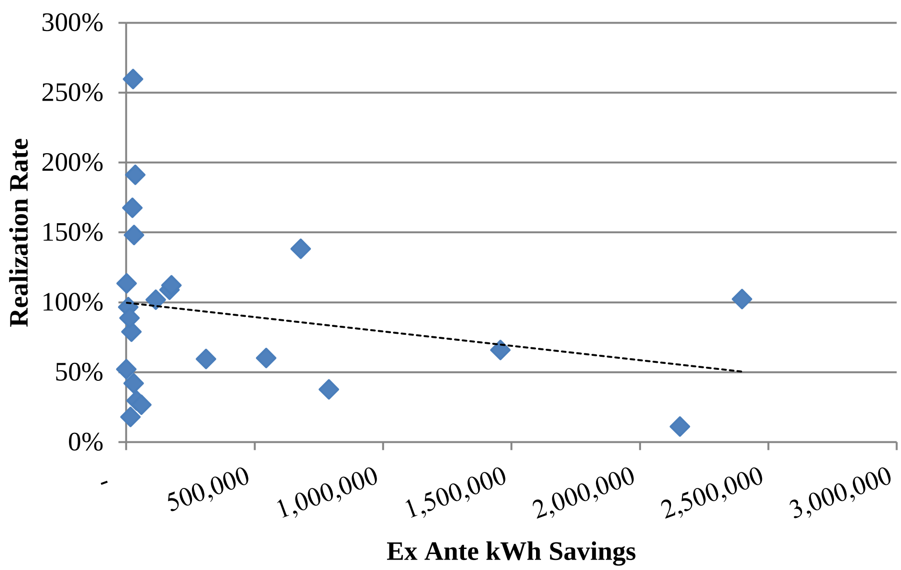


Figure 3-1 Custom Incentives and New Construction Programs Sample Project Realization Rate versus Ex Ante kWh Savings

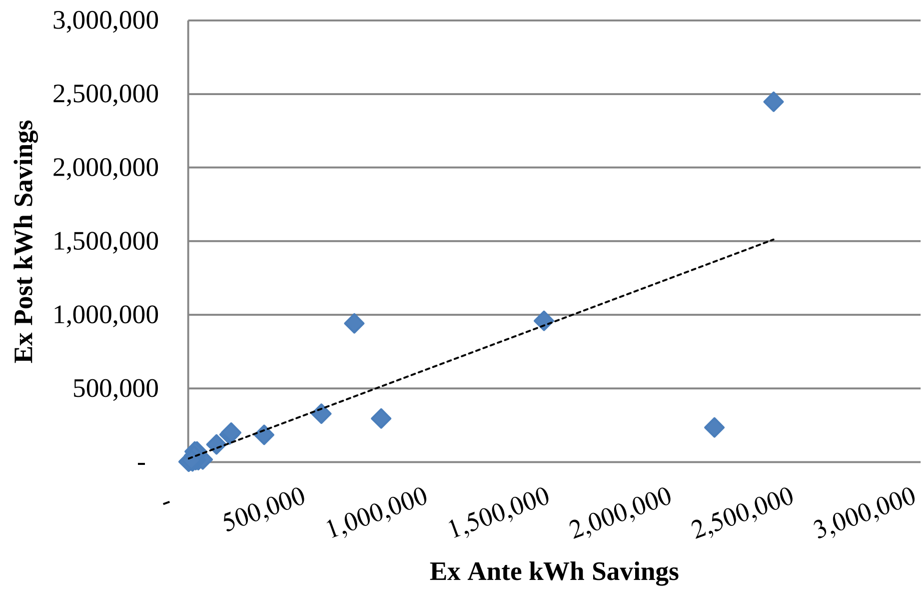


Figure 3-2 Custom Incentives and New Construction Programs Sample Project Ex Post kWh Savings versus Ex Ante kWh Savings

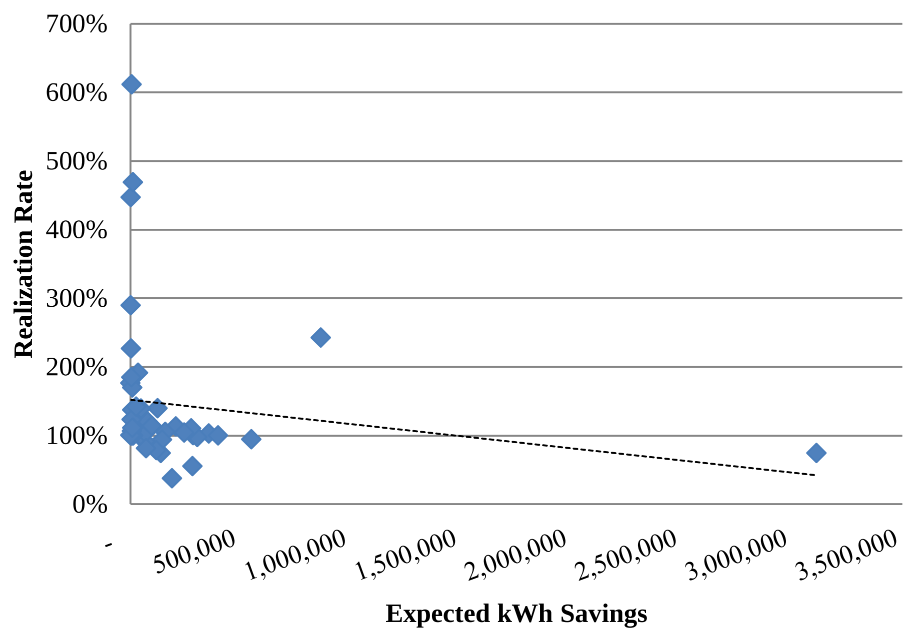


Figure 3-3 Standard Incentives Program Sample Project Realization Rate versus Ex Ante kWh Savings

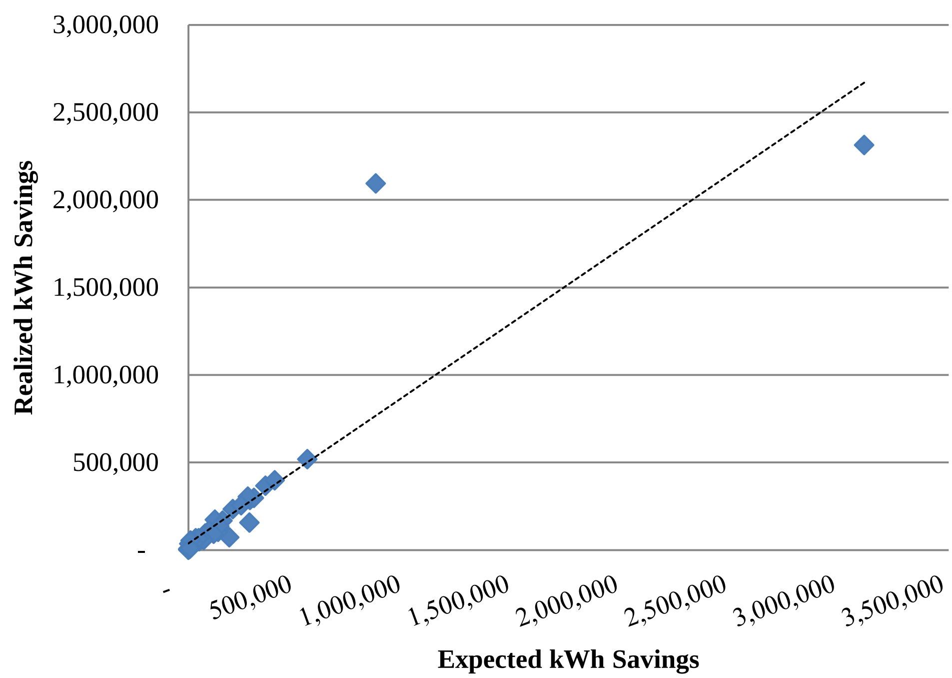


Figure 3-4 Standard Incentives Program Sample Project Ex Post kWh Savings (ADM Calculated) versus Ex Ante kWh Savings

Similarly, for the Custom Incentives and New Construction Programs projects, 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 standard incentive project realized therm savings against the expected therm savings for each sample point. For the Standard Incentives Program projects, 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 kWh savings. Figure 3-8 plots the standard incentive project realized energy savings against the expected energy 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.

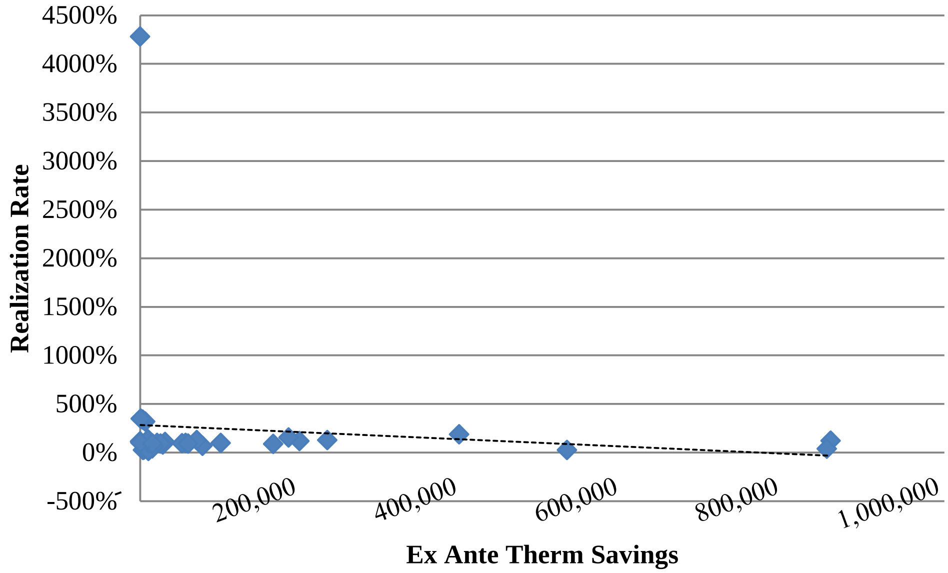


Figure 3-5 Custom Incentives and New Construction Programs Sample Project Realization Rate versus Ex Ante Therm Savings

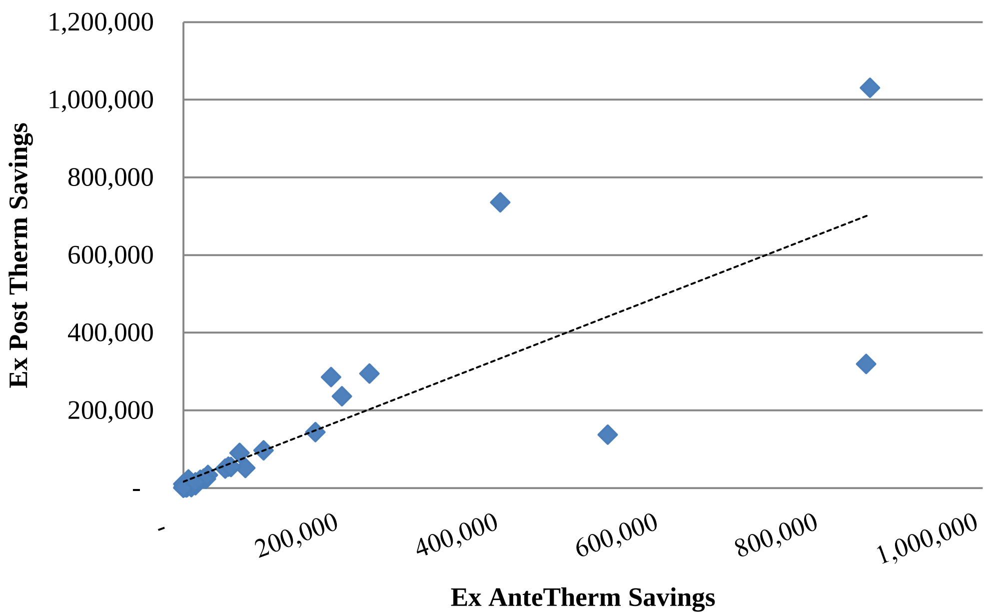


Figure 3-6 Custom Incentives and New Construction Programs Sample Project Ex Post Therm Savings versus Ex Ante Therm Savings

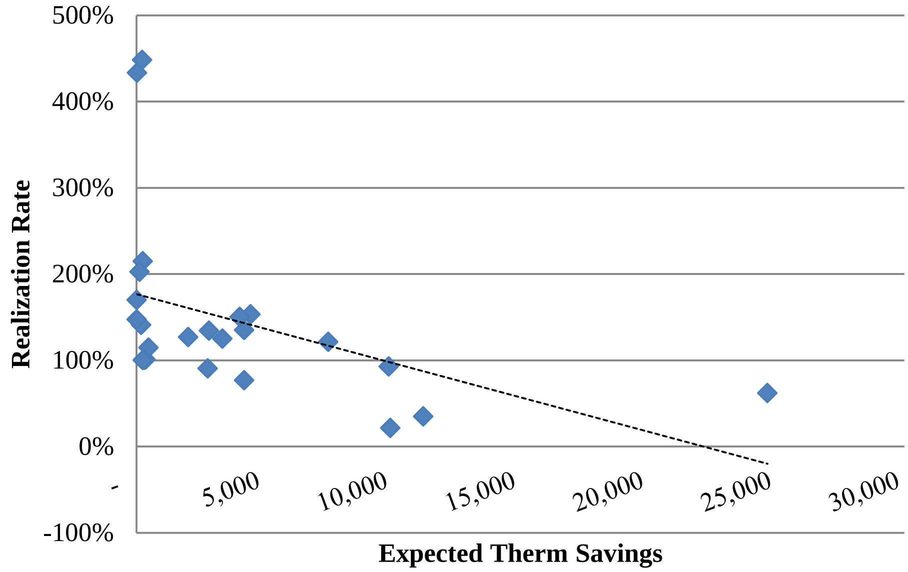


Figure 3-7 Standard Incentives Program Sample Project Realization Rate versus Ex Ante Therm Savings

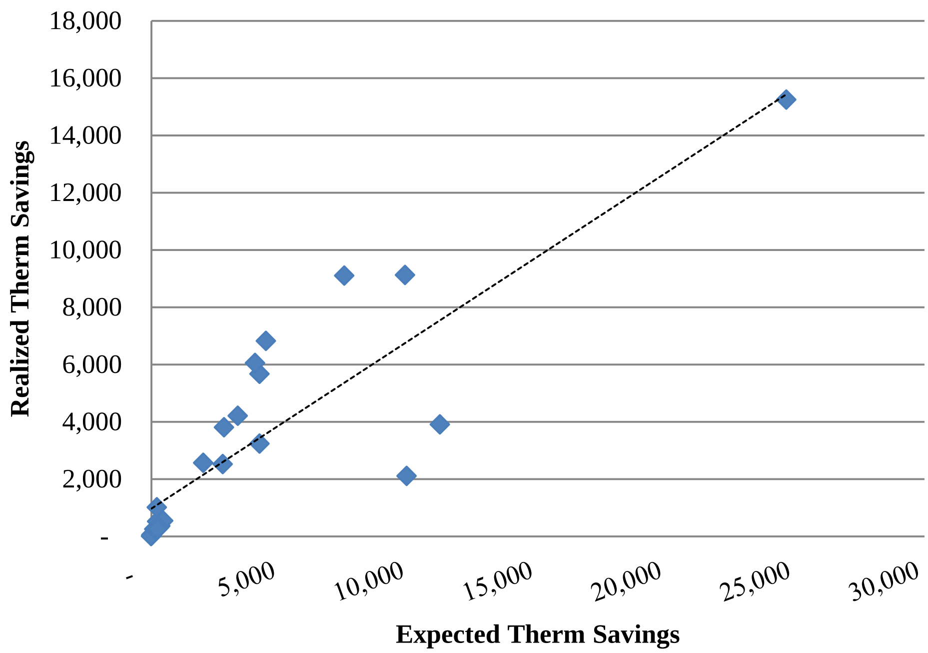


Figure 3-8 Standard Incentives Program Sample Project Ex Post Therm Savings (ADM Calculated) versus Ex Ante Therm Savings

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 results of estimated net impacts of the Custom and Standard Incentives Programs and the New Construction Program during the period June 2013 through May 2014.

4.1 Methodology for Estimating Net Savings

Net savings are defined as the portion of gross savings that can be attributed to the effects of the program. Net savings may be less than gross savings as a result of free ridership. Free riders are defined as those program participants that would have implemented the same energy efficiency measures and achieved the observed energy changes at the same time, even in the absence of the program.

In general, net savings are equal to gross savings less the impact of free ridership. Because 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, skewing the results.

ADM performed a net savings analysis to estimate the impacts of the energy efficiency measures attributable to the Custom Incentives, Standard Incentives, and the New Construction Programs that were net of free ridership. Information collected from a sample of program participants through a decision maker survey was used to estimate the extent of free ridership. Appendix B provides a copy of the survey instrument for Custom and Standard Incentives Program Participants, and Appendix C presents tabulated responses for each survey question. Appendix D provides a copy of the survey instrument for New Construction Program Participants, and Appendix E presents tabulated responses for each survey question.

Based on a review of this information, the preponderance of evidence regarding free ridership inclinations was used to assess the likelihood of participant free ridership and estimate net savings.

Several criteria were used for determining what portion, if any, of a participant's savings for a particular project should be attributed to free ridership. The criteria used to attribute free ridership correspond to three factors. The three factors are:

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

For each of these factors, rules were applied to develop binary variables indicating whether or not a participant's behavior showed free ridership. These rules made use of answers to questions on the decision maker survey questionnaire.

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

The first, more restrictive criteria indicating participant plans and intentions that likely signify free ridership are as follows:

- The respondent answered “yes” to the following two questions: “Did you have plans to install the measure before participating in the program?” and “Would you have gone ahead with this planned installation of the measure even if you had not participated in the programs?”
- The respondent answered “definitely would have installed” to the following question: “If the financial incentive from the programs had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?”
- The respondent answered “did not affect timing of purchase and installation” to the following question: “How did the availability of information and financial incentives through the programs affect the timing of your purchase and installation of [Equipment/Measure]?”
- The respondent answered “no, the program did not affect level of efficiency that we chose for equipment” in response to the following question: “How did the availability of information and financial incentives through the programs affect the level of energy efficiency you chose for [Equipment/Measure]?

The second, less restrictive criteria indicating participant plans and intentions that likely signify free ridership are as follows:

- The respondent answered “yes” to the following two questions: “Did you have plans to install the measure before participating in the program?” and “Would you have gone ahead with this planned installation of the measure even if you had not participated in the programs?”
- Either the respondent answered “definitely would have installed” or “probably would have installed” to the following question: “If the financial incentive from the programs had not been available, how likely is it that you would have installed [Equipment/Measure] anyway?”
- Either the respondent answered “did not affect timing of purchase and installation” to the following question: “How did the availability of information and financial incentives through the programs affect the timing of your purchase and installation of [Equipment/Measure]?” or the respondent indicated that that while program information and financial incentives did

affect the timing of equipment purchase and installation, in the absence of the program they would have purchased and installed the equipment within the next two years.

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

The second factor required determining if a participant reported that a recommendation from a program representative was influential in the decision to install a particular piece of equipment or measure.

The criterion indicating that program influence may signify a lower likelihood of free ridership is that the following conditions are true:

- The respondent answered "yes" to the following question: "Did a representative of the programs recommend that you install [Equipment/Measure]?" and "probably would not have" or "definitely would not have" to the question: "If the Public Sector Energy Efficiency Program representative had not recommended installing the equipment, how likely is it that you would have installed it anyway?"

The third factor required determining if a participant in the program indicated that he or she had previously installed an energy efficiency measure similar to one that they installed under the program without an energy efficiency program incentive during the last three years. A participant indicating that he or she had installed a similar measure is considered to have a likelihood of free ridership.

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

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

The four sets of rules just described were used to construct four different indicator variables that address free ridership behavior. For each participant, a free ridership value was assigned based on the combination of variables. With the four indicator variables, there were 11 applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 4-1 shows these values.

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

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

4.2 Results of Net Savings Estimation

The procedures described in the preceding section were used to estimate free ridership rates and net to gross ratios for the Custom and Standard Incentives Programs and the New Construction Program for the period June 2013 through May 2014.

4.2.1 Net Ex Post kWh Savings

For the Custom and Standard Incentives Program, the data used to assign free ridership scores were collected through a survey of participant decision makers for projects completed during the period June 2013through May 2014. In total, 267 of 540 decision makers contacted completed the survey. For the New Construction Program, seven participant decision makers completed the survey out of eight participant decision makers contacted for projects completed during the period June 2013 through May 2014.

Individual free ridership rates were estimated for the Standard and Custom Incentives Programs and the New Construction Program.

Table 4-2 shows the percentage of survey respondents who relayed the following: They had plans and intentions to install the measures without any program incentive (under two alternative definitions as described in the preceding section), that the program influenced their decision to install the measure, or that they previously installed a similar energy efficiency measure without an energy efficiency program incentive during the last three years. Percentages reported are averages weighted by project gross ex post savings.

Table 4-2 Weighted Average Indicator Variable Values

Program	*Had Plans and Intentions to Install Measure without Program (Definition 1)*	*Had Plans and Intentions to Install Measure without Program (Definition 2)*	*Program had influence on Decision to Install Measure*	*Had Previous Experience with Measure*
Custom kWh	21%	43%	4%	19%
Custom Therm	7%	0%	31%	7%
Standard kWh	2%	18%	11%	25%
Standard Therm	0%	5%	1%	56%
New Construction kWh	0%	55%	12%	15%
New Construction Therm	0%	24%	23%	0%

Table 4-3 shows percentages of total gross ex post Custom Incentives Program kWh savings that are associated with different combinations of free ridership indicator variable values.

Table 4-3 Estimated Free ridership for kWh Savings from Custom Incentives Program Projects

Had Plans and Intentions to Install Measure without the C&S Program? (Definition 1)	*Had Plans and Intentions to Install Measure without the C&S Program? (Definition 2)*	*C&S Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Realized Gross kWh Savings*	*Free Ridership Score*
N	N	N	N	50%	0%
Y	N/A	N	N	14%	100%
N	Y	N	N	13%	33%
N	Y	N	Y	9%	67%
Y	N/A	N	Y	7%	100%
N	N	Y	N	4%	0%
N	N	N	Y	3%	33%
Total				100%	32%

Table 4-4 shows percentages of total gross ex post Standard Incentives Program kWh savings that are associated with different combinations of free ridership indicator variable values.

Table 4-4 Estimated Free ridership for kWh Savings from Standard Incentives Program Projects

Had Plans and Intentions to Install Measure without the C&S Program? (Definition 1)	*Had Plans and Intentions to Install Measure without the C&S Program? (Definition 2)*	*C&S Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Realized Gross kWh Savings*	*Free Ridership Score*
N	N	N	N	56%	0%
N	N	N	Y	16%	33%
N	N	Y	N	10%	0%
N	Y	N	Y	9%	67%
N	Y	N	N	7%	33%
Y	N/A	N	N	1%	100%
Y	N/A	N	Y	1%	100%
Total				100%	15%

Table 4-5 shows percentages of total gross ex post New Construction Program kWh savings that are associated with different combinations of free ridership indicator variable values.

Table 4-5 Estimated Free ridership for kWh Savings from New Construction Program Projects

Had Plans and Intentions to Install Measure without the NC Program? (Definition 1)	*Had Plans and Intentions to Install Measure without the NC Program? (Definition 2)*	*NC Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Realized Gross kWh Savings*	*Free Ridership Score*
N	Y	N	N	40%	33%
N	N	N	N	33%	0%
N	Y	N	Y	15%	67%
N	N	Y	N	12%	0%
Total				100%	23%

Table 4-6 shows percentages of total gross ex post Custom Incentives Program therm savings that are associated with different combinations of free ridership indicator variable values.

Table 4-6 Estimated Free ridership for Therm Savings from the Custom Incentives Program

Had Plans and Intentions to Install Measure without the C&S Program? (Definition 1)	*Had Plans and Intentions to Install Measure without the C&S Program? (Definition 2)*	*C&S Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Realized Gross Therm Savings*	*Free Ridership Score*
N	N	N	N	54%	0%
N	N	Y	N	31%	0%
Y	N/A	N	N	5%	100%
N	N	N	Y	5%	33%
N	Y	N	N	3%	33%
Y	N/A	N	Y	2%	100%
Total				100%	10%

Table 4-7 shows percentages of total gross ex post Standard Incentives Program therm savings that are associated with different combinations of free ridership indicator variable values.

Table 4-7 Estimated Free ridership for Therm Savings from the Standard Incentives Program

Had Plans and Intentions to Install Measure without the C&S Program? (Definition 1)	*Had Plans and Intentions to Install Measure without the C&S Program? (Definition 2)*	*C&S Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Realized Gross Therm Savings*	*Free Ridership Score*
N	N	N	Y	56%	33%
N	N	N	N	38%	0%
N	Y	N	N	5%	33%
N	N	Y	N	1%	0%
Total				100%	20%

Table 4-8 shows percentages of total gross ex post New Construction Program therm savings that are associated with different combinations of free ridership indicator variable values.

Table 4-8 Estimated Free ridership for Therm Savings from the New Construction Program

Had Plans and Intentions to Install Measure without the NC Program? (Definition 1)	*Had Plans and Intentions to Install Measure without the NC Program? (Definition 2)*	*NC Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	*Percentage of Total Realized Gross Therm Savings*	*Free Ridership Score*
N	N	N	N	52%	0%
N	Y	N	N	24%	33%
N	N	Y	N	23%	0%
Total				100%	8%

The net ex post electric savings of the Custom and Standard Incentives and New Construction Programs during the period June 2013 through May 2014 are summarized by utility in Table 4-9, Table 4-10, and Table 4-11. For the period, net ex post electric savings for the Custom Incentives Program total 12,692,998 kWh and net ex post electric savings for the Standard Incentives Program total 79,511,435 kWh. For the New Construction Program, net ex post electric savings total 1,073,636 kWh. The net to gross ratio for the Custom Incentives Program is 68%, while the net to gross ratio for the Standard Incentives Program is 84%; for the New Construction Program, the net to gross ratio is 77%.

Table 4-9 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	6,444,643	6,170,854	4,196,453	68%
ComEd	17,494,785	12,494,107	8,496,545	68%
Total	23,939,429	18,664,961	12,692,998	68%

Table 4-10 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	18,657,883	21,383,441	18,066,277	84%
ComEd	60,543,376	72,727,155	61,445,159	84%
Total	79,201,259	94,110,595	79,511,435	84%

Table 4-11 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	708,736	554,018	424,136	77%
ComEd	1,126,092	848,393	649,500	77%
Total	1,834,828	1,402,411	1,073,636	77%

The net ex post natural gas savings of the Custom and Standard Incentives, and New Construction Programs during the period June 2013 through May 2014 are summarized by utility in Table 4-12, Table 4-13, and Table 4-14. For the period, net ex post natural gas savings for the

Custom Incentives Program total 4,893,051 therms and net ex post natural gas savings for the Standard Incentives Program total 115,136 therms. Net ex post natural gas savings total 43,757 therms for the New Construction Program. The net to gross ratio for the Custom Incentives Program is 90%, and the net to gross ratio for the Standard Incentives Program is 80%. For the New Construction Program, the net to gross ratio is 92%.

Table 4-12 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	1,826,963	1,643,318	1,483,516	90%
Nicor	1,066,541	1,064,189	960,704	90%
North Shore	146,573	149,439	134,907	90%
Peoples	2,645,671	2,563,175	2,313,924	90%
Total	5,685,748	5,420,120	4,893,051	90%

Table 4-13 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	25,577	32,959	26,228	80%
Nicor	107,245	101,598	80,848	80%
North Shore	3,189	4,581	3,645	80%
Peoples	3,008	5,549	4,415	80%
Total	139,019	144,686	115,136	80%

Table 4-14 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	10,091	10,685	9,814	92%
Nicor	46,401	36,955	33,942	92%
Total	56,492	47,640	43,757	92%

4.2.2 Net Ex Post Peak kW Reductions

The net ex post peak kW reductions for the Custom and Standard Incentives, and New Construction Programs during the period June 2013 through May 2014 are summarized by utility in Table 4-15, Table 4-16, and Table 4-17.

The net ex post peak demand savings for the Custom Incentives Program total 2,567.57 kW and the net ex post peak demand savings for the Standard Incentives Program total 10,170.64 kW. For the New Construction Program, the net ex post peak demand savings total 188.46 kW.

Table 4-15 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	-	1,002.88	652.35	65%
ComEd	-	2,944.29	1,915.21	65%
Total	-	3,947.16	2,567.57	65%

Table 4-16 *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	2,625.87	2,629.84	1,923.23	73%
ComEd	9,031.78	11,277.59	8,247.41	73%
Total	11,657.65	13,907.42	10,170.64	73%

Table 4-17 Summary of Net Peak kW Reductions 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	-	108.27	86.01	79%
ComEd	-	181.45	144.15	79%
Total	-	289.72	230.17	79%

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 six and natural gas program year three (EPY6/GPY3). The process evaluation focuses on the effectiveness of program policies and organization, as well as the program delivery framework. The evaluation had a particular focus on identifying barriers to participation in the state buildings and municipal governments in the Chicago region where the program has had less success in meeting its goals. Additionally, a survey of participating trade allies was completed to identify opportunities where the trade ally program could potentially be improved.

5.1. **Evaluation Objectives**

A key purpose of the process evaluation is to examine barriers to public sector efficiency projects, particularly in the municipal and state buildings markets. The process evaluation also documents program activity during the year in terms of timing of projects, types of organizations participating, location of completed projects.

Key research questions to be addressed by this evaluation of EPY6/GPY3 activity include:

- What program changes were implemented and what were the key successes and challenges during the program year?
- What factors may limit participation by state agencies? What program activities are effective in encouraging projects in state agencies?
- What factors may limit participation by municipalities? What program activities are effective in encouraging projects in municipal buildings?
- What are trade ally perspectives on reaching public sector clients? What aspects of the trade ally program work well and which may be in need of improvement?

5.2. **Summary of Primary Data Collection**

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

- **In-Depth Interviews and Surveys of Participant and Non-Participant Municipality and Local Government Decision Makers in the Chicago Metropolitan Area**: Data collected through surveys and interviews of participating and non-participating municipalities provide insight into the key challenges these agencies face in implementing energy efficiency projects.

- **Interviews with Key Staff at State Agencies**: Interviews were completed with staff from the Department of Central Management Services (CMS) and the Capital Development Board (CDB). These agencies play important roles in the adoption of energy saving measures in state buildings. CMS has management authority over several state facilities and CDB is responsible for funding capital improvement projects on behalf of state agencies. In addition to interviews with these agencies, staff members from a large state agency active in the program were also interviewed. These interviews provided insight on challenges in encouraging energy efficiency projects with the state building sector.
- **Surveys of Registered Trade Allies**: DCEO's implementation partner, the Energy Resources Center manages a trade ally program for contractors, vendors, and other professionals who provide services to incentive program participants. Surveys of registered trade allies provided insight into how aware their customers are of incentive programs, the application process, and suggestions for improving the programs.
- **Interviews with Program Staff**: Interviews with DCEO and program implementation partner staff members provided information about program progress and observations of service providers and participants. Staff members reported on recent program changes and future plans to improve program operational efficiency.

5.3. **Summary of Conclusions and Recommendations**

The following presents a selection of key findings from EPY6/GPY3:

- **Combined Gross Realized Savings Decreased from Prior Program Year: In** comparison to last year, the realized gross electric and natural gas savings for all three programs combined decreased. The lower activity was due to decreased Custom and New Construction Incentives Program savings. Realized gross savings for the Standard Incentives Program increased from EPY5/GPY2.
- **DCEO and Partners Working to Provide a Clear, More Consistent Brand:** DCEO's partners have adopted the Illinois Energy Now branding. The intent is to provide a clear message to the market and to communicate to public entities the partnership with the incentive programs. The Smart Energy Design Assistance Center (SEDAC) plans to host a support call center for program participants.
- **Multiple New Initiatives Launched:** DCEO launched several new initiatives during the program year including: The Clean Water Energy Efficiency Initiative directing participants to leverage funding provided by the Illinois EPA and the Illinois Clean Energy Community Foundation to implement high efficiency aeration systems, a pilot project for data centers, and a bonus incentive for large custom gas projects that exceeded 50,000 therms to increase natural gas savings.
- **Database Improvements are needed to Track New Construction Projects and Meet Accounting Requirements:** Improvements need to be made to the database because it was

found to be insufficient for tracking the early phases of new construction projects, and does not accurately report annual program expenditures.

Key findings from interviews with staff in the state buildings sector and a review of state policy pertaining to energy efficiency in state government are summarized below.

- **There are State Policies in place to Encourage Energy Efficiency in State Buildings, but Budget Policy Limits Implementation Potential:** There are several state policies that encourage or require the state to adopt energy conservation measures in existing and new facilities. However, reductions in state agency appropriations and the under-funding of capital budgets present significant constraints on resources available for the implementation of energy saving measures.
- **Decision Making and Approval Processes are Complex:** The approval processes for energy efficiency projects is complicated and it may involve either staff from the agency that is primarily using the building or CMS staff, depending on which agency has primary responsibility for the building. In addition, larger capital improvement projects require additional approval by the Capital Development Board (CDP). The multiple decision makers and organizations involved in the process likely create challenges for program outreach and for trade allies seeking to develop business opportunities by encouraging energy efficiency improvements in state buildings. Trade allies noted that there were many parties involved in making decisions about equipment purchasing for state buildings and approval processes were slow.
- **Agencies Lack Budget Line Item for Incentive Projects to Participation:** Some agencies do not have a line item in their budgets for incentive dollars from DCEO. Incentives for these agencies are funneled into the general fund rather than funding the agency directly. This likely reduces the efficacy of incentives for encouraging energy efficiency projects. One large agency has developed a solution that uses funds for managing cash flow to finance projects. Other agencies may be able to replicate this strategy.
- **Funding Constraints Create Multiple Barriers:** The lack of state funds for capital improvements and agency facilities disincentives the replacement of old equipment, or equipment that is not operating optimally. Because of the lack of capital funds, most capital improvements are approved only to make emergency repair. Energy saving options may not be fully considered in these cases because short time frames to identify energy efficient equipment options and to apply for grant opportunities. Complicating this, many state facilities have older equipment that is more expensive to replace than newer equipment more commonly found in private sector buildings.

Some state government entities such as state universities and the Department of Military Affairs have access to non-state funds that are available to pay for energy efficiency improvements. The availability of these funds likely contributes to the higher level of participation by state universities.

- **New Construction Program Time Requirements and Lack of Incentives for Incorporating Design Features Limit Participation:** Allowing projects to span multiple grant years may improve new construction program activity. Additionally, either providing incentives to designers or more fully leveraging SEDAC design assistance to incorporate efficiency may encourage additional projects.
- **Support Services Provided by ERC and SEDAC are Valued:** Staff of several state agencies stated services provided by ERC and SEDAC are valued for developing energy saving projects.

Key findings from decision makers from local government agencies in the Chicago metropolitan area collected through interviews and surveys are summarized below.

- **Local Government Decision Making and Approval Processes are Complex:** Decision making about energy efficiency projects involves multiple decision makers, as is typical of public sector organizations. Interview respondents reported that facility management staff typically initiates projects, but projects require review from other managers and approval by the governing board for the municipality, the city council, and/or the mayor. This can complicate program outreach efforts because it increases the complexity and timeline of the approval process. Most municipalities have specific contracting requirements, which may affect project implementation timelines.
- **Barriers to Natural Gas Projects:** Three barriers to natural gas projects were identified: natural gas incentives cover a smaller share of equipment cost than incentives for electricity efficiency projects; organizations have already planned electricity efficiency projects; and there is less awareness of natural gas incentives. These factors explain why meeting natural gas efficiency goals has been more challenging than meeting electricity efficiency goals, but do not explain why DCEO has had greater difficulty reaching its natural gas saving goals in the Nicor service territory.
- **Opportunities to Improve Awareness and Understanding of Programs:** DCEO may be able to improve outreach efforts by targeting associations such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association. The facility management staff who often initiate energy saving projects are members of these organizations. There may also be opportunities to develop a clear presentation of how to complete an incentive project that would better inform municipalities of the process.

- **Franchise Agreements may have Moderate Impact on Completion of Incentive Projects:** Program staff has noted that franchise agreements that cover all or a portion of municipality energy costs may limit program activity. Interview and survey responses suggest that these agreements may have a moderate impact on program participation. Most survey respondents report that they have franchise agreements that cover all or part of the cost of electricity (78%) and natural gas service (69%). However, none indicated that these arrangements made it much more difficult to get projects approved and only 22% indicated that it made it somewhat more difficult. One interview respondent indicated that not having utility costs made getting approval for energy efficiency projects more difficult. The effect of these agreements may be greater than respondents stated. Respondents may be reluctant to report that the agreements reduce their motivation to complete energy saving projects that could result in environmental benefits and reduce municipal energy costs being passed on to residents.
- **Incentive Dollars May Not be Returned to Budgets used to Finance Projects:** Nearly one-half of respondents (48%) reported that the incentive funds for energy efficiency projects would not be returned to the department or budget that financed the project. As such, some organizations may not implement energy efficient equipment because the incremental costs are not recouped.
- **DCEO Sponsored Audits and Project Reviews are Highly Valued:** Interview respondents valued audits and project reviews performed by SEDAC and the 360 Energy Group. These services provided a credible source of information on energy saving improvements, assisted with the development of projects, and provided clear equipment specifications used to develop bid requests.

The following recommendations are offered for improving the DCEO public sector programs.

- **Consider Outreach to Additional Associations:** Outreach efforts to groups such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association may be effective at reaching municipal facility staff who often initiate energy efficiency projects.
- **Continue to Leverage Audits and Project Reviews as Gateway to Program Participation:** Energy assessments and project reviews appear to be an effective means of assisting public entities with developing energy saving projects. Program staff should continue to leverage these services and target non-participating organizations to encourage participation in the incentive programs. Moreover, specifically targeting utility service territories where the programs are underperforming may improve goal attainment.

- **Explore Financing Mechanisms for Government Agencies:** Incentive payments are often not returned to the state agency budget used to pay for the improvement. Program staff should explore models developed by other state agencies for funding energy efficiency improvements in the absence of a budget line for accepting incentives can be applied elsewhere. DCEO should leverage its position on the Energy Efficiency Committee to press for the implementation of budget line items for state agencies to receive incentives mandated by Executive Order 7 of 2009.

  Similar budget issues may limit the effectiveness of the incentives for local government agencies. Staff should also consider implementing a utility bill credit process to fund efficiency projects for other public sector entities.

- **Opportunity to Improve Consistency of Program Information and Relevance:** Program staff reported that their partners were adopting consistent use of the Energy Now Brand to communicate that the DCEO energy efficiency incentives and technical services are part of a single program. SEDAC will be hosting a call center that will be the main telephone contact for program participants. These developments are moving the DCEO programs to a more consolidated presence. However, additional improvements are possible. For example, program information can be found separately on the DCEO, SEDAC, and ERC websites. Creating a single site that is used by DCEO and its partners to present information that is organized effectively may encourage program participation and help establish the DCEO programs a resource for energy efficiency. For example, the information could be presented by target market (e.g., state agencies, municipalities, parks departments), by facility type (e.g., waste water treatment facilities, correctional facilities, or public pools), by equipment type (e.g., lighting equipment, kitchen equipment), or by some combination of these options.

- **Monitor Effectiveness of Sweet Deal Bonus:** Although program activity spiked around the two deadlines for the sweet deal bonus (October 31st and February 14th), it is unclear if these bonus incentives influenced additional projects or shifted their timeline to earlier in the program year. It is important to note that for both the Standard and Custom Programs, the majority of savings occurred after the sweet deal timeline had passed.

- **Consider Specialized Training to Trade Allies to help them Navigate Public Sector Approval Processes:** Trade allies reported issues developing projects at state agencies involving complex decision-making processes and slow approval processes. These issues are also found in other public sector entities. Staff may be able to provide guidance to trade allies on navigating decision-making processes at public sector organizations to make the process more transparent and facilitate their ability to sell projects.

5.4. **Custom and Standard Incentives Program Activity**

The following sections summarize EPY6/GPY3 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 one-half of the custom and standard electricity savings occurred after the bonus period.

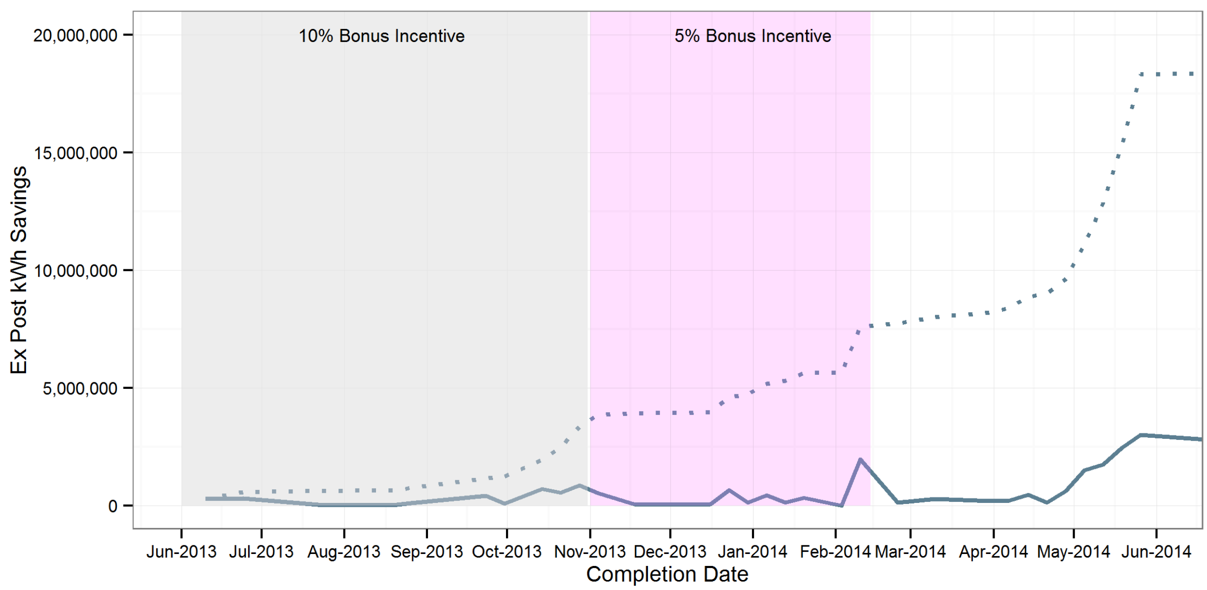


Figure 5-1 Custom Electricity Savings by Final Application Date during EPY6/GPY3

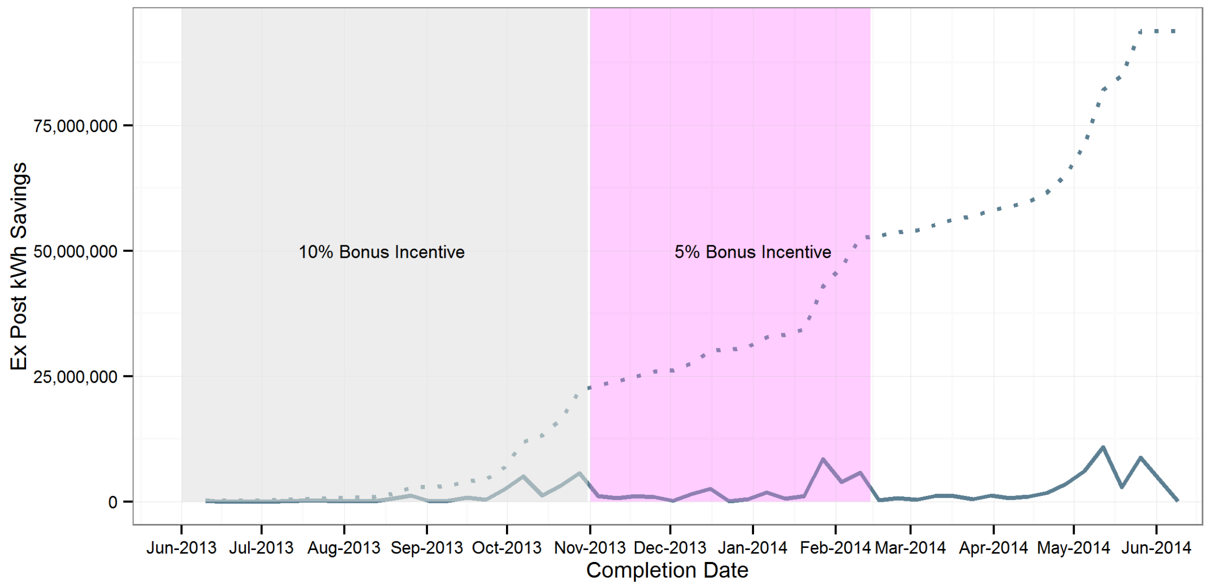


Figure 5-2 Standard Electricity Savings by Final Application Date during EPY6/GPY3

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. As with electricity savings, there were increases in natural gas project savings shortly before the cutoff dates for the bonus periods. However, approximately two-thirds of custom project savings and one-half of the standard project savings occurred after the bonus period.

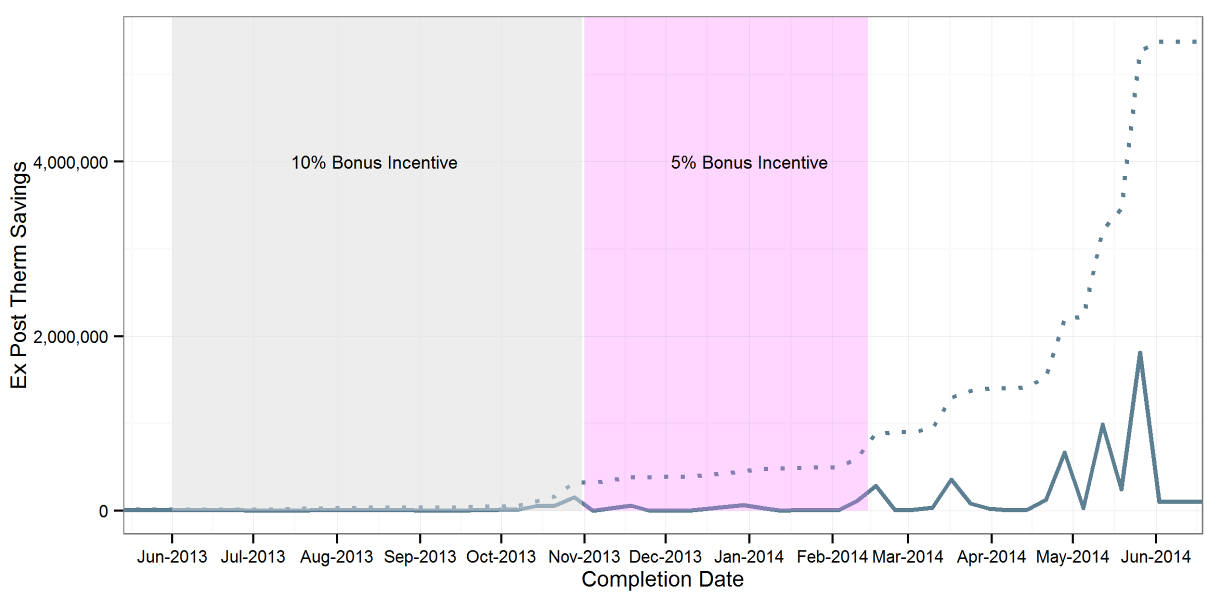


Figure 5-3 Custom Natural Gas Savings by Final Application Date during EPY6/GPY3

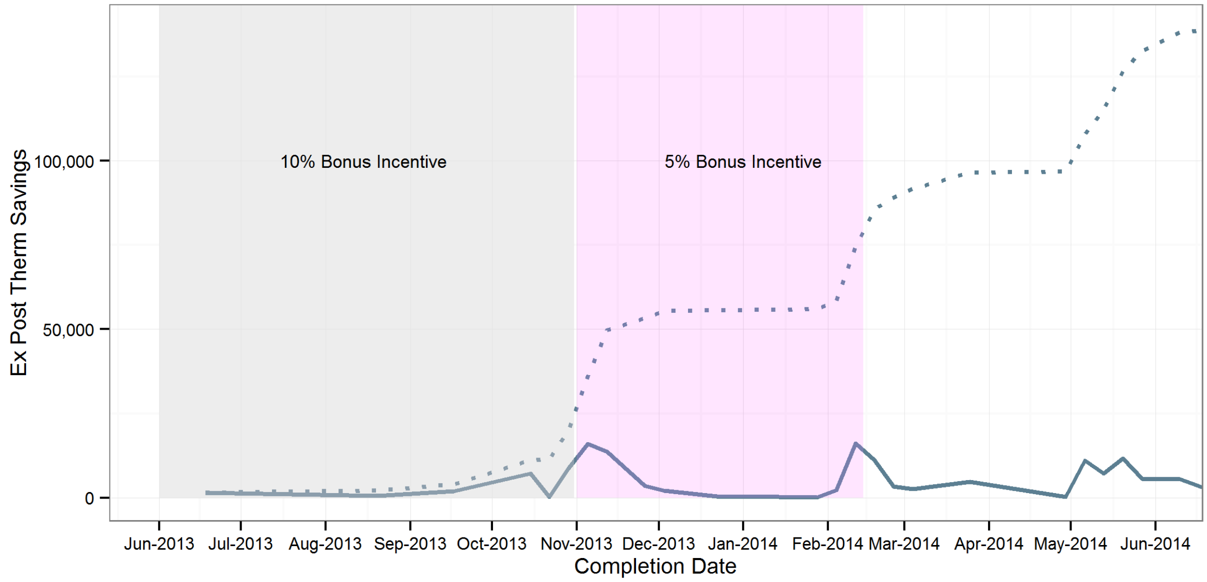


Figure 5-4 Standard Natural Gas Savings by Final Application Date during EPY6/GPY3

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.

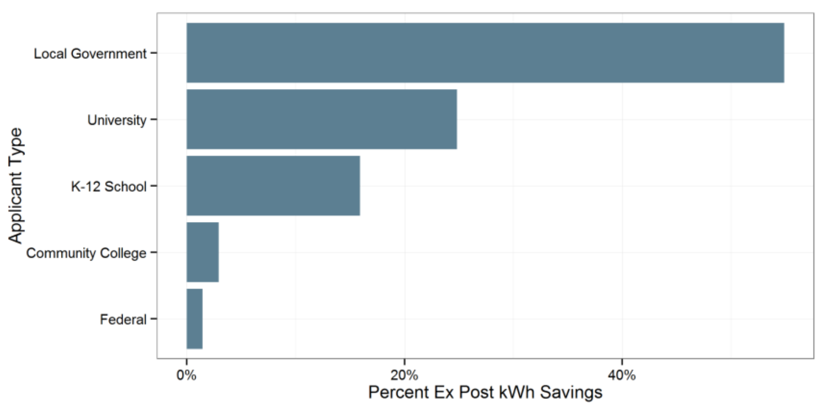


Figure 5-5 Custom Electricity Savings by Applicant Type

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 two-thirds 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	2%	3%
Federal	4%	-
K-12 School	1%	23%
Local Government	29%	67%
University	63%	6%
Total	100%	100%

K-12 schools accounted for the largest share of standard incentive project electricity savings, although local government accounted for a similar share.

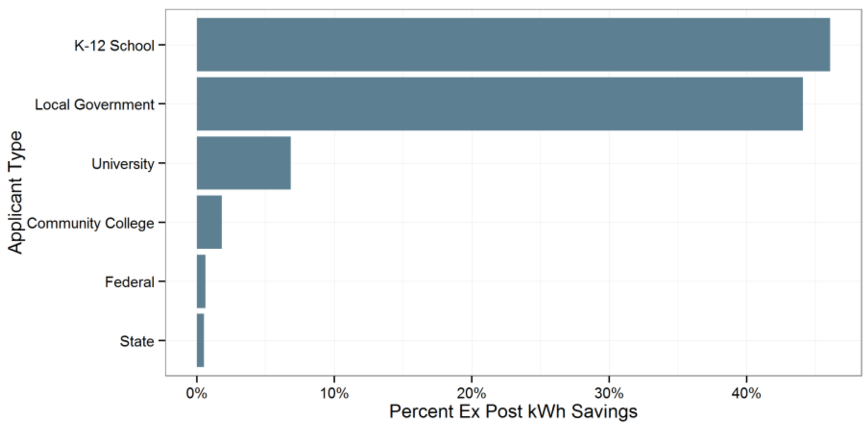


Figure 5-6 Standard Electricity Savings by Applicant Type

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	4%	1%
Federal	1%	1%
K-12 School	39%	48%
Local Government	40%	45%
State	-	1%
University	17%	4%
Total	100%	100%

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.

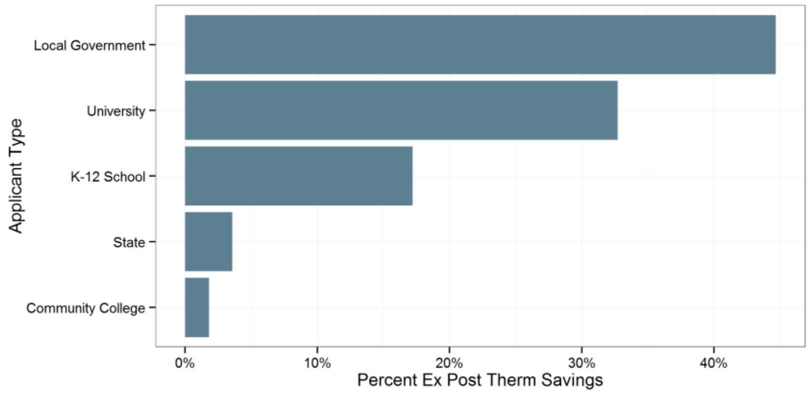


Figure 5-7 Custom Natural Gas Savings by Applicant Type

State university applicants accounted for 86% of custom natural gas savings in the Ameren service territory, and local government applicants accounted for 78% of custom natural gas savings in the Peoples Gas service territory. In the Nicor and North Shore service territories, K-12 schools and local governments accounted for most natural gas savings.

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

Applicant Type	*Ameren*	*Nicor*	*North Shore*	*Peoples*
Community College	1%	9%	-	-
K-12 School	5%	36%	54%	16%
Local Government	7%	29%	46%	78%
State	-	17%	-	-
University	86%	10%	-	6%
Total	100%	100%	100%	100%

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.

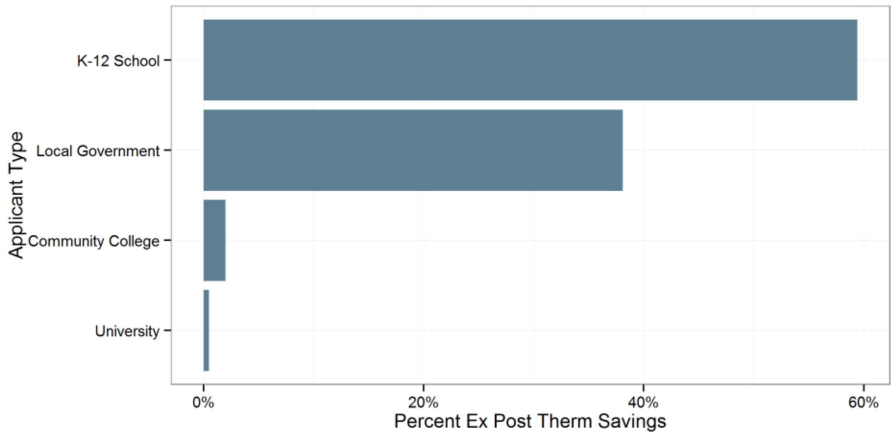


Figure 5-8 Standard Natural Gas Savings by Applicant Type

The distribution of natural gas saving projects in each utility service territory was similar to the program overall, with the exception of Peoples Gas. Savings from K-12 schools accounted for the majority of natural gas standard savings in the Peoples Gas service territory.

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

Applicant Type	*Ameren*	*Nicor*	*North Shore*	*Peoples*
Community College	1%	3%	-	-
K-12 School	61%	58%	52%	82%
Local Government	36%	39%	48%	18%
University	2%	-	-	-
Total	100%	100%	100%	100%

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.

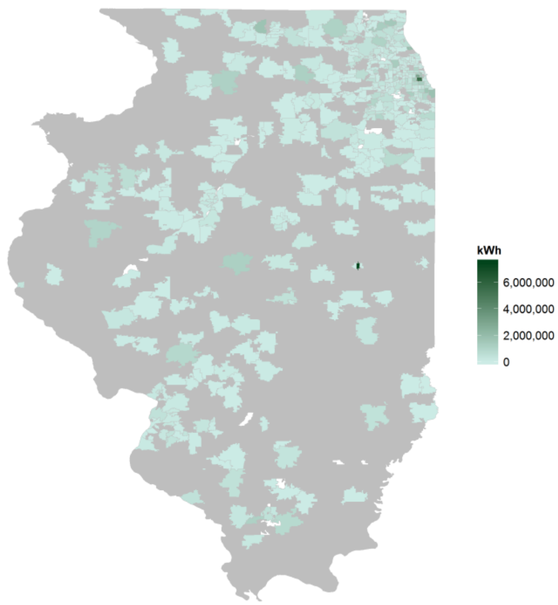


Figure 5-9 Geographical Distribution of Gross Ex Post Electricity Savings

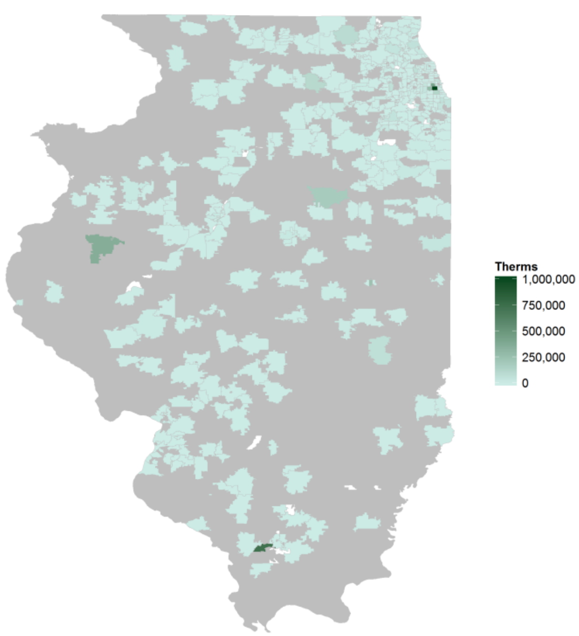


Figure 5-10 Geographical Distribution of Gross Ex Post Natural Gas Savings

5.5. Public Sector Custom and Standard Incentives Programs Operation Perspective

Interviews were completed with two DCEO Custom and Standard Program staff members. The interviews were designed to address topics related to the current progress of the programs, key changes that were made and challenges and success during the program year. Interview topics also included staffing and program design changes, staffs' experience with the new application and database developed for the programs, changes in program participation and reasons for these, and changes in roles performed by program partner organizations.

5.5.1. Summary of Interview Findings

Key trends and issues addressed by respondents include:

- **Program Changes made During the Year:** Interview respondents identified several program changes that took place during the program year, as listed below.

  DCEO implemented a new fillable PDF application and database. This form allows participants complete the form on a computer and submit it electronically. Some challenges with this change included incorrect transfer of records from the old to the new data systems, and staff inability to make changes to submitted applications.

  Program partners adopted the Illinois Energy Now branding. In prior program years DCEO's three partners—Midwest Energy Efficiency Alliance (MEEA), the Smart Energy Design Assistance Center (SEDAC), and the Energy Resources Center (ERC)—have used their own logo and materials to promote the program. The consistent use of the Illinois Energy Now branding avoids confusion in the market and informs potential participants of the program.

  In response to the Federal and State Clean Water Initiatives, DCEO implemented a Clean Water Energy Efficiency Initiative. This initiative directs participants to leverage funding provided by the Illinois EPA and the Illinois Clean Energy Community Foundation to implement high efficiency aeration systems.[5]

  DCEO initiated a data center pilot program for data centers. During EPY6/GPY3, DCEO identified five sites with potential savings, and selected two sites for participation. The data center pilot program is funded with the ComEd grant for the Savings Through Efficient Products (STEP) Program implemented by MEEA. MEEA is assisted by Willdan Energy Solutions in delivering the program.

  Audits will be performed and an implementation roadmap will be prepared during the coming program year for the selected sites.

[5] DCEO (2014). *Clean Water Energy Efficiency Initiative: Addendum to Public Sector Enegy Efficiency Program 2014-2015. http://www.illinois.gov/dceo/whyillinois/KeyIndustries/Energy/Documents/Clean%20Water%20Energy%20Efficiency%20Initiative%20PY7%20Final.docx*

DCEO offered an additional bonus incentive for large scale natural gas saving projects referred to as the High Impact Natural Gas Efficiency (HINGE) bonus. This incentive provided additional incentives for natural gas saving projects that resulted in gas reductions greater than 50,000 therms.

The Assistant Deputy Director left DCEO during the first quarter of 2014. This position has since been filled.

- **Program Challenges**: The DCEO public sector programs have had ongoing challenges in reaching the municipal market. A key issue identified by program staff is the franchise agreements between investor owned utilities and municipalities. These agreements include provisions that reduce or eliminate the direct cost of electric and natural gas service to the municipalities.[6] As such, they reduce the incentive for municipal organizations to implement measures that reduce energy consumption including installing energy efficient equipment. Program staff noted that municipalities cannot always complete the large projects they would like to because of such restrictions.

  Another barrier to program participation is the timing of the school year. The summer months, when most schools have time to complete projects, coincides adversely with program deadlines. The program deadlines are particularly problematic for HVAC measures because of the required downtime for retrofitting during cold months. Overlapping program years and extending projects to three years could help alleviate this problem.

  Program staff noted that the DCEO public sector programs have not been reaching the natural gas savings goals in the Nicor and North Shore service areas. Factors may include lack of customers, and franchise agreements that reduce incentives for efficiency projects. Staff stated that there have been recent efforts to identify public sector decision makers and inform them about program offerings by collaborating with the Metropolitan Mayors Caucus.

- **Program Successes**: The Public Sector Custom and Standard Incentives Programs have seen increased natural gas saving measures with the exception of Nicor and North Shore. Program staff reported that there have been more incentivized natural gas measures this program year than in the previous two program years. The increase in natural gas measures resulted from the HINGE program, which provides bonus incentives for projects with savings exceeding 50,000 therms.

  The Illinois Energy Now Programs have also experienced increased participation from water treatment facilities during EPY6/GPY3, as a result of their Clean Water Energy Efficiency Initiative.

[6] TechLaw, Inc. (2009). *Utility Franchise Agreements Summary Report. Research on Municipal Franchise Agreements Gas and Electric Utilities. http://epa.gov/r5climatechange/pdfs/franchise-agreement-report.pdf*

- **Future Program Plans:** Several changes are planned for the upcoming program year. During EPY7/GPY4, DCEO will introduce partner bonus coupons for program participants. These coupons will increase incentive amounts by 15%. If a participant attends a Trade Ally sponsored event, a partner event, or participates in a partner program such as a SEDAC Energy Assessment, they will receive a coupon for increased custom and standard incentives. Staff indicated that customers respond well to the bonus programs and that the coupon is another way to drive participation.

  SEDAC will host a call center for all Illinois Energy Now Programs. It will be the primary customer support line for participants who have questions regarding applications, program guidelines, or technical support. The objective of the call center is to further streamline communication and reduce the administrative burden on DCEO program staff.

  The following measures will be added to the standard list of measure offerings: multi-level light switching, occupancy controlled bi-level lighting fixtures, demand controlled ventilation, solar light tubes, compressed air low pressure drop filters, compressed air no-loss condensate drain, interior induction lighting, cold cathode lighting, and kitchen equipment.

  Lastly, two of the EPY7/GPY4 deadlines were moved up by several weeks. The deadline for submitting new pre-approval applications was moved from April 15th to April 1, 2015 during PY6. The deadline for completing projects and submitting final applications has been moved from May 15th to May 8, 2015..

5.6. Public Sector New Construction Program Participant Profile

Figure 5-11 displays the share of electricity savings from new construction projects by applicant type. Savings were evenly distributed across applicant types, although no projects were completed by state government buildings or community college applicants.

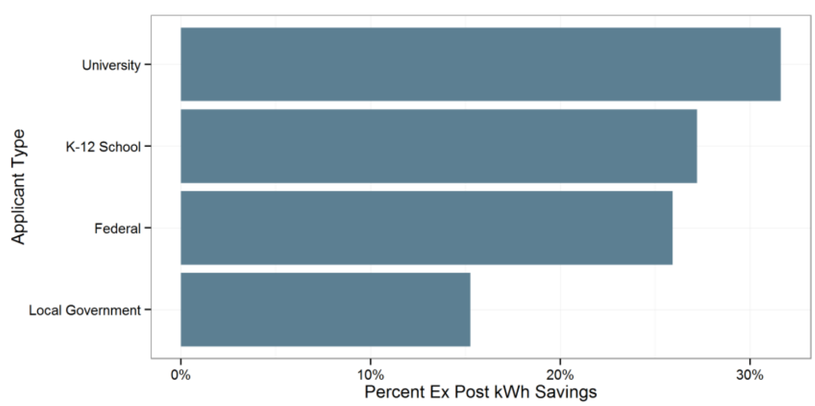


Figure 5-11 New Construction Electricity Savings by Applicant Type

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

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

Applicant Type	*Ameren*	*ComEd*
Federal	-	43%
K-12 School	16%	35%
Local Government	4%	22%
University	80%	-
Total	100%	100%

Figure 5-12 displays the share of natural gas savings from new construction projects by applicant type. Local government buildings accounted for the largest share of new construction natural gas savings. No state, community college, or federal applicants completed gas saving projects.

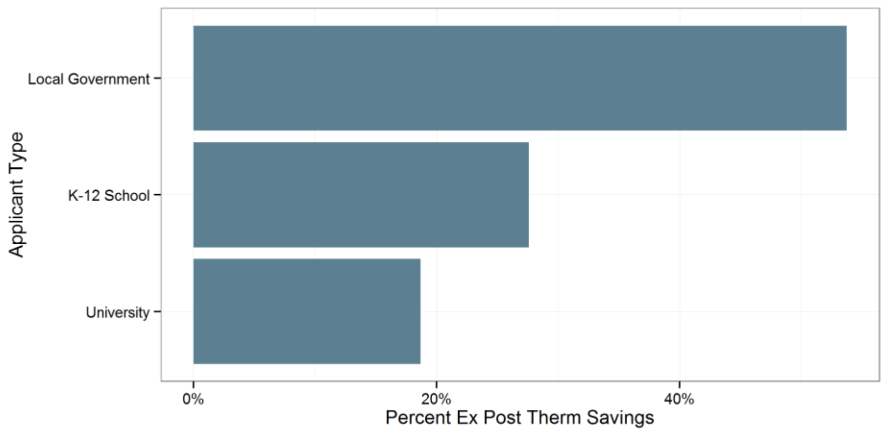


Figure 5-12 New Construction Natural Gas Savings by Applicant Type

Table 5-6 displays the distribution of projects across applicant types by utility service territory.

Table 5-6 New Construction Natural Gas Savings by Applicant Type and Utility

Applicant Type	*Ameren*	*Nicor*
K-12 School	-	36%
Local Government	17%	64%
University	83%	-
Total	100%	100%

5.7. Public Sector New Construction Incentive Program Operations Perspective

Interviews were conducted with three New Construction Program staff members; the DCEO Program Manager, Program Director and the Assistant Director for Program Monitoring and Evaluation at SEDAC. The interviews addressed current program operations, changes made during EPY6/GPY3, planned changes for next year, as well as the program's greatest successes and challenges. The conversations also touched on staffing and the new database.

5.7.1. Summary of Interview Findings

Key trends and issues addressed by respondents include:

- **EPY6/PY3 Program Changes:** As the Public Sector New Construction Program continues to evolve and attract more participants, staff has streamlined internal project management and communication. During EPY6/GPY3 staff worked to refine the incentive review process begun when pre-applications are submitted. In prior years staff would conduct a comprehensive review of all construction documents including those project aspects that were not being incentivized, such as plumbing. The application volume has since increased and staff has consolidated their efforts to only focus on design elements that are incentivized, and have potential to save energy. Feedback indicates that these changes have decreased the time and effort required to complete an incentive review; staff report this allows for increased volume with the same resources.

  Education and outreach was prioritized during EPY6/GPY3. To support the professional development of SEDAC program staff, all staff members received training on the new ICC 2012 Commercial Building Code. Staff explained that it is critical that program staff is familiar with code requirements, and comfortable interpreting and explaining its technical application because the commercial building code is used as the baseline scenario that energy savings potential and incentives are calculated.

  Other education and outreach efforts have focused on external communication with applicants, and the development of targeted marketing material. During EPY6/GPY3 staff educated applicants about program guidelines and the two participation paths, the prescriptive approach or the whole building model approach. Each path has different participation and technical requirements, causing confusion among some participants. Staff educated participants early in the design process to ensure that the energy efficiency features and other requirements were understood.

  SEDAC hosted several workshops for architects and building owners during EPY6/GPY3. Workshops were held throughout the state of Illinois and provided participants with resources on buildings codes, energy savings opportunities, and general information about the program. Marketing materials such as energy saving tips, frequently asked questions and an owners guide for new construction were distributed at events, and made available on the website, as displayed in Figure 5-13 below. Staff indicated that the new marketing materials help clarify program offerings and serve as an effective medium for communicating the benefits of energy efficiency to New Construction Program stakeholders.

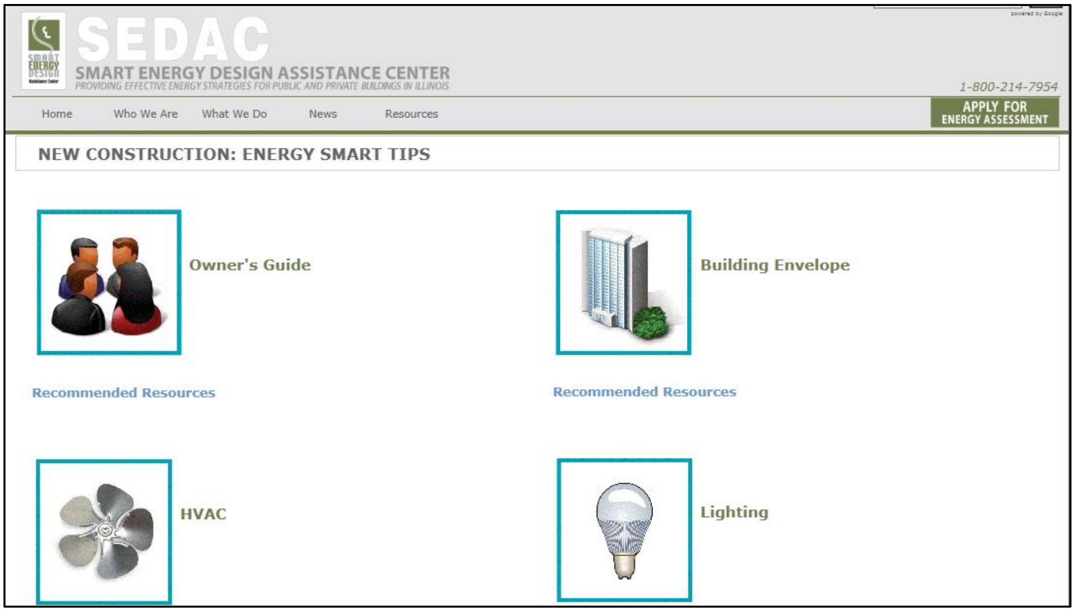


Figure 5-13: SEDAC Website – Smart Energy Design Tips

- **Program Successes**: The program continued to offer prescriptive incentives during EPY6/GPY3. Staff received positive feedback from participants about the incentive change, and stated that it made the application easier and more straightforward.

  There has been a significant increase in program activity. More applications were received during EPY6/GPY3 than in any previous program year. Staff noted that increase in activity occurred at the end of the program year. This was influenced by the fact that minimum buildings standards would be increasing in EPY7/GPY4, and the IECC 2012 would be adopted.

  Table 5-7 below provides a summary of program activity over the last three program years. According to feedback from staff, school districts and community colleges are the two sectors that have had the greatest increase in program participation.

Table 5-7 Summary of New Construction Program Activity

Program Year	*Incentive Reviews*	*Incentivized Projects*	*Total Incentives Paid (Including Gas & Electric)*
PY4	6	6	11
PY5	5	6	9
PY6	15	10	18

- **Program Challenges:** Both DCEO and SEDAC staff have stated that they are working to improve how project information and records are shared. Proactively tracking and managing projects has become more challenging as program activity increases. One aspect of the challenge is the lack of a system that works both to track projects through pre-application to final completion, and to track and account for program expenditures. The program accounting procedures operate well if projects that are initiated during the program year are completed during the same program year. However, this situation makes it difficult for the program to track projects that apply for pre-approval review through to completion because projects submitted for pre-approval review are often not completed in the same program year. As a result, program staff has put off entering projects into the data system until a final application is submitted. The disadvantage of this "work around" is that it creates difficulty a project from pre-approval to completion. Another limitation of the project tracking system is that, at the time of the interview, it was not set up to administer the new construction prescriptive incentives, which differ from the retrofit standard incentives. Future modifications to the database should address this issue.

Another issue, noted by SEDAC staff was that program participants often request some administrative costs to be covered by program funds. Currently, administrative costs are not eligible for reimbursement. Staff noted that public agencies have strict guidelines on timekeeping that require all hours worked to be billed against some budgetary item. While technical and engineering efforts are covered, general administrative functions are not. Participants have noted this as a barrier to participation.

- **EPY7/GPY4 Planned Changes:** Several changes are planned for the upcoming program year. During EPY7/GPY4 the New Construction Program will incorporate the new IECC 2012 and ASHRAE 90.1-2010 building codes, which will become the new baseline for all new construction projects that begin after January 1st, 2013. Staff stated that minor adjustments were made to the prescriptive incentive levels to align with changes made to all DCEO Public Sector Programs.

  Staff developed an intake checklist that program staff are required to complete when reviewing pre-approval applications. The checklist allows for a more systematic and efficient screening of applications in order to quickly identify projects or applications that needs additional support. The intake checklist was developed as a quality assurance tool to ensure consistency with application processing and document collection.

5.8. State Buildings Sector

In order to better understand potential barriers to energy efficiency in the state buildings sector, ADM completed targeted research that involved a review of the policy environment as it relates to energy efficiency in the state buildings sector and in-depth interviews with key informants. Specifically, ADM completed interviews with key staff from the Illinois Department of Central Management Services and the Illinois Capital Development Board. These agencies play critical roles in the implementation of energy efficiency measures in state buildings. ADM also interviewed staff from a large state agency that had recently overcome barriers to implementing energy saving projects. Interviews lasted approximately 20 minutes to one hour. The objective of these interviews was to better understand potential barriers to efficiency in state buildings.

5.8.1. Energy Efficiency Policy Context

The key legislation and executive orders pertaining to energy efficiency in state buildings are summarized below.

- **Public Act 095-0612 of 2007:** Public Act 095-0612 amended the Local Government Energy Conservation Act, the School Code, the Public University Energy Conservation Act, and the Public Community College Act to facilitate local governments and public schools, colleges, and universities entering into energy service contracts. The intent of the legislation was to promote flexibility in the means by which these entities procure and install energy conservation measures.
- **Green Buildings Act of 2009:** The intent of the Green Buildings Act was to reduce energy costs for public buildings and reduce the state's overall energy use. The act established new standards for state-funded building construction. The act requires state-funded buildings to meet LEED or Green Globe standards. Certification is not required for buildings of less than 10,000 square feet. Waivers from the requirements may be granted on the basis that the requirements would create an unreasonable financial burden, create an unreasonable impediment to construction, impair building functioning, or compromise the historic nature of the building.
- **Agency Energy Efficiency Act of 2007 (Public Act 095-0559):** The Energy Efficiency Act required all executive branch state agencies to reduce facility energy use by 10% within 10 years of the effective date of the Act. The Act directs state agencies to work with the Department of Central Management Services (CMS) to achieve this goal. CMS's role is to ensure that all existing State energy efficiency objectives are achieved, provide technical expertise for implementation of the policies, and implement an energy efficiency information system to measure progress towards the goal. The Act directs agencies to implement energy information systems to track energy use, purchase Energy Star equipment unless CMS waives the requirement based on justifications provided, form an internal committee to assess the environmental impacts of that agency's activities and identify ways to conserve energy.
- **Executive Order 7 of 2009:** EO 7 directs Central Management Services to implement a program to increase energy efficiency, track and reduce energy usage, and improve the procurement of energy for all state-owned and state-leased facilities for all agencies. The Order establishes the Energy Efficiency Committee that comprises members from DCEO, the Capital Development Board and is chaired by Central Management Services. The committee oversees energy audits in State facilities and the implementation of those recommendations, enter into contracts for equipment services designed to decrease energy consumption in state-owned or state-leased facilities or equipment, and to coordinate with state agencies to establish individual budget line items for acceptance of energy efficiency incentives available through State and private programs.

- **Executive Order 11 of 2009:** EO 11 includes a number of provisions related to energy efficiency. These provisions include directing State agencies to reduce electricity and natural gas consumption at state owned facilities by 25% by July 1st 2025, as compared to fiscal year 2008 levels; to the extent feasible, achieve building energy performance criteria necessary to attain ENERGY STAR® qualification in all eligible state owned buildings by July 1st, 2015 and where possible achieve LEED status; and increase purchase of renewable energy so that by 2015 50% of overall energy use is generated from renewable energy and that 100% is from renewable energy by 2025.

5.8.2. Key Findings from Interviews with State Building Staff

Interviews were completed with staff from the Department of Central Management Services (CMS) and the Capital Development Board (CDB). These agencies play important roles in the adoption of energy saving measures in state buildings. CMS has management authority over several facilities in the stated and CDB is responsible for funding capital improvement projects on behalf of state agencies. In addition to interviews with these agencies, staff members from a large state agency that has been successful in the program were also interviewed. Both staff members interviewed were involved in the agencies adoption of energy efficiency measures.

- **Decision Making Authority for Building Retrofits Varies by Facility:** CMS is responsible for leading the state's energy efficiency initiative, but does not have operational control over all facilities. Agencies may self-manage all, or some of their facilities, while CMS manages others. Some agencies occupy leased space or multi-tenant state owned buildings (e.g., Department of Children Family Services). While the state does not make investments in leased facilities, CMS has control over multi-tenant state owned buildings.
- **Building Retrofit Project Funding Process Dependent on Scope and Sector:** Most significant energy saving projects in state owned buildings require a capital budget request and approval by the Capital Development Board (CDB). The project cost and scope determine which projects require CDB approval. For example, a lighting retrofit in a single room in a building would not require CDB approval, but retrofitting a large portion of a building's lighting would. CDB receives budget allocations to fund and manage projects in state owned buildings. Capital development funding operates differently for universities and community colleges. Universities fund capital improvements through their own budgets and CDB receives an appropriation to manage the process. For community colleges, projects are funded with local funds and matched by state dollars.
- **Meeting Required Energy Savings Targets:** As presented above, state policy encourages energy efficiency and sets targets for reduced energy use in state facilities. CMS is primarily responsible for implementing this effort, but staff noted that the responsibility is split with the other state agencies for facilities that CMS does not directly control. Missing targets is allowed if sufficient funding is not available to meet targets. Currently the demand for capital development funds exceeds what is available and often other priorities for funds take

precedence. Staff at CMS reported that the state is using performance contracting to bridge the funding gap to meet savings targets.

- **Performance Contracting:** There have been recent changes to the requirements for performance contracting by the state including a change in CMS's authority to enter into performance contracts. Previously, CMS was given authority to enter into performance contracts on behalf of agencies as part of their role as the state's procurement authority. Currently CMS sets up performance contracts by entering into inter-agency agreements for state owned facilities that CMS does not have appropriations authority for. One interviewee described CMS's role in performance contracting as supervisory.

  CMS staff stated that there are no significant barriers to the state entering into performance contracts. The state currently contracts performance contractors. In previous years, lack of familiarity with the request for proposal process led to hesitancy to enter into performance contracts. Multiple interviewees provided favorable assessments of the state's progress in entering into performance contracts.

- **Age of Equipment in State Buildings is a Potential Barrier:** The state has a number of buildings that have systems that are more than 50 years old. The cost of retrofitting older equipment can be prohibitively high as rebate dollars and efficiency gains do not fully offset the cost of retrofitting old equipment to modern equipment.

- **Potential for Split Incentives for Energy Efficiency Investment:** Utility costs are funded at the agency level. For facilities managed by CMS, utility costs are included in the rate structure CMS charges to manage facilities on behalf of other agencies. In these cases, CMS also helps set up capital improvements for these agencies. In most cases, significant building energy efficiency retrofits would require capital requests funded and approved by the Capital Development Board. However, during the interview it was emphasized that the State has an interest in investing energy efficiency for state owned facilities and that this is being done on an "increasingly aggressive scale."

- **Funding Constraints are Significant:** State funding constraints have presented a significant barrier to completion of efficiency projects. Agencies receive few funds for facility maintenance and there has not been a capital budget appropriation in several years. Many facilities have deferred maintenance for issues such as broken equipment. There is currently a waitlist for capital funds, and capital improvement projects are funded on an emergency basis. An interview respondent from a state agency indicated that they typically issue large annual capital fund requests that go unfunded. The funding of projects on an emergency basis may also restrict opportunities to implement energy efficient equipment because of a lack of time to plan a project to minimize energy use and to apply for EEPS incentive funds. Other state funded public entities such as universities and agencies that receive federal funds such as the Illinois Department of Military Affairs have other sources of funds that can be used.

- **New Construction Barriers:** Two main barriers to completion of new construction projects were identified. The first barrier is that the grant cycle period requires new construction projects to be completed in the same year the grant is awarded. Allowing the grant to carry-over could facilitate projects that require a longer timeline. The second major barrier is that the new construction program does not provide incentives to design professionals to incorporate program compliance into a project. Design professionals typically seek additional compensation to comply with program requirements which add to the overall project cost.
- **Lack of Budget Line Items to Receive Incentive Funds:** Multiple interviewees mentioned that financial incentives may have limited impact when the incentive dollars are returned to a general fund rather than the agency budget funding the project. Under these conditions, the project costs cannot be recouped through incentive payments. One state agency developed a resolution that involves financing projects through a fund used to manage cash flow rather than through the facility budget. This strategy could be implemented by other agencies. However, ongoing agency budget cuts may limit the long term viability of this strategy.
- **Program Support Facilitates Projects:** Interviewees mentioned two forms of program support that were particularly valuable to assisting in the development and completion of energy saving projects in state buildings. These were information and assistance provided by the Energy Resources Center, and the facility audits provided by the Smart Energy Design Assistance Center.

5.9. Chicago Metropolitan Area Local Governments

To better understand barriers that exist for local government agencies, and for municipalities in particular, ADM completed in-depth interviews with seven local government agencies in the Chicago Metropolitan Area that have received incentives for the DCEO public sector programs. Additionally, a survey was administered to a sample of members of the Mayors Metropolitan Caucus (MMC). MMC, which supports the delivery of DCEOs incentive programs to municipalities in the Chicago area, provided ADM with contact information for its membership. The survey targeted nonparticipants, but some respondents indicated that their organizations had previously participated in the DCEO programs.

The purpose of the interviews and surveys was to understand the following:

- What factors limit municipalities and other local government agencies from participating in DCEO incentive programs?
- What aspects of the program have been influential in encouraging the development of energy saving projects?
- Are there barriers to participation that have an impact on natural gas saving projects in the Nicor and North Shore service territories?

- How can the DCEO programs be improved to better meet the needs of municipalities and other local government agencies?

5.9.1. Participating Local Government Decision Maker Interviews

Semi-structured interviews were completed with representatives of seven local government agencies that had either completed a project or had a project initiated through the DCEO programs at the time of the interviews. Six of the interview respondents were from municipalities and one was from a park district. The interview respondents discussed the following topics during the interviews:

- Previous experience with DCEO programs;
- Project development and completion; and
- Suggestions for improving the programs and outreach to local governments.

5.9.1.1. Previous Experience with DCEO Programs

The number of years of experience interview respondents had with the DCEO incentive programs and the number of projects they had completed varied. One respondent from a park district had a project in progress but had not yet completed a project. When asked why they had not completed a project, the respondent stated that they had been aware of the programs but that "government works slowly." Most of the remaining respondents had completed their first project around the time that the EEPS program funding became available. All of these respondents had completed multiple projects. The final respondent was relatively new to their position and could not provide information on when the municipality had begun participating in the programs.

A common theme that emerged from discussions of how local government agencies first became involved in the program was that key gateways to projects were provided by both building audits conducted by SEDAC/360 Energy, and the technical assistance provided by 360 Energy. For some respondents, these services provided an introduction to the programs and for other respondents technical services were instrumental in identifying additional projects as well as providing equipment recommendations and financial analyses that facilitated project decision making.

5.9.1.2. Trade Allies and Technical Assistance

Four of the interview respondents emphasized the value of the technical assistance provided through audits performed by SEDAC or through 360 Energy's partnership with the MMC for developing and planning projects. One interview respondent described the audits as more credible and trustworthy than assessments provided by contractors or others who would financially benefit from project implementation. Another respondent stated that the audits provided information needed to develop bid specifications. A different respondent said they relied on the technical service provided by the programs because they do not have the capacity to identify energy saving projects.

Two participants discussed seeking external technical assistance that was not provided by DCEO. One participant contracted with an engineering firm to design an HVAC system and another was looking to complete an assessment of their facilities to identify energy saving improvements.

Another issue, mentioned by two participants, was that contractors were not considered a trustworthy source of information. This may limit the effectiveness of trade allies as a technical resource for local agencies and as a mechanism to drive program activity.

5.9.1.3. Experiences with Natural Gas and Electricity Saving Projects

Interview respondents were asked to discuss their experience and plans for electricity and natural gas saving projects. One respondent stated that the incentive dollars were available for electricity saving projects prior to the availability of incentives for natural gas saving projects. This respondent indicated they had plans to complete natural gas saving projects in the future, but were currently implementing electricity saving projects because these incentives had been available longer. Differences in the incentives coverage of the project cost and the payback associated with gas and electricity saving projects was also noted. Specifically, one respondent noted that electricity saving projects tended to have shorter payback periods and two others stated that the natural gas incentives were smaller, in terms of the share of equipment cost that they cover, than the electric incentives.

In contrast to these responses, one of the interview respondents indicated that from her perspective, there was not a structural difference between the natural gas and electricity incentives available that would result in her organization favoring one type of project over the other.

Overall, the two primary factors respondents discussed that could result in the implementation of fewer natural gas saving projects than electric saving projects were that the natural gas incentives were more recently made available and that the natural gas incentives tend to cover less of the equipment cost. However, neither of these factors is unique to organizations operating in the Nicor service territory. As such, they do not explain the greater difficulty DCEO has had in achieving its natural gas saving goals in that territory.

5.9.1.4. Payment of Utilities

Some municipal organizations have franchise agreements with their electricity and natural gas service providers that cover a portion or all of their energy costs. Interview respondents were asked to discuss whether or not their organizations covered the cost of natural gas and electricity use and what impact, if any, this had on their decisions to implement energy saving projects.

Most of the respondents from municipalities indicated that they do not pay the full cost of their natural gas and electric service and one indicated they pay for the electricity service but not their natural gas service. The respondent from the park district stated that the park district pays the full cost of their utilities.[7]

Only one of the interview respondents stated that the franchise agreements reduce the number of energy saving projects that they would otherwise complete. The remainder gave various reasons for why the franchise agreements did not impact the number of projects they complete. Those interview respondents who indicated that the franchise agreements did not impact their organization’s decisions about implementing energy efficient equipment gave a variety of reasons for this. A common reason given for justifying the investment in more energy efficient equipment was the organizations interest in meeting sustainability goals, reducing their carbon foot print, or other environmental benefits. Others noted that they justified investments in energy saving equipment based on reduced maintenance costs and because the investments cut utility costs that are subsequently passed on to inhabitants of the municipality.

5.9.1.5. Decision Making Process

Interview respondents described the decision making process for energy efficiency investments in their organizations. A common theme was that multiple decision makers are involved in these decisions. Often, projects are initiated by a facility manager or a person in a similar role; however one respondent indicated that the municipality employs capital project engineers who also initiate projects. Other managers, such as the village manager and finance directors, are also typically involved in the decision making process as well. Ultimate responsibility for approving projects resides with the governing board for the municipality, city council, or mayor.

Most respondents reported that they were responsible for identifying and lining up grant funding opportunities, such as the funds provided by DCEO, for projects. However, two respondents reported the availability of additional resources. One respondent indicated that they have a staff member whose role is to identify grant funding opportunities for the municipalities and the other respondent worked with an external consultant to identify grant-funding opportunities.

Decision makers from the municipalities reported that they generally receive multiple bids for projects. The multiple bid process was not generally seen as a barrier, although respondents considered it to be a time consuming process. One respondent reported that multiple bids can complicate projects if the equipment specifications are not well defined in the bid requests. This respondent described an experience where multiple contractors returned proposals with varied types of equipment and costs, which necessitated further research on his part to identify the best

[7] Only municipalities enter into franchise agreements.

proposal. The respondent noted that one of the advantages of the technical services provided by DCEO is that equipment specifications are well defined which facilitates the bidding process.

Interview respondents reported using several financial metrics to evaluate energy efficiency projects such as project cost and maintenance costs. Some respondents reported that they also use payback and return on investment as financial metrics even when their organizations are not directly responsible for the cost of the utilities.

Respondents explained that projects were financed in a variety of ways including through ongoing operations and maintenance budgets, capital project budgets, or other budgets that the organizations had established. One respondent indicated that there are several potential budgets that can be used to fund these projects and that identifying which budget to use can complicate the process of completing projects. Three of the interview respondents reported that they had also completed projects that received funding through the Illinois Clean Energy Foundation[8] as well as through DCEO.

5.9.1.6. Goals and Sustainability Plans

Most respondents reported that their organizations have energy saving objectives, although none reported that their organizations had specific numerical energy saving targets. Respondents described sustainability plans focused on reducing carbon footprints, energy consumption, and energy costs. One respondent reported they have a “Green Team” that focuses on environmental concerns. Although respondents described these plans and objectives as not having “teeth” or as “verbal objectives,” some indicated that they guide the procurement process to focus on project parameters related to energy consumption. Additionally, two respondents reported that their organizations track their facilities’ energy consumption through monitoring bills and one reported using the Energy Star Portfolio Manager sponsored by ComEd.

5.9.1.7. Suggestions for Improvement

Interview respondents discussed suggestions for improving the DCEO program to facilitate participation by local government agencies. One idea presented was that awareness and understanding of the DCEO programs could be improved. Three respondents emphasized the need for clear information on how to complete the incentive application process including information on projects that qualify, the steps in the process, and what resources are available to help identify energy saving projects. One of these respondents suggested something similar to a recorded webinar that would demonstrate how the process could be effective.

[8] The Illinois Clean Energy Foundation was formed with an endowment from ComEd and provides grants to fund energy efficiency projects at nonprofit and government organizations.

Two respondents indicated that they thought that DCEO's outreach efforts were largely focused on the wrong people in local government agencies. These respondents suggested working with groups whose facility managers and public works directors belonged to professional organizations such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association.

One respondent stated that learning about the status of grants sooner would significantly help the planning process.

Some respondents described what they saw as the strengths of DCEO's programs. These included DCEO's outreach effort, the program website, the Peer Exchange (an event that presented information on DCEO programs), and the ease of the process. Specifically, respondents stated that working with the Metropolitan Mayors Caucus and 360 Energy made the process seamless. One person emphasized that receiving a DCEO sponsored audit was the gateway to participating in the incentive programs.

5.9.1.8. Conclusions

The following summarizes the key points and implications from the interviews with participating municipalities.

- Audits provided through the SEDAC building energy assessments program or through the partnership between the Metropolitan Mayors Caucus and 360 Energy were highly valued by interview respondents and considered to be key drivers of program activity. These assessments provided information about the potential projects available, and how to define bid specifications for projects.
- Franchise agreements that cover utility costs may not limit project activity. Only one respondent stated that the agreements may limit program activity, while the other respondents with franchise agreements indicated that the municipality's other objectives provided sufficient rationale for completing energy saving projects. For example, most interview respondents reported that they had energy saving objectives or sustainability plans. However, it is important to note that these respondents may be reluctant to suggest that environmental concerns or the energy costs that are passed on to the inhabitants of the municipality are insufficient reasons for focusing on saving energy.
- Decision-making about energy efficiency projects involve multiple steps and decision makers. Interview respondents reported that facility management staff typically initiates projects, but projects require review from other managers and approval by the governing board for the municipality, the city council, and/or the mayor. This complexity can slow decision making and complicate program outreach efforts. Other factors that can slow the project development include the need to target multiple people within an organization, and the fact that most municipalities have contracting requirements mandating multiple bids for projects.

- Some respondents expressed a preference for pursuing electricity saving projects over natural gas saving projects. Respondents explained that there was a perception that dollars for gas incentives would not adequately cover the cost of the project, and electricity funds were available first. Although these reasons do not explain why DCEO has had greater difficulty reaching its natural gas saving targets in the Nicor service territory, they do provide an explanation for why meeting natural gas savings goals has been more challenging than meeting electricity saving goals.
- DCEO may be able to improve outreach efforts by targeting associations such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association. The facility management staff members who often initiate energy saving projects are members of these organizations. Through these efforts there may be opportunities to develop a clear presentation of how to complete an incentive project that would better inform municipalities of the process.

5.9.2. Survey of Metropolitan Mayors Caucus Membership

The MMC provided an email contact list of its membership to assess non-participating municipalities' awareness of the DCEO incentives, internal processes, and resources to identify potential barriers to energy savings projects. To focus the survey on municipalities that have not participated in a DCEO program, known previous program participants were removed from the list. Previous program participants were identified using DCEO tracking data and MMC participant records.

The sample frame consisted of 72 MMC members. Email invitations were sent to the 72 members on three separate occasions. Four emails were returned as undeliverable, reducing the effective sample frame to 68 members. In total, 23 members of the sample completed the survey. However, nine of the survey respondents reported that they had already applied for or received a DCEO incentive for installing energy saving equipment. Thus, despite efforts to focus the survey on non-participants, the sample consisted of a mix of participant and nonparticipant municipalities.

5.9.2.1. Firmographics and Job Titles

Ninety-percent of survey respondents indicated that between 75% and 100% of their organizations' facilities were owned rather than leased. The respondents who owned less than 75% of their organization's facilities reported that they owned 0-25% or 50-75% of their organization's facilities.

Eighty-two percent of respondents stated that they received gas service from Nicor. The remainder received service from North Shore Gas. All but one respondent indicated they received electrical service from ComEd.

Table 5-8 displays the job titles of survey respondents. Most respondents were managers (52%) thirteen percent were public works directors, and four percent were public works staff. Thirteen percent of respondents held financial positions.

Table 5-8 Survey Respondent Job Titles

Job Title	*Percent of Respondents (n=23)*
Manager	52%
Facilities manager	0%
Energy manager	0%
Other facilities management/maintenance position	0%
Chief financial officer	9%
Other financial / administrative position	4%
Public works director	13%
Public works staff	4%
Other	17%

5.9.2.2. Franchise Agreements

A number of municipalities have franchise agreements established with their natural gas and electricity service providers. These agreements discount the cost of energy in part or in full through varying mechanisms. In exchange, municipalities give service provides the right of way for utility infrastructure and maintenance. Because the reduced cost of receiving electricity or natural gas service may create a disincentive for municipalities to implement energy saving projects, survey respondents were asked about the presences of these arrangements and the effect they may have on decision making as it relates to making energy saving improvements.

Table 5-9 and Table 5-10 display the share of survey respondents reporting that their municipalities have franchise agreements. For natural gas service, 39% percent of respondents reported that their organization has an agreement that covered the full cost of natural gas and an additional 30% reported that they have an agreement that covers part of the cost.

Table 5-9 Natural Gas Service Franchise Agreements

	Response	*Percent of Respondents (n=23)*
Does your organization have a franchise agreement with its natural gas service provider that covers part or all of the cost of its natural gas service?	Yes, the agreement covers all of the natural gas cost	39%
	Yes, the agreement covers part of the natural gas cost	30%
	No, we pay the full cost of natural gas service	22%
	No, we do not have natural gas service	0%
	Don't know	9%

With regards to electricity service, 26% of respondents stated they have an agreement that covers the full cost of the electricity service and 52% report that they have an agreement that covers part of the electricity service.

Table 5-10 Electric Service Franchise Agreements

	Response	*Percent of Respondents (n=23)*
Does your organization have a franchise agreement with its electric service provider that covers part or all of the cost of its electricity service?	Yes, the agreement covers all of the electricity cost	26%
	Yes, the agreement covers part of the electricity cost	52%
	No, we pay the full cost of electricity service	17%
	Don't know	4%

As shown in Table 5-11, 22% of respondents stated that franchise agreements make getting approvals for energy efficiency projects somewhat more difficult and a similar share (26%) stated that the agreements have no effect on project approval. A large share of respondents, 48%, did not know if the agreements impacted project approval.

Table 5-11 Effect of Agreements on Energy Efficiency Projects

	Response	*Percent of Respondents (n=23)*
Do the franchise agreements make getting approvals for energy efficiency projects....	A lot more difficult	0%
	Somewhat more difficult	22%
	Slightly more difficult	4%
	It has no effect on project approvals	26%
	Don't know	48%

A large share of organizations reported that they have a franchise agreement that covers part or the full cost of electricity or natural gas, and most respondents did not seem to think that these agreements had a large impact on approvals for energy efficiency projects.

5.9.2.3. Energy Efficiency Decision Making

Survey respondents were asked a series of questions related to how their organizations make decisions about energy efficiency improvements.

Table 5-12 displays the sources responding municipalities use to learn about ways to save energy. Natural gas and electric utilities (68%) and DCEO (55%) were both considered primary sources. Additional sources mentioned were the Metropolitan Mayors Caucus (41%), other associations for local governments (41%), journals and trade magazines (32%), and their regional planning agency (27%).

Table 5-12 Sources of Information on Saving Energy

	Response	*Percent of Respondents (n=22)*
3. What sources, if any, does your organization use to learn about ways to save energy?	Your gas and / or electric utility	68%
	The Illinois DCEO	55%
	The Metropolitan Mayors Caucus	41%
	Other associations for local governments	41%
	Contractors, vendors, or energy services providers	41%
	Journals or trade magazines	32%
	Our regional planning agency	27%
	The Smart Energy Design Assistance Center	9%
	The Energy Resources Center	0%
	Some other source (Please explain)	9%
	We have not sought information about energy efficiency from any source	0%
	Don't know	5%

**Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.*

As shown in Figure 5-14, the payback period for an investment in energy efficiency was considered to be a very important factor by 70% of survey respondents and the reduction in utility costs was considered very important by 64% of respondents. Respondents may consider these factors to be important because some agreements cover energy costs up to a set amount, and as a result, the municipalities may still benefit from reducing their energy costs. Additionally, costs to fund the discounted utilities are generally passed on to residents and businesses in the municipality and decision makers may consider the impact of utility costs on these groups.

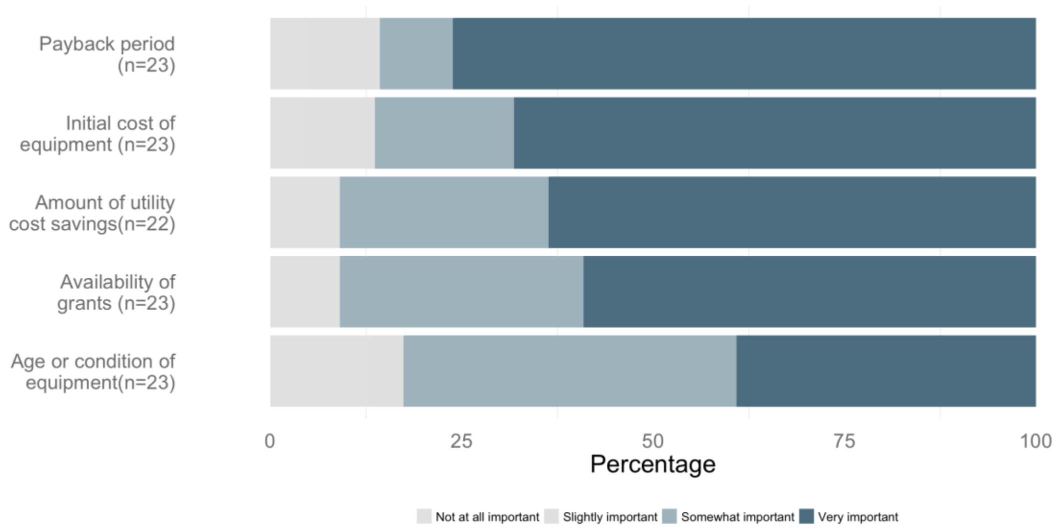


Figure 5-14 Importance of Factors Related to Energy Efficiency Decision Making

As shown in Table 5-13, nearly one-half of survey respondents reported that any incentive funds received would go to a general fund rather than the department or budget that funded the project. Not being able to recoup the costs of the funds spent on making the energy efficiency improvements may limit the effectiveness of incentive dollars to encourage energy saving projects.

Table 5-13 Whether or Not the Incentive Used would be Returned to the General Fund

	Response	*Percent of Respondents (n=23)*
If your organization completed an energy saving project and received a DCEO incentive, would the incentive be returned to the department or budget used to fund the project or would it return to a general fund?	The incentive would go to the department or budget that funded the project	26%
	The incentive would go to a general fund	48%
	Neither of these	4%
	Don't know	22%

A small share of respondents, 17%, indicated that their organizations had previously received grants or incentives from another organization.

Table 5-14 Previous Experience with Non-DCEO Funding

Not including DCEO, has your organization received any grants or incentives from any other external organization such as an Energy Efficiency Conservation Block Grant or a grant though the Illinois Clean Energy Community Foundation for an energy saving project?	*Response*	*Percent of Respondents (n=23)*
	Yes	17%
	No	61%
	Don't know	22%

5.9.2.4. Awareness of DCEO Incentive Programs

Seventy percent of survey respondents stated that they were aware that DCEO provided incentives for helping public sector organizations improve their energy efficiency and of these, nine respondents reported that they had applied or received incentives from DCEO for energy efficiency improvements.

Respondents who had not previously participated in a DCEO program were asked to indicate whether or not they were aware of various incentives and services that DCEO offers. As shown in Table 5-15, a larger share of respondents (88%) was aware of incentives for electricity saving projects than were aware of incentives for natural gas saving projects (44%). Awareness of incentives for new construction projects was also relatively high.

Table 5-15 Awareness of DCEO Incentives and Services

Which of the following services and incentives are you aware of?	*Aware*	*Not Aware*
Incentives for equipment that reduces natural gas consumption (n=16)	44%	56%
Incentives for equipment that reduces electricity consumption (n=16)	88%	13%
Retro-commissioning studies and facility audits that identify ways to save energy and are provided at no cost (n=16)	64%	36%
Incentives to incorporate energy efficient design features into new construction and building rehabilitation (n=16)	81%	19%

As shown in Table 5-16, roughly one-half of the respondents were aware of the services provided by the Metropolitan Mayors Caucus to help local government agencies plan energy saving projects and apply for DCEO grants.

Table 5-16 Awareness of Metropolitan Mayors Caucus Services

Were you aware that the Metropolitan Mayors Caucus offers services to help local government agencies plan energy saving projects and apply for grants funded through DCEO's Energy Now Programs?	*Response*	*Percent of Respondents (n=23)*
	Yes	57%
	No	43%

When asked if they knew where to get more information on DCEO incentive programs, about one-half of respondents (56%) indicated that they did know where to get this information.

Table 5-17 Awareness of Where to get More Information on DCEO Incentive Programs

	Response	*Percent of Respondents (n=16)*
Do you have a clear sense of where to get more information about DCEO incentive programs?	Yes	56%
	No	25%
	Don't know	19%

5.9.2.5. Energy Efficiency Needs

In order to better understand what assistance municipalities needed to facilitate completion of DCEO incentive projects, survey respondents were asked to assess various services in terms of how critical they are to completing energy saving project. Responses are summarized in Figure 5-15.

As shown below, financial assistance was most frequently cited as critical to completing an energy efficiency project. Forty-three percent of survey respondents considered this a critical factor. Other important factors were assistance in understanding what DCEO incentive options are available, assistance with identifying specific types of equipment and building features to save energy, and assistance in assessing potential energy savings resulting from projects.

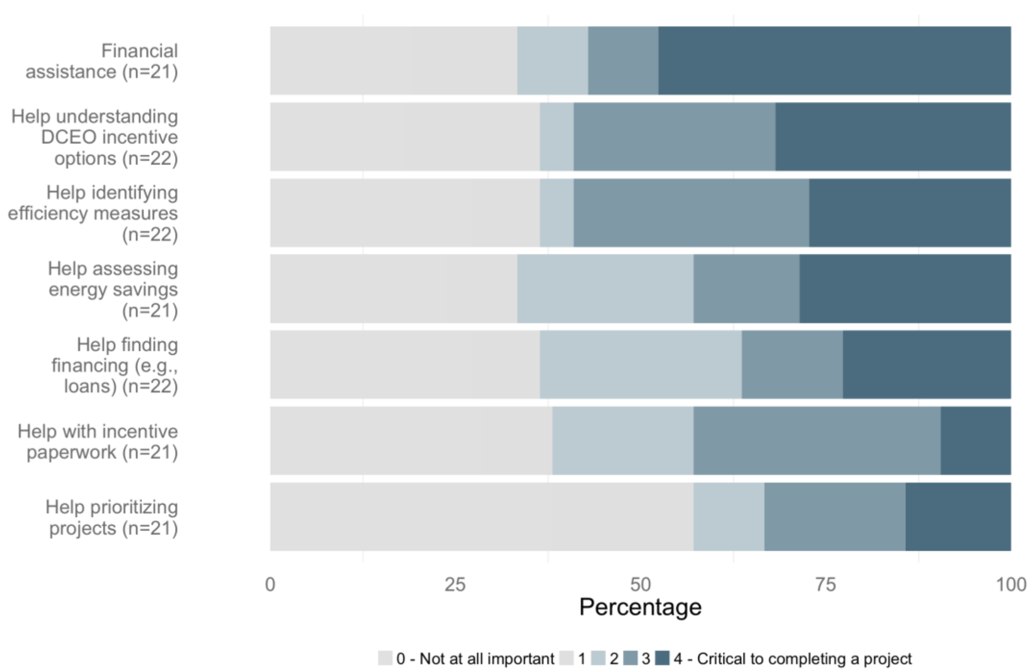


Figure 5-15 Criticality of Potential Services to Completing Incentive Projects

5.9.2.6. Future Energy Efficiency Plans

Fifty-two percent of respondents stated that their organizations had plans to make energy saving improvements in the next two years. As shown in Table 5-18, HVAC projects were most often sited, followed by lighting projects and projects involving data centers or information technology equipment.

Table 5-18 Types of Equipment Involved in Future Energy Efficiency Plans

	Response	*Percent of Respondents (n=12)*
What equipment or building features do these plans involve?	Heating, cooling, HVAC	75%
	Exterior lighting or lighting controls	58%
	Interior lighting or lighting controls	58%
	Data center or IT equipment	42%
	Windows	33%
	Insulation (ceiling, attic or wall)	17%
	Motors or motor controls	8%
	Water heating equipment	8%
	Food preparation / kitchen equipment	0%
	Refrigeration or freezing	0%
	Other	0%
	Don't know	0%

Most respondents with projects planned for the next two years reported that they were very likely (58%) or somewhat likely (25%) to apply to DCEO for project incentives.

Table 5-19 Likelihood of Applying for DCEO Incentives

	Response	*Percent of Respondents (n=12)*
How likely are you to apply for a DCEO incentive for those replacements or upgrades?	Very likely	58%
	Somewhat likely	25%
	Not very likely	0%
	Not at all likely	8%
	Don't know	8%

Respondents who expressed uncertainty about whether or not they would apply for DCEO incentives were asked what factors may lead them to not apply for a DCEO incentive. Reasons given included that the incentives are too low to be worth the effort of applying, the project is too small to be worth the effort of applying, and not knowing enough about the incentives. In open-ended comments, two respondents stated that they were not sure if the planned equipment would qualify and another indicated that the improvements would be made in a building where they do not pay for natural gas or electricity costs. This last respondent may have erroneously assumed that they are not eligible for incentives because they do not pay the cost of electricity and natural gas service.

Table 5-20 Reasons for potentially not Applying for DCEO Incentives

	Response	*Percent of Respondents (n=5)*
Why might you not apply for a DCEO incentive?	The incentives are too low to be worth the effort of applying	40%
	The project is too small to be worth the effort of applying	20%
	Don't know enough about the incentives that are available	20%
	Don't know how to apply for incentives from DCEO	0%
	Not applicable- Energy management firm or property manager will make decision	0%
	For some other reason (please explain):	60%
	Not sure	0%

5.9.2.7. Conclusions

The key findings from the survey are summarized below:

- Most respondents reported that they have franchise agreements that cover all or part of the cost of electricity (78%) and natural gas service (69%). However, none indicated that these arrangements made it a lot more difficult to get projects approved and only 22% indicated that it made it somewhat more difficult. This is consistent with what was reported in in-depth interviews of prior program participants. However, respondents may be reluctant to state that their organizations are unwilling to fund efficiency improvements in the absence of utility cost savings.
- Nearly one-half of respondents (48%) reported that the incentive funds for energy efficiency projects would not be returned to the department or budget that financed the project. This may prevent some organizations from implementing energy efficient equipment.
- Overall, there appear to be opportunities to improve awareness of the DCEO incentives and services. A smaller share of survey respondents indicated that they were aware of the natural gas incentives available (44%) than the share that indicated awareness of the electricity incentives (88%). Similarly, a sizable share of respondents indicated that they were not aware of the services provided by the Mayors Metropolitan Caucus that would help them complete a DCEO incentive project. Lastly, only 56% of respondents indicated that they knew where to get more information about DCEO incentive programs.
- The most critical needs for completing an energy efficiency project identified were financial assistance, better understanding of the DCEO programs, and assistance with identifying energy saving equipment.

5.10. Trade Ally Program

DCEO launched a trade ally program in October of 2011. The program is implemented by its partner, the Energy Resources Center (ERC) at the University of Illinois at Chicago. The trade ally program is funded primarily through the Energy Efficiency Portfolio Standard (EEPS). However, this past program year, the program received supplementary funding through a grant from the Department of Education (DoE) to improve energy efficiency in Illinois. The only contribution asked from trade allies is the entrance fee required at trade ally rallies.

There are four primary objectives of the trade ally program: increase the number of participating trade allies, increase trade ally participation in the DCEO incentives programs, provide training to trade allies, and facilitate interaction between public sector actors and trade allies.

5.10.1. Trade Ally Training

The trade ally program provides training in the form of webinars and lunch-and-learns. The webinars serve as a basic introduction to the DCEO programs for new trade allies and provide updates to existing trade allies. A major component of the basic training is helping trade allies navigate through the trade ally program website. The trade allies are provided with slides after the basic training. The basic training webinars are scheduled for every two months. In addition to the basic training webinars, ERC has hosted several webinars targeting specific public sectors (i.e., schools, parks and municipalities).

DCEO also provides technical resources to trade allies, such as access to in-house engineers and SEDAC staff. ERC provides a folder of marketing materials that trade allies receive upon request. Only newer trade allies usually need these folders. The majority of this information is available on trade ally program website.

The trade ally program hosts many trade ally rallies in order to recognize trade allies and aim to help trade allies become more involved and interactive. The rallies also allow the public sector customers to learn more about the program and increase interaction between the public sector and trade allies.

5.11. Trade Ally Perspectives

A telephone survey of DCEO registered trade allies was conducted in June of 2014. The trade allies were asked questions about:

- Types of energy efficiency services provided;
- Benefits of DCEO's Trade Ally Program;
- Participation in training webinars;
- Usefulness of training webinars;

- Participation in trade ally rallies;
- Benefits of trade ally rallies;
- Energy efficiency projects completed;
- Interaction with DCEO staff
- Awareness of the DCEO Programs among customers;
- Satisfaction with program elements; and
- Suggestions for improving the programs.

Telephone surveys and in-depth interviews were conducted with trade allies participating in the DCEO Trade Ally Program. ADM received a list of 361 DCEO registered trade allies in May 2014. Of the 361 trade allies, 359 had valid phone numbers. In total, 99 trade allies completed the survey.

5.11.1. **Trade Ally Background**

The surveyed trade allies' firms varied in size. As demonstrated in Table 5-21, the majority of trade allies (33%) came from very small firms with only 1 to 4 employees. A significant share of trade allies came from medium-sized firms with 20 to 99 employees (22%). Only 5% of trade allies were from large firms with 500 or more employees.

Table 5-21 Number of Employees at Trade Ally Firm

	Response	*Percent of Respondents (n=99)*
Approximately how many employees work at your firm?	1 to 4 employees	33%
	5 to 9 employees	12%
	10 to 19 employees	15%
	20 to 99 employees	22%
	100 to 499 employees	9%
	500 or more employees	5%
	Don't know	3%

The trade allies also came from various types of business. As shown in Table 5-22, the largest share of trade allies was electrical contractors (16%), distributors (13%) and manufacturers or manufacturer representatives (16%).

Table 5-22 Trade Ally Types of Business

	Response	*Percent of Respondents (n=99)*
How would you characterize your type of business?	Architect	3%
	Contractor - Electrical	16%
	Contractor - Mechanical	8%
	Distributor	13%
	Engineer	6%
	Manufacturer	14%
	Manufacturer representative	2%
	Vendor/Retailer	0%
	Other	37%

*Since respondents were able to select more than one response, the sum of the percentages in the table above may exceed 100%.

Respondents were asked whether they typically provide services to public sector entities, private sector entities, or both. The majority (81%) of the respondents provided services to both private and public sector entities. Only 10% provided services solely to public sector entities and 8% said they provided services only to the private sector. It is likely that the latter respondents were participants in the DCEO trade ally program because they were seeking to expand their client base to the public sector.

5.11.2. **Program Benefits**

The trade allies were asked about the benefits of participation in the Trade Ally Program. Specifically, they were asked if participating in the program broadened their public sector customer base, increased their sales, and/or was a source of information on new technologies or measures that could save energy for their customers. As seen in Table 5-23, the program was most beneficial as a source of information on new technologies or measures that could save energy for customers. Twenty-nine percent of respondents found that the program was not at all beneficial for increasing sales and 23% felt that it was not at all beneficial for broadening their public sector customer base. However, approximately a third of respondents felt that the program was beneficial or somewhat beneficial in increasing sales and broadening their public sector customer base.

Table 5-23 Benefits of the Trade Ally Program

Please indicate how beneficial the program is for…	*Very beneficial*	*Somewhat beneficial*	*Not at all beneficial*	*Don't know*
Broadening your public sector customer base	34%	35%	24%	8%
Increasing your sales	31%	27%	29%	12%
As a source of information on new technologies or measures that could save energy for your customers	40%	41%	14%	4%

5.11.3. **Participation in Training Webinars**

Respondents were asked about their firm's participation in training webinars hosted by DCEO's implementation partner, the Energy Resource Center (ERC). The majority of respondents (66%) noted that they attended at least one webinar. A third of the trade allies stated that neither they nor their colleagues attended a webinar. Of respondents who reported attending a webinar, Seventy-eight percent stated that they attended more than one webinar. The average number of webinars attended by the trade allies was 2.7.

As demonstrated in Table 5-24, the majority of trade allies noted that the training webinar they attended covered general application requirements (85%), qualifying equipment (63%), and navigating the Trade Ally Program (55%). However, a significant percentage of respondents (62%) stated that their webinars did not cover M&V requirements. According to the program staff, the webinar trainings primarily cover the application process. Specifically, trade allies are trained on how to complete necessary forms. While some M&V topics may be covered, this is not the primary intent of the webinars.

Table 5-24 Topics Covered by Training Webinars

Which of the following topics did the training cover?	*Yes*	*Don't know*
General application requirements (n=65)	85%	11%
Calculating savings and incentives (n=64)	66%	16%
Qualifying equipment (n=65)	63%	11%
Navigating the Trade Ally Program website (n=65)	55%	8%
How to sell the benefits of energy efficiency (n=65)	43%	15%
M&V requirements (n=65)	38%	17%

The respondents who attended the webinar trainings were asked to indicate the clarity of information presented in the training that they received. Table 5-25 shows that the majority of trade allies (74%) felt that the information was very clear. Approximately 23% felt that the information was somewhat clear. None of the respondents felt that the information was somewhat unclear or very unclear.

Table 5-25 Clarity of Information in Training Webinars

	Response	*Percent of Respondents (n=65)*
How clear was the information presented in the training you received? Would you say…	Very clear	74%
	Somewhat clear	23%
	Somewhat unclear	0%
	Very unclear	0%
	Don’t know	3%

Training webinar participants were asked whether the level of detail provided in the training was appropriate. As demonstrated in Table 5-26, the vast majority of trade allies (90%) felt that the webinars were about right with regard to the level of detail provided. Only 2% noted that the webinar trainings were too detailed. Further, only 5% stated that the webinar trainings were not detailed enough.

Table 5-26 Level of Detail Provided in Training Webinars

	Response	*Percent of Respondents (n=65)*
Would you say that the level of detail provided in the training was about right, too detailed, or not detailed enough?	About right	91%
	Too detailed	2%
	Not detailed enough	5%
	Don't know	3%

Trade allies were also asked whether the length of the training webinars was appropriate. As seen in Table 5-27, 94% of respondents noted that the training webinars were about right with regard to length. Only 2% felt that the trainings were too long, and an additional 2% felt that the trainings were not long enough.

Table 5-27 Length of Training Webinars

	Response	*Percent of Respondents (n=65)*
Would you say that the length of the training was about right, too long, or not long enough?	About right	91%
	Too long	2%
	Not long enough	5%
	Don't know	3%

The respondents who attended the training were asked about the comprehensiveness of the webinars. The trade allies were asked if there were topics not covered in the training that should have been. Approximately 69% of respondents felt that the webinar trainings were sufficient and comprehensive. However, 15% felt that there were topics not covered in the training that should have been.

Table 5-28 displays the topics that trade allies indicated should have been covered in the training. The most common suggestion was to provide additional information on reaching public sector customers. Some of the specific comments were that the training should cover:

> *"how to seek out more public sector opportunities."*

> *"better ways to network and get in front of customers."*

> *"marketing outreach. It's an issue I've got with all energy programs. There doesn't seem to be a lot of marketing done other than relying on trade allies to put projects through."*

Table 5-28 Training Topics Suggested by Trade Allies

	Response	*Percent of Respondents (n=8)*
What topics would you have liked to see covered?	Reaching customers	63%
	Technical topic	13%
	Participation requirements	13%
	New construction program information	13%

5.11.4. **Trade Ally Rally Participation**

Trade allies were asked whether or not they had attended any trade ally rallies. Approximately 58% had attended at least one trade ally rally. Only one respondent noted that someone else at their company had attended. Approximately 39% percent of trade allies stated that neither someone at their company nor they had attended a rally. These findings suggest that the trade allies are well attended by DCEO trade allies.

Respondents who had not attended any trade ally rallies were asked why they had not attended. Of the 40 trade allies who stated that no one from their firm had attended a trade ally rally, the reasons given for not attending, in descending order of the frequency with which they were mentioned were: insufficient time or schedule conflict (30%), the location was inconvenient (18%), did not know about rallies (18%), they were too new to the program (10%), lack of interest (8%), or they did not think that attending would be useful (5%).

Table 5-29 Reasons for Not Attending Trade Ally Rallies

	Response	*Percent of Respondents (n=40)*
Why have you not attended a rally?	Lack of time / schedule conflicts	30%
	Location is not convenient	18%
	Did not know about the rallies	18%
	New to DCEO programs	17%
	No interest / benefit	8%
	Other	8%

Respondents that attended the trade ally rallies were asked how useful the rallies were for getting updates on the DCEO incentive programs. As seen in Table 5-30, the vast majority of participants found that the rallies were very useful (73%) or somewhat useful (23%).

Table 5-30 Usefulness of Trade Ally Rally for Incentive Program Updates

	Response	*Percent of Respondents*
How useful was the rally for getting updates on the DCEO incentive programs? Would you say…	Very useful	73%
	Somewhat useful	23%
	Not very useful	4%
	Don't know	0%

Additional questions were asked to further assess the value of the trade ally rallies. Respondents were asked to rate how beneficial the trade ally rallies were in providing opportunities to network with other trade allies and to meet with potential public sector clients. As seen in Table 5-31, most respondents felt that the trade ally rallies were either very beneficial or somewhat beneficial for providing an opportunity to network with other trade allies and providing an opportunity to meet with potential public sector clients.

Table 5-31 Benefits of Trade Ally Rallies

Thinking about your experience at the trade ally rallies, how beneficial was the rally for each of the following:	*Very beneficial*	*Somewhat beneficial*	*Not at all beneficial*	*Don't know*
Providing an opportunity to network with other trade allies (n=57)	67%	23%	11%	0%
Providing an opportunity to meet with potential public sector clients (n=57)	39%	42%	18%	2%

5.11.5. DCEO Incentive Program Participation and Process

Trade allies were asked if they completed or assisted in the completion of any DCEO public sector energy efficiency incentive projects in the last year. Approximately 45% of the respondents had completed or assisted in the completion of DCEO projects in the previous year. The average number of DCEO incentive projects completed was 27.

The respondents who completed DCEO public sector projects completed the projects through various programs. As seen in Table 5-32, over one-half (58%) of the projects were completed through DCEO Custom or Standard Incentive Programs. Fourteen respondents (31%) completed projects through the DCEO Retro-commissioning Program. In addition, nine respondents (20%) completed projects through the DCEO Boiler Tune-up Program. Further, seven respondents (16%) completed projects through the DCEO New Construction Program.

Table 5-32 Programs Energy Efficiency Projects Completed Through

	Response	*Percent of Respondents* (n=45)*
Which DCEO programs were these projects completed through?	DCEO Custom or Standard Incentive Programs	58%
	DCEO New Construction Program	16%
	DCEO Retro-commissioning Program	31%
	DCEO Boiler Tune-up Program	20%
	Don't know	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

The trade allies who previously completed DCEO public sector projects were asked if there were any aspects of the application process that should be modified, and 47% said that there were. Suggestions for how to improve the process are summarized below in Table 5-33.

Table 5-33 Trade Ally Suggestions for Modifying Application Process

	Response	*Percent of Respondents (n=17)*
In what ways would you recommend the application process be changed?	Streamline process/Speed up approvals	24%
	Provide more detailed information on application	12%
	Confirmation that paperwork received/Notification of application status	12%
	Make it shorter	12%
	Add file upload capacity to website	6%
	Clarify guidelines for program participants	6%
	Make it easier to edit application	6%
	Provide guidelines earlier	6%
	Simplify lighting survey	6%
	Other	12%

5.11.6. **Interaction with Program Staff**

DCEO incentive program participants were asked about their interactions with program staff. First, they were asked if they sought assistance from program staff for incentive projects they were working on. Approximately 55% of the trade allies had sought assistance from program staff members, whereas 45% had not.

As seen in, Table 5-34, of the respondents who had sought assistance from program staff, 67% spoke with DCEO staff. Only one trade ally interacted with the Smart Energy Design Assistance Center (SEDAC) or the 360 Energy Group staff and one trade ally interacted with ERC.

The trade allies who communicated with program staff were asked what types of things they needed assistance with from program staff. As shown in Table 5-35, the most prominent reasons for contacting program staff included questions about qualifying equipment, and questions about how to complete an incentive application. However, trade allies also contacted program staff for general program information.

One-third of respondents indicated that they communicated with staff about other issues. Four of the respondents stated that these communications were about incentive amounts, two stated they had questions about qualifying a customer, and one was interested in other incentives programs that might be available.

All of the respondents noted that they received the assistance that they needed.

Table 5-34 Trade Ally Communication with Program Staff

	Response	*Percent of Respondents (n=24)*
With whom did you speak?	DCEO staff	67%
	Smart Energy Design Assistance Center (SEDAC) or 360 Energy Group staff	4%
	Energy Resources Center (ERC) staff	4%
	All three	8%
	Other	13%

Table 5-35 Reasons for Program Staff Communication

	Response	*Percent of Respondents* (n=24)*
What did you need help with?	General program information	33%
	Questions about how to complete an incentive application	33%
	Check on the status of an incentive application	8%
	Questions about the Trade Ally Network	0%
	Questions about using DCEO's or the Illinois Energy Now name or logo in promoting the program	4%
	Questions about qualifying equipment	42%
	Other	33%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

5.11.7. Client Awareness and Completion of DCEO Incentive Projects

Trade allies were asked about their marketing effort, the level of clients' awareness of the incentives, share of jobs that relate to energy efficiency projects, clients acceptance of energy efficient equipment, and clients willingness to apply for incentives. The responses to these questions provide insights into the points in the trade ally delivery of the incentive programs where they may not be effectively reaching the target market.

A substantial share of trade allies, 71%, reported that they actively market the programs to their customers. However, among those trade allies who actively market the incentive programs, one-third said that less than 40% of their clients were aware previously aware of the incentives offered by DCEO.

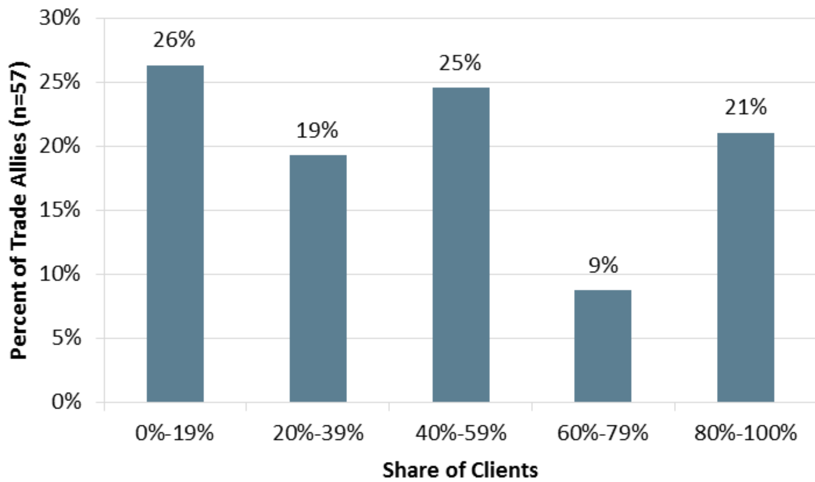


Figure 5-16 Awareness of Incentives

Trade allies were asked what percentage of all the jobs they completed in the past year could qualify for DCEO incentives. As Figure 5-17 shows, that a majority stated that 80%-100% of the projects proposed to or discussed with public sector clients involved equipment that qualified for DCEO incentives. However, more than a quarter of trade allies stated that less than one-fifth of the projects discussed with clients involved equipment that qualified for DCEO incentives.

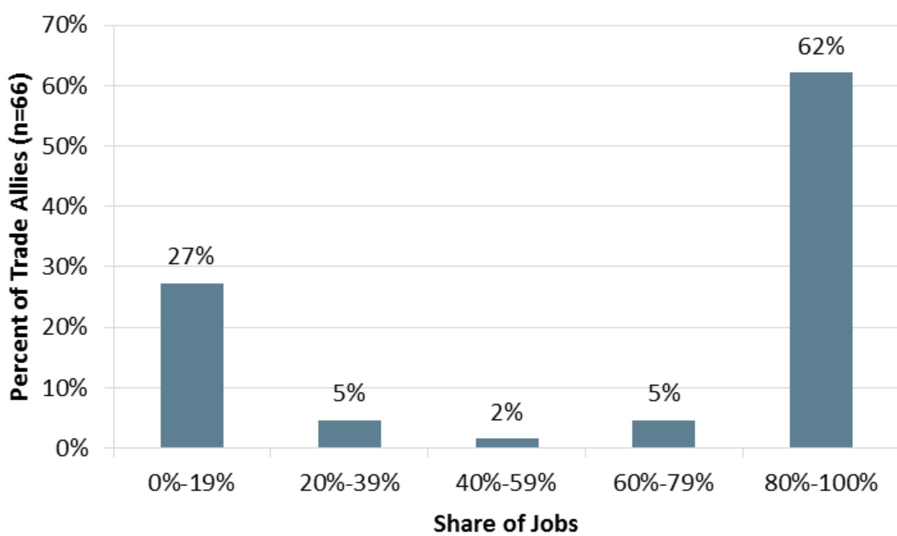


Figure 5-17 Projects Qualified for DCEO Incentives

The trade allies were also asked about the percentage of jobs in which clients agreed to most of the qualifying equipment proposed. As shown in Figure 5-18 the majority of trade allies (57%) noted that 80-100% of clients agreed to their proposed qualifying equipment. Only 14% of trade allies stated that less than 40% of their clients agreed to implement most of the proposed qualifying equipment.

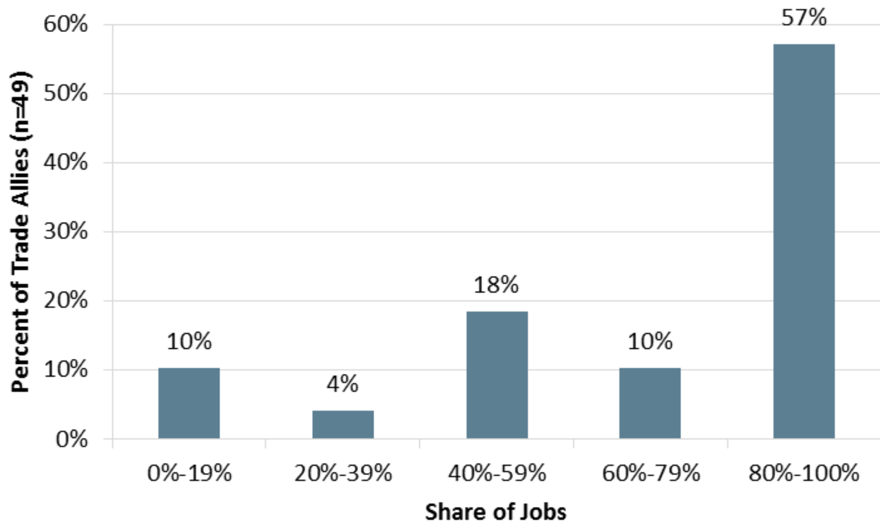


Figure 5-18 Client Agreement to Proposed Qualifying Equipment

Trade allies were asked the reasons clients gave for not installing the incentive qualifying equipment. Cost was the most frequently noted reason given by clients for not installing energy efficient equipment.

Table 5-36 Reasons for Not Installing Qualifying Equipment

	Response	*Percent of Respondents* (n=25)*
For those clients that didn't agree to install most of the incentive qualifying equipment, what reasons did they give?	Cost of energy efficient equipment	63%
	Uncertainty about potential energy savings	13%
	Time investment or paperwork requirements	12%
	No reason given by trade ally	8%
	Project timing or administrative issues	8%
	Energy efficiency not a priority	8%
	Insufficient funding	4%
	Disbelief of savings potential	4%

Finally, the trade allies were asked to describe what percentage of clients that accepted the qualifying equipment proposed chose to apply for a DCEO incentive. As seen in Figure 5-19 the majority (31) of trade allies stated that 90-100% of the public sector clients applied for a DCEO incentive.

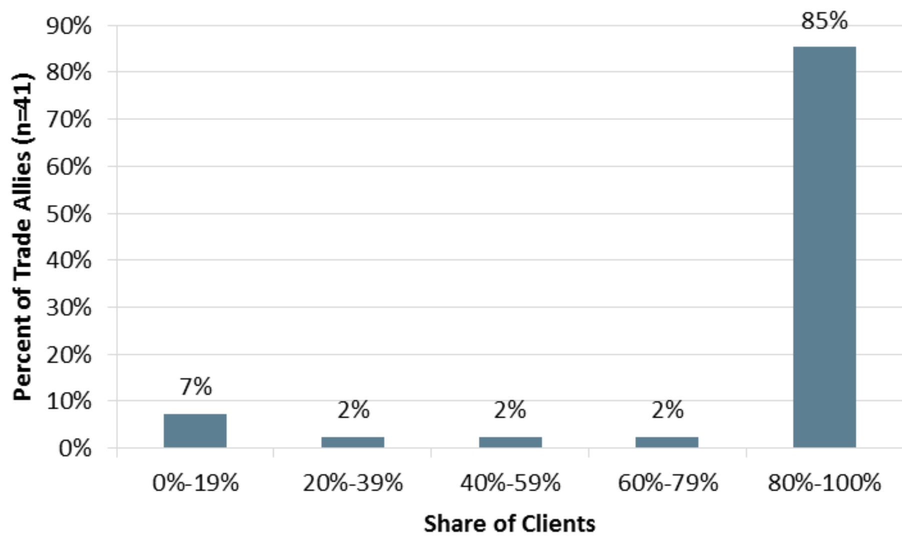


Figure 5-19 Clients Applying for DCEO Incentives

In summary, the key barriers to DCEO incentive projects are as follows:

- More than one-quarter of trade allies reported that they proposed efficient equipment options for less than 40% of their jobs. Although energy efficient equipment may not be feasible for all jobs, there may also be additional opportunities for these trade allies to develop DCEO incentive projects.
- Thirty-two percent of trade allies reported that less than 60% of the time, their clients agreed to implement most of the energy saving equipment proposed. Cost was the most commonly mentioned reason for not agreeing to the energy efficient equipment and likely reflects the financial conditions faced by public sector entities.
- For those clients that accept the proposed energy saving equipment, trade allies report that most apply for a DCEO incentive.

5.11.8. Challenges in Implementing Projects in State Buildings

To better understand the challenges to completing energy savings projects in the state buildings sector, trade allies were asked if they had proposed or discussed any projects with clients at facilities owned or leased by the Illinois State Agencies. Approximately one-third (36%) stated that they had.

Trade allies who indicated that they had proposed or discussed energy saving projects for the state buildings sector were asked if there were any challenges unique to completing projects at these facilities. Open-ended responses are summarized in Table 5-37.

Table 5-37 Coded Open-Ended Responses for Identified Challenges Unique to Completing Projects in State Facilities

	Response	*Percent of Respondents (n=37)*
Are there any challenges to completing incentive projects that are unique to state owned or leased facilities?	Complex decision making/approval processes	19%
	Funding	14%
	Slow approval process	11%
	Incentive doesn't go to facility	5%
	Incentives help	3%
	Longer to get paid	3%
	Hard to get leads	3%
	Unfair bid process	3%
	Lack of knowledge	3%
	Don't want to do additional paperwork	3%
	Other	11%
	No challenges identified	30%

As shown, the most common challenge, noted by 19% of the respondents, was the complex decision making and approval processes required for state facilities to implement energy saving projects. Some examples of this type of remark are:

> *"There are too many road blocks. There are too many people to go through and gain strong contacts. [Is it hard to reach decision maker?] We can't educate and try to convince people while we try and get business. It takes 6-9 months to pitch our products and by that time they will give the business away."*

> *"There are time constraints. Some projects don't start for 3-5 years and you never know what will happen in that time. The process is not clear and a lot of people have to approve it before anything is done."*

> *"There are more layers in the process. Particularly with administration, budgeting, and the approval process."*

Funding constraints were noted by 14% of the respondents. Examples of these types of comments include:

> *"They are not aware that there is money there for projects. I spend a lot of time educating and not negotiating."*

> *"Yes, because of budget constraints. The state's broke."*

Three trade allies (11%) noted that the approval process for state projects was slow. Lastly, two respondents noted that another barrier is that the incentive payment does not go to the facility. These comments were:

"Yes, we are working with one facility the [Facility] that because everyone there is a state employee, the incentive funding is tied to the Federal ID number for the employees which means that if they get incentives, it doesn't go back to the facility, it goes to the Illinois State pot that is managed under central management/ supply. The facility doesn't believe they can get any incentive money so the problem seems to be that the money is tied to the Federal employee ID number."

"They are not allowed to receive the incentive dollars so it just goes into the general fund, they don't get the money back, it just goes back to the general fund."

Trade allies were also asked if they had any suggestions for increasing program activity. Table 5-38 displays their suggestions. As shown, there was substantial variety in the types of suggestions made.

Table 5-38 Suggestions for Improving Program to Increase Projects Completed

	Response	*Percent of Respondents (n=21)*
Is there anything that DCEO could do to improve their programs so that more incentive projects are completed?	Increase incentives	14%
	Simplify/speed process.	14%
	Additional prescriptive incentives	10%
	More public sector contacts	10%
	Allow contractor to assist with RCx implementation	5%
	Allow contractor to keep incentive	5%
	Provide contacts for projects	5%
	DCEO needs more staff	5%
	Fund share of project cost	5%
	Improve communication	5%
	Increased promotion of program	5%
	Provide more feedback on application process	5%
	Need DCEO staff to verify TA sales claims about incentives	5%
	Offer a loan program to fund projects	5%
	Simplify/speed process.	5%
	Provide marketing materials	5%

5.11.9. Changes to Types of Equipment and Services Provided

Respondents were asked if their involvement in the DCEO energy efficiency incentive programs affected the types of equipment or services that they provide. Twenty-eight percent of participants stated that participation in the programs did affect their equipment and services selection. These respondents were asked how their participation impacted the equipment and services provided. As seen in Table 5-39, 33% stated that program participation made them offer new types of energy efficient equipment or services. In addition, 22% noted that program participation encouraged them to offer more energy efficient equipment or services. Further 11% stated that the program made them recommend equipment that qualifies for program more often.

Table 5-39 Impacts of Incentive Program on Trade Ally Equipment/Service Options

	Response	*Percent of Respondents (n=29)*
In what ways has your involvement in the incentive programs affected the types of equipment or services that you provide?	Offer more energy efficient equipment or services	24%
	Offer new types of energy efficient equipment or services	34%
	Recommend equipment that qualifies for program	10%
	Help customers identify energy saving opportunities	7%
	Other	24%

5.11.10. Program Satisfaction

Respondents were asked about their satisfaction with various aspects of the program. As seen in Table 5-40, trade allies were most satisfied with the range of measures and products for which DCEO offers incentive and the DCEO incentive programs overall. Eighty percent of respondents were either very satisfied or satisfied with the range of measures and products for which DCEO offers incentives. Eighty seven percent of the trade allies were either very satisfied or satisfied with the DCEO incentive programs overall. Six respondents were either dissatisfied or very dissatisfied with the program application process. Further seven, respondents were either dissatisfied or very dissatisfied with the range of measures and products for which DCEO offers incentives.

Table 5-40 Levels of Satisfaction

Program Component	*Very Satisfied*	*Satisfied*	*Neither Satisfied nor Dissatisfied*	*Dissatisfied*	*Very Dissatisfied*	*Don't know*	*Average*
The program application process (n=99)	30%	42%	16%	5%	1%	5%	4.0
The range of measures and products for which DCEO offers incentives (n=99)	46%	34%	8%	2%	5%	4%	4.2
The level of incentives offered (n=99)	30%	56%	5%	2%	3%	4%	4.1
The DCEO incentive programs overall. (n=99)	41%	46%	6%	2%	0%	4%	4.3

5.11.11. Summary

Overall, trade allies appeared to have benefitted from participation in the trade ally program. Respondents indicated that the program was most beneficial with regard to the source of information on new technologies or measures that could save energy for customers. Some respondents also felt that the program was beneficial in broadening their public sector customer base and increasing their sales.

Trade ally webinar trainings and rallies were also valued by respondents. Respondents felt that these training webinars were appropriate with regard to level of detail, clarity, and length. Trade ally rallies were particularly useful to respondents. They provided opportunities to network with other trade allies and to meet with potential public sector clients.

Satisfaction levels were high across various components of the program. The majority of participants were satisfied with the range of measures and products for which DCEO offers incentives, the level of incentives offered, and the overall DCEO incentive programs.

6 Conclusions and Recommendations

The interviews and surveys that were conducted with EPY6/GPY3 participants in the Custom and Standard Incentives Programs, and participants in the New Construction Program suggest that the programs were effective in their delivery and operations.

6.1 Key Conclusions

The following presents a selection of key findings from EPY6/GPY3:

- **Combined Gross Realized Savings Decreased from Prior Program Year**: In comparison to last year, the realized gross electric and natural gas savings for all three programs combined decreased. The lower activity was due to decreased Custom and New Construction Incentives Program savings. Realized gross savings for the Standard Incentives Program increased from EPY5/GPY2.
- **DCEO and Partners Working to Provide a Clear, More Consistent Brand:** DCEO's partners have adopted the Illinois Energy Now branding. The intent is to provide a clear message to the market and to communicate to public entities the partnership with the incentive programs. The Smart Energy Design Assistance Center (SEDAC) plans to host a support call center for program participants.
- **Multiple New Initiatives Launched:** DCEO launched several new initiatives during the program year including: The Clean Water Energy Efficiency Initiative directing participants to leverage funding provided by the Illinois EPA and the Illinois Clean Energy Community Foundation to implement high efficiency aeration systems, a pilot project for data centers, and a bonus incentive for large custom gas projects that exceeded 50,000 therms to increase natural gas savings.
- **Database Improvements are needed to Track New Construction Projects and Meet Accounting Requirements:** Improvements need to be made to the database because it was found to be insufficient for tracking the early phases of new construction projects, and does not accurately report annual program expenditures.

Key findings from interviews with staff in the state buildings sector and a review of state policy pertaining to energy efficiency in state government are summarized below.

- **There are State Policies in place to Encourage Energy Efficiency in State Buildings, but Budget Policy Limits Implementation Potential:** There are several state policies that encourage or require the state to adopt energy conservation measures in existing and new facilities. However, reductions in state agency appropriations and the under-funding of capital budgets present significant constraints on resources available for the implementation of energy saving measures.

- **Decision Making and Approval Processes are Complex:** The approval processes for energy efficiency projects is complicated and it may involve either staff from the agency that is primarily using the building or CMS staff, depending on which agency has primary responsibility for the building. In addition, larger capital improvement projects require additional approval by the Capital Development Board (CDP). The multiple decision makers and organizations involved in the process likely create challenges for program outreach and for trade allies seeking to develop business opportunities by encouraging energy efficiency improvements in state buildings. Trade allies noted that there were many parties involved in making decisions about equipment purchasing for state buildings and approval processes were slow.
- **Agencies Lack Budget Line Item for Incentive Projects to Participation:** Some agencies do not have a line item in their budgets for incentive dollars from DCEO. Incentives for these agencies are funneled into the general fund rather than funding the agency directly. This likely reduces the efficacy of incentives for encouraging energy efficiency projects. One large agency has developed a solution that uses funds for managing cash flow to finance projects. Other agencies may be able to replicate this strategy.
- **Funding Constraints Create Multiple Barriers:** The lack of state funds for capital improvements and agency facilities disincentives the replacement of old equipment, or equipment that is not operating optimally. Because of the lack of capital funds, most capital improvements are approved only to make emergency repair. Energy saving options may not be fully considered in these cases because short time frames to identify energy efficient equipment options and to apply for grant opportunities. Complicating this, many state facilities have older equipment that is more expensive to replace than newer equipment more commonly found in private sector buildings.

  Some state government entities such as state universities and the Department of Military Affairs have access to non-state funds that are available to pay for energy efficiency improvements. The availability of these funds likely contributes to the higher level of participation by state universities.
- **New Construction Program Time Requirements and Lack of Incentives for Incorporating Design Features Limit Participation:** Allowing projects to span multiple grant years may improve new construction program activity. Additionally, either providing incentives to designers or more fully leveraging SEDAC design assistance to incorporate efficiency may encourage additional projects.
- **Support Services Provided by ERC and SEDAC are Valued:** Staff of several state agencies stated services provided by ERC and SEDAC are valued for developing energy saving projects.

Key findings from decision makers from local government agencies in the Chicago metropolitan area collected through interviews and surveys are summarized below.

- **Local Government Decision Making and Approval Processes are Complex:** Decision making about energy efficiency projects involves multiple decision makers, as is typical of public sector organizations. Interview respondents reported that facility management staff typically initiates projects, but projects require review from other managers and approval by the governing board for the municipality, the city council, and/or the mayor. This can complicate program outreach efforts because it increases the complexity and timeline of the approval process. Most municipalities have specific contracting requirements, which may affect project implementation timelines.
- **Barriers to Natural Gas Projects:** Three barriers to natural gas projects were identified: natural gas incentives cover a smaller share of equipment cost than incentives for electricity efficiency projects; organizations have already planned electricity efficiency projects; and there is less awareness of natural gas incentives. These factors explain why meeting natural gas efficiency goals has been more challenging than meeting electricity efficiency goals, but do not explain why DCEO has had greater difficulty reaching its natural gas saving goals in the Nicor service territory.
- **Opportunities to Improve Awareness and Understanding of Programs:** DCEO may be able to improve outreach efforts by targeting associations such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association. The facility management staff who often initiate energy saving projects are members of these organizations. There may also be opportunities to develop a clear presentation of how to complete an incentive project that would better inform municipalities of the process.
- **Franchise Agreements may have Moderate Impact on Completion of Incentive Projects:** Program staff has noted that franchise agreements that cover all or a portion of municipality energy costs may limit program activity. Interview and survey responses suggest that these agreements may have a moderate impact on program participation. Most survey respondents report that they have franchise agreements that cover all or part of the cost of electricity (78%) and natural gas service (69%). However, none indicated that these arrangements made it much more difficult to get projects approved and only 22% indicated that it made it somewhat more difficult. One interview respondent indicated that not having utility costs made getting approval for energy efficiency projects more difficult. The effect of these agreements may be greater than respondents stated. Respondents may be reluctant to report that the agreements reduce their motivation to complete energy saving projects that could result in environmental benefits and reduce municipal energy costs being passed on to residents.

- **Incentive Dollars May Not be Returned to Budgets used to Finance Projects:** Nearly one-half of respondents (48%) reported that the incentive funds for energy efficiency projects would not be returned to the department or budget that financed the project. As such, some organizations may not implement energy efficient equipment because the incremental costs are not recouped.
- **DCEO Sponsored Audits and Project Reviews are Highly Valued:** Interview respondents valued audits and project reviews performed by SEDAC and the 360 Energy Group. These services provided a credible source of information on energy saving improvements, assisted with the development of projects, and provided clear equipment specifications used to develop bid requests.

6.2 Program Recommendations

The following recommendations are offered for improving the DCEO public sector programs.

- **Consider Outreach to Additional Associations:** Outreach efforts to groups such as the Northwest Municipal Conference and the Illinois Chapter of the American Public Works Association may be effective at reaching municipal facility staff who often initiate energy efficiency projects.
- **Continue to Leverage Audits and Project Reviews as Gateway to Program Participation:** Energy assessments and project reviews appear to be an effective means of assisting public entities with developing energy saving projects. Program staff should continue to leverage these services and target non-participating organizations to encourage participation in the incentive programs. Moreover, specifically targeting utility service territories where the programs are underperforming may improve goal attainment.
- **Explore Financing Mechanisms for Government Agencies:** Incentive payments are often not returned to the state agency budget used to pay for the improvement. Program staff should explore models developed by other state agencies for funding energy efficiency improvements in the absence of a budget line for accepting incentives can be applied elsewhere. DCEO should leverage its position on the Energy Efficiency Committee to press for the implementation of budget line items for state agencies to receive incentives mandated by Executive Order 7 of 2009.

  Similar budget issues may limit the effectiveness of the incentives for local government agencies. Staff should also consider implementing a utility bill credit process to fund efficiency projects for other public sector entities.
- **Opportunity to Improve Consistency of Program Information and Relevance:** Program staff reported that their partners were adopting consistent use of the Energy Now Brand to communicate that the DCEO energy efficiency incentives and technical services are part of a single program. SEDAC will be hosting a call center that will be the main telephone contact for program participants. These developments are moving the DCEO programs to a more consolidated presence. However, additional improvements are possible. For example, program information can be found separately on the DCEO, SEDAC, and ERC websites. Creating a single site that is used by DCEO and its partners to present information that is organized effectively may encourage program participation and help establish the DCEO programs a resource for energy efficiency. For example, the information could be presented by target market (e.g., state agencies, municipalities, parks departments), by facility type (e.g., waste water treatment facilities, correctional facilities, or public pools), by equipment type (e.g., lighting equipment, kitchen equipment), or by some combination of these options.
- **Monitor Effectiveness of Sweet Deal Bonus:** Although program activity spiked around the two deadlines for the sweet deal bonus (October 31st and February 14th), it is unclear if these

bonus incentives influenced additional projects or shifted their timeline to earlier in the program year. It is important to note that for both the Standard and Custom Programs, the majority of savings occurred after the sweet deal timeline had passed.

- **Consider Specialized Training to Trade Allies to help them Navigate Public Sector Approval Processes:** Trade allies reported issues developing projects at state agencies involving complex decision-making processes and slow approval processes. These issues are also found in other public sector entities. Staff may be able to provide guidance to trade allies on navigating decision-making processes at public sector organizations to make the process more transparent and facilitate their ability to sell projects.

Appendix A: Site-Level Reports

Name N-1

Executive Summary

Application N-1 received custom incentives from Illinois DCEO for above-code renovations. The electric realization rate for this project is 259%, and the natural gas realization rate is 41%.

Project Description

The customer made above-code renovations to the existing structure and the new construction addition to the school. The above-code renovations include: high efficiency rooftop packaged VAV equipment, high efficiency boilers, high efficiency domestic hot water boiler, insulation, and windows.

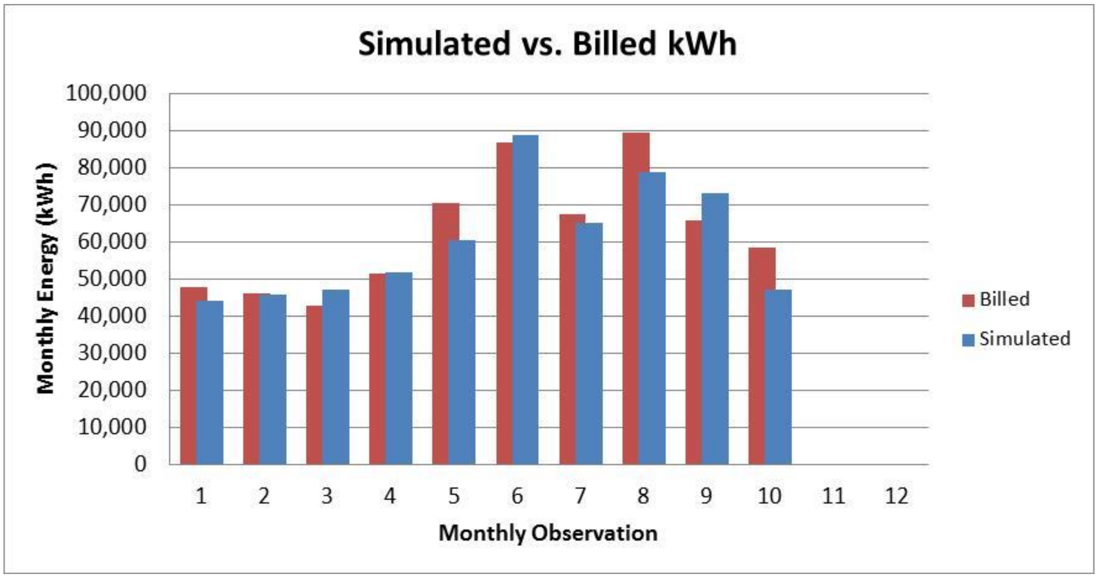
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the above-code measures. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules.

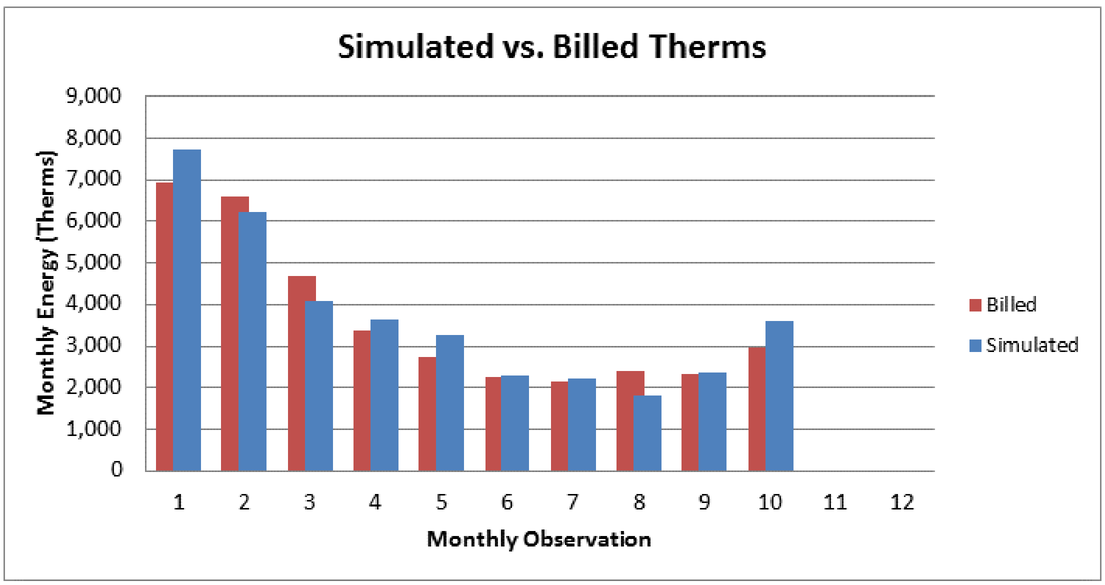
Custom Incentives

Energy savings were calculated using eQuest modeling of the school. ADM compiled a model of the as-built facility. Upon the completion of the initial model, a custom weather file was created using 2014 NOAA weather data for the Chicago Midway area. Using this weather file and billing data for the facility, ADM was able to ensure 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 Therms Calibration



Upon completion of the calibration for the as-built eQuest model, a baseline model was created in which all the above-code measures were removed. Once the baseline model was completed, the baseline and as-built models were run using TMY3 weather data for the region. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Energy Consumption

End-Use	Baseline kWh	As-Built kWh	Annual kWh Savings	Baseline Therms	As-Built Therms	Annual Therm Savings
Lighting	273,389	239,215	34,174	0	0	0
Miscellaneous Equipment	113,474	113,474	0	0	0	0
Heating	2,564	2,718	-154	24,026	22,417	1,609
Cooling	235,137	197,747	37,390	0	0	0
Heat Rejection	0	0	0	0	0	0
Pumps	22,626	22,969	-343	0	0	0
Fans	108,622	109,103	-481	0	0	0
Domestic Hot Water	0	0	0	31,673	26,859	4,814
Total	**755,811**	**685,226**	**70,585**	**55,700**	**49,276**	**6,424**

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for Above Code Renovations

Measure	Annual Gross kWh Savings	
	Ex Ante	ADM Calculated Ex Post
Above Code Renovations	27,201	70,585
Total	27,201	70,585

Annual Therms Savings for Above Code Renovations

Measure	Annual Gross Therms Savings	
	Ex Ante	ADM Calculated Ex Post
Above Code Renovations	15,520	6,424
Total	15,520	6,424

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	Above Code Renovations	15,520	70,585	259%	-	1,058,775[9]
Total		***15,520***	***70,585***	***259%***	***-***	***1,058,775***

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	Above Code Renovations	15,520	6,424	41%	96,354
Total		***15,520***	***6,424***	***41%***	***96,354***

The 259% verified electric realization rate is due to differences in analysis approaches. The ex-ante analysis used and un-calibrated Trane Trace model. The ex post used calibrated eQuest simulation. The main difference in total realized savings is that the Trane Trace model had a significant fan energy penalty for the as-built model. The ex post model only had a small fan energy penalty.

The 41% verified natural gas realization rate is due to the ex post model being calibrated. The ex-ante model assumed a larger heating load, which resulted in an over estimate of savings.

[9] 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-1

Executive Summary

Application S-1 received standard incentives from Illinois DCEO for retrofitting lighting and installing boilers, gas water heaters, and a total of ground source heat pumps as part of a standard project. The electric realization rate is 55%, and the natural gas realization rate is 93%.

Project Description

The customer retrofitted or installed the following fixtures in their facility:

- (57) 72w 4’ 2LT12 fixtures with (57) 38w 2x2 LED fixtures
- (51) 144w 4’ 2LT12 fixtures with (64) 38w 2x2 LED fixtures
- (7) 150w MH wall packs with (7) LED 30w LED wall packs in the exterior
- (9) Incandescent exit signs with (7) LED exit signs
- (61) 4’ 4LT12 fixtures with (61) 4’ 2LT5HO fixtures
- (15) 4’ 2LT12 fixtures with (15) 4’ 2LT8 fixtures
- (3) hot water boilers
- (5) gas water heaters
- (1) 7 ton, (1) 14 ton, (1) 16 ton, (40) 20 ton, and (3) 25 ton water source heat pumps

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the boilers, water heaters, and WSHPs were installed. During this time ADM collected name plate information to compare against invoices and the project application. ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.3, 4.5.4, 4.5.5, and 4.5.12 were used.

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 estimated the water source heat pump energy savings according to the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems.

ELECTRIC ENERGY SAVINGS

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool\ +}\ \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/SEERbase) - (1/SEERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{cool}) * [(1/HSPFbase) - (1/HSPFee)] * EFLH_{heat}$$

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool\ +}\ \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/EERbase) - (1/EERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{heat})/3.412 * [(1/COPbase) - (1/COPee)] * EFLH_{heat}$$

Where:

$kBtu/h_{cool}$	= capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).
	= Actual installed
SEERbase	=Seasonal Energy Efficiency Ratio of the baseline equipment; see table below for values.
SEERee	= Seasonal Energy Efficiency Ratio of the energy efficient equipment.
	= Actual installed
$EFLH_{cool}$	= cooling mode equivalent full load hours
HSPFbase	= Heating Seasonal Performance Factor of the baseline equipment; see table above for values.
HSPFee	= Heating Seasonal Performance Factor of the energy efficient equipment.

= Actual installed

$EFLH_{heat}$ = heating mode equivalent full load hours; see table above for default values.

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

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

= Actual installed

$kBtu/h_{heat}$ = capacity of the heating equipment in kBtu per hour.

= Actual installed

3.412 = Btu per Wh.

COPbase = coefficient of performance of the baseline equipment; see table above for values.

COPee = coefficient of performance of the energy efficient equipment.

= Actual installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = (kBtu/h_{cool}) * [(1/EERbase) - (1/EERee)] *CF$$

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)

NATURAL GAS ENERGY SAVINGS

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.10 High Efficiency Boiler.

$$\Delta Therm = \frac{EFLH * Capacity * \left(\frac{Eff_{efficient} - EFF_{base}}{Eff_{base}}\right)}{100{,}000}$$

Where:

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

Capacity = Nominal Heating Capacity Boiler Size (btuh)

= custom Boiler input capacity in Btu/hr

EFFefficient = 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

EFFbase = Efficient Boiler Efficiency Rating use actual value

For the water heater, Section 4.3.1 (Version 2.0) Storage Water Heater was used.

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 equaling 251[10]</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.[11]
<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>
</table>
</td></tr>
</table>

[10] 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

[11] Gas Storage Water Heater 0.67. Work Paper WPRSGNGDHW106. Resource Solutions Group. December 2010

		Other	148	

Measure-level Gross Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
RF- LED Bulbs and Fixtures	72	44.9	4311	1.23	31,511	8,191
RF- LED Bulbs and Fixtures	144	44.9	4311	1.23		23,704
RF- LED Bulbs and Fixtures	150	44.9	4311	1		3,172
RF-Commercial LED Exit Signs	35	2	8766	1.23	2,005	3,202
RF- T5 Fixtures and Lamps	144	128	4311	1.23	7,480	5,175
RF- High Performance and Reduced Wattage T8 Fixtures and Lamps	72	49	4311	1.23	2,655	1,829
Total					43,651	45,274

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

Annual kWh Savings for Water Source Heat Pumps (WSHP)

Measure	*Measure Metrics*									*Annual Gross kWh Savings*		
	Program Type	*Equipment Type*	*Electric Resistance heat?*	*Qty*	*Cooling Capacity (kBtu/H)*	*Heating Capacity (kBtu/H)*	*SEERee*	*HSPFee*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*	*ADM Calculated Ex Post*
WSHP	*TOS*	*Water Source*	*FALSE*	*1*	*82.0*	*101.0*	*16.7*	*16.4*	*3 (Springfield)*	*7,547*	*2,220*	
WSHP	*TOS*	*Water Source*	*FALSE*	*3*	*150.0*	*186.0*	*15.4*	*16.0*	*3 (Springfield)*	*41,617*		*15,574*
WSHP	*TOS*	*Water Source*	*FALSE*	*1*	*166.0*	*204.2*	*17.1*	*16.7*	*3 (Springfield)*	*15,315*		*7,334*
WSHP	*TOS*	*Water Source*	*FALSE*	*1*	*190.0*	*238.4*	*16.8*	*16.4*	*3 (Springfield)*	*17,535*		*8,037*
WSHP	*TOS*	*Water Source*	*FALSE*	*4*	*238.5*	*291.0*	*16.8*	*17.4*	*3 (Springfield)*	*87,007*		*43,619*
WSHP	*TOS*	*Water Source*	*FALSE*	*3*	*300.0*	*372.0*	*15.4*	*16.0*	*3 (Springfield)*	*69,474*		*34,056*
Total										*238,495*	*2,220*	*108,621*

It should be noted that the last five line items shown in the above Water Source Heat Pump savings table are being reported under the "ADM Calculated" field. This is due to the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems, only providing baseline efficiencies for water source heat pumps with capacities under 135,000 Btus/hr. Due to this limitation ADM, relied on the efficiencies set forth by the federal appliance standards[12] for all units above 135,000 Btus/hr.

Annual Therms Savings for Gas Storage Water Heaters

Measure					*Annual Gross Therms Savings*	
	Program Type	*Measure Type*	*Tank Size*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Gas Water Heater	TOS	Gas, High-Efficiency	80 gallons	Education – Primary/Secondary	740	1,255
Total					740	1,255

[12] 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

Project-level Gross Savings Results

Annual Therms Savings for High Efficiency Boilers

Measure	Measure Metrics							Annual Gross Therms Savings		
	Program Type	Qty	Boiler btuh	Base Boiler type	Boiler Efficiency	Zone	Building Type	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
High Efficiency Boiler	TOS	3	3,000,000	Hot Water >2,500,000 Btu/h	87.0%	3 (Springfield)	High School	9,079	9,043	7,867
Total								9,079	9,043	7,867

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	WSHP	238,495	110,840	46%	57.39	1,662,603
Standard	Lighting Retrofit	43,651	45,274	104%	1.40	405,847
Total		***282,146***	***156,114***	***55%***	***58.79***	***2,068,450***

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	Gas Water Heater	740	1,255	170%	18,825
Standard	High Efficiency Boiler	9,079	7,867	87%	157,343
Total		***9,819***	***9,122***	***93%***	***176,168***

The lighting retrofit realization rate is 104%. The ex ante savings estimate was calculated with the variable for annual lighting hours selected from a data table with four building types. The ex post determined the actual function of the retrofitted spaces during the M&V site visit; and then the appropriate building type was selected from the TRM data table with 20 building types.

The water source heat pump realization rate for this project is 46%. The low realization rate can be attributed to the project assuming that the installed heat pumps were air cooled; however, they are water source heat pumps. Due to the heat pumps being water source, the baseline efficiency is much higher resulting in less energy savings.

The natural gas realization rate for this project is 93%. The realization rate for the water heater is 170%, and the boiler is 87%. This is because of ex ante assumptions used for building type. The building type has a significant impact on the gas savings for both measures. The typical building that is assumed underestimated savings for the water heater and slightly over estimated savings for the boiler.

Name S-2

Executive Summary

Application S-2 received standard incentives from Illinois DCEO for retrofitting and installing lighting, an electric steam cooker, and ground source heat pumps in their facility. The electric realization rate is 91%.

Project Description

The customer installed or retrofitted the following fixtures:

- (18) Hardwired CFL fixtures
- (28) 4’ 4LT12 fixtures with (36) 4’ 2LT5 fixtures
- (1) 4’ 4LT12 fixture with (1) 4’ 2LT5 fixture
- (51) 4’ 4LT12 fixtures with (44) 4’ 2LT5 fixtures
- (2) 4’ 1LT8 fixtures with (2) 4’ 2LT5 fixtures
- (2) 4’ 3LT8 fixtures with (2) 4’ 2LT5 fixtures
- (5) 4’ 4LT12 fixtures with (3) 4’ 2LT5 fixtures
- (2) 4’ 4LT12 fixtures with (1) 4’ 2LT5 fixture
- (9) 4’ 4LT12 fixtures with (7) 4’ 2LT8 fixtures
- (1) six pan electric steam cooker
- (27) .75 ton, (2) 1 ton, (2) 1.5 ton, (3) 2 ton, (2) 2.5 ton, (1) 3 ton, and (1) 5 ton ground source heat pumps

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the cooking equipment and claimed ground source heat pumps were installed. During this time ADM collected name plate information to compare against invoices and the project application. ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Lighting energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.1, 4.5.3, and 4.5.12 were used.

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 estimated the electric steam cooker energy savings according to the Illinois TRM Version 2.0, Section 4.2.3 Commercial Steam Cooker.

ELECTRIC ENERGY SAVINGS

$$\Delta Savings = (\Delta Idle + \Delta Preheat + \Delta Cooking) * Days/Year$$

Where:

ΔIdle Energy = ((((1- $CSM_{\%Baseline}$)* $IDLE_{BASE}$ + $CSM_{\%Baseline}$ * PC_{BASE} * E_{FOOD} / EFF_{BASE})*($HOURS_{day}$ - (F / PC_{Base}) - (PRE_{number} *0.25))) - (((1- $CSM_{\%ENERGYSTAR}$) * $IDLE_{ENERGYSTAR}$ + $CSM_{\%ENERGYSTAR}$ * PC_{ENERGY} * E_{FOOD} / $EFF_{ENERGYSTAR}$) * ($HOURS_{Day}$ - (F l/ PC_{ENERGY}) - (PRE_{number} * 0.25))))

$CSM_{\%Baseline}$ = Baseline Steamer Time in Manual Steam Mode (% of time)

= 90%

$IDLE_{Base}$ = Idle Energy Rate of Base Steamer

PC_{Base} = Production Capacity of Base Steamer

E_{FOOD}= Amount of Energy Absorbed by the food during cooking known as ASTM Energy to Food (Btu/lb or kW/lb)

=105 Btu/lb (gas steamers) or 0.0308(electric steamers)

EFF_{BASE} =Heavy Load Cooking Efficiency for Base Steamer

=15% (gas steamers) or 26% (electric steamers)

$HOURS_{day}$ = Average Daily Operation (hours)

F = Food cooked per day (lbs/day)

= custom or if unknown, use 100 lbs/day

$CSM_{\%ENERGYSTAR}$ = ENERGY STAR Steamer's Time in Manual Steam Mode (% of time)

= 0%

$IDLE_{ENERGYSTAR}$	= Idle Energy Rate of ENERGY STAR®
PC_{ENERGY}	= Production Capacity of ENERGY STAR® Steamer
$EFF_{ENERGYSTAR}$	= Heavy Load Cooking Efficiency for ENERGY STAR® Steamer(%)
	=38% (gas steamer) or 50% (electric steamer)
PRE_{number}	= Number of preheats per day
	=1 (if unknown, use 1)
ΔPreheat Energy	= (PRE_{number} * Δ Pre_{heat})
PRE_{number}	= Number of Preheats per Day
	=1 (if unknown, use 1)
PRE_{heat}	= Preheat energy savings per preheat
	= 11,000 Btu/preheat (gas steamer) or 0.5 kWh/preheat (electric steamer)
ΔCooking Energy	= ((1/ EFFBASE) - (1/ EFFENERGY STAR®)) * F * E_{FOOD}
EFF_{BASE}	=Heavy Load Cooking Efficiency for Base Steamer
	=15% (gas steamer) or 26% (electric steamer)
$EFF_{ENERGYSTAR}$	=Heavy Load Cooking Efficiency for ENERGY STAR® Steamer
	=38% (gas steamer) or 50% (electric steamer)
F	= Food cooked per day (lbs/day)
	= custom or if unknown, use 100 lbs/day
E_{FOOD}	= Amount of Energy Absorbed by the food during cooking known as ASTM Energy to Food

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = \frac{\Delta kWh}{HOURSDay * DaysYear} * CF$$

Where:

CF	=Summer Peak Coincidence Factor for measure
$Days_{Year}$	=Annual Days of Operation, custom or 365.25 days a year

ADM estimated the ground source heat pump energy savings according to the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems.

ELECTRIC ENERGY SAVINGS

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool} + \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/SEERbase) – (1/SEERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{cool}) * [(1/HSPFbase) – (1/HSPFee)] * EFLH_{heat}$$

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool} + \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/EERbase) – (1/EERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{heat})/3.412 * [(1/COPbase) – (1/COPee)] * EFLH_{heat}$$

Where:

$kBtu/h_{cool}$	= capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).
	= Actual installed
SEERbase	=Seasonal Energy Efficiency Ratio of the baseline equipment; see table below for values.
SEERee	= Seasonal Energy Efficiency Ratio of the energy efficient equipment.
	= Actual installed
$EFLH_{cool}$	= cooling mode equivalent full load hours
HSPFbase	= Heating Seasonal Performance Factor of the baseline equipment; see table above for values.
HSPFee	= Heating Seasonal Performance Factor of the energy efficient equipment.
	= Actual installed
$EFLH_{heat}$	= heating mode equivalent full load hours; see table above for default values.
EERbase	= Energy Efficiency Ratio of the baseline equipment; see the table above for values. Since IECC 2006 does not provide EER requirements for air-cooled heat pumps < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1.
EERee	= Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EERee is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.
	= Actual installed
$kBtu/h_{heat}$	= capacity of the heating equipment in kBtu per hour.
	= Actual installed
3.412	= Btu per Wh.

COPbase = coefficient of performance of the baseline equipment; see table above for values.

COPee = coefficient of performance of the energy efficient equipment.

= Actual installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = (kBtu/h_{cool}) * [(1/EERbase) – (1/EERee)] *CF$$

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)

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 Lighting Retrofit

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated Ex Post*
Commercial Energy Star Standard CFL	0	36	4311	1.23	554	1,211
Commercial Energy Star Standard CFL	0	55	4311	1.23	-	942
Commercial Energy Star Standard CFL	0	46	4311	1.23	-	269
RF – T5 Fixtures and Lamps	139	64	4311	1.23	9,754	8,420
RF – T5 Fixtures and Lamps	139	64	4311	1.23	355	398
RF – T5 Fixtures and Lamps	139	64	4311	1.23	25,410	22,658
RF – T5 Fixtures and Lamps	32	64	4311	1.23	200-	(339)
RF – T5 Fixtures and Lamps	88	64	4311	1.23	-	255
RF – T5 Fixtures and Lamps	139	64	4311	1.23	3,096	2,667
RF – T5 Fixtures and Lamps	139	64	4311	1.23	1,215	1,135
RF – High Performance and Reduced Wattage T8 Fixtures and Lamps	139	49	4311	1.23	5,948	4,815
Total					46,532	42,429

Annual kWh Savings for Commercial Steam Cooker

Measure	*Measure Metrics*				*Annual Gross kWh Savings*	
	Program Type	*Equipment Type*	*No. of Pans*	*Type of Food Service*	*Ex Ante*	*TRM-Calculated Ex Post*
Commercial Steam Cooker	*TOS*	*Electric Steam Cooker*	*6*	*Cafeteria*	*2,153*	*2,153*
Total					2,153	2,153

Annual kWh Savings for Ground Source Heat Pumps

Measure	*Measure Metrics*									*Annual Gross kWh Savings*	
	Program Type	*Equipment Type*	*Electric Resistance heat?*	*Qty*	*Cooling Capacity (kBtu/H)*	*Heating Capacity (kBtu/H)*	*SEERee*	*HSPFee*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*
WSHP	*TOS*	*Water Source*	*FALSE*	*27*	*9.3*	*11.1*	*16.8*	*16.4*	*3 (Springfield)*	*7,768*	*7,781*
WSHP	*TOS*	*Water Source*	*FALSE*	*2*	*11.7*	*13.8*	*16.9*	*15.4*	*3 (Springfield)*	*1,110*	*632*
WSHP	*TOS*	*Water Source*	*FALSE*	*2*	*18.6*	*23.0*	*16.5*	*17.7*	*3 (Springfield)*	*1,110*	*1,111*
WSHP	*TOS*	*Water Source*	*FALSE*	*3*	*25.1*	*29.5*	*17.8*	*16.7*	*3 (Springfield)*	*2,372*	*2,261*
WSHP	*TOS*	*Water Source*	*FALSE*	*2*	*28.2*	*34.9*	*16.8*	*17.1*	*3 (Springfield)*	*2,220*	*1,612*
WSHP	*TOS*	*Water Source*	*FALSE*	*1*	*33.0*	*39.8*	*18.3*	*18.8*	*3 (Springfield)*	*1,186*	*1,274*
WSHP	*TOS*	*Water Source*	*FALSE*	*1*	*61.0*	*70.4*	*17.5*	*17.1*	*3 (Springfield)*	*2,372*	*1,830*
Total										18,138	16,502

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*
Standard	Lighting Retrofit	46,532	42,429	91%	1.37	408,832
Standard	Electric Steam Cooker	2,153	2,153	100%	0.35	25,838
Standard	WSHP	18,138	16,502	3%	10.82	247,523
Total		***66,823***	***61,084***	***91%***	***12.54***	***682,193***

The project-level realization rate is 91%. The ex ante estimate for the T5 and T8 measures assumed a greater than was determined in the ex post savings analysis by using the TRM prescribed figures. The ex ante savings calculation included the difference in the actual baseline watts for the sum of all fixtures less the actual watts for the retrofit fixtures. The ex post savings calculation utilized the actual fixtures as found during the site visit and the deemed savings by fixture type from the TRM. During the M&V site visit, ADM also verified the installation of Occupancy Sensors, but this measure was not in the application and a Standard incentive was not received.

The ground-source heat pumps realization rate is 91%. The low realization rate can be attributed to the project assuming that the installed heat pumps were air cooled; however they are water source heat pumps. Due to the heat pumps being water source, the baseline efficiency is much higher resulting in a net reduction of savings.

Name S-3, C-1

Executive Summary

Application S-3, C-1 received standard incentives from Illinois DCEO for installing ground source heat pumps, unitary air conditioners, and a storage water heater. They also received custom incentives for a new control system. The electric realization for this project is 62%, and the natural gas realization is 313%.

Project Description

The participant installed ground source heat pumps in Building A to replace an existing VVT system. In Buildings C, D and E, they installed (6) roof-top units to replace the original roof-top units nearing the end of their useful life. The new roof-top units use the existing hot water system. The baseline system was tied into a control system but had no scheduling. The new control system in Buildings C, D and E utilizes occupancy scheduling with temperature setback.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational, documented new equipment nameplate data, and gathered temperature set points and scheduling information from the building automation system.

Standard Incentives

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings resulting from the new ground source heat pumps heat pumps using the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems, which provided the following equations:

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

$$\Delta kWh_{cool} = EFLH_{cool} * Capacity_{cool} * \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{actual}}\right)$$

$$\Delta kWh_{heat} = EFLH_{heat} * Capacity_{heat} * \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{actual}}\right)$$

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

$$\Delta kWh_{cool} = EFLH_{cool} * Capacity_{cool} * \left(\frac{1}{EER_{base}} - \frac{1}{EER_{actual}}\right)$$

$$\Delta kWh_{heat} = EFLH_{heat}/3.412 * Capacity_{heat} * \left(\frac{1}{COP_{base}} - \frac{1}{COP_{actual}}\right)$$

Where:

$EFLH_{cool}$	= Equivalent Full Load Hours for cooling
$EFLH_{heat}$	= EFLH for heating
$Capacity_{cool}$	= Cooling Capacity (kBtu/h)
$Capacity_{cool}$	= Heating Capacity (kBtu/h)
$SEER_{base}$	= Baseline Seasonal Energy Efficiency Ratio (deemed)
$SEER_{actual}$	= As-built Seasonal Energy Efficiency Ratio
$HSPF_{base}$	= Baseline Heating Seasonal Performance Factor (deemed)
$HSPF_{actual}$	= Actual HSPF of energy efficient equipment
EER_{base}	= Energy Efficiency Ratio of the baseline equipment (deemed)
EER_{actual}	= Actual EER of energy efficient equipment

ADM estimated energy savings resulting from the new unitary air conditioners using the Illinois TRM Version 2.0, Section 4.4.14 provided the following formula for electric energy savings:

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

$$\Delta kWh_{cool} = EFLH_{cool} * Capacity_{cool} * \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{actual}}\right)$$

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

$$\Delta kWh_{cool} = EFLH_{cool} * Capacity_{cool} * \left(\frac{1}{EER_{base}} - \frac{1}{EER_{actual}}\right)$$

Where:

$EFLH_{cool}$	= Equivalent Full Load Hours for cooling
$Capacity_{cool}$	= Cooling Capacity (kBtu/h)
$SEER_{base}$	= Baseline Seasonal Energy Efficiency Ratio (deemed)
$SEER_{actual}$	= As-built Seasonal Energy Efficiency Ratio
EER_{base}	= Energy Efficiency Ratio of the baseline equipment (deemed)
EER_{actual}	= Actual EER of energy efficient equipment

NATURAL GAS ENERGY SAVINGS

ADM estimated energy savings resulting from the new storage water heater using the Illinois TRM Version 2.0, Section 4.3.1 Storage Water Heater. This chapter provides a deemed savings of 251 therms for a high efficiency (>88%) storage water heater.

Custom Incentives

ADM performed an energy simulation in eQUEST to estimate savings resulting from the implementation of unoccupied scheduling and temperature setback for the new rooftop units in Buildings C, D and E. To do so, ADM used a prototypical model for community colleges and customized the scheduling and set point parameters to match the baseline and as-built facilities. Model savings were calculated as the difference between the baseline and as-built consumption. Model savings were then normalized by scaling to the conditioned area of Buildings C, D, and E.

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 Ground Source Heat Pumps

Measure	*Measure Metrics*									*Annual Gross kWh Savings*	
	Program Type	*Equipment Type*	*Electric Resistance heat?*	*Qty*	*Cooling Capacity (kBtu/H)*	*Heating Capacity (kBtu/H)*	*SEERee*	*HSPFee*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*
GSHP	*RF*	*Ground Source Heat Pump*	*FALSE*	*2*	*58.5*	*38.0*	*23.8*	*13.8*	*2 (Chicago)*		*4,269*
GSHP	*RF*	*Ground Source Heat Pump*	*FALSE*	*13*	*49.5*	*30.0*	*24.6*	*13.1*	*2 (Chicago)*		*22,042*
GSHP	*RF*	*Ground Source Heat Pump*	*FALSE*	*9*	*35.6*	*22.0*	*24.8*	*13.1*	*2 (Chicago)*		*11,097*
GSHP	*RF*	*Ground Source Heat Pump*	*FALSE*	*3*	*34.6*	*25.8*	*22.2*	*14.3*	*2 (Chicago)*		*3,990*
Total										174,484	41,398

Annual kWh Savings for Unitary Air Conditioners

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Equipment type*	*Subcategory or rating Condition*	*Qty*	*New Cooling Capacity (kbtu/h)*	*EER of Efficient Equipment*	*Zone*	*Electric Resistance Heat?*	*Ex Ante*	*TRM-Calculated Ex Post*
Single-Package and Split System Unitary Air Conditioners	*RF*	Air conditioners, Air cooled	*Single Package*	*1*	*684*	*11.0*	*2 (Chicago)*	*N*	*2,829*	*6,236*
Single-Package and Split System Unitary Air Conditioners	*RF*	Air conditioners, Air cooled	*Single Package*	*1*	*696*	*11.0*	*2 (Chicago)*	*N*	*2,879*	*6,345*
Single-Package and Split System Unitary Air Conditioners	*RF*	Air conditioners, Air cooled	*Single Package*	*1*	*456*	*10.9*	*2 (Chicago)*	*N*	*1,886*	*3,846*
Single-Package and Split System Unitary Air Conditioners	*RF*	Air conditioners, Air cooled	*Single Package*	*1*	*684*	*10.8*	*2 (Chicago)*	*N*	*2,829*	*5,293*
Single-Package and Split System Unitary Air Conditioners	*RF*	Air conditioners, Air cooled	*Single Package*	*1*	*401*	*10.8*	*2 (Chicago)*	*N*	*1,658*	*3,101*
Single-Package and Split System Unitary Air Conditioners	*RF*	Air conditioners, Air cooled	Single Package	1	655	10.8	2 (Chicago)	N	2,710	5,070
Total									14,791	29,891

Annual Therms Savings for Storage Water Heater

Measure	*Measure Metrics*		*Annual Gross Therms Savings*	
	Qty	*Thermal Efficiency*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	1	96%	178	251
Total			178	251

Custom Incentives

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

Annual kWh Savings for HVAC Controls

Measure	*Measure Metrics*			*Annual Gross kWh Savings*	
	Area (ft2)	*Cooling Capacity (kbtu/h)*	*Heating Capacity (kbtu/h)*	*Ex Ante*	*ADM Calculated Ex Post*
Unoccupied Scheduling and Temp. Setback	108,952	3,576	18,000	116,266	118,122
Total				116,266	118,122

Annual Therms Savings for HVAC Controls

Measure	*Measure Metrics*			*Annual Gross kWh Savings*	
	Area (ft2)	*Cooling Capacity (kbtu/h)*	*Heating Capacity (kbtu/h)*	*Ex Ante*	*ADM Calculated Ex Post*
Unoccupied Scheduling and Temp. Setback	108,952	3,576	18,000	6,754	21,420
Total				6,754	21,420

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	Ground Source Heat Pumps	174,484	41,398	24%	31.85	620,972
Standard	Unitary AC	14,793	29,891	202%	33.32	448,371
Subtotal		*189,277*	*71,289*	*38%*	*65.17*	*1,069,343*
Custom	Controls	116,266	118,122	102%	0	1,771,823
Subtotal		*116,266*	*118,122*	*102%*	*0*	*1,771,823*
Total		***305,543***	***189,411***	***62%***	***65.17***	***2,841,166***

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	178	251	141%	3,765
Subtotal		*178*	*251*	*141%*	*3,765*
Custom	Controls	6,754	21,420	317%	321,301
Subtotal		*6,754*	*21,420*	*317%*	*321,301*
Total		***6,932***	***21,671***	***313%***	***325,066***

The overall project realization rate is 62% for electric and 313% for natural gas. The low realization rate for the ground source heat pumps appears to be attributed to the ex-ante savings claiming 174,484 kWh for both annual savings and lifetime savings. The 174,484 kWh is more appropriate for lifetime savings and leads ADM to believe that this is an error within the IEN database. This error is the reason the overall electric realization rate is low for the project.

Ex-ante savings (178 Therms) for the storage water heater were based on a standard efficiency unit; however, the actual unit installed was a high efficiency unit. The Illinois TRM Version 2.0 estimates savings of 251 Therms per high efficiency unit. The realization rate for this measure is 141%.

The ex ante savings calculation estimated that the HVAC controls would save 15% of the HVAC energy and natural gas used in the 2011-2012 usage period; however, the assumptions used for this estimation are unknown, as the calculations provided with project documentation were not comprehensive. ADM determined savings using a prototypical community college energy model and typical weather data for the Peoria (Greater Peoria) weather station. The electric realization rate for this measure is 102% and the natural gas realization rate is 317%.

Name S-4

Executive Summary

Application S-4 received standard incentives from Illinois DCEO for installing natural gas furnaces and electric heat pumps. The natural gas realization rate is 19%, and the electric realization rate is 156%.

Project Description

The participant installed (6) 80 MBH York natural gas furnaces to replace (5) 106 MBH Lennox furnaces in one building and (1) unknown make and size furnace in another building. Also installed were (2) 5-ton, (3) 4-ton, and (1) 3-ton York cooling heat pumps. Based on mechanical schedules provided by the site staff, there was previously no air conditioning. The new gas furnaces are tied into the same air system as the new electric heat pumps.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational and documented equipment nameplate data, temperature set points, and mechanical schedules for the baseline system in the Burl Ives building.

Standard Incentives

NATURAL GAS ENERGY SAVINGS

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.11High Efficiency Furnace, which provided the following equation:

$$\Delta Therm = EFLH * Capacity * \left(\frac{1}{AFUE_{base}} - \frac{1}{AFUE_{efficient}}\right)$$

Where:

$AFUE$ = Annual Fuel Utilization Efficiency Rating

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings resulting from the new heat pumps using the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems, which provided the following equations:

$$\Delta kWh_{cool} = EFLH_{cool} * Capacity_{cool} * \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{actual}}\right)$$

$$\Delta kWh_{heat} = EFLH_{heat} * Capacity_{heat} * \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{actual}}\right)$$

Where:

$EFLH_{cool}$ = Equivalent Full Load Hours for cooling

$Capacity_{cool}$ = Cooling capacity (kBtu/h)

$SEER_{base}$ = baseline seasonal energy efficiency ratio (deemed)

$SEER_{actual}$ = as-built seasonal energy efficiency ratio

Because the heat pumps do not provide heating, the equation for savings from heating was ignored for this measure.

SPILLOVER

Spillover occurred in the form of energy savings from furnace fan usage. The Illinois TRM Version 3.0, Section 4.4.11 provided the following formula for electric energy savings:

$$\Delta kWh = Heating + Cooling + Shoulder\ Season$$

Where:

$$Heating = 418\text{kWh}$$

$$Cooling = \text{Deemed Savings in TRM}$$

$$Shoulder\ \text{Season} = 51\text{kWh}$$

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	*Qty*	*Furnace MBH*	*AFUE*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Furnace	RF	6	80	96%	3 (Springfield)	358	376	361
Total						358	376	361

Annual kWh Savings for High Efficiency Furnaces

Measure	*Measure Metrics*							*Annual Gross kWh Savings*		
	Program Type	*Qty*	*AC or No AC*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Eff. Furnace	TOS	6	Air Conditioning	92.1%	College/University	3 (Springfield)	80,000	2,272	4,392	4,392
Total								2,272	4,392	4,392

Annual kWh Savings for Heat Pumps

Measure	*Measure Metrics*				*Annual Gross Savings*	
	Program Type	*Qty*	*Tons*	*SEER*	*Ex Ante kWh*	*TRM-Calculated Ex Post kWh*
Heat Pump System	TOS	2	5	16	496	1,733
Heat Pump System	TOS	3	4	15	596	1,478
Heat Pump System	TOS	1	3	15	148	370
Total					1,240	3,581

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 Furnace	358	361	101%	5,956
Total		***358***	***361***	***101%***	***5,956***

Verified Electric Savings/Realization Rates

Incentive Type	*Measure Category*	*Annual Gross Savings*				*Lifetime Gross Savings*
		Ex Ante kWh	*Ex Post kWh*	*Ex Post kW*	*Realization Rate*	*Ex Post kWh*
Standard	Heat Pump System	1,240	3,581	0.90	289%	59,078
Standard	High Efficiency Furnace	2,272	4,392	3.50	193%	87,840
Total		***3,512***	***7,973***	***4.00***	***227%***	***146,918***

The ex ante natural gas savings estimate is calculated using a deemed savings of 0.746 therms per kBtuh based on a “college/university” facility type, but the assumptions applied to this savings value are unknown. The Illinois TRM version 3.0 determines EFLH based on building type and climate zone and applies a baseline boiler efficiency rating based on system type. This results in an ex post savings of 0.752 therms per kBtuh. The natural gas realization rate is 101%

The ex ante electric savings estimate for unitary and split system air conditioning and heat pumps uses a deemed savings of 49.6 kWh per ton of cooling capacity based on a “college/university” facility type and equipment SEER of 15, but other assumptions are unknown. The Illinois TRM version 2.0 determines EFLH based on climate zone and determines the baseline system efficiency based on equipment type and size. This results in a savings of 143.2 kWh per ton of cooling capacity. Additionally, the ex ante savings estimate for natural gas furnaces applies savings of 4.73 kWh per kBtuh based on “college/university” facility type. The TRM version 3.0 applies savings for each unit of 732 kWh, resulting in savings of 9.15 kWh per kBtuh. The electric realization rate is 227%.

Name S-5

Executive Summary

Application S-5 received standard incentives from DCEO for installing lighting fixtures, low flow faucet aerators, and beverage machine controls in their facility. The electric realization rate is 113%, and the natural gas realization rate is 433%.

Project Description

The customer installed (5) low flow faucet aerators in restrooms and a beverage machine controller. There was also delamping of 4-foot and 8-foot lamps, retrofitting T12 to T8 4-foot lamps and 2-foot lamps, installation of LED exit signs, installation of LED fixtures, installation of LED wall packs, replacement of metal halides with T8 fluorescent fixtures, and installation of exterior LED fixtures.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed; however, the beverage machine controls were installed on an Energy Star unit, which controls the machine in the same manner as the Beverage Miser. Thus, savings are zero for this measure. There were a few discrepancies in that there were fewer installed fixtures than expected, but the site contact indicated that some of the new fixtures are in storage.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5 was used.

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 estimated energy savings according to the Illinois TRM Version 3.0, Section 4.3.2 Low Flow Faucet Aerators.

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 = 100%
GPM_base	= Average flow rate, in gallons per minute, of the baseline faucet "as-used"
	= 1.2 or custom based on metering studies
GPM_low	= Average flow rate, in gallons per minute, of the low-flow faucet aerator "as-used"
	= 0.94 or custom based on metering studies
Usage	= Estimated usage of mixed water (mixture of hot water from water heater line and cold water line) per faucet (gallons per year)
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
	Where:
RE_gas	= Recovery efficiency of gas water heater
	= 67%
100,000	= Converts Btus to Therms (Btu/Therm)
ISR	= In service rate = deemed value based on direct install = 95%

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 Lighting Retrofit

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated Ex Post*
RF - Fluorescent Delamping	33.7	0	4439	1.25	65,626	67,317
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	92	49	4439	1.25	70,138	47,958
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	82	49	4439	1.25		32,960
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	46	25	4439	1.25		2,863
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	68	49	4439	1.25		1,160
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	92	49	4439	1.25	1,055	1,071
TOS/NC/RF - LED Screw Bulbs	65	9.5	3088	1.25	2,776	926
TOS/NC/RF - LED Screw Bulbs	60	12	3088	1.25		185
TOS/NC/RF - LED Screw Bulbs	25	9	3088	1.25		233
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	455	206	4439	1.25	42,259	44,212
RF - Commercial LED Exit Signs	35	2	8766	1.25	8,974	14,102
TOS/NC/RF - LED Bulbs and Fixtures	455	104	4903	1	1,222	3,442
TOS/NC/RF - LED Bulbs and Fixtures	285	52	4903	1	3,435	5,712
TOS/NC/RF - LED Bulbs and Fixtures	115	18	4903	1	3,418	1,427
RF - Fluorescent Delamping	60.3	0	4439	1.25	3,206	7,361
TOS/NC/RF - LED Bulbs and Fixtures	201	26	4903	1	492	1,716
Total					202,603	232,646

Annual Therms Savings for Low Flow Faucet Aerators

Measure	Quantity	Building Type	Annual Gross Therms Savings		
			Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
Low Flow Faucet Aerators	5	Large Office	12	52	52
Total			12	52	52

Annual kWh Savings for Refrigerated Beverage Machine Controls

Measure	Quantity	Annual Gross kWh Savings	
		Ex Ante	TRM-Calculated Ex Post
Beverage and Snack Machine Controls	1	3,226	0
Total		3,226	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
Standard	Low Flow Faucet Aerators	12	52	433%	465
Total		***12***	***52***	***433%***	***465***

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	Beverage and Snack Machine Controls	3,226	0	0%	0	0
Standard	Lighting Retrofit	202,603	232,646	115%	33.14	2,381,965
Total		***205,829***	***232,646***	***113%***	***33.14***	***2,381,965***

The ex ante natural gas savings estimate is calculated using a deemed savings of 4.54 therms per low flow faucet aerator for offices, but the assumptions applied to this savings value are unknown. The Illinois TRM uses average flow rates and water usage to estimate savings from the faucet aerators, resulting in a savings of 10.4 therms per aerator. The natural gas realization rate is 433%

The ex ante electric savings estimate uses a deemed savings of 1,612 kWh per beverage machine control. The M&V site visit found that the beverage machine was installed on an Energy Star beverage machine, which rendered the installed controller useless. The electric realization rate is 0%.

The verified standard measure electric realization rate is 115%. The ex-ante savings estimation results from deemed savings values for each measure based on the facility type “office”. The ex-post savings estimation is based on the Illinois TRM Version 2.0, which considers usage hours based on space type and fixture type and allows for the use of custom baseline and energy efficient equipment wattage to estimate savings.

Name C-2

Executive Summary

Application C-2 received custom-measure incentives from Illinois DCEO for installing a new turbo blower at their Plant. The electric realization rate is 37%.

Project Description

The customer installed (1) HSi turbo blower with dissolved oxygen feedback control to take over the load for the aeration and aerobic digester tanks. The previous system rotated (3) 125 HP and (1) 75 HP Hoffman blowers in and out of service. They have been left in place as back-up.

Methodology for Estimating Gross Savings

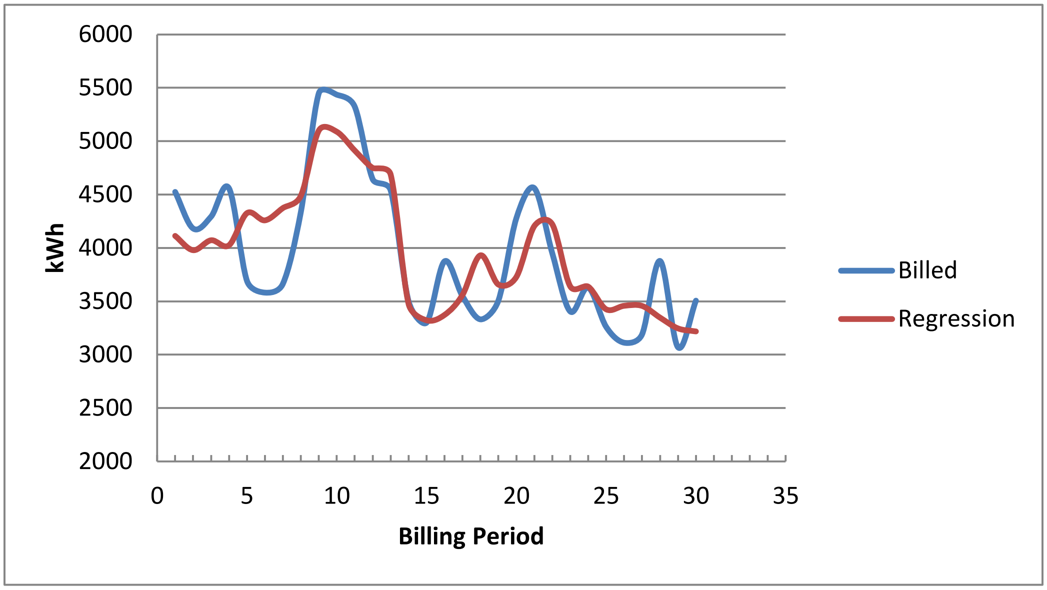
During the M&V visit, ADM staff verified that the equipment was installed and operational and photographed the new and existing equipment. Pre- and post- project plant flow, CFM, and temperature data was provided to be used in the energy savings analysis.

ADM performed a regression using billing data as the dependent variable and using daily average influent and effluent flow, plant temperature, and a binary variable used to indicate pre- and post- project as the dependent variables. The regression results are shown below.

	Coefficients	*Standard Error*	*t Stat*
Intercept	3210.99004	387.3427	8.28979
Daily Influent	1583.25012	527.4284	3.00183
Daily Effluent	-1056.94516	480.0508	-2.20174
Plant Avg Temp	-7.51031	3.8657	-1.94281
PrePost	809.05657	155.6913	5.19654

Regression Statistics	
Multiple R	0.8342035
R Square	0.6958954
Adjusted R Square	0.6491101
Standard Error	401.2454108
Observations	31

Billed Usage vs. Regression



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 Turbo Blower

Measure	*Regression Coefficients*					*Annual Gross kWh Savings*	
	Daily Influent	*Daily Effluent*	*Plant Avg. Temp*	*PrePost*	*Intercept*	*Ex Ante*	*ADM Calculated Ex Post*
Turbo blower	1,583.3	-1,056.9	-7.5	809.1	3,211.0	790,412	295,508
Total						*790,412*	*295,508*

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	Turbo blower	790,412	295,508	37%	33.71	5,910,160[13]
Total		***790,412***	***295,508***	***37%***	***33.71***	***5,910,160***

The realization rate for this project is 37%. Engineering calculations used for the ex ante savings were provided with documentation. These calculations accounted for a much lower air demand (1,416 CFM average) than is shown in the data that was provided to ADM (2,782 CFM average), so the new blower is actually running at a higher speed, which is very impactful due to the cubic relationship between fan speed and power.

[13] The life expectancy is estimated to be 20 years. See: http://www.energy.siemens.com/us/pool/hq/compression/special-applications/aeration/Applicationbrochure_January2010.pdf.

Name S-6

Executive Summary

Application S-6 received standard incentives from Illinois DCEO for installation of a high efficiency split HVAC system. The electric realization rate for this project is 184%, and the natural gas realization rate is 57%.

Project Description

The customer installed a new high efficiency split HVAC system. The installed split AC unit has an efficiency of 16 SEER. The installed furnace has an efficiency of 96.7% AFUE.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented unit nameplates.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 3.0 (errata-corrected).

For the furnace, TRM section 4.4.11 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
Cooling Savings	= Brushless DC motor or electronically commutated motor (ECM) If air conditioning = 263 kWh
Shoulder Season Savings	= Brushless DC motor or electronically commutated motor (ECM) = 51 kWh

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = (\Delta kWh/(HOURSyear * DaysYear)) \; * \; CF$$

Where:

HOURSyear	= Actual hours per year if known, otherwise use hours from Table
CF	=Summer Peak Coincidence Factor

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = EFLH * Capacity * ((AFUE(eff) - AFUE(exist)) / AFUE(exist)) / 100{,}000 \text{ Btu/Therm})$$

Where:

EFLH	= Equivalent Full Load Hours for heating
Capacity	= Nominal Heating Capacity Furnace Size (btuh)
AFUE(exist)	= Existing Furnace Annual Fuel Utilization Efficiency Rating
AFUE(eff)	= Efficent Furnace Annual Fuel Utilization Efficiency Rating

For the AC, section 4.4.14 Single-Package and Split System Unitary Air Conditioners was used.

ELECTRIC ENERGY SAVINGS

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

$$\Delta kWH = (kBtu/h) * [(1/SEERbase) – (1/SEERee)] * EFLH$$

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

$$\Delta kWH = (kBtu/h) * [(1/EERbase) – (1/EERee)] * EFLH$$

Where:

kBtu/h	= capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).
SEERbase	= Seasonal Energy Efficiency Ratio of the baseline equipment; see table
SEERee	= Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).
EERbase	= 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
EERee	= Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EERee 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

$$\Delta kW_{SSP} = (kBtu/h * (1/EERbase - 1/EERee)) * CF_{SSP}$$

Where:

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

<u>Measure-level Gross Savings Results</u>

Standard Incentives

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

Annual kWh Savings for High Efficiency Split HVAC Unit

Measure									*Annual Gross kWh Savings*	
	Program Type	*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*
Single-Package and Split System Unitary Air Conditioners	TOS	Lodging Hotel/Motel/ Multifamily	Air conditioners, Air cooled	Split System	60	16	2 (Chicago)	No	816	1440.8
Total									816	1440.8

Annual Therms Savings for High Efficiency Furnace

Measure							*Annual Gross Therms Savings*		
	Program Type	*AC or No AC*	*AFUE of Efficient Equipment*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Furnace	TOS	Air Conditioning	96.7%	Lodging Hotel/Motel/ Multifamily	2 (Chicago)	120,000	466.8	531	513.5
Total							466.8	531	513.5

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	816	1,440.8	177%	0.96	22,709	0.96
Total		***816***	1,440.8	***177%***	***0.96***	22,709	***0.96***

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 Furnace	239	513.5	215%	8,473
Total		***239***	***513.5***	***215%***	8,473

The 177% verified electric realization rate is likely due to TRM Version 2.0 using a cooling EFLH of 252 for multifamily in Chicago. The ex ante prescriptive savings is 77 kWh per ton, and it is likely based on averages of building types, climate zones, baseline and as-built efficiencies.

The 215% verified natural gas realization rate is likely due to TRM Version 3.0 allowing an time-of-sale baseline efficiency of 80% resulting in savings higher than the ex ante. The ex ante uses 3.89 Therms per kBtuh. The assumptions and values used in the ex ante are unknown, so definitive conclusions cannot be made.

Name S-7

Executive Summary

Application S-7 received Standard incentives from Illinois-DCEO for retrofitting lighting in their facility. The realization rate for this project is 170%.

Project Description

The customer installed and retrofitted the following:

- (50) 4’ 1LT8 fixtures with (10) 2x2 LED fixtures
- (46) 4’ 2LT8 fixtures with (29) 2x2 LED fixtures
- Installation of Occupancy Sensors

Methodology for Estimating Gross Savings.

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.4 and 4.5.10 were used.

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:

kWcontrolled = 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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
RF - LED Bulbs and Fixtures	32	44.9	3540	1.14	1,788	4,645
RF - LED Bulbs and Fixtures	59	44.9	3540	1.14	2,190	5,698
Total					3,978	10,343

Annual kWh Savings for Lighting Controls

Measure	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Annual Gross kWh Savings*	
					Ex Ante	*TRM-Calculated Ex Post*
RF - Occupancy Sensor Lighting Controls	3,071	3540	0.41	1.5	5,088	5,081
Total					5,088	5,081

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	LED Bulbs and Fixtures	3,978	10,343	260%	2.15	102,260
Standard	Occupancy Controls	5,088	5,081	100%	1.06	142,911
Total		***9,066***	***15,424***	***170%***	***3.21***	***245,171***

The project level realization rate is 170%. For the lighting retrofit the realization rate is high because the ex ante savings estimate applied a savings of 2.15 kWh per connected watt reduced (ranging from 75.52 kWh to 178.80 kWh per fixture), whereas the ex post analysis used the TRM savings calculation per fixture ranging from 196.48 kWh to 464.50 kWh. For the occupancy sensors the ex ante estimate was highly accurate.

Name S-8

Executive Summary

Application S-8 received standard incentives from Illinois DCEO for retrofitting lighting and installing low flow faucet aerators in their facility. The electric realization rate is 125%, and the natural gas realization rate is 149%.

Project Description

The customer retrofitted and installed the following fixtures:

A Building:

- (174) 4’T12 lamps were removed
- (3) 4’ 1LT12 lamps with (3) 4’ 1LT8 lamps
- (1) 4’ 2LT12 lamps with (1) 4’ 2LT8 lamps
- (87) 4’ 2LT12 lamps with (87) 4’ 2LT8 lamps
- (2) 100w Incandescent lamps with (2) 19w LED lamps in the exterior area
- (6) 60w Incandescent lamps with (6) 9w LED lamps
- (2) 60w Incandescent lamps with (2) 19w LED lamps in the exterior area
- (5) 75w Incandescent lamps with (5) 9w LED lamps
- (4) 60w Incandescent lamps with (4) 9w LED lamps
- (6) Incandescent exit signs with (6) LED exit signs

B Building:

- (6) 4’ 2LT12 lamps with (6) 4’ 2LT8 lamps
- (1) 4’ 2LT12 lamps with (1) 4’ 2LT8 lamps
- (2) 60w Incandescent lamps with (2) 9w LED lamps
- (1) 75w Incandescent lamp with (1) 9w LED lamp
- (3) 45w Incandescent lamps with (3) 19w LED lamps in the exterior
- (2) 90w Incandescent lamps with (2) 19w LED lamps in the exterior
- (4) Incandescent exit signs with (4) LED exit signs
- (12) T12 lamps removed
- (2) Halogen wall packs with (2) LED wall packs in the exterior
- (1) 458w Metal Halide lamp with (1) 92w LED lamp in the exterior
- (2) 150w Halogen lamps with (2) 18w LED lamps in the exterior

The customer also installed (4) low flow faucet aerators in restrooms.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the low flow faucet aerators were installed. ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.2, 4.5.3, 4.5.4, 4.5.5 were used.

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 estimated energy savings according to the errata corrected Illinois TRM Version 3.0, Section 4.3.2 Low Flow Faucet Aerators.

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 = 100%
GPM_base	= Average flow rate, in gallons per minute, of the baseline faucet “as-used”
	= 1.39 or custom based on metering studies
GPM_low	= Average flow rate, in gallons per minute, of the low-flow faucet aerator “as-used”
	= 0.94 or custom based on metering studies
Usage	= Estimated usage of mixed water (mixture of hot water from water heater line and cold water line) per faucet (gallons per year)
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

Where:

RE_gas = Recovery efficiency of gas water heater

= 67%

100,000 = Converts Btus to Therms (Btu/Therm)

ISR = In service rate = deemed value based on direct install = 95%

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 Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
A Bldg.						
RF- Fluorescent Delamping	33.7	0	4439	1.25	29,737	32,537
RF- High Performance and Reduced Wattage T8 Fixtures and Lamps	46	25	4439	1.25	15,732	350
RF- High Performance and Reduced Wattage T8 Fixtures and Lamps	92	49	4439	1.25	-	239
RF- High Performance and Reduced Wattage T8 Fixtures and Lamps	92	49	4439	1.25	-	20,758
TOS/NC/RF – LED Screw Bulbs	90	18.75	4903	1	2,242	699
TOS/NC/RF – LED Screw Bulbs	65	9	3088	1.25	-	1,297
TOS/NC/RF – LED Screw Bulbs	65	18.75	4903	1	-	454
TOS/NC/RF – LED Screw Bulbs	75	9	3088	1.25	-	1,274
TOS/NC/RF – LED Screw Bulbs	60	9	3088	1.25	-	787
RF- Commercial LED	35	2	8766	1.25	1,381	2,170

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
Exit Sign						
B Building						
RF- High Performance and Reduced Wattage T8 Fixtures and Lamps	92	49	4439	1.25	1,230	1,432
RF- High Performance and Reduced Wattage T8 Fixtures and Lamps	92	49	4439	1.25	-	239
TOS/NC/RF – LED Screw Bulbs	60	9	3088	1.25	854	394
TOS/NC/RF – LED Screw Bulbs	75	9	3088	1.25	-	255
TOS/NC/RF – LED Screw Bulbs	45	18.75	4903	1	-	386
TOS/NC/RF – LED Screw Bulbs	90	18.75	4903	1		699
RF- Commercial LED Exit Sign	35	2	8766	1.25	920	1,446
RF- Fluorescent Delamping	33.7	0	4439	1.25	2,051	2,244
TOS/NC/RF – LED Bulbs and Fixtures	150	26	4903	1	492	1,216
TOS/NC/RF – LED Bulbs and Fixtures	458	92	4903	1	1,156	1,794
TOS/NC/RF – LED Bulbs and Fixtures	150	18	4903	1	1,603	1,294
Total					57,400	71,962

Annual Therms Savings for Low Flow Faucet Aerators

Measure			*Annual Gross Therms Savings*		
	Quantity	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Low Flow Faucet Aerators	3	Small Office	6.9	6.9	10.3
Low Flow Faucet Aerators	1	Small Office	2.3	2.3	3.4
Total			9.2	9.2	13.7

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	Fluorescent Delamping	31,787	34,781	109%	5.38	382,587
	T8 Fixtures and Lamps	16,963	23,016	136%	3.56	130,147
	LED Bulbs and Fixtures	6,348	10,549	208%	0.89	65,834
	LED Exit Signs	2,301	3,616	157%	0.28	57,856
Total		***57,400***	***71,962***	***125%***	***10.11***	***662,434***

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	Low Flow Faucet Aerators	9.2	13.7	149%	123.5
Total		***9.2***	***13.7***	***149%***	***123.5***

The electric realization rate is 125%. The ex ante estimate for the Fluorescent Delamping provides 171 kWh per lamp removed while the ex post savings analysis utilized the TRM calculation of 187 kWh per lamp removed. For High Performance T8 lamps the ex ante used 88 kWh per fixture while the TRM savings ranged from 117 kWh to 239 kWh per fixture. The ex ante savings for LED lamps and fixtures ranged from 107 kWh to 246 kWh per lamp/fixture while the TRM savings ranged from 349 kWh to 608 kWh. In addition, for Commercial LED exit signs the ex ante savings estimate used 230 kWh while the ex post utilized the TRM savings of 362 kWh per sign.

The ex ante natural gas savings estimates are calculated using the Illinois TRM Version 2.0. The ex post analysis used Version 3.0 since this is an errata measure. Version 3.0 increases the baseline flow from 1.2 gpm to 1.39 gpm. Thus, the natural gas realization rate is 149%.

Name S-9

Executive Summary

Application S-9 received standard incentives from Illinois DCEO for installation of lighting throughout its facility. The electric realization rate for this project is 148%.

Project Description

The customer installed (12) LED wall packs, (270) high performance 4 foot T8 lamps, LED fixtures with a connected watt reduction of 7,176 watts, and T8 high bay fluorescent fixtures with a connected watt reduction of 1,734 watts.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented installed equipment quantities and wattages.

Standard Incentives

For the lighting retrofit, energy savings were calculated according to the TRM Version 2.0, Section 4.5 Lighting End Use.

ELECTRIC ENERGY SAVINGS

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

Where:

$Watts_{base}$ = Input wattage of the existing system.

$Watts_{EE}$ = New Input wattage of EE fixture.

Hours = Average hours of use per year are provided in the Reference Table in Section 4.5, Screw based bulb annual operating hours, for each building type. If unknown, use the Miscellaneous value.

WHFe = Waste heat factor for energy to account for cooling energy savings from efficient lighting are provided below for each building type in the Referecne Table in Section 4.5. If unknown, use the Miscellaneous value.

ISR =In service Rate -the percentage of units rebated that actually get installed. Use 100% unless an evaluation shows a lesser value

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = ((Watts_{base} - Watts_{EE})/1000) * ISR * WHF_d * CF$$

Where:

WHFd = Waste Heat Factor for Demand to account for cooling savings from efficient lighting in cooled buildings is provided in Reference Table in Section 4.5. If unknown, use the miscellaneous value.

CF = Summer Peak Coincidence Factor for measure is provided in the Reference Table in Section 4.5. If unknown, use the miscellaneous value

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 Lighting

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
LED	78	52.5	3,540	1.00	6,114	25,371
LED	458	52.5	4,903	1.00	12,780	23,858
T8	94	72	3,540	1.00	9,195	2,053
T8	59	25	4,311	1.23		8,473
T8	88	72	4,311	1.23	6,872	848
T8	114	94	4,311	1.23		1,590
T8	59	49	4,311	1.23		4,772
LED	78	52.5	3,540	1.00		25,371
Total					34,961	66,967

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	Lighting	34,961	66,967	148%	8.23	668,008
Total		34,961	***66,967***	***148%***	***8.23***	***668,008***

The verified electric realization rate is 192%, which is due to several factors.

For the LED Wall Packs, the ex ante savings estimation applies savings of 1,883 kWh per fixture in a school, whereas the TRM calculations result in savings of 1,988 kWh per fixture.

For the new interior LEDs, the ex ante savings estimation applies savings of 2.15 kWh per connected watt reduced (equaling savings of 857.1 kWh per fixture), whereas the TRM calculations result in savings per fixture of 1,409.5 kWh. The difference is mainly due to a large number of baseline fixtures that are unaccounted for in the ex ante savings estimation.

For the T8 high bay fixtures, savings of 2.15 kWh per connected watt reduced are applied in the ex ante savings estimation (equaling savings of 71.7 kWh per fixture), but the TRM calculations result in savings of 202.4 kWh per fixture. The high realization is due to the difference between TRM assumptions of baseline and as-built fixture wattages versus ex ante baseline and as-built fixture wattages.

For the reduced wattage 4 foot T8 lamps, the ex ante savings estimation applies savings of 12.6 kWh per lamp, but the TRM calculations result in savings of 26.7 kWh per lamp. The ex ante assumptions are unknown, so definitive conclusions cannot be made.

Name S-10

Executive Summary

Application S-10 received standard incentives from Illinois DCEO for installation of Demand Control Ventilation (DCV) on air handling units serving 31,000 ft^2 of space. The natural gas realization rate is 21%.

Project Description

The customer installed DCV sensors to control the minimum outside air being supplied to conditioned spaces by the two primary air handling units. Originally minimum outside air was being supplied to spaces regardless of occupancy; with the addition of DCV the volume of outside air being supplied to spaces is dependent upon the percent of CO_2 gas present in the space.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 3.0. Since a calculation methodology was not available in the Illinois TRM Version 2.0, ADM opted to use the provided calculation in the Illinois TRM Version 3.0.

For the DCV controls, TRM Section 4.4.19 Demand Control Ventilation was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = \frac{SqFt}{1000} * SF$$

Where:

SqFt =	Actual square footage of conditioned spaced controlled
SF =	Therms savings factor based on building type and weather zone

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \frac{SqFt}{1000} * SF$$

Where:

SqFt =	Actual square footage of conditioned spaced controlled
SF =	kWh savings factor based on building type and weather zone

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 DCV Controls

Measure					*Annual Gross kWh Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	RF	Default	2 (Chicago)	31,000	0	18,879
Total					0	18,879

Annual Therms Savings for DCV Controls

Measure					*Annual Gross Therm Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	RF	Default	2 (Chicago)	31,000	9,920	2,108
Total					9,920	2,108

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	DCV	-	18,879	N/A	-	188,790	-
Total		***-***	***18,879***		***-***	***188,790***	***-***

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	DCV	9,920	2,108	21%	21,080
Total		***9,920***	***2,108***	***21%***	***21,080***

The ex-ante project application failed to claim electrical savings for the installation of DCV. The reported savings by ADM are based upon the calculation methodology reported in the IL TRM Version 3.0.

ADM is unable to fully explain the savings documented in the project application. This is due to ex-ante calculations not being provided as part of the project documentation packet. The verified natural gas savings results in a realization rate of 21%.

Name S-11, C-3

Executive Summary

Application S-11, C-3 received standard and custom incentives from Illinois DCEO for installing natural gas furnaces, natural gas boilers, unitary AC units, and demand control ventilation in their facility. The natural gas realization rate is 71%, and the electric realization rate is 46%.

Project Description

The participant installed (3) 80 MBH Lochinvar boilers, (3) 78,000 Btu Carrier furnaces, (1) 7.5 Ton Carrier package A/C unit, (1) 3 Ton Carrier package A/C unit to replace, (17) 3 Ton Carrier split A/C units, and (3) 4 Ton Carrier package A/C units. The facility also installed demand control ventilation sensors and controls on HVAC units serving 20 rooms. The new controls are designed to regulate the amount of outside air being supplied, dependent upon the occupancy levels within the classroom. This results in energy savings by reducing the amount of unnecessary outdoor air at any given time while reducing load on the HVAC system.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational and documented equipment nameplate information.

Standard Incentives

NATURAL GAS ENERGY SAVINGS

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.10 High Efficiency Boiler.

$$\Delta Therm = \frac{EFLH * Capacity * \left(\frac{Eff_{efficient} - EFF_{base}}{Eff_{base}}\right)}{100{,}000}$$

Where:

EFLH	= Equivalent Full Load Hours for heating (see table)
Capacity	= Nominal Heating Capacity Boiler Size (btuh)
	= custom Boiler input capacity in Btu/hr
EFFefficient	= 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
EFFbase	= Efficient Boiler Efficiency Rating use actual value

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.11High Efficiency Furnace, which provided the following equation:

$$\Delta Therm = \frac{EFLH * Capacity * \left(\frac{AFUE_{efficient} - AFUE_{base}}{AFUE_{base}}\right)}{100{,}000}$$

Where:

EFLH = Equivalent Full Load Hours for heating

Capacity = Nominal Heating Capacity Furnace Size (btuh)

AFUE(base) = Existing Furnace Annual Fuel Utilization Efficiency Rating

AFUE(efficient) = Efficient Furnace Annual Fuel Utilization Efficiency Rating

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings resulting from the new furnaces using the Illinois TRM Version 3.0, Section 4.4.11 provided the following formula for electric energy savings:

$$\Delta kWh = Heating + Cooling + Shoulder\ Season$$

Where:

$Heating = 418\text{kWh}$

$Cooling = \text{Deemed Savings in TRM}$

$Shoulder\ \text{Season} = 51\text{kWh}$

ADM estimated energy savings resulting from the new unitary air conditioners using the Illinois TRM Version 2.0, Section 4.4.14 provided the following formula for electric energy savings:

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

$$\Delta kWH = (kBtu/h) * [(1/SEERbase) – (1/SEERee)] * EFLH$$

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

$$\Delta kWH = (kBtu/h) * [(1/EERbase) – (1/EERee)] * EFLH$$

Where:

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

SEERbase = Seasonal Energy Efficiency Ratio of the baseline equipment; see table

SEERee = Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).

EERbase = 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

EERee = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EERee 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

$$\Delta kW_{SSP} = (kBtu/h * (1/EERbase - 1/EERee)) * CF_{SSP}$$

Where:

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

= 91.3%

Custom Incentives

NATURAL GAS ENERGY SAVINGS

ADM estimated energy savings according to the Illinois TRM Version 3.0, Section 4.4.19 Demand Control Ventilation.

$$\Delta Therms = \frac{SqFt}{1000} * SF$$

Where:

SqFt = Actual square footage of conditioned spaced controlled

SF = Therms savings factor based on building type and weather zone

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings according to the Illinois TRM Version 3.0, Section 4.4.19 Demand Control Ventilation.

$$\Delta kWh = \frac{SqFt}{1000} * SF$$

Where:

SqFt = Actual square footage of conditioned spaced controlled

SF = kWh savings factor based on building type and weather zone

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	*Qty*	*Boiler btuh*	*Base Boiler type*	*Boiler Efficiency*	*Zone*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Boiler	TOS	3	800,000	Hot Water ≥300,000 & ≤2,500,000 Btu/h	92.5%	3 (Springfield)	Elementary	2,520	3,758	3,476
Total								2,520	3,758	3,476

Annual Therms Savings for High Efficiency Furnaces

Measure	*Measure Metrics*							*Annual Gross Therms Savings*		
	Program Type	*Qty*	*AC or No AC*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Eff. Furnace	TOS	3	Air Conditioning	92.1%	Elementary	3 (Springfield)	78,000	312	356	328
Total								312	356	328

Annual kWh Savings for High Efficiency Furnaces

Measure	*Measure Metrics*							*Annual Gross kWh Savings*		
	Program Type	*Qty*	*AC or No AC*	*Efficient Measure*	*Building Type*	*Zone*	*Furnace Capacity (BTUH)*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Eff. Furnace	TOS	3	Air Conditioning	92.1%	Elementary	3 (Springfield)	78,000	1,107	2,196	2,196
Total								1,107	2,196	2,196

Annual kWh Savings for High Efficiency Unitary AC

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Equipment type*	*Subcategory or rating Condition*	*Qty*	*New Cooling Capacity (kbtu/h)*	*SEER of Efficient Equipment*	*Zone*	*Electric Resistance Heat?*	*Ex Ante*	*TRM-Calculated Ex Post*
Single-Package and Split System Unitary Air Conditioners	TOS	Air conditioners, Air cooled	Single Package	1	89.0	13.2	3 (Springfield)	FALSE	372	675
Single-Package and Split System Unitary Air Conditioners	TOS	Air conditioners, Air cooled	Single Package	1	36.0	15	3 (Springfield)	FALSE	149	172
Single-Package and Split System Unitary Air Conditioners	TOS	Air conditioners, Air cooled	Split System	17	34.4	14.5	3 (Springfield)	FALSE	2,532	4,658
Single-Package and Split System Unitary Air Conditioners	TOS	Air conditioners, Air cooled	Split System	3	46.0	14.5	3 (Springfield)	FALSE	596	1,099
Total									3,649	6,604

Custom Incentives

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

Annual Therms Savings for DCV

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	TOS	Elementary	3 (Springfield)	18,000	3,966	1,008
Total					3,966	1,008

Annual kWh Savings for DCV

Measure	*Measure Metrics*				*Annual Gross kWh Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	TOS	Elementary	3 (Springfield)	18,000	41,114	12,096
Total					41,114	12,096

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 Eff. Boiler	2,520	3,476	138%	69,525
	High Eff. Furnace	312	328	105%	16,246
Subtotal		*2,832*	3,804	134%	85,771
Custom	DCV	3,966	1,008	25%	10,080
Subtotal		*3,966*	*1,008*	*25%*	*10,080*
Total		***6,798***	***4,812***	***71%***	***95,851***

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	High Eff. Furnace	1,107	2,196	198%	2.39	36,234	2.39
	High Eff. HVAC	3,649	6,604	181%	6.56	99,060	6.56
Subtotal		*4,756*	*8,800*	185%	8.96	135,294	8.96
Custom	DCV	41,114	12,096	29%	0.00	120,960	0.00
Subtotal		*41,114*	*12,096*	*29%*	*0.00*	*120,960*	*0.00*
Total		***45,870***	***20,896***	***46%***	***8.96***	***256,254***	***8.96***

The overall 71% gas and 46% electric realization rates can be attributed to an overestimation in the DCV savings in the ex-ante calculations. By reviewing the submitted calculations, it appears that the calculations failed to include heating and cooling system efficiencies. The reported ex-ante savings are actually the thermal energy saved not the electrical or gas energy savings.

Name S-12

Executive Summary

Application S-12 received standard incentives from Illinois DCEO for installation of high efficiency spray valves and electronically commutated motors (EC Motors, ECMs). The electric realization rate for this project is 126%, and the natural gas realization rate is 115%.

Project Description

The customer retrofitted the following:

Building A

- (2) 4’ 4LT12 lamps with (2) 4’ 2LT8 lamps
- Permanent removal of (4) T12 lamps
- (1) Incandescent Exit Sign with (1) LED Exit Sign
- (5) MH 1,150w Pole Lamps with (5) LED 169w Pole Lamps
- (6) MH 285w Pole Lamps with (6) LED 85w Pole Lamps
- (3) MH 201w Pole Lamps with (3) LED 85w Pole Lamps

Building B

- (4) MH 201w lamps with (4) LED 85w lamps
- (2) MH 285w Pole Lamp with (2) LED 85w Pole Lamp
- (5) MH 115w Lamps with (5) LED 43w Lamps
- (9) MV 285w Lamps with (9) LED 20w Lamps
- (4) high efficiency spray valves
- (6) EC motors – (2) in the walk-in freezer, (4) in the walk-in cooler

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.2, 4.5.3, 4.5.4, and 4.5.5 were used.

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 spray valves, TRM Section 4.2.11 High Efficiency Pre-Rinse Spray Valve was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta\text{Therms} = \Delta\text{Gallons x 8.33 x 1 x (Tout - Tin) x (1/EFF) /100,000 Btu}$$

Where:

ΔGallons	= amount of water saved as calculated belowCapacity = Nominal Heating Capacity Furnace Size (btuh)
	= (FLObase - FLOeff)gal/min x 60 min/hr x HOURSday x DAYSyear
FLObase	= Base case flow in gallons per minute, or custom
FLOeff	= Efficient case flow in gallons per minute or custom
HOURSday	= Hours per day that the pre-rinse spray valve is used at the site, custom, otherwise see table
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.
8.33 lbm/gal	= specific mass in pounds of one gallon of water
1 Btu/lbm°F	= Specific heat of water: 1 Btu/lbm/°F
Tout	= Water Heater Outlet Water Temperature
	= custom, otherwise assume Tin + 70° F temperature rise from Tin
Tin	= Inlet Water Temperature
	= custom, otherwise assume 54.1 degree F
EFF	= Efficiency of electric water heater supplying hot water to pre-rinse spray valve
	=custom, otherwise assume 97%

For the ECMs, TRM Section 4.6.4 Electronically Commutated Motors (ECM) for Walk-in and Reach-in Coolers / Freezers was used.

CALCULATION OF SAVINGS

Savings values are obtained from the SCE workpaper for efficient evaporator fan motors, which covers all 16 California climate zones. SCE savings values were determined using a set of assumed conditions for restaurants and grocery stores. We have used only PG&E climate zones in calculating our averages and have taken out the drier, warmer climates of southern California. SCE's savings approach calculates refrigeration demand, by taking into consideration temperature, compressor efficiency, and various loads involved for both walk-in and reach-in refrigerators. Details on cooling load calculations, including refrigeration conditions, can be found in the SCE workpaper. The baseline for this measure assumes that the refrigeration unit has a shaded-pole motor.

The tables are values calculated within the SCE workpaper and are presented in the TRM. Relevant table shown below:

	Restaurant			
SCE Workpaper Values	Cooler		Freezer	
Northern California Climate Zones	kWh Savings Per Motor	Peak kW Savings Per Motor	kWh Savings Per Motor	Peak kW Savings Per Motor
1	318	0.0286	507	0.03
2	253	0.033	263	0.037
3	364	0.0315	649	0.034
4	365	0.0313	652	0.034
5	350	0.0305	605	0.033
11	410	0.0351	780	0.04
12	399	0.034	748	0.039
13	407	0.0342	771	0.039
16	354	0.0315	620	0.034
Average	358	0.0322	622	0.036

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 Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
Building A						
RF - Fluorescent Delamping	33.7	0	4439	1.25	684	748
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	184	49	4439	1.25	352	1,498
RF - Commercial LED Exit Signs	40	2	8766	1.25	230	416
TOS/NC/RF - LED Bulbs and Fixtures	203	18.6	4903	1	214	1,808
TOS/NC/RF - LED Bulbs and Fixtures	1100	116.8	4903	1	21,484	24,103
TOS/NC/RF - LED Bulbs and Fixtures	361.4	116.8	4903	1	5,256	7,196
TOS/NC/RF - LED Bulbs and Fixtures	361.4	116.8	4903	1	1,524	3,598
Building B						
TOS/NC/RF - LED Bulbs and Fixtures	233	116.8	4439	1.25	2,268	2,579
TOS/NC/RF - LED Bulbs and Fixtures	115	52.5	4903	1	1,577	1,532
TOS/NC/RF - LED Bulbs and Fixtures	295	116.8	4903	1	1,752	1,747
TOS/NC/RF - LED Bulbs and Fixtures	78	18.6	4903	1	2,365	2,621
Total					37,706	47,847

Annual kWh Savings for EC Motors

Measure					*Annual Gross kWh Savings*	
	Measure Type	*Temp*	*Building Type*	*Number of Motors*	*Ex Ante*	*TRM-Calculated Ex Post*
ECMs	Walk-in	Cooler	Restaurant	4	1,604	1,432
ECMs	Walk-in	Freezer	Restaurant	2	802	1,244
Total					2,406	2,676

Annual Therms Savings for High Efficiency Spray Valves

Measure	*Program Type*	*Heating fuel*	*Application*	*Annual Gross Therms Savings*	
				Ex Ante	*TRM-Calculated Ex Post*
High Efficiency Pre-Rinse Spray Valve	RF	Gas	Large institutional establishments with cafeteria	472	541
Total				472	541

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	Fluorescent Delamping	684	748	109%	0.12	8,228
	T8 Fixture and Lamps	352	1,498	426%	0.23	8,629
	LED Bulbs and Fixtures	36,456	45,185	123%	0.00	439,255
	LED Exit Signs	214	416	195%	0.03	6,662
	ECMs	2,406	2,676	111%	0.20	40,140
Total		***40,112***	***50,523***	***126%***	***0.58***	***502,914***

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 Pre-Rinse Spray Valve	472	541	115%	2,705
Total		***472***	***541***	***115%***	***2,705***

The 126% verified electric realization rate is due to the ex ante using weighted savings values from the TRM. Whereas, the ex post used TRM savings values specific to the temperatures of the as-built walk-ins. The weighted values assume 80% walk-in cooler and 20% freezer ECMs. This project involved 33% freezer, which resulted in a higher realization rate because ECMs installed on freezers save more. For the T12 delamping measure the ex ante savings estimate used 171 kWh per lamp removed while the ex post utilized the TRM calculation of 187 kWh per lamp removed. The ex ante savings estimate for high performance and reduced wattage T8 fixtures and lamps assumed a savings of 176 kWh per fixture while the ex post TRM calculation utilized 749 kWh per fixture. For the Commercial LED exit signs the ex ante savings estimate allowed for 230 kWh of savings while the TRM savings is 416 kWh per exit sign. For the new LED fixtures and lamps measure the ex ante savings estimate ranged from 107 kWh to 4,297 kWh per fixture while the ex post savings analysis utilizing the TRM resulted in a savings range of 291 kWh to 4,821 kWh.

The 115% verified natural gas realization rate is due to the ex ante analysis using TRM example calculations and default days of use assumption. The ex post analysis used the actual day of use in the TRM calculations. The increase in days of use resulted in more realized savings.

Name S-13

Executive Summary

Application S-13 received standard incentives from Illinois DCEO for installation of VFDs on pumps and fans at their facility. The electric realization rate for this project is 75%.

Project Description

The customer installed the following VFDs:

- (4) 7.5 Hp HVAC Supply/Return Fans
- (4) 10 Hp HVAC Supply/Return Fans
- (2) 15 Hp HVAC Supply/Return Fans
- (2) 10 Hp HVAC Hot Water Pumps
- (1) 25 Hp HVAC Chilled Water Pump
- (2) 40 Hp HVAC Chilled Water Pumps

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verity the installed equipment, ADM field staff documented equipment nameplates.

Standard Incentives

Energy savings for the VFDs were calculated according to the Illinois TRM Version 2.0.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected = 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

$$\Delta kW = kWconnected * DSF$$

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 kWh Savings for VFDs on Pumps

Measure	*Application*	*Program Type*	*Type*	*HP*	*Building Type*	*Annual Gross kWh Savings*	
						Ex Ante	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	7.5 HP	School (K-12)	4,611	1,909
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	7.5 HP	School (K-12)	4,611	1,909
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	7.5 HP	School (K-12)	4,611	1,909
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	7.5 HP	School (K-12)	4,611	1,909
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	10 HP	School (K-12)	6,148	2,543
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	10 HP	School (K-12)	6,148	2,543
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	10 HP	School (K-12)	6,148	2,543
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	10 HP	School (K-12)	6,148	2,543
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	15 HP	School (K-12)	9,222	3,817
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	15 HP	School (K-12)	9,222	3,817
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	10 HP	School (K-12)	6,148	6,849
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	10 HP	School (K-12)	6,148	6,849
Variable Speed Drives for HVAC	Chilled Water Pump	RF	HVAC	25 HP	School (K-12)	15,370	15,268
Variable Speed Drives for HVAC	Chilled Water Pump	RF	HVAC	40 HP	School (K-12)	24,592	24,429
Variable Speed Drives	Chilled Water Pump	RF	HVAC	40 HP	School	24,592	24,429

Measure	Application	Program Type	Type	HP	Building Type	Annual Gross kWh Savings	
						Ex Ante	TRM-Calculated Ex Post
for HVAC					(K-12)		
Total						138,329	103,266

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	138,329	103,266	75%	28.92	1,548,995	28.92
Total		***138,329***	***103,266***	***75%***	***28.92***	***1548,995***	***28.92***

This 75% electric realization rate can be attributed to all of the VFDs being rebated as controlling chilled water pumps. This is an incorrect method as the VFDs where installed on air handler fans and hot water pumps. The greatest impact on savings comes from the air handler fan VFDs as they have an energy savings factor of 0.092 while the chilled water pumps have an energy savings factor of 0.432.

Name S-14

Executive Summary

Application S-14 received standard incentives from Illinois DCEO for installing high-efficiency boilers in their facility. The natural gas realization rate is 62%.

Project Description

The customer installed (3) new Fulton boilers, each with 2,000 MBH input and 92.5% efficiency to replace (4) Burnham cast iron, forced draft boilers.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational by documenting unit nameplates and interviewing facility staff.

Standard Incentives

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.10 High Efficiency Boiler.

NATURAL GAS ENERGY SAVINGS

ΔTherms = EFLH * Capacity * (EfficiencyRating(actual) - EfficiencyRating(base)) / EfficiencyRating(base)/100,000

Where:

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

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	*Qty*	*Boiler btuh*	*Base Boiler type*	*Boiler Efficiency*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Boiler	RF	3	2,000,000	Hot Water <300,000 Btu/h < June 1, 2013	92.5%	1 (Rockford)	14,580	9,831	9,094
Total							14,580	9,831	9,094

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 Boiler	14,580	9,094	62%	181,875
Total		***14,580***	***9,094***	***62%***	***181,875***

The ex ante savings estimate is calculated using a deemed savings of 2.43 therms per efficient boiler kBtuh for schools, but the assumptions applied to this savings value are unknown. The Illinois TRM Version 3.0 utilizes an EFLH value based on an Elementary School building type in the Rockford climate zone and applies an ex post savings of 1.52 therms per kBtuh, resulting in a realization rate of 62%.

Name S-15, C-4

Executive Summary

Application S-15, C-4 received Standard and Custom incentives from Illinois - DCEO for retrofitting lighting and received standard and custom incentives for installing unitary AC units, beverage machine controls, and demand control ventilation at three of their facilities. The electric realization rate for this project is 62%. The natural gas realization rate is 27%.

Project Description

The customer installed and retrofitted the following :

Building A

- (24) HID High Bay fixtures with (24) 4' 6LT8 fixtures in the Gym
- (6) HID High Bay fixtures with (6) 4' 4LT8 fixtures in the Gym
- Installation of fixture mounted Occupancy Sensors

Building B:

- (8) HID fixtures with (8) 4' 4LT8 fixtures in the Multipurpose Room
- Installation of fixture mounted Occupancy Sensors

Building C:

- (8) HID fixtures with (8) 4' 4lT8 fixtures in the Gym/Multipurpose Room
- Installation of fixture mounted Occupancy Sensors

The participant installed (4) beverage machine controllers, and (4) 5 Ton Carrier package A/C units at three separate schools. The customer also installed demand control ventilation (DCV) sensors and controls on HVAC units serving each of the three schools. The new controls are designed to regulate the amount of outside air being supplied, dependent upon the occupancy levels within the classroom. DCV results in energy savings by reducing the amount of unnecessary outdoor air that needs to be conditioned by the HVAC system.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.3 and 4.5.10 were used.

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

ADM estimated energy savings resulting from the beverage machine controls using the Illinois TRM Version 2.0, Section 4.6.2 provided the following formula for electric energy savings:

ELECTRIC ENERGY SAVINGS

ΔkWh = WATTSbase / 1000 * HOURS * ESF

Where:

WATTSbase	= connected W of the controlled equipment; see table below for default values by connected equipment type:
1000	= conversion factor (W/kW)
HOURS	= operating hours of the connected equipment; assumed that the equipment operates 24 hours per day, 365.25 days per year
	= 8766
ESF	= Energy Savings Factor; represents the percent reduction in annual kWh consumption of the equipment controlled

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings resulting from the new unitary air conditioners using the Illinois TRM Version 2.0, Section 4.4.14 provided the following formula for electric energy savings:

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

$$\Delta kWH = (kBtu/h) * [(1/SEERbase) – (1/SEERee)] * EFLH$$

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

$$\Delta kWH = (kBtu/h) * [(1/EERbase) – (1/EERee)] * EFLH$$

Where:

kBtu/h	= capacity of the cooling equipment actually installed in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).
SEERbase	= Seasonal Energy Efficiency Ratio of the baseline equipment; see table
SEERee	= Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).
EERbase	= 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
EERee	= Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EERee 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/EERbase - 1/EERee)) * CF_{SSP}

Where:

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

Custom Incentives

ADM estimated energy savings according to the Illinois TRM Version 3.0, Section 4.4.19 Demand Control Ventilation.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = \frac{SqFt}{1000} * SF$$

Where,

SqFt =	*Actual square footage of conditioned spaced controlled*
SF =	*Therms savings factor based on building type and weather zone*

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings according to the Illinois TRM Version 3.0, Section 4.4.19 Demand Control Ventilation.

$$\Delta kWh = \frac{SqFt}{1000} * SF$$

Where,

SqFt =	*Actual square footage of conditioned spaced controlled*
SF =	*kWh savings factor based on building type and weather zone*

Measure-level Gross Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
Building A RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	455	206	4311	1.23	28,761	31,688
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	295	146	4311	1.23	4,422	4,740
Building B RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	295	146	2422	1.21	3,259	3,493
Building C RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	295	146	2422	1.21	3,259	3,493
Total					39,701	43,415

Annual kWh Savings for Lighting Controls

Measure					*Annual Gross kWh Savings*	
	kW Controlled	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Building A RF - Occupancy Sensor Lighting Controls	6,492	4311	0.3	0.74	14,114	10,327
Building B RF - Occupancy Sensor Lighting Controls	1,232	2422	0.3	1.33	1,480	1.083
Building C RF - Occupancy Sensor Lighting Controls	1,232	2422	0.3	1.33	1,480	1.083
Total					17,074	12,494

Annual kWh Savings for Beverage Machine Controls

Measure	*Measure Metrics*			*Annual Gross kWh Savings*	
	Program Type	*Equipment type*	*Qty*	*Ex Ante*	*TRM-Calculated Ex Post*
Beverage and Snack Machine Controls	RF	Refrigerated Beverage Vending Machines	2	3,226	3,226
Beverage and Snack Machine Controls	RF	Refrigerated Beverage Vending Machines	1	1,613	1,613
Beverage and Snack Machine Controls	RF	Refrigerated Beverage Vending Machines	1	1,613	1,613
Total				6,452	6,452

Annual kWh Savings for High Efficiency HVAC Unit

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Equipment type*	*Subcategory or rating Condition*	*Qty*	*New Cooling Capacity (kbtu/h)*	*SEER of Efficient Equipment*	*Zone*	*Electric Resistance Heat?*	*Ex Ante*	*TRM-Calculated Ex Post*
Single-Package and Split System Unitary Air Conditioners	TOS	Air conditioners, Air cooled	Single Package	2	57.5	15.2	3 (Springfield)	FALSE	496	649
Single-Package and Split System Unitary Air Conditioners	TOS	Air conditioners, Air cooled	Single Package	2	57.5	15.2	3 (Springfield)	FALSE	496	649
Total									992	1,298

Custom Incentives

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

Annual Therms Savings for DCV

Measure	*Measure Metrics*				*Annual Gross Therm Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	TOS	High School	3 (Springfield)	24,955	5,000	1,348
Total					5,000	1,348

Annual kWh Savings for DCV

Measure	*Measure Metrics*				*Annual Gross kWh Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	TOS	High School	3 (Springfield)	24,955	20,956	16,470
DCV	TOS	Elementary	3	23,410	59,698	15,732

Measure	Measure Metrics				Annual Gross kWh Savings	
	Program Type	Building Type	Zone	Conditioned Space (Sq. Ft.)	Ex Ante	ADM Calculated Ex Post
			(Springfield)			
DCV	TOS	Elementary	3 (Springfield)	18,875	30,324	12,684
Total					110,978	44,886

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	T8 Fixtures and Lamps	39,701	43,415	109%	1.82	651,225
	Occupancy Controls	17,074	12,494	73%	0.53	99,948
	Beverage and Snack Machine Controls	6,452	6,452	100%	0.00	48,388
	High Eff. HVAC	992	1,298	131%	1.30	19,474
Subtotal		*64,219*	*63,659*	*99%*	*3.65*	*819,035*
Custom	DCV	110,978	44,886	40%	0.00	448,858
Subtotal		*110,978*	*44,886*	*40%*	*0.00*	*448,858*
Total		***175,197***	***108,545***	***62%***	***3.65***	***1,267,893***

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	DCV	5,000	1,348	27%	13,476
Total		***5,000***	***1,348***	***27%***	***13,476***

The overall electric realization rate is 62%. For the lighting retrofit (4.5.3), the realization rate is high because the ex ante savings estimate applied a savings of 2.15 kWh per connected watt reduced (ranging between 184.25 kWh to 1,198.38 kWh per fixture in savings), while the ex post savings used the TRM savings of 197.52 kWh to 1,320.33 kWh per fixture. The high realization is due to the difference between TRM assumptions of baseline and as-built fixture wattages versus ex ante baseline and as-built fixture wattages. For the occupancy sensor (4.5.10), the realization rate is low because the ex ante savings estimate was based on a prescriptive value of 1 per connected watt, while the ex post savings follows the TRM calculation for occupancy sensors.

The HVAC portion of the project which produced a 27% natural gas and 44% electric realization rates can be attributed to an overestimation in the DCV savings in the ex ante calculations. By reviewing the submitted calculations, it appears that the ex ante calculations did not include heating and cooling system efficiencies. The reported ex ante savings are actually the thermal energy saved and not the electrical or gas energy savings.

Name S-16

Executive Summary

Application S-16 received Standard incentives from Illinois-DCEO for retrofitting the lighting in their facility. The realization rate for this project is 611%.

Project Description

The customer retrofitted the following (71) HPS fixtures with (71) LED fixtures in the main campus lobby.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.4 was used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
TOS/NC/RF - LED Bulbs and Fixtures	144	18.6	3540	1.14	5,877	35,931
Total					5,877	35,931

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	4.5.4	5,877	35,931	611%	7.48	355,246
Total		***5,877***	***35,931***	***611%***	***7.48***	***355,246***

The project level realization rate 611%. The ex post savings analysis utilized the TRM savings calculations. The high realization is due to the baseline wattage default value is higher than the TRM nominal data table for baseline wattages.

Name S-17

Executive Summary

Application S-17 received standard incentives from Illinois DCEO for installing lighting and high-efficiency boilers and an air-cooled chiller at their facility. The natural gas realization rate is 135% and the electric realization rate is 104%.

Project Description

The customer replaced T8 fluorescent lighting with T5 fluorescent lighting, which reduced the connected load by 16,016 Watts. The customer also installed occupancy sensors to control fixtures accounting for a load of 16,072 Watts.

The customer installed (2) Aerco Benchmark 2.0 Low NOx boilers, each with 2,000 MBH input to replace (2) Kewanee steam, fire-tube boilers. The customer also added a chilled water system and installed a Trane CGAM, 80 ton, air-cooled chiller.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational by documenting unit nameplates and interviewing facility staff.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit, TRM Section 4.5.12 was used.

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

ADM estimated energy savings for the boilers according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.10 High Efficiency Boiler.

NATURAL GAS ENERGY SAVINGS

ΔTherms = EFLH * Capacity * (EfficiencyRating(actual) - EfficiencyRating(base))/EfficiencyRating(base) / 100,000

Where:

EFLH	= Equivalent Full Load Hours for heating (see table)
Capacity	= Nominal Heating 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)	= Efficent Boiler Efficiency Rating use actual value

ADM estimated energy savings for the new chiller according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.6 Electric Chiller.

ELECTRIC ENERGY SAVINGS

ΔkWH = TONS * ((12/IPLVbase) – (12/IPLVee))* EFLH

Where:

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

12	= conversion factor to express Integrated Part Load Value (IPLV) EER in terms of kW per ton
IPLVbase	= efficiency of baseline equipment expressed as Integrated Part Load Value EER. Dependent on chiller type.
IPLVee	= efficiency of high efficiency equipment expressed as Integrated Part Load Value EER
EFLH	= equivalent full load hours dependent on location

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 Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
T5 Fixtures and Lamps	128	56	2,422	1.21	36,715	36,715
T5 Fixtures and Lamps	64	56	2,422	1.21	10,222	10,222
Total					46,937	46,937

Annual kWh Savings for Lighting Controls

Measure					*Annual Gross kWh Savings*	
	kW Controlled	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
Occupancy Sensor Lighting Controls	16,072	2,422	0.41	1.33	19,311	19,311
Total					19,311	19,311

Annual Therms Savings for High Efficiency Boilers

Measure	Measure Metrics						Annual Gross Therms Savings		
	Program Type	Qty	Boiler btuh	Base Boiler Type	Boiler AFUE	Zone	Ex Ante	TRM-Calculated Ex Post	TRM-Calculated (Errata Corrected) Ex Post
High Efficiency Boiler	RF	2	2,000,000	Steam - all except natural draft >2,500,000 Btu/h	93.5%	2 (Chicago)	4,200	6,596	5,670
Total							4,200	6,596	5,670

Annual kWh Savings for the High Efficiency Chiller

Measure	Measure Metrics							Annual Gross Savings		
	Qty	Chiller Size (tons)	Chiller Type	Zone	Building Type	As-Built IPLV EER	Baseline IPLV EER	Ex Ante kWh	TRM-Calculated Ex Post kWh	TRM-Calculated (Errata Corrected) Ex Post
Electric Chiller	1	80	Air Cooled	2 (Chicago)	Elementary School	15.6	12	2,710	20,496	5,448
Total								2,710	20,496	5,448

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 Boiler	4,200	5,670	135%	113,400
Total		***4,200***	***5,670***	***135%***	***113,400***

The ex ante savings estimate for the boilers is calculated using a deemed savings of 2.43 therms per efficient boiler kBtuh for schools, but the assumptions applied to this savings value are unknown. The Illinois TRM Version 3.0 utilizes an EFLH value based on an Elementary School building type in the Chicago climate zone and applies an ex post savings of 1.42 therms per kBtuh, resulting in a realization rate of 135%.

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	T5 Fixtures and Lamps	46,937	46,937	100%	4.69	704,052
	Lighting Controls	19,311	19,311	100%	1.93	154,491
	Electric Chiller	2,710	5,448	201%	18.62	108,967
Total		***68,958***	***71,696***	***104%***	***25.24***	***967,510***

For the lighting retrofit and lighting controls, the realization rate is 100%.

The ex ante savings estimate for the chiller is calculated using a deemed savings of 127.4 kWh per efficient chiller ton for schools, but the assumptions applied to this savings value are unknown. The Illinois TRM Version 3.0 utilizes an EFLH value based on the building type in the Chicago climate, resulting in a realization rate of 53%.

The electric realization rate is 104%.

Name C-5

Executive Summary

Application C-5 received Custom incentives from Illinois - DCEO for retrofitting lighting in their facility. The realization rate for this project is 191%.

Project Description

The customer retrofitted the following (105) Halogen 250w lamps with (105) LED 19w lamps in the ballroom area.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment installation, baseline and post-retrofit connected load, and placed one photo-sensor logger at the site (from 07/30/2014 to 11/10/2014) to monitor lighting operation. These data were used to calculate energy savings.

Custom Incentives

For the lighting retrofit, ADM used a custom calculation to estimate savings.

ELECTRIC ENERGY SAVINGS

$$kWh_{savings} = \sum_{Area} \left[HCIF \times t \times \left(N_{base} \times W_{base} - N_{as-built} \times W_{as-built} \right) / 1000 \right]$$

Where:

$kWh_{savings}$	= Annual energy savings
N	= Number of fixtures
W	= Wattage of each fixture
t	= Lighting operating hours
HCIF	= HVAC interactive factor

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 Lighting Retrofit

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*Heating Cooling Interaction Factor*	*Annual Gross kWh Savings*	
					Ex Ante	*ADM Calculated Ex Post*
Halogen to LED	250	19	2,448	1.17	36,375	69,472
Total					36,375	69,472

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*	*Ex Post Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*
Custom	Lighting Retrofit	36,375	69,472	191%	16.81	981,243
Total		***36,375***	***69,472***	***191%***	***16.81***	***981,243***

The project-level realization rate is 191%. The realization rate is high because the ex post hours of operation verified during the M&V site visit (2,448) are greater than those used to perform ex ante savings estimate (1,500). In addition, the ex post savings analysis included an HCIF for a University in the Springfield region (1.17), while the ex ante savings estimate did not account for HVAC interactive effects.

Name C-6

Executive Summary

Application C-6 received custom incentives from Illinois DCEO for sealing HVAC air leaks. The electric realization rate for this project is 97%, and the natural gas realization rate is 103%.

Project Description

The customer sealed HVAC air leaks. The rooftop HVAC units had to be remounted and sealed. There were large leaks around the bases of the units.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the repairs had been made. To verify the energy savings for the repairs, ADM field staff documented equipment nameplates and spec sheets.

Custom Incentives

Energy savings were calculated using engineering equations and temperature bin analysis.

Local TMY3 weather data was used to generate 2 degree temperature bins. The bins range from -10°F to 100°F. The cooling electric energy savings were calculated using heat transfer saved, cooling operating hours, and cooling system efficiency. Operating hours were calculated using a utilization factor and the number of hours in each temperature bin. The utilization factor was determined using the ratio of total cooling runtime hours to total system runtime hours. See Electric Energy Savings calculations.

Gas heating energy savings were found using the same method. Gas heating energy savings were calculated using heat transfer saved, heating system operating hours, and heating system efficiency.

Energy savings were realized from the amount of conditioned air that was no longer being lost.

NATURAL GAS ENERGY SAVINGS

$$\Delta \text{Therms} = Q_{saved} * \text{Utilization Factor} * \text{Bin Hours} * / (\text{Heating Efficiency} * 100{,}000)$$

Where:

Q_{saved}	= Amount of heat transfer saved
	= 1.08 * cfm * (ΔT)
1.08	= a constant for sensible heat equations
cfm	= quantity of air flow being lost
ΔT	= Design Supply Air Temp (SAT) – Mixed Air Temp (MAT)
Utilization Factor	= Ratio of building operating hours per week to total hours in a week
Bin Hours	= Hours in each temperature bin
Heating Efficiency	= Efficiency of the heating equipment

100,000	= BTUs to Therms conversion

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = Q_{saved} / 12{,}000 * 12 / \text{Cooling EER} * \text{Utilization Factor} * \text{Bin Hours}$$

Where:

Q_{saved}	= Amount of heat transfer saved
	= 1.08 * cfm * (ΔT)
1.08	= a constant for sensible heat equations
cfm	= quantity of air flow being lost
ΔT	= Design Supply Air Temp (SAT) – Mixed Air Temp (MAT)
Utilization Factor	= Ratio of building operating hours per week to total hours in a week
Bin Hours	= Hours in each temperature bin
Cooling EER	= Cooling Energy Efficiency Ratio
12	= EER to kW/ton Conversion

SUMMER COINCIDENT PEAK DEMAND SAVINGS

Summer peak demand savings were calculated similar to the electric energy savings methodology. The differences being that the operating hours and utilization factor were removed, and an average peak mixed air temperature was determined. It is assumed that the system would have been operating for a full hour during the peak.

$$\Delta kW = Q_{saved} / 12{,}000 * 12 / \text{Cooling EER}$$

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for HVAC Air Leak Repairs

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
HVAC Air Leak Repairs	9,455	9,119
Total	9,455	9,119

Annual Therms Savings for HVAC Air Leak Repairs

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
HVAC Air Leak Repairs	818	845
Total	818	845

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	HVAC Air Leak Repairs	9,445	9,119	96%	8.7	27,357[14]
Total		***9,445***	***9,119***	***96%***	***8.7***	***27,357***

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 Air Leak Repairs	818	845	103%	2,532
Total		***818***	***845***	***103%***	***2,532***

The 96% verified electric realization rate is due to differences in weather data. The ex ante did not use TMY3 weather data. The TMY3 weather data did not have quite as high of temperatures.

The 103% verified natural gas realization rate is due to the use of TMY3 weather data. The TMY3 weather data had some lower temperatures.

[14] Lifetime savings were calculated using the remaining useful life of the measure. In this case, the expected useful life (EUL) of 15 years came from IL TRM. The remaining useful life was calculated by subtracting the age of the existing HVAC equipment from the EUL.

Name S-18, C-8

Executive Summary

Application S-18, C-8 received standard incentives from Illinois DCEO for retrofitting lighting in three of their buildings, and they received custom incentives for making chilled water system modifications, the addition of VFDs to hot water pumps, and the addition of thermostatic controls to a supply and exhaust fan in one building. The electric realization rate for this project is 29%.

Project Description

The customer installed or retrofitted the following:

Building 1:

- (88) 4’ 2LT12 fixtures with (88) 4’ 2LT8 fixtures
- (67) Incandescent lamps with (67) CFL lamps
- (13,402) T8 lamps with (13,402) high performance T8 lamps
- (6) 3’ 2LT12 fixtures with (6) 3’ 2LT8 fixtures
- (9) Incandescent Exit Signs with (9) LED Exit Signs
- Installation of Occupancy Sensors

Building 2:

- (9) Incandescent lamps with (9) CFL lamps
- (7) 4’ 2LT12 fixtures with (7) 4’ 2LT8 fixtures
- (1) 4’ 4LT12 fixture with (1) 4’ 4LT8 fixture
- (7,016) T8 lamps with (7,016) high performance T8 lamps
- (18) Incandescent Exit Signs with (18) LED Exit Signs
- Installation of Occupancy Sensors

Building 3:

- Installation of Occupancy Sensors

The customer received incentives for three projects based on an RCx study. Project one involved the replacement of two existing chillers with two new high efficiency air cooled chillers with free cooling capabilities, increasing the chilled water setpoint from 39^{o}F to 42^{o}F, and the conversion of approximately 200 tons of DX process load cooling to chilled water by the addition of a new chiller water loop. The second project involves the installation of four VFDs on how water pumps serving the building’s VAV reheat loop. The final projects involved the addition of thermostatic controls on a supply and exhaust fan serving a mechanical room which original operated 24/7. The addition of the controls will allow the fans to cycle on/off based on the cooling needs of the room.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verity the installed equipment, ADM field staff documented equipment nameplates.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.1, 4.5.3, 4.5.5, and 4.5.10 were used.

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

Custom Incentives

ELECTRIC ENERGY SAVINGS

Annual savings for the pair of chillers and economizer feature was calculated through the use of a temperature bin analysis informed by a prototypical eQuest Hospital model. In order to maximize the certainty of the analysis, the referenced prototypical eQuest model was configured to use two air cooled reciprocating chillers instead of the original three water cooled chiller configuration. The model was then run using TMY3 weather for the Chicago, IL area to determine the typical Part Load Ratios (PLRs) for the rebated chillers. The annual load profile were then determined by calculating the average PLRs for five degree temperature bins and multiplying by the total capacity of the chillers. The savings for the increase in chiller efficiency for each bin was calculated by using the following formula:

$$kWh_{Savings} = Tons \times (kW/ton_{base} - kW/ton_{ee}) \times Hrs$$

Where:

kWhsavings = Annual cooling energy savings

Tons = Cooling Capacity, Tons

kW/tonbase = Integrated Part Load Value of baseline chiller

kW/tonee = Integrated Part Load Value of the newly installed systems

Hrs = Annual hours of operation

The savings for the free cooling abilities of the new chillers was also calculated use a five degree temperature bin analysis informed by the same eQuest model. Baseline energy consumption was calculated for each bin using the derived load profile and the efficiency of the new chillers. The as-built consumption was calculated by assuming that the free cooling option would reduce the cooling load on the chillers starting at an ambient temperature of 43.4 ^{o}F based upon manufacture chiller curves, in which the remaining required mechanical cooling tonnage was multiplied by the efficiency of the as-built chillers. The annual energy savings is the difference baseline and as-built energy consumption.

Annual energy savings for the thermostatic controls on the mechanical room supply and exhaust fans was calculated through the use of the following equation in which fan hours were informed by the prototypical eQuest model:

$$kWh_{Savings} = \frac{Hp \times .746 \times LF \times (Hrs_{base} - Hrs_{as-built})}{Eff}$$

Where:

kWhsavings = Annual cooling energy savings

Hp = Rated horsepower of the fan motor

LF = Assumed load factor of the fan, 0.75

Hrs_{base} = Baseline hours of operation

$Hrs_{as\text{-}built}$ = As-Built hours of operation

Eff = Fan motor efficiency

Energy savings for the VFDs were calculated according to the Illinois TRM Version 2.0.

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected = 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.

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.

Measure-level Gross Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*Annual Gross kWh Savings* *TRM-Calculated Ex Post*
Building 1 RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	82	49	3540	1.14	11,251	11,719
Commercial Energy Star Standard CFL			3540	1.14	6,523	4,534
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	32	25	3540	1.14	259,635	339
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	59	49	3540	1.14	-	234,993
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	114	94	3540	1.14	-	35,190
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	88	49	3540	1.14	575	944
RF - Commercial LED Exit Signs	35	2	8766	1.14	1,889	2,968
Building 2 Commercial Energy Star Standard CFL			3540	1.14	876	609
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	82	49	3540	1.14	1,151	932
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	164	94	3540	1.14	-	282
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	32	25	3540	1.14	135,900	56
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	59	49	3540	1.14	-	119,777
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	88	72	3540	1.14	-	6,070
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	114	94	3540	1.14	-	16,062
RF - Commercial LED Exit Signs	35	2	8766	1.14	3,777	5,936
Total					421,578	440,412

Annual kWh Savings for Lighting Controls

Measure	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Annual Gross kWh Savings* *Ex Ante*	*Annual Gross kWh Savings* *TRM-Calculated Ex Post*
Building 3 RF - Occupancy Sensor Lighting Controls	7,976	3,500	0.41	1.5	13,197	13,197
Building 1 RF - Occupancy Sensor Lighting Controls	45,791	3,500	0.41	1.5	75,766	75,766
Building 2 RF - Occupancy Sensor Lighting Controls	10,338	3,500	0.41	1.5	17,105	17,105
Total					106,068	106,068

Custom Incentives

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

Annual kWh Savings for High Efficiency Chillers

Temperature			*Hours*	*Tonnage*		*Baseline kW*		*As-Built kW*		*kWh Savings*	
High	*Low*	*Average*		*Chiller 1*	*Chiller 2*	*Chiller 1*	*Chiller 2*	*Chiller 1*	*Chiller 2*	*Chiller 1*	*Chiller 2*
95	90	92.5	27	160.15	160.15	150.54	150.54	142.53	142.53	216	216
90	85	87.5	160	142.64	124.22	134.08	116.77	126.95	110.56	1,141	994
85	80	82.5	335	136.50	97.72	128.31	91.86	121.49	86.97	2,286	1,637
80	75	77.5	493	141.65	50.76	133.15	47.71	126.07	45.18	3,492	1,251
75	70	72.5	668	137.82	21.20	129.55	19.93	122.66	18.87	4,603	708
70	65	67.5	768	114.07	5.99	107.22	5.63	101.52	5.33	4,380	230
65	60	62.5	692	71.14	9.45	66.87	8.88	63.31	8.41	2,461	327
60	55	57.5	686	44.49	3.27	41.82	3.07	39.59	2.91	1,526	112
55	50	52.5	651	35.69	0.42	33.55	0.39	31.77	0.37	1,162	14
50	45	47.5	544	34.74	0.00	32.66	0.00	30.92	0.00	945	0
45	40	42.5	596	35.43	0.00	33.31	0.00	31.54	0.00	1,056	0
40	35	37.5	642	36.02	0.51	33.86	0.48	32.05	0.45	1,156	16
35	30	32.5	832	33.84	0.13	31.81	0.12	30.12	0.12	1,408	5
30	25	27.5	552	31.20	0.00	29.32	0.00	27.76	0.00	861	0
25	20	22.5	320	33.84	0.00	31.81	0.00	30.12	0.00	542	0
20	15	17.5	344	26.92	0.00	25.30	0.00	23.96	0.00	463	0
15	10	12.5	162	29.42	0.00	27.65	0.00	26.18	0.00	238	0
10	5	7.5	125	26.43	0.00	24.84	0.00	23.52	0.00	165	0
5	0	2.5	84	9.67	0.00	9.09	0.00	8.61	0.00	41	0
0	-5	-2.5	54	0.00	0.00	0.00	0.00	0.00	0.00	0	0
-5	-10	-7.5	25	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total kWh Savings										33,653	

Annual kWh Savings for Chiller Free Cooling

Temperature			*Hours*	*Baseline Tonnage*		*As-Built Tonnage*		*kWh Savings*	
High	*Low*	*Average*		*Chiller 1*	*Chiller 2*	*Chiller 1*	*Chiller 2*	*Chiller 1*	*Chiller 2*
95	90	92.5	27	160.15	160.15	160.15	160.15	0	0
90	85	87.5	160	142.64	124.22	142.64	124.22	0	0
85	80	82.5	335	136.50	97.72	136.50	97.72	0	0
80	75	77.5	493	141.65	50.76	141.65	50.76	0	0
75	70	72.5	668	137.82	21.20	137.82	21.20	0	0
70	65	67.5	768	114.07	5.99	114.07	5.99	0	0
65	60	62.5	692	71.14	9.45	71.14	9.45	0	0
60	55	57.5	686	44.49	3.27	44.49	3.27	0	0
55	50	52.5	651	35.69	0.42	35.69	0.42	0	0
50	45	47.5	544	34.74	0.00	34.74	0.00	0	0
45	40	42.5	596	35.43	0.00	17.29	0.00	9,623	0
40	35	37.5	642	36.02	0.51	0.00	0.00	20,579	289
35	30	32.5	832	33.84	0.13	0.00	0.00	25,061	96
30	25	27.5	552	31.20	0.00	0.00	0.00	15,325	0
25	20	22.5	320	33.84	0.00	0.00	0.00	9,639	0
20	15	17.5	344	26.92	0.00	0.00	0.00	8,241	0
15	10	12.5	162	29.42	0.00	0.00	0.00	4,241	0
10	5	7.5	125	26.43	0.00	0.00	0.00	2,940	0
5	0	2.5	84	9.67	0.00	0.00	0.00	723	0
0	-5	-2.5	54	0.00	0.00	0.00	0.00	0	0
-5	-10	-7.5	25	0.00	0.00	0.00	0.00	0	0
Total kWh Savings								96,757	

Annual kWh Savings for Thermostatic Controls

Measure						*Annual Gross kWh Savings*	
	Fan	*HP*	*Eff*	*Baseline Hours*	*As-Built Hours*	*Ex Ante*	*ADM Calculated Ex Post*
Thermostatic Controls	*S-13*	*50*	*93.0%*	*8,760*	*6,579*	*94,600*	*65,606*
Thermostatic Controls	E-12	25	91.7%	*8,760*	*6,579*	47,300	*33,268*
Total						141,900	*98,874*

Annual kWh Savings for VFDs

Measure						*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex-Ante*	*ADM Calculated Ex Post*
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	3 Hp	College/ University	61,225	3,912
Total						61,225	3,912

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	Compact Fluorescent Lamp	7,501	5,143	69%	1.47	26,322
	T8 Fixtures and Lamps	408,512	426,365	104%	88.75	6,286,797
	LED Exit Signs	5,666	8,904	157%	0.75	142,464
	Occupancy Controls	106,068	106,068	100%	22.08	848,543
Subtotal		*527,646*	*546,480*	*104%*	*113.04*	*7,304,126*
Custom	Chilled Water Modifications	1,953,400	130,410	7%	5.25	1,956,151
	HW Pump VFDs	61,225	3,912	6%	0.00	58,682
	Thermostatic Controls	141,900	98,874	70%	11.29	1,483,108
Subtotal		*2,156,525*	*233,196*	*11%*	*16.54*	*3,497,942*
Total		***2,684,171***	***779,676***	***29%***	***129.58***	***10,802,068***

For the standard incentive projects, the realization rate is 104%. The realization rate is slightly high because the ex ante savings estimate for the LED Exit Signs (210 kWh per fixture) was lower than the ex post savings analysis which utilized the TRM calculation (330 kWh per fixture). The measure for T8 lamps had the ex ante savings estimate (41 kWh – 128 kWh per lamp) slightly lower than the ex post TRM calculations (43 kWh – 157 kWh per lamp). For the CFL measure the ex ant savings estimate (73 kWh – 97 kWh per lamp) was higher than the TRM calculation (51 kWh – 68 kWh per lamp). The ex ante estimate for the Occupancy Sensors was highly accurate.

For the custom incentive project, the 11% electric realization rate can be attributed to the facility not completing all of the claimed measures during the time of ADM's M&V visit. One of largest contributors was part of the chilled water modification measure; in which 200 tons of process load were to be tied into the chilled water system and the original DX units decommissioned. During the M&V visit, ADM was informed that this measure had not been completed and had been postponed. Due to this, no savings were attributed to the chilled water re-piping and only savings for the efficiency increase with the new chillers was given. Also as part of the chilled water modification measure the chilled water set point was to be raised from 39^{o}F to 42^{o}F. During the M&V visit, ADM obtained the chilled water setpoint from the BMS system and discovered it was set at 29^{o}F and the second chiller was sequenced to come on when the chilled water temperature rose above 33^{o}F. Due to the chilled water temperature setpoint being lower than originally claimed the energy consumption would be technically higher; therefore, zero savings was attributed to this measure.

The 6% realization rate for the hot water pump VFDs is due to the ex-ante claiming the installation of four VFDs. However, during the site visit, ADM was informed the scope of the project had been changed to only a single VFD being installed on hot water pump P-30, which only has a 3 Hp motor.

The project level realization rate is 29%

Name C-9, C-10, C-11, & C-12

Executive Summary

Applications C-9, C-10, C-11, & C-12 received custom incentives from Illinois DCEO for renovations to their existing HVAC equipment and controls. The electric realization rate for this project is 620%, and the natural gas realization rate is 176%.

Project Description

The applicant made various renovations to their existing HVAC systems and controls under the (4) project reviewed in this report. The installed energy efficiency measures are as follows:

Project Number	***Description of Measures***
C-9	Replace existing boilers with new, high efficiency, units. New boilers are also installed with advanced controls to optimize combustion efficiency.
C-10	Existing unit heaters (used primarily in classrooms) throughout the facility were replaced with VRF system – now allowing for cooling where there previously was none. In addition, ERVs were added to condition the outside air for each VRF system.
C-11	The packaged rooftop unit (RTU-1) serving the library was replaced with a new, high efficiency, unit with DCV controls
C-12	DCV controls were retrofitted onto the existing air handler serving the north gym (AHU-1).

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment and controls were installed and operational. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM staff also reviewed the new building energy management system to identify control inputs, set-points, and operations.

Custom Incentives

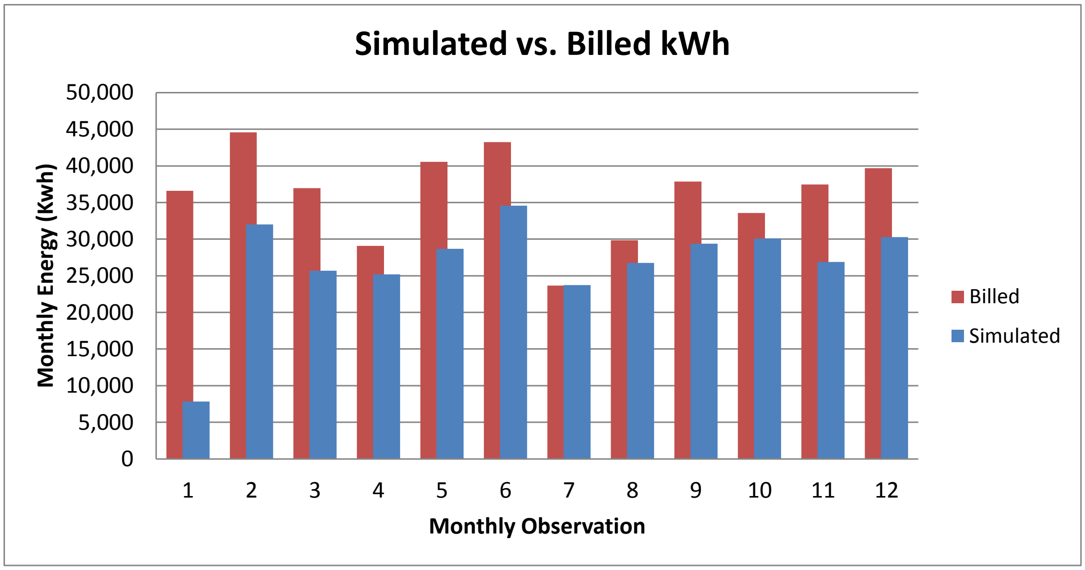
Energy savings were calculated using IPMVP Option D. ADM developed several building energy models of school – each representing the measures installed for a particular project (including one model which represented baseline conditions). In all, six models were developed:

Number	***Model Name***	***Model Description***
0	Calibrated Baseline	Represents baseline conditions. Simulated using real weather data from NOAA and calibrated to facility billing history (see graphs below)
1	Typical Baseline	Same as above, but simulated with TMY3 weather data to represent 'Typical' annual energy performance. Note that one

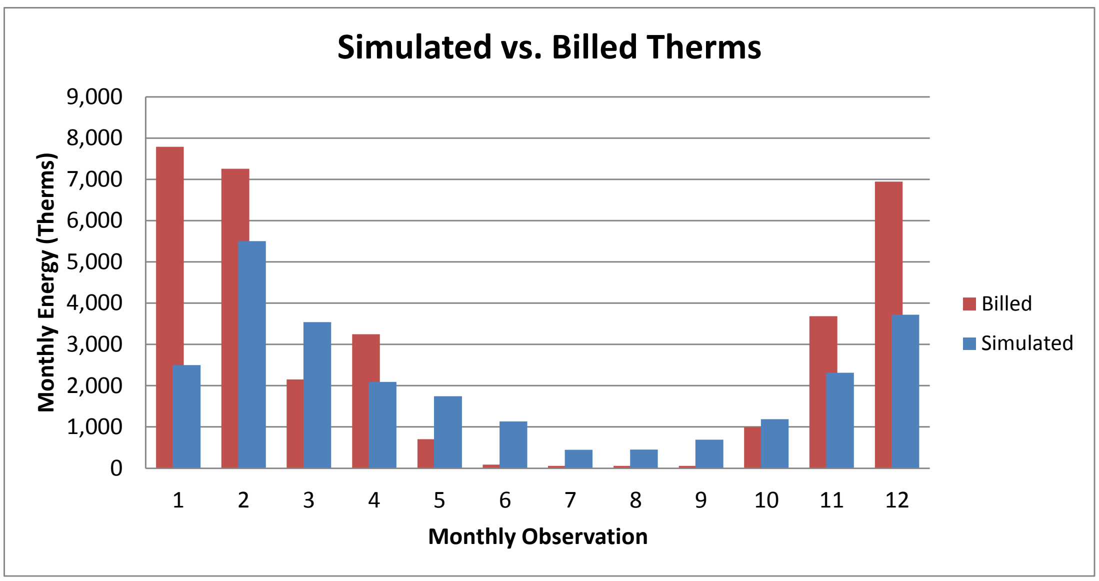
		key addition was made to this model. The unit heaters serving the classrooms and south auditorium were replaced with a Water Loop Heat Pump System. The reason for this is discussed later in this section.
2	C-12	Measures implemented in *Project C-12* (DCV controls on AHU-1) were added to the *Typical baseline*. The difference between the annual energy performance predicted by this model and the model above (Model #1) are the ex post impacts for this project.
3	C-11	Measures implemented in *Project C-11* (replacement of RTU-1) were added to Model # 2. The difference between the annual energy performance predicted by this model and the model above (Model #2) are the ex post impacts for this project.
4	C-10	Measures implemented in *C-10* (Addition of ERVs and VRF systems) were added to Model #3. The difference between the annual energy performance predicted by this model and the model above (Model #3) are the ex post impacts for this project.
5	C-12	Measures implemented in *C-12* (Replacement of boilers and boiler controls) were added to Model #4. The difference between the annual energy performance predicted by this model and the model above (Model #4) are the ex post impacts for this project.

To ensure that the modeled results are grounded in real-world facility energy performance, ADM calibrated the baseline model (Model #0 in the list above) to actual facility billing history. A custom weather file was created using historical weather data, downloaded from NOAA, for the Chicago Midway area. The results of this calibration effort can be seen below:

2014 Monthly kWh Calibration



2014 Monthly Therms Calibration



A special note should be made regarding the billed and simulated values for the month of January. The billing data available to ADM for the month of January happened to include a significant portion of energy use from the previous December – thus the simulated results for that month are not comparable to the corresponding billing data. This is the only month for which this is the case.

It is also noted in the table of models (at the beginning of this section) that the baseline unit heaters were replaced with Water Loop Heat Pumps to represent the *Typical Baseline* conditions for these projects. This is on account of the VRF system installed in Project C-10. With the addition of VRF these spaced now have the ability to provide cooling were there previously was none. While the addition of cooling does represent an increase in electrical loads, the facility installed cooling to improve the conditions for those spaces and chose to install an inherently efficient HVAC technology to do so. Thus, this particular portion of Project C-10 is considered new construction in nature and an appropriate baseline was determined via the IECC 2009 building energy code to which this project was permitted – a minimally compliant Water Loop Heat Pump system.

Energy impacts for each project were simulated using the models described above and used TMY3 weather data for the region to normalize savings for yearly variations in weather. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

Simulated Annual Electric Energy Consumption for each Model [kWh]

End Use	*Model 1 [kWh]*	*Model 2 [kWh]*	*Model 3 [kWh]*	*Model 4 [kWh]*	*Model 5 [kWh]*
Lighting	198,378.52	198,378.52	198,378.52	198,378.52	198,378.52
Task lighting	0.00	0.00	0.00	0.00	0.00
Miscellaneous equipment	86,307.58	86,307.58	86,307.58	86,307.58	86,307.58
Heating	96,767.14	97,296.14	97,280.39	123.81	123.81
Cooling	179,752.96	178,187.41	175,121.86	112,491.74	112,491.74
Heat rejection	2,964.58	2,964.74	2,964.59	0.00	0.00
Auxiliary (pumps)	134,505.84	134,539.58	134,502.87	49,532.03	49,532.03
Vent fan	96,091.72	96,119.24	96,082.80	226,521.38	226,521.38
Refrigeration systems	0.00	0.00	0.00	0.00	0.00
Supplemental heat pump	0.00	0.00	0.00	0.00	0.00
Domestic hot water	0.00	0.00	0.00	0.00	0.00
Exterior to the building	50.30	50.30	50.30	50.30	50.30
Total end-use energy	**794,818.66**	**793,843.54**	**790,688.98**	**673,405.32**	**673,405.32**

Simulated Annual Electric Energy Consumption for each Model [kW]

End Use	*Model 1 [kW]*	*Model 2 [kW]*	*Model 3 [kW]*	*Model 4 [kW]*	*Model 5 [kW]*
Lighting	21.06	21.06	21.06	21.06	21.06
Task lighting	0.00	0.00	0.00	0.00	0.00
Miscellaneous equipment	14.22	14.22	14.22	14.22	14.22
Heating	0.99	0.99	0.99	0.00	0.00
Cooling	88.50	86.20	84.07	47.45	47.45
Heat rejection	1.88	1.88	1.88	0.00	0.00
Auxiliary (pumps)	15.67	15.67	15.67	5.91	5.91
Vent fan	11.42	11.42	11.43	27.76	27.76
Refrigeration systems	0.00	0.00	0.00	0.00	0.00
Supplemental heat pump	0.00	0.00	0.00	0.00	0.00
Domestic hot water	0.00	0.00	0.00	0.00	0.00
Exterior to the building	0.00	0.00	0.00	0.00	0.00
Total end-use energy	**153.75**	**151.45**	**149.33**	**116.40**	**116.40**

Simulated Annual Gas Energy Consumption for each Model [Therms]

End Use	*Model 1 [Therms]*	*Model 2 [Therms]*	*Model 3 [Therms]*	*Model 4 [Therms]*	*Model 5 [Therms]*
Lighting	0.00	0.00	0.00	0.00	0.00
Task lighting	0.00	0.00	0.00	0.00	0.00
Miscellaneous equipment	4,456.65	4,456.65	4,456.65	4,456.65	4,456.65
Heating	30,764.37	20,708.41	17,610.88	6,330.43	4,627.76
Cooling	0.00	0.00	0.00	0.00	0.00
Heat rejection	0.00	0.00	0.00	0.00	0.00
Auxiliary (pumps)	0.00	0.00	0.00	0.00	0.00
Vent fan	0.00	0.00	0.00	0.00	0.00
Refrigeration systems	0.00	0.00	0.00	0.00	0.00

Supplemental heat pump	0.00	0.00	0.00	0.00	0.00
Domestic hot water	3,139.87	3,137.96	3,137.96	3,137.86	3,137.86
Exterior to the building	0.00	0.00	0.00	0.00	0.00
Total end-use energy	**38,360.89**	**28,303.02**	**25,205.49**	**13,924.94**	**12,222.27**

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 Project Renovations

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
C-9: Boiler System and Controls Upgrade	-	-
C-10: Install Energy Recovery Ventilators (Add VRF)	-	117,284
C-11: Replace LRC RTU and Controls	17,698	3,155
C-12: Install DCV on Auditorium AHU	1,878	975
Total	19,576	121,413

Annual Therms Savings for Project Renovations

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
C-9: Boiler System and Controls Upgrade	10,416	1,703
C-10: Install Energy Recovery Ventilators (Add VRF)	3,330	11,281
C-11: Replace LRC RTU and Controls	894	3,098
C-12: Install DCV on Auditorium AHU	235	10,058
Total	14,875	26,139

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[15]
Custom	C-9: Boiler System and Controls Upgrade	-	-	N/A	0.00	0
Custom	C-10: Install Energy Recovery Ventilators (Add VRF)	-	117,284	N/A	32.92	1,759,255
Custom	C-11: Replace LRC RTU and Controls	17,698	3,155	18%	2.13	47,318
Custom	C-12: Install DCV on Auditorium AHU	1,878	975	52%	2.30	12,189
Total		**19,576**	**121,413**	***620%***	***37.4***	***1,058,775***

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	C-9: Boiler System and Controls Upgrade	10,416	1,702.67	16%	34,053
Custom	C-10: Install Energy Recovery Ventilators (Add VRF)	3,330	11,280.55	339%	169,208
Custom	C-11: Replace LRC RTU and Controls	894	3,097.53	346%	46,463
Custom	C-12: Install DCV on Auditorium AHU	235	10,057.87	4,280%	125,723
Total		**14,875**	**26,139**	**176%**	**375,448**

The verified electric and gas impacts are higher than the ex ante estimates (620% and 176% realization rates for electric and gas respectively). One large reason for this is because rebate C-10, which included the addition of the VRF system, did not attempt to claim the energy savings resulting from the VRF systems. Additional variation between the ex-ante and ex post electric impacts (affecting all measures) is present due to differences in the methods used to calculate ex

[15] The lifetime savings were calculated by multiplying typical first year savings by the expected useful life found in California DEER Effective Useful Life worksheets: *DEER2014-EUL-table-update_2014-02-05.xlsx*

ante and ex post impacts. The ex ante impact were calculated using deemed savings estimates and an un-calibrated Trane Trace model. The ex post used calibrated eQuest simulation.

Name C-13

Executive Summary

Application C-13 received custom incentives from Illinois DCEO for retrofitting the existing HVAC system serving their facility. The electric realization rate for this project is 109%, and the natural gas realization rate is 97%.

Project Description

The customer retrofitted the existing HVAC system serving the A.C. Building. The existing system was constant volume and used pneumatic controls. The new system is variable air volume (VAV), with DDC controls.

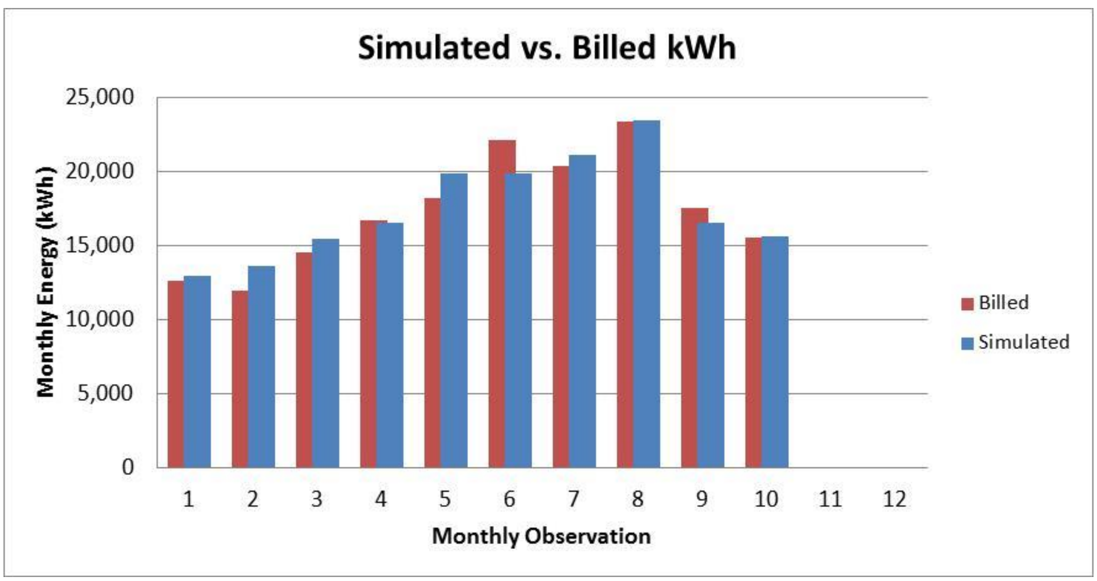
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified completion of the HVAC retrofit. To verify energy savings for the retrofit, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules.

Custom Incentives

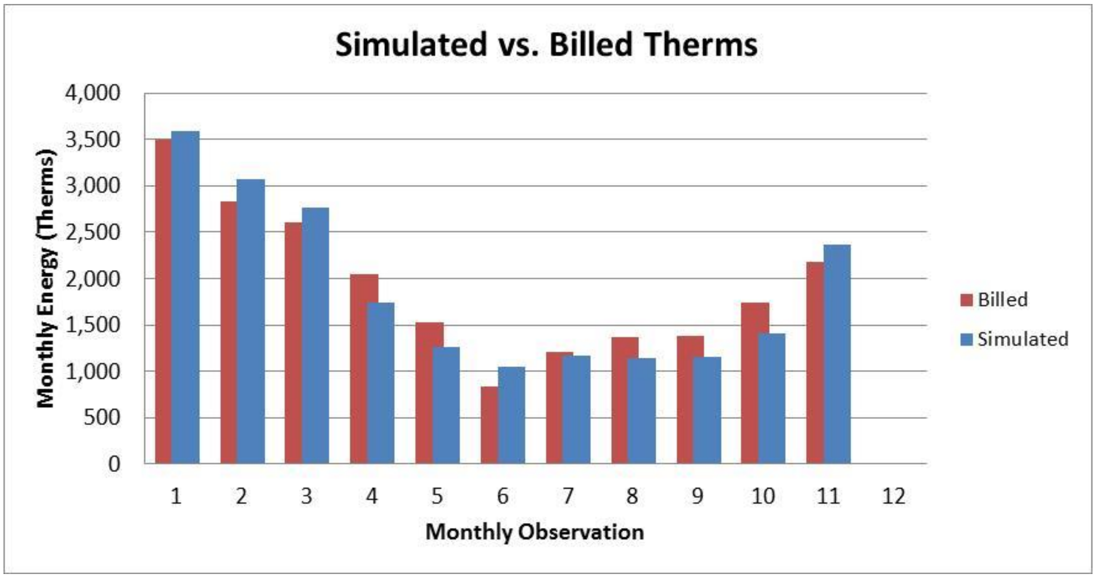
Energy savings were calculated using eQuest modeling of the campus. ADM compiled a model of the as-built facility. Upon completion of the initial model, a custom weather file was created using 2014 NOAA weather data for the Chicago Midway area. Using this weather file and billing data[16] for the facility, ADM was able to ensure that the model's energy load shape matched that of the bills. The result of this calibration effort can be seen below:

2014 Monthly kWh Calibration



[16] Billing data was normalized to building area because the meters serve multiple buildings.

2014 Monthly Therms Calibration



Upon completion of the calibration for the as-built eQuest model, a baseline model was created in which all the above-code measures were removed. Once the baseline model was completed, the baseline and as-built models were run using TMY3 weather data for the region. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	*65,999*	*65,999*	*0*	*0*	*0*	*0*
Miscellaneous Equipment	*23,329*	*23,329*	*0*	*0*	*0*	*0*
Heating	*0*	*0*	*0*	*29,121*	*8,446*	*20,674*
Cooling	*75,477*	*40,096*	*35,381*	*0*	*0*	*0*
Heat Rejection	*0*	*0*	*0*	*0*	*0*	*0*
Pumps	*22,361*	*14,227*	*8,135*	*0*	*0*	*0*
Fans	*235,195*	*93,425*	*141,771*	*0*	*0*	*0*
Domestic Hot Water	*0*	*0*	*0*	*1,229*	*1,229*	*0*
Total	**422,362**	**237,076**	**185,286**	**42,623**	**21,948**	**20,675**

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for Above Code Renovations

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
HVAC Retrofit	170,274	185,285
Total	170,274	185,285

Annual Therms Savings for Above Code Renovations

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
HVAC Retrofit	21,307	20,675
Total	21,307	20,675

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	HVAC Retrofit	170,274	185,285	109%	25.49	2,779,281[17]
Total		***170,274***	***185,285***	***109%***	***25.49***	***2,779,281***

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 Retrofit	21,307	20,675	97%	310,119
Total		***21,307***	***20,675***	***97%***	***310,119***

[17] 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 109% verified electric realization rate and 97% verified natural gas realization rate are due to differences in analysis approaches. The ex ante analysis used HVAC system information and engineering calculations. The ex post used calibrated eQuest simulation. The main difference in total realized savings is that the calibrated model accounts for interactive effects of the actual building.

Name S-19, S-20, C-14, & S-21

Executive Summary

Applications S-19, S-20, & S-21 received standard incentives from Illinois DCEO for installation of three high efficiency boilers, VFDs on pumps and AHUs, and a high efficiency tanked water heater. Under application C-14 the facility received a custom incentive to replace the HVAC control system with new DDC controls. The electric realization rate for the combination of projects is 131%, and the natural gas realization rate is 94%.

Project Description

The customer installed (3) new Lochnivar Knight KBN 801 high efficiency boilers. The installed boilers have an efficiency of 94% AFUE. VFDs were installed on 20 motors for the AHUs and hot water pumps. The water heater has been replaced with an A.O. Smith Cyclone Xi tanked water heater. The customer also replaced the aging control system with new DDC controls, including DCV, HW reset, zone temperature setbacks, and static pressure reset.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented equipment nameplates.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Versions 2.0 and 3.0 (errata corrected).

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)	= Efficent Boiler Efficiency Rating use actual value

For the AHU and hot water pump VFDs, Section 4.4.17 (Version 2.0) Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected = 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

$$\Delta kW = kWconnected \ * DSF$$

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

For the water heater, Section 4.3.1 (Version 2.0) Storage Water Heater was used.

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 equaling 251[18]</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.[19]
<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>
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<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>
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<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

Savings for the DDC controls were broken into separate calculations as the new controls had four main features which included; DCV, HW reset, zone temperature setbacks, and static pressure reset. The savings for the DCV and HW reset features of the DDC controls were calculated using the Illinois TRM Version 3.0.

Section 4.4.19 Demand Control Ventilation

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = \frac{SqFt}{1000} * SF$$

Where:

SqFt = Actual square footage of conditioned spaced controlled

SF =Therms savings factor based on building type and weather zone

ELECTRIC ENERGY SAVINGS

$$\Delta kWh = \frac{SqFt}{1000} * SF$$

18 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

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

Where:

SqFt	= Actual square footage of conditioned spaced controlled
SF	= kWh savings factor based on building type and weather zone

Section 4.4.4 Boiler Reset Controls.

NATURAL GAS ENERGY SAVINGS

$$\text{Therm Savings} = \text{Binput} * \text{SF} * \text{EFLH} /(100)$$

Where:

Binput	= Boiler Input Capacity (kBtu/hr)
	= custom
SF	= Savings factor
	= 8% or custom
EFLH	= Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use

Savings for the temperature setback control strategy was calculated by using a modified version of the Illinois TRM Version 3.0 Section 4.4.18 Programmable Thermostat. The TRM analysis methodology relies on; heating system capacity, equivalent full load hours, degree of setback and a savings factor. However, it is noted in the TRM that Section 4.4.18 is only applicable for single zone systems. To make the provided savings factor appropriate for the site, ADM used electric and natural gas billing data to create a regression to predict HVAC heating and cooling energy use based on local weather data. Since the savings factor form TRM Section 4.4.18 is reported in a percent savings per degree setback format, TMY3 weather for the area was used to determine annual HVAC kWh and Therm consumption. The following equations were then used to determine annual energy savings.

NATURAL GAS ENERGY SAVINGS

$$\Delta\text{Therms} = (\text{HVAC} * \text{DOS} * \text{SF})$$

Where:

HVAC	= Annual Therm consumption by HVAC system
DOS	= The degrees in Fahrenheit the temperature is setback from the space temperature setpoint (°F). Baseline manual setback should be determined and only the incremental setback due to the programmable thermostat be applied.
SF	= The percent savings per incremental ^{o}F setback, Section 4.4.18

ELECTRIC ENERGY SAVINGS

$$\Delta\text{kWh} = (\text{HVAC} * \text{DOS} * \text{SF})$$

Where:

HVAC	= Annual kWh consumption by HVAC system

DOS	= The degrees in Fahrenheit the temperature is setback from the space temperature setpoint (°F). Baseline manual setback should be determined and only the incremental setback due to the programmable thermostat be applied.
SF	= The percent savings per incremental ^{o}F setback, Section 4.4.18

Electrical savings for the static pressure reset control was determined using a temperature bin calculation methodology similar to what was used in the ex-ante analysis. The bin analysis is informed by TMY3 weather and corresponding fan hours determined through the use of a prototypical elementary school model. The static pressure reset control strategy assumes that the static pressure will be reset linearly when the outside air is between 82^{o}F and 50^{o}F. The effect that this has on the demand of the air handler's fan is calculated through the use of the fan affinity laws. The following equation was used to calculate individual fan kW demand for a given static pressure.

ELECTRIC ENERGY SAVINGS

$$kW = \left(\frac{SP_N}{SP_o}\right)^{1.25} \times kW_O$$

Where:

SP_N	= The new reset static pressure of the system
SP_O	= The original static pressure of the system
kW_O	= The original kW demand of the air handler's fan at the original static pressure

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

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	AHU 1 SF	RF	HVAC	10 HP	School(K-12)		7,602
Variable Speed Drives for HVAC	AHU 1 RF	RF	HVAC	5 HP	School(K-12)		3,807
Variable Speed Drives for HVAC	AHU 2 SF	RF	HVAC	10 HP	School(K-12)		7,602
Variable Speed Drives for HVAC	AHU 2 RF	RF	HVAC	5 HP	School(K-12)		3,807
Variable Speed Drives for HVAC	AHU 3 SF	RF	HVAC	10 HP	School(K-12)		7,602
Variable Speed Drives for HVAC	AHU 3 RF	RF	HVAC	5 HP	School(K-12)		3,807
Variable Speed Drives for HVAC	AHU 4 SF	RF	HVAC	10 HP	School(K-12)		7,602
Variable Speed Drives for HVAC	AHU 4 RF	RF	HVAC	5 HP	School(K-12)		3,807
Variable Speed Drives for HVAC	AHU 5 SF	RF	HVAC	7.5 HP	School(K-12)		5,704
Variable Speed Drives for HVAC	AHU 5 RF	RF	HVAC	3 HP	School(K-12)		2,269
Variable Speed Drives for HVAC	AHU 6 SF	RF	HVAC	5 HP	School(K-12)		3,807
Variable Speed Drives for HVAC	AHU 6 RF	RF	HVAC	3 HP	School(K-12)		2,269
Variable Speed Drives for HVAC	AHU 7 SF	RF	HVAC	10 HP	School(K-12)		7,602
Variable Speed Drives for HVAC	HWP P-EX (1)	RF	HVAC	20 HP	School(K-12)		13,698
Variable Speed Drives for HVAC	HWP P-EX (2)	RF	HVAC	20 HP	School(K-12)		13,698
Total						***79,001***	***94,683***

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	800,000	Elementary	AFUE 90%	927	933	840
High Efficiency Boiler	TOS	800,000	Elementary	AFUE 90%	927	933	840
High Efficiency Boiler	TOS	800,000	Elementary	AFUE 90%	927	933	840
Total					***2,781***	***2,800***	***2,520***

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,High Efficiency	120 gallons	Medical	124	251
Total					***124***	***251***

Custom Incentives

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

Annual Therms Savings for DDC

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
DDC Controls	10,835	10,174
Total	***10,835***	***10,174***

Annual kWh Savings for DDC

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
DDC Controls	24,731	41,388
Total	***24,731***	***41,388***

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	VFDs	79,001	94,683	120%	19.87	1,420,238
Subtotal		*79,001*	*94,683*	*120%*	*19.87*	*1,420,238*
Custom	DDC	24,731	41,388	167%	0.00	307,017
Subtotal		*24,731*	*41,388*	*167%*	*0.00*	*307,017*
Total		***103,732***	***136,071***	***131%***	***19.87***	***1,727,255***

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	2,781	2,520	91%	50,400
Standard	Storage Water Heater	124	251	202%	3,765
Subtotal		*2,905*	*2,771*	*95%*	*54,165*
Custom	DDC	10,835	10,174	94%	71,314
Subtotal		*10,835*	*10,174*	*94%*	*71,314*
Total		***13,740***	***12,945***	***94%***	***125,479***

The 131% verified electric realization rate is due to TRM Version 3.0 using hours and an energy savings factor associated with VSDs for hot water pumps, supply, and return fans. The prescriptive ex ante savings is 270 kWh per horsepower, and is likely based on averages of energy savings factors for pumps and fans. Another contributing factor is the ex-ante calculations incorrectly calculated the impact on fan kW that a reduction in static pressure would cause as they failed to utilize the Affinity Laws, resulting in an underestimation of energy savings.

The 94% verified natural gas realization rate is due to the ex-ante analysis for the temperature setback portion of the DDC controls failing to use a regression to determine annual HVAC energy usage. Instead they assumed that the HVAC used 12% of annual electric consumption and 20% of the heating natural gas consumption.

Name S-22, S-23, & C-15

Executive Summary

Application S-22 & S-23 received standard and incentives from Illinois DCEO for installing unitary AC units and VFDs on HVAC supply and return fans. The site also received custom incentives under project C-15 for the installation of demand control ventilation on the air conditioners serving the gym. The overall natural gas realization rate is 114%, and the electric realization rate is 118%.

Project Description

The participant installed (2) 10 Ton McQuay A/C units, (1) 7.5 Hp VFD on a supply fan, and (1) 3 Hp VFD on a return fan. The facility also installed demand control ventilation sensors and controls on HVAC units serving the gymnasium. The new controls are designed to regulate the amount of outside air being supplied, dependent upon the occupancy levels within the gymnasium. This results in energy savings by reducing the amount of unnecessary outdoor air at any given time while reducing load on the HVAC system.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational and documented equipment nameplate information.

Standard Incentives

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings resulting from the new unitary air conditioners using the Illinois TRM Version 2.0, Section 4.4.14 provided the following formula for electric energy savings:

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

$$\Delta kWH = (kBtu/h) * [(1/SEERbase) – (1/SEERee)] * EFLH$$

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

$$\Delta kWH = (kBtu/h) * [(1/EERbase) – (1/EERee)] * EFLH$$

Where:

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

SEERbase = Seasonal Energy Efficiency Ratio of the baseline equipment; see table

SEERee = Seasonal Energy Efficiency Ratio of the energy efficient equipment (actually installed).

EERbase = 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

EERee = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EERee 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

$$\Delta kW_{SSP} = (kBtu/h * (1/EERbase - 1/EERee)) * CF_{SSP}$$

Where:

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

= 91.3%

For the supply and return fan VFDs, Section 4.4.17 (Version 2.0) Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected = 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

$$\Delta kW = kWconnected \; * DSF$$

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

Custom Incentives

NATURAL GAS ENERGY SAVINGS

ADM estimated energy savings according to the Illinois TRM Version 3.0, Section 4.4.19 Demand Control Ventilation.

$$\Delta Therms = \frac{SqFt}{1000} * SF$$

Where:

SqFt = Actual square footage of conditioned spaced controlled

SF = Therms savings factor based on building type and weather zone

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings according to the Illinois TRM Version 3.0, Section 4.4.19 Demand Control Ventilation.

$$\Delta kWh = \frac{SqFt}{1000} * SF$$

Where:

SqFt = Actual square footage of conditioned spaced controlled

SF = kWh savings factor based on building type and weather zone

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 High Efficiency Unitary AC

Measure	*Measure Metrics*								*Annual Gross kWh Savings*	
	Program Type	*Equipment type*	*Subcategory or rating Condition*	*Qty*	*New Cooling Capacity (kbtu/h)*	*SEER of Efficient Equipment*	*Zone*	*Electric Resistance Heat?*	*Ex Ante*	*TRM-Calculated Ex Post*
Single-Package and Split System Unitary Air Conditioners	TOS	Air conditioners, Air cooled	Split System	2	120	12.8	2 (Chicago)	FALSE	993	977
Total									993	977

Annual kWh Savings for High Efficiency Unitary AC

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	AHU SF	TOS	HVAC	7.5 HP	School(K-12)	4,611	5,704
Variable Speed Drives for HVAC	AHU RF	TOS	HVAC	3 HP	School(K-12)	1,844	2,269
Total						6,455	7,973

Custom Incentives

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

Annual kWh Savings for DCV

Measure	*Measure Metrics*				*Annual Gross kWh Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	TOS	Elementary	2 (Chicago)	5,452	2,800	3,173
Total					2,800	3,173

Annual Therms Savings for DCV

Measure	*Measure Metrics*				*Annual Gross Therms Savings*	
	Program Type	*Building Type*	*Zone*	*Conditioned Space (Sq. Ft.)*	*Ex Ante*	*ADM Calculated Ex Post*
DCV	TOS	Elementary	2 (Chicago)	5,452	350	398
Total					350	398

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	VFDs	6,455	7,973	124%	2.35	119,602	2.35
	HVAC	993	977	98%	1.09	14,658	1.09
Subtotal		7,448	8,950	120%	3.44	134,260	3.44
Custom	DDC	2,800	3,173	113%	0.00	31,731	0.00
Subtotal		*2,800*	*3,173*	*113%*	*0.00*	*31,731*	*0.00*
Total		***10,248***	***12,123***	***118%***	***3.44***	***165,991***	***3.44***

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	350	398	114%	3,980
Total		***350***	***398***	***114%***	***3,980***

The overall 114% gas and 118% electric realization rates can be attributed the difference between the calculation methodologies used in the ex-ante and ex-post analysis. The ex-ante analysis relied on a straight deemed savings regardless of building type and weather zone, while ADM opted to use the methodology set forth by the Illinois TRM V3.0.

Name S-24

Executive Summary

Application S-24 received Standard incentives from Illinois-DCEO for retrofitting their exterior lighting. The realization rate for this project is 447%.

Project Description

The customer retrofitted (10) MH wall packs with (10) LED wall packs on the exterior

Methodology for Estimating Gross Savings.

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.4 was used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
TOS/NC/RF - LED Bulbs and Fixtures	130	18.6	4903	1	1,222	5,462
Total					1,222	5,462

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	4.5.4	1,222	5,462	447%	0.00	38,990
Total		***1,222***	***5,462***	***447%***	***0.00***	***38,990***

The project level realization rate is 447%. The realization rate is high because the ex ante savings estimate used 122 kWh per fixture while the ex post savings analysis utilized the TRM calculation of 546 kWh per fixture.

Name S-25

Executive Summary

Application S-25 received standard incentives from Illinois DCEO for retrofitting lighting and installation of VSDs on HVAC equipment in Building A, installation of VFDs on HVAC equipment in Building B, and installation of electric kitchen equipment in Building C. The applicant also received standard natural gas incentives from Illinois DCEO for installation of kitchen equipment in Building B. The electric realization rate for this project is 130% and the natural gas realization rate is 100%.

Project Description

The customer retrofitted and installed the following:

Building A:

- (315) 4' 2LT12 fixtures with (315) 4' 2LT8 fixtures
- (480) 4' 1LT12 fixtures with (480) 4' 1LT8 fixtures
- VSDs on (4) 5 HP hot water pumps
- VSDs on (1) 2 HP hot water pump

Building B:

- (1) Energy Star Oven
- (1) 25 Hp and (2) 40 Hp VFDs on HVAC fans

Building C:

- (1) ENERGY STAR Hot Food Holding Cabinet
- (1) ENERGY STAR Dishwasher

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operational. To verity the installed equipment, ADM field staff photographed equipment and nameplates and interviewed staff to determine equipment operation.

Building A:

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.3 was used.

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

Energy savings for the VFDs were calculated according to the Illinois TRM Version 2.0, Section 4.4.17.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected = 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

$$\Delta kW = kWconnected \ * DSF$$

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

Building B:

Standard Incentives

NATURAL GAS ENERGY SAVINGS

Energy savings for the convection oven were calculated according to the Illinois TRM Version 2.0, Section 4.2.5 ENERGY STAR Convection Oven, which provides a deemed savings of 306 Therms.

ELECTRIC ENERGY SAVINGS

Energy savings for the VFDs were calculated according to the Illinois TRM Version 2.0, Section 4.4.17.

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected = 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 = 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

Building C:

Standard Incentives

Energy savings for the hot food holding cabinet were calculated according to the Illinois TRM Version 2.0, Section 4.2.9.

ELECTRIC ENERGY SAVINGS

The TRM provides a deemed savings of 9,308 kWh per unit for full-size hot food holding cabinets, unless custom variables are known.

$$\Delta kWh \quad = HFHCBaselinekWh - HFHCENERGYSTARkWh$$

Where:

$$HFHCBaselinekWh = PowerBaseline * HOURSday * Days/1000$$

$$PowerBaseline \; = Custom, otherwise$$

$HOURSday \quad = Average\ daily\ operation$

$= custom\ or\ if\ unknown, use\ 15\ hours$

$Days \quad = Annual\ days\ of\ operation$

$= custom$

$HFHCENERGYSTARkWh = PowerENERGYSTAR * HOURSday * Days/1000$

$PowerENERGYSTAR = Custom$

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW \quad = \Delta kWh/AnnualHours$*CF

Where

$Hours \quad = Hoursday * Days$

$Hoursday$ = Average daily operation

$= custom, or\ if\ unknown\ use\ 15\ hours$

$Days \quad = Annual\ days\ of\ operation$

$= custom$

Energy savings for the dishwasher were calculated according to the Illinois TRM Version 2.0, Section 4.2.6.

ELECTRIC ENERGY SAVINGS

The TRM provides a deemed savings value of 34,153 kWh for high-temperature, multi-tank conveyor dishwashers.

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$\Delta kW \quad = \Delta kWh/AnnualHours$

Where

AnnualHours $= Hours * Days$

$= 365.25 * 18$

$= 6575\ annual\ hours$

Measure-level Gross Savings Results

Building A:

Standard Incentives

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

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	80	49	3540	1.14	70,957	39,408
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	40	25	3540	1.14		29,056
Total					70,957	68,464

Annual kWh Savings for VFDs

Measure	*Measure Metrics*					*Annual Gross Savings*	
	Application	*Program Type*	*Motor Eff.*	*HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Hot Water Pump	TOS	87.5%	5	College/ University	5,883	9,290
Variable Speed Drives for HVAC	Hot Water Pump	TOS	84.0%	5	College/ University	5,883	9,677
Variable Speed Drives for HVAC	Hot Water Pump	TOS	84.0%	5	College/ University	5,883	9,677
Variable Speed Drives for HVAC	Hot Water Pump	TOS	88.0%	5	College/ University	5,883	9,237
Variable Speed Drives for HVAC	Hot Water Pump	TOS	84.0%	2	College/ University	2,353	3,871
Total						25,885	41,752

Building B:

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual Therms Savings for Convection Oven

Measure	*Measure Metrics*		*Annual Gross Therms Savings*	
	Program Type	*Qty*	*Ex Ante*	*TRM-Calculated Ex Post*
ENERGY STAR Convection Oven	TOS	1	305	306
Total			305	306

Annual kWh Savings for VFDs

Measure	*Measure Metrics*					*Annual Gross Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex Ante kWh*	*TRM-Calculated Ex Post kWh*
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	25	College/ University	29,414	48,507
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	40	College/ University	47,063	61,936
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	40	College/ University	47,063	61,936
Total						123,540	172,379

Building C:

Savings for Hot Food Holding Cabinet

Measure	*Measure Metrics*				*Annual Gross Savings*	
	Program Type	*Cabinet Size*	*Qty*	*Annual Hours*	*Ex Ante kWh*	*TRM-Calculated Ex Post kWh*
ENERGY STAR Hot Food Holding Cabinet	TOS	Full size	1	3,913	9,314	3,913
Total					9,314	3,913

Annual kWh Savings for Dishwasher

Measure	*Measure Metrics*			*Annual Gross Savings*	
	Program Type	*Qty*	*Dishwasher Type*	*Ex Ante kWh*	*TRM-Calculated Ex Post kWh*
ENERGY STAR Dishwasher	TOS	1	High Temp Multi-Tank Conveyor	17,465	34,153
Total				17,465	34,153

Project-level Gross Savings Results

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

Verified Electric Savings/Realization Rates

Incentive Type	Location	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	Building A	T8 Fixtures and Lamps	70,957	68,464	96%	14.25	511,137
	Building A	Variable Speed Drives for HVAC	25,885	41,752	161%	0.00	626,280
Subtotal			96,842	110,216	114%	14.25	1,137,417
Standard	Building B	Variable Speed Drives for HVAC	123,540	172,379	140%	27.82	2,585,687
Subtotal			123,540	172,379	140%	27.82	2,585,687
Standard	Building C	ENERGY STAR Hot Food Holding Cabinet	9,314	3,913	42%	0.36	46,961
	Building C	ENERGY STAR Dishwasher	17,465	34,153	196%	5.19	683,060
Subtotal			26,779	38,066	142%	5.55	730,021
Total			***247,161***	***320,661***	***130%***	***47.62***	***4,453,125***

Verified Natural Gas Savings/Realization Rates

Incentive Type	Location	Measure Category	Annual Gross Savings			Lifetime Gross Savings
			Ex Ante Therms	Ex Post Therms	Realization Rate	Ex Post Therms
Standard	Building B	Oven	305	306	100%	3,672
Total			***305***	***306***	***100%***	***3,672***

The overall project electric realization rate is 130% and the gas realization rate is 100%.

For Building A the lighting retrofit, the realization rate is slightly low due to the ex ante estimate for reduced wattage T8 lamps applying a savings of 64.51 kWh per lamp, while the ex post utilized the TRM calculation for reduced wattage T8 lamps in a university, ranging from 60.53 kWh to 62.55 kWh per lamp. The ex-ante electric savings estimate for VFDs uses a deemed savings of 1,176.6 kWh per controlled HP based on a “University” facility type, but other assumptions are unknown. The Illinois TRM version 2.0 determines hours of operation based on

HVAC application and building type and determines energy savings factor based on VFD application, resulting in savings of 1,897.8 kWh per controlled HP.

Building B’s ex-ante electric savings estimate for VFDs uses a deemed savings of 1,176.6 kWh per controlled HP for a “University” facility type, but other assumptions are unknown. The Illinois TRM version 2.0 determines hours of operation based on HVAC application and building type and determines energy savings factor based on VFD application, resulting in an electric realization rate of 140%.

For Building C the ex-ante savings estimation for the hot food holding cabinet used a deemed savings of 9,314 kWh per unit for a full size cabinet. The Illinois TRM v2.0, however, requires custom variables when available to determine savings, which resulted in a savings of 3,913 kWh and a realization rate of 42%.

Name S-26

Executive Summary

Application S-26 received standard incentives from Illinois DCEO for installation of ground source heat pumps at a newly constructed facility. The electric realization rate for this project is 111%.

Project Description

The customer installed the following a total of 139 ground source heat pumps ranging from one ton to 30 tons. The ground source heat pumps were installed at a newly constructed facility and utilize a series of ground wells to maintain a high efficiency during periods of extreme weather temperatures.

During the site visit and documentation review, it was discovered that the site also applied for incentives for the installation of VFDs on two 10hp chilled water pumps; however neither savings nor incentives were allocated for this measure.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verity the installed equipment, ADM field staff documented equipment nameplates.

Standard Incentives

ADM estimated the ground source heat pump energy savings according to the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems.

ELECTRIC ENERGY SAVINGS

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool} + \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/SEERbase) – (1/SEERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{cool}) * [(1/HSPFbase) – (1/HSPFee)] * EFLH_{heat}$$

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool} + \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/EERbase) – (1/EERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{heat})/3.412 * [(1/COPbase) – (1/COPee)] *EFLH_{heat}$$

Where:

$kBtu/h_{cool}$ = capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h).

	= Actual installed
SEERbase	=Seasonal Energy Efficiency Ratio of the baseline equipment; see table below for values.
SEERee	= Seasonal Energy Efficiency Ratio of the energy efficient equipment.
	= Actual installed
$EFLH_{cool}$	= cooling mode equivalent full load hours
HSPFbase	= Heating Seasonal Performance Factor of the baseline equipment; see table above for values.
HSPFee	= Heating Seasonal Performance Factor of the energy efficient equipment.
	= Actual installed
$EFLH_{heat}$	= heating mode equivalent full load hours; see table above for default values.
EERbase	= Energy Efficiency Ratio of the baseline equipment; see the table above for values. Since IECC 2006 does not provide EER requirements for air-cooled heat pumps < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1.
EERee	= Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EERee is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1.
	= Actual installed
$kBtu/h_{heat}$	= capacity of the heating equipment in kBtu per hour.
	= Actual installed
3.412	= Btu per Wh.
COPbase	= coefficient of performance of the baseline equipment; see table above for values.
COPee	= coefficient of performance of the energy efficient equipment.
	= Actual installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = (kBtu/h_{cool}) * [(1/EERbase) - (1/EERee)] *CF$$

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)

Energy savings for the VFDs were calculated according to the Illinois TRM Version 2.0.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected	= 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.

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.

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 Ground Source Heat Pumps

Measure	Measure Metrics									Annual Gross kWh Savings		
	Program Type	Equipment Type	Electric Resistance heat?	Qty	Cooling Capacity (kBtu/H)	Heating Capacity (kBtu/H)	SEERee	HSPFee	Zone	Ex Ante	TRM-Calculated Ex Post	ADM Calculated Ex Post
GSHP	NC	Ground Source Heat Pump	FALSE	5	14.2	10.5	17.5	11.6	3 (Springfield)		1,146	
GSHP	NC	Ground Source Heat Pump	FALSE	10	16.6	13.3	16.6	10.6	3 (Springfield)		1,269	
GSHP	NC	Ground Source Heat Pump	FALSE	2	18.5	14.7	20.9	14.0	3 (Springfield)		1,341	
GSHP	NC	Ground Source Heat Pump	FALSE	8	21.7	15.0	23.1	13.6	3 (Springfield)		6,526	
GSHP	NC	Ground Source Heat Pump	FALSE	1	27.2	19.5	20.5	14.3	3 (Springfield)		944	
GSHP	NC	Ground Source Heat Pump	FALSE	12	29.4	20.0	24.1	13.6	3 (Springfield)		13,817	
GSHP	NC	Ground Source Heat Pump	FALSE	20	35.5	29.1	18.0	12.5	3 (Springfield)		16,191	
GSHP	NC	Ground Source Heat Pump	FALSE	1	35.0	24.1	24.2	15.0	3 (Springfield)		1,525	
GSHP	NC	Ground Source Heat Pump	FALSE	1	40.2	27.0	22.1	14.3	3 (Springfield)		1,502	
GSHP	NC	Ground Source Heat Pump	FALSE	1	42.0	27.5	23.5	14.3	3 (Springfield)		1,669	
GSHP	NC	Ground Source Heat Pump	FALSE	14	49.8	36.2	18.8	12.1	3 (Springfield)		15,483	
GSHP	NC	Ground Source Heat Pump	FALSE	2	50.0	37.4	19.8	14.0	3 (Springfield)		3,262	
GSHP	NC	Ground Source Heat Pump	FALSE	3	49.3	35.3	21.7	13.6	3 (Springfield)		5,206	
GSHP	NC	Ground Source Heat Pump	FALSE	30	57.4	46.1	17.7	11.4	3 (Springfield)		28,107	
GSHP	NC	Ground Source Heat Pump	FALSE	4	66.8	43.2	21.5	13.3	3 (Springfield)		9,210	
GSHP	NC	Ground Source Heat Pump	FALSE	2	67.6	45.8	19.8	13.3	3 (Springfield)		4,153	
GSHP	NC	Ground Source Heat Pump	FALSE	1	83.0	55.0	21.7	12.6	3 (Springfield)		2,729	
GSHP	NC	Ground Source Heat Pump	FALSE	7	76.0	51.3	19.5	11.9	3 (Springfield)		13,088	
GSHP	NC	Ground Source Heat Pump	FALSE	1	109.1	82.1	17.9	13.2	3 (Springfield)		2,802	
GSHP	NC	Ground Source	FALSE	3	122.0	83.0	19.8	12.3	3		9,881	

Measure	Measure Metrics									Annual Gross kWh Savings		
	Program Type	Equipment Type	Electric Resistance heat?	Qty	Cooling Capacity (kBtu/H)	Heating Capacity (kBtu/H)	SEERee	HSPFee	Zone	Ex Ante	TRM-Calculated Ex Post	ADM Calculated Ex Post
		Heat Pump							(Springfield)			
GSHP	NC	Ground Source Heat Pump	FALSE	3	171.0	97.0	23.1	12.6	3 (Springfield)			31,491
GSHP	NC	Ground Source Heat Pump	FALSE	1	185.0	109.0	20.4	11.6	3 (Springfield)			9,620
GSHP	NC	Ground Source Heat Pump	FALSE	3	246.0	184.0	19.1	13.0	3 (Springfield)			43,287
GSHP	NC	Ground Source Heat Pump	FALSE	1	274.3	190.0	20.4	14.3	3 (Springfield)			17,698
GSHP	NC	Ground Source Heat Pump	FALSE	2	291.0	224.0	20.9	14.3	3 (Springfield)			40,296
GSHP	NC	Ground Source Heat Pump	FALSE	1	430.6	315.9	17.5	12.6	3 (Springfield)			22,070
Total										275,326	139,850	164,460

It should be noted that the last six line items shown in the above Ground Source Heat Pump savings table are being reported under the "ADM Calculated" field. This is due to the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems, only providing baseline efficiencies for ground source heat pumps with capacities under 135,000 Btus/hr. Due to this limitation ADM, relied on the efficiencies set forth by the federal appliance standards[20] for all units above 135,000 Btus/hr.

[20] http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/77

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	GSHPs	275,326	304,310	111%	179.64	4,564,652
Total		***275,326***	***304,310***	***111%***	***179.64***	***4,564,652***

The electric realization rate of 111% can be attributed can be attributed to the ex-ante analysis aggregating the total tons of the ground source heat pump units in the savings estimation. The ex post analysis calculated the savings for each unit based on size. Units under 135,000 Btus/hr were calculated with the TRM Version 2.0, Section 4.4.9 Heat Pump Systems and units over were calculated with EERE appliance standards.

Name S-27

Executive Summary

Application S-27 received standard incentives from Illinois DCEO for installation of a high efficiency boiler and VFDs on pumps. The electric realization rate for this project is 111%, and the natural gas realization rate is 77%.

Project Description

The customer installed (2) new high efficiency boilers, but only one is used at a time. The installed boilers have an efficiency of 96% AFUE. VFDs were also installed on a 5 HP, a 7.5 HP, and (3) 3 HP hot water pumps.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented equipment nameplates.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Versions 2.0 and 3.0 (errata corrected).

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)	= Efficent Boiler Efficiency Rating use actual value

For the pump VFDs, Section 4.4.17 (Version 2.0) Variable Speed Drives for HVAC was used.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected	= 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

$$\Delta kW = kWconnected \ * DSF$$

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 kWh Savings for VFDs on Pumps

Measure	*Application*	*Program Type*	*Type*	*HP*	*Building Type*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated* *Ex Post*
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	7.5 HP	School(K-12)	4,611	5,139
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	5 HP	School(K-12)	3,074	3,430
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	3 HP	School(K-12)	1,844	2,044
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	3 HP	School(K-12)	1,844	2,044
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	3 HP	School(K-12)	1,844	2,044
Total						13,218	14,702

Annual Therms Savings for High Efficiency Boilers

Measure	*Program Type*	*Boiler btuh*	*Base Boiler Type*	*Efficient Measure*	*Zone*	*Building Type*	*Annual Gross Therms Savings* *Ex Ante*	*TRM-Calculated* *Ex Post*	*TRM-Calculated (Errata Corrected)* *Ex Post*
High Efficiency Boiler	RF	2,000,000	Hot Water ≥300,000 & ≤2,500,000 Btu/h	AFUE ≥ 96%	1 (Rockford)	Elementary	4,200	3,500	3,228
Total							4,200	3,500	3,228

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*	*Lifetime Gross Savings* *Ex Post kWh*
Standard	Variable Speed Drives for HVAC	13,218	14,702	111%	0.00	220,527
Total		***13,218***	14,702	111%	0.00	220,527

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	4,200	3,228	77%	64,560
Total		***4,200***	***3,228***	***77%***	***64,560***

The 111% verified electric realization rate is due to the ex post using the actual building type. The building type affects the hours of the equipment. The ex ante likely used an average for the hours.

The 77% verified natural gas realization rate is due to savings being claimed for two boilers when only one is used at a time. The other factor affecting realized savings is that the ex post used TRM Version 3.0, which has EFLH associated with an elementary school. The ex ante likely used an average for the EFLH.

Name C-16

Executive Summary

Application C-16 upgraded its HVAC operating procedures, including turning off reheat during summer months. No new hardware is installed; this is a change in operating procedures. The natural gas realization rate is 126%.

Project Description

The applicant implemented a change in the control strategy and set-points of their central plant hot water loops which significantly reduced re-heat during summer months (beginning June 1st and ending mid-September). The heating system for the airport is a centralized superheated water system with 8 “boilers”. The low temperature water loop that feeds the reheat coils, radiant panels, etc. is heated by heat exchangers between the high temperature water loop and the low temperature loop. The high temperature water loop supply temperature set-point is 400F during cold months, and is now reduced down to around 250F during summer months. Space thermostat set points are at 75F in the summer and 72F in the winter. The low temperature loops that feed the reheat coils have their temperatures read at the pumps. They were turned down from 160F to 70F for this project (during summer months).

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the Hot water loop set-point changes were implemented. To verify the energy savings for the measures, ADM field staff documented boiler equipment, loop temperatures, and site maps. Furthermore, ADM staff reviewed the set-points in the building energy management system to verify operations. The Ex Post annual energy impact estimates for this project are estimated using IPMVP Option C (Whole Facility Billing Analysis). Billing histories were requested for all gas meters listed under the facilities utility account. These billing data were transformed into observation so *Therms Per Day* for each billing period and then regressed against Heating Degree Days (HDD) and Cooling Degree Days (CDD). The final regression equation took the following form.[21] The X in the equation below indicates a cross product of the terms.

$$Therms_{Per\ Day} = Meter_{Dummy} \times HDD \times PrePost \times CDD$$

Where:

$Meter_{Dummy}$ = Is a dummy variable used to represent each meter for which billing data was regressed.

HDD = The heating degree days for each billing period. Note that the regression found that a base of 60 degrees resulted in the optimum fit.

[21] Note that equation shown is the general form of the final regression equation, The only difference is that several terms were removed from the final cross-product due to a lack of significance and/or appropriateness in physical first principles.

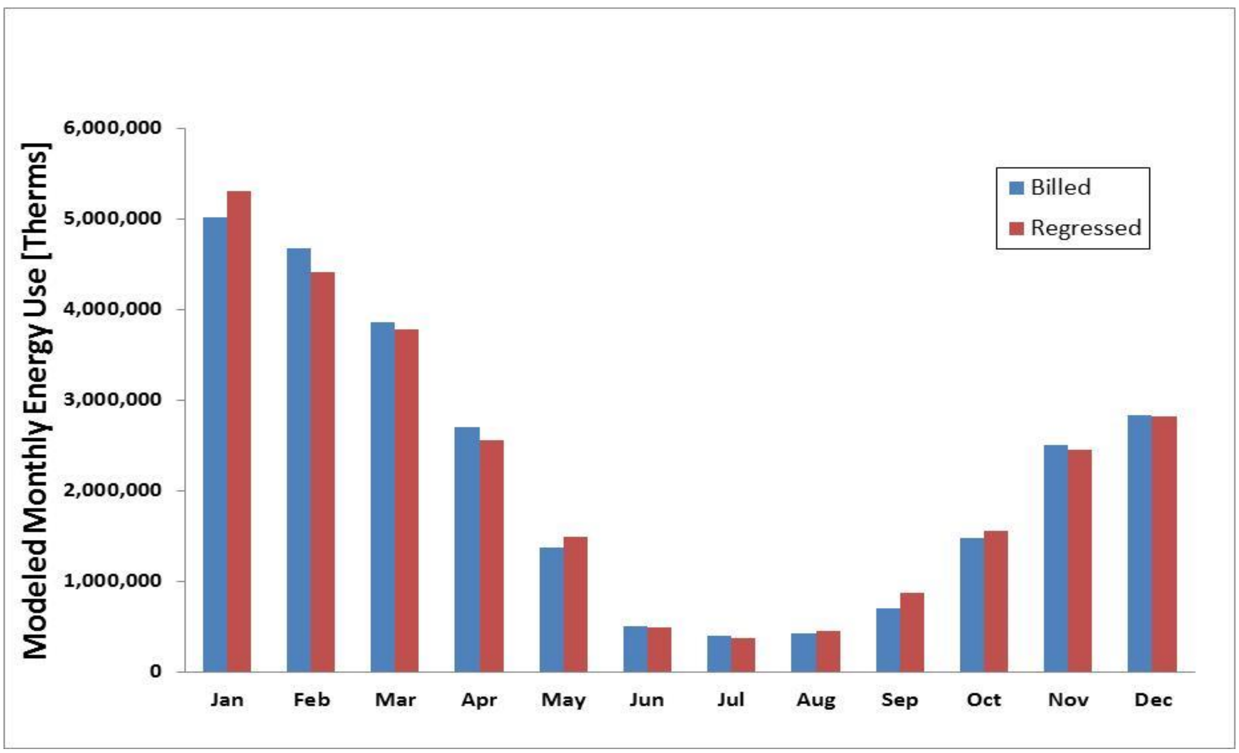
CDD = The cooling degree days for each billing period. Note that the regression found that a base of 65 degrees resulted in the optimum fit.

PrePost = A dummy variable used to represent differences in energy usage between the baseline and post periods.

The following graphic illustrates the monthly regressed total gas usage for the facility against the actual billing history for one year in the baseline period (2012). Regressions were generated using the R statistical analysis software and final regression coefficients are provided in the following table Note that the measure(s) implemented only reduce the hot water loop temperature during the summer months. As such, the only components of the regression model for which savings can be attributed to this measure are coefficients in which the *PrePost* variable interacts with the *CDD* variable.

Heating and cooling degree days were calculated using recorded weather data[22] for the same period as the billing histories. These weather data were used to derive the regression coefficients listed in the table below. Once the regression coefficients were derived, HDD and CDD values were re-calculated using TMY3 weather data for the facility and the regression coefficients were applied to the “typical” weather data in order to derive weather normalized impact estimates.

Comparison of Bills and Regressed Usage



[22] Downloaded from the National Oceanic and Atmospheric Administration’s (NOAA’s) FTP site.

List of Regression Coefficients and their Values

Coefficient Term	*Estimate*	*Std. Error*	*t value*	*Pr(>|t|)*
(Intercept)	1.52E+04	3.71E+02	41.009	< 2e-16
Account.Number A	-1.52E+04	5.25E+02	-28.995	< 2e-16
Account.Number B	-1.51E+04	4.93E+02	-30.579	< 2e-16
Account.Number C	-1.52E+04	5.25E+02	-29.005	< 2e-16
Account.Number D	-1.52E+04	5.10E+02	-29.792	< 2e-16
Account.Number E	-1.52E+04	5.25E+02	-28.985	< 2e-16
Account.Number F	-1.52E+04	5.25E+02	-28.994	< 2e-16
Account.Number G	-1.52E+04	5.25E+02	-28.974	< 2e-16
Account.Number H	-1.43E+04	5.25E+02	-27.255	< 2e-16
Account.Number I	-1.51E+04	4.94E+02	-30.614	< 2e-16
HDD60	3.45E+01	5.07E-01	68.063	< 2e-16
PrePost	-1.70E+03	3.80E+02	-4.46	1.26E-05
Account.Number A:HDD60	-3.43E+01	7.17E-01	-47.824	< 2e-16
Account.Number B:HDD60	-3.45E+01	7.08E-01	-48.718	< 2e-16
Account.Number C:HDD60	-3.43E+01	7.17E-01	-47.833	< 2e-16
Account.Number D:HDD60	-3.45E+01	7.56E-01	-45.631	< 2e-16
Account.Number E:HDD60	-3.42E+01	7.17E-01	-47.769	< 2e-16
Account.Number F:HDD60	-3.42E+01	7.17E-01	-47.758	< 2e-16
Account.Number G:HDD60	-3.44E+01	7.17E-01	-47.989	< 2e-16
Account.Number H:HDD60	-3.10E+01	7.17E-01	-43.251	< 2e-16
Account.Number I:HDD60	-3.39E+01	7.10E-01	-47.762	< 2e-16
Account.Number A:PrePost	1.71E+03	5.38E+02	3.174	0.001699
Account.Number B:PrePost	1.66E+03	5.38E+02	3.083	0.002285
Account.Number C:PrePost	1.68E+03	5.38E+02	3.123	0.002009
Account.Number D:PrePost	1.68E+03	6.27E+02	2.683	0.007808
Account.Number E:PrePost	1.69E+03	5.38E+02	3.143	0.001883
Account.Number F:PrePost	1.74E+03	5.38E+02	3.228	0.001421
Account.Number G:PrePost	1.70E+03	5.38E+02	3.168	0.001735
Account.Number H:PrePost	1.54E+03	5.38E+02	2.861	0.004594
Account.Number I:PrePost	1.61E+03	5.38E+02	3	0.002982
Account.Number J:CDD65	-2.04E+01	1.67E+00	-12.179	< 2e-16

Coefficient Term	*Estimate*	*Std. Error*	*t value*	*Pr(>|t|)*
Account.Number A:CDD65	-6.34E-03	1.67E+00	-0.004	0.996981
Account.Number B:CDD65	-3.86E-01	1.58E+00	-0.245	0.806798
Account.Number C:CDD65	1.26E-02	1.67E+00	0.008	0.99399
Account.Number D:CDD65	-5.49E-02	1.63E+00	-0.034	0.973096
Account.Number E:CDD65	-1.80E-02	1.67E+00	-0.011	0.991438
Account.Number F:CDD65	1.77E-02	1.67E+00	0.011	0.991556
Account.Number G:CDD65	1.65E-04	1.67E+00	0	0.999922
Account.Number H:CDD65	-2.74E+00	1.67E+00	-1.634	0.103631
Account.Number I:CDD65	-3.03E-01	1.58E+00	-0.192	0.847866
PrePost:CDD65	-1.13E+01	3.19E+00	-3.539	0.000482
Account.Number A:PrePost:CDD65	1.12E+01	4.52E+00	2.487	0.01355
Account.Number B:PrePost:CDD65	1.12E+01	4.53E+00	2.467	0.014336
Account.Number C:PrePost:CDD65	1.14E+01	4.52E+00	2.522	0.012306
Account.Number D:PrePost:CDD65	1.13E+01	6.39E+00	1.773	0.077446
Account.Number E:PrePost:CDD65	1.13E+01	4.52E+00	2.505	0.012899
Account.Number F:PrePost:CDD65	1.11E+01	4.52E+00	2.452	0.014931
Account.Number G:PrePost:CDD65	1.12E+01	4.52E+00	2.487	0.013576
Account.Number H:PrePost:CDD65	1.02E+01	4.52E+00	2.262	0.024622
Account.Number I:PrePost:CDD65	1.16E+01	4.53E+00	2.554	0.011277

Measure-level Gross Savings Results

Custom Incentives

The table below presents the verified gross savings for measures that received Custom incentives.

Annual Therms Savings for Project Renovations

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
Hot Water Loop Set-Point Set-Back	233,175	294,512
Total	233,175	294,512

Project-level Gross Savings Results

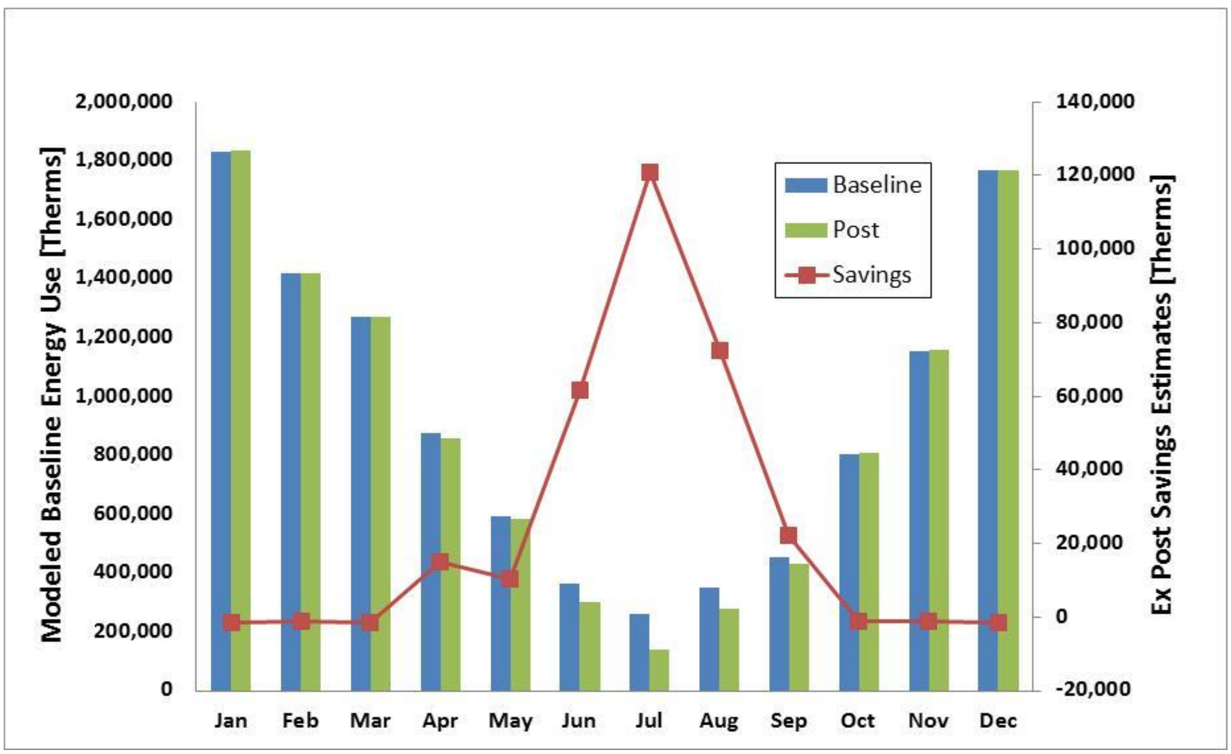
The tables shown below present the verified gross savings for this project.

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	Hot Water Loop Set-Point Set-Back	233,175	294,512	126%	4,417,680
Total		***233,175***	***294,512***	***126%***	***4,417,680***

The verified gas impacts are higher than the ex-ante estimates (126% realization rate). This can be attributed to differences between the approaches used to derive each estimate. The Ex Ante estimates were based on engineering assumptions and formulas (IPMVP Option A) while the Ex Post estimates are based on a billing history regression analysis (IPMVP Option C). Results from the billing analysis (comparing “typical” baseline and post periods) are below:

Summary of Ex-Post Savings Estimates



Name S-28, C-17

Executive Summary

Application S-28, C-17 received standard and custom incentives from DCEO for installation of a Storage Water Heater and cutting down ventilation rate during unoccupied periods via DDC. The natural gas realization rate is 70%.

Project Description

The customer installed (4) new high efficiency storage water heaters. DDC reduced ventilation rate on multiple air handlers during unoccupied hours, effectively reduce overall 9,255 CFM of heating load.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented equipment nameplates.

Standard Incentives

For the Storage Water Heater incentives, Illinois TRM Version 2.0, Section 4.3.1 Storage Water Heater was used. The facility installed water heaters that have thermal efficiency of 92%. Per TRM's definition, the thermal efficiency is greater than 88% and the installed equipment are high efficiency storage water heater. The high efficiency units have deemed annual natural gas savings of 251 Therms/year/unit.

Custom Incentives

Energy savings were calculated using engineering equation and outdoor temperature during unoccupied hours.

$$Sensible\ Heat\ Savings\ (Btuh) = 1.08\ \times \left(T_{setpoint} - T_{outdoor}\right) \times \left(CFM_{base} - CFM_{as\_built}\right)$$

Where:

1.08	= Conversion Factor, 1.08 min/hour x Btu/ft^3 °F
$T_{setpoint}$	= Heating system temperature setpoint, 70 °F
$T_{outdoor}$	= Outside air temperature based on TMY3 weather data (°F)
CFM_{base}	= Baseline ventilation airflow rate, 17,309 CFM
CFM_{as_built}	= As built ventilation airflow rate, 8,054 CFM

The HVAC system keeps neutral pressure inside, the system bring equal amount of outside air as the amount of air ventilated out. The total gas savings is calculated as follows,

$$Gas\ Savings\ (Therms) = \frac{\sum_{hour=1}^{8760} Sensible\ Heat\ Savings}{Heating\ System\ Efficiency\ \times 100{,}000}$$

Where:

Heating System Efficiency= Heating System Efficiency, 83%

100,000 = Conversion Factor, 100,000 Btuh/therm

Measure-level Gross Savings Results

Standard Incentives

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

Annual Gas Savings for Storage Water Heaters

Measure	*Measure Metrics*					*Annual Gross Therms Savings*	
	Program Type	*Measure Type*	*Qty.*	*Tank Size*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	Gas,High Efficiency	4	80 gallons	Education – Primary/Secondary	224	1,004
Total						224	1,004

Custom Incentives

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

Annual Gas Savings for Ventilation Reduction

Temperature Range	*Hours*	*CFM_{base}*	*CFM_{as_built}*	*Annual Gross Therms Savings*	
				Ex Ante	*Ex Post*
-20 to -16	2	17,309	8,054	21	21
-15 to -11	15	17,309	8,054	110	149
-10 to -6	16	17,309	8,054	254	151
-5 to -1	14	17,309	8,054	466	122
0 to 4	47	17,309	8,054	729	387
5 to 9	52	17,309	8,054	872	392
10 to 14	98	17,309	8,054	1,145	693
15 to 19	131	17,309	8,054	1,474	821
20 to 24	109	17,309	8,054	2,133	629
25 to 29	212	17,309	8,054	3,003	1,101
30 to 34	224	17,309	8,054	3,839	1,023
35 to 39	355	17,309	8,054	2,639	1,398
40 to 44	346	17,309	8,054	1,581	1,161
45 to 49	406	17,309	8,054	1,066	1,149
50 to 54	488	17,309	8,054	0	1,047
55 to 59	326	17,309	8,054	0	521
60 to 64	332	17,309	8,054	0	298
65 to 70	410	17,309	8,054	0	89
>70	797	17,309	8,054	0	0
TOTAL	**4,380**			**19,332**	**11,152**

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	224	1,004	448%	15,060
Custom	Ventilation Reduction	17,131	11,153	65%	167,296
Total		***17,335***	***12,157***	***70%***	***182,356***

The project has 70% realization rate is due to different approached used for storage water heater and different temperature profile used for ventilation reduction. The storage water heater measure falls under TRM methodology and a deemed Therms savings is given regardless of the size or efficiency of the installed unit. Ventilation reduction during unoccupied hours is calculated using TMY3 weather data for Midway airport. The main difference between the ex-ante and ex post calculations is the number of hours per temperature bin. ADM cannot verify the source of temperature bin used in ex ante savings estimation. A comparison of the ex-ante and ex-post hours can be seen in the following table:

Unoccupied Hours at Different Temperature Bin

Temperature Bin	-18	-13	-8	-3	2	7	12	17	22	27	32	37	42	47	52	57	62	65	>70	TOTAL
Ex Post (TMY3)	2	15	16	14	47	52	98	131	109	212	224	355	346	406	488	326	332	410	797	4,380
Ex Ante	2	11	27	53	89	115	164	231	369	580	839	664	469	385	0	0	0	0	0	3,998

Name S-28, C-17

Executive Summary

Application S-28, C-17 consisted of five sites. Building A received standard and custom incentives from DCEO for installation of a Storage Water Heater and cutting down ventilation rate during unoccupied periods via DDC. Building B received custom-measure incentives from Illinois DCEO for installing new fire tube boilers in the powerhouse building. Building C received custom incentives from DCEO for installation of high efficiency burners for their boilers. Building D received custom incentives from DCEO for installation of carbon monoxide and nitrogen oxide sensors in a parking garage to control supply and exhausts to reduce the heating demand on the make-up air handling unit. Building E received custom incentives from DCEO for making HVAC controls improvements. The natural gas project realization rate is 85%.

Project Description

Building A:

The customer installed (4) new high efficiency storage water heaters. DDC reduced ventilation rate on multiple air handlers during unoccupied hours, effectively reduce overall 9,255 CFM of heating load.

Building B:

The customer installed (3) Cleaver Brooks CBEX 200-1400-200ST fire tube boilers to take on the full load of the steam heating plant, while the existing aged water tube boilers remain in-place for back-up.

Building C:

The customer retrofitted three boilers, each with a maximum capacity of 36,500 MBTUH. The intent of this energy retrofit is to replace the burners with high efficiency low turndown modulating burners with new digital combustion management controls and variable speed drive control of the burner motor. This measure will maintain O_2 levels between 3.0 and 5.0. The boilers were furnished with new high efficiency Weishaupt burner package on each of the three boilers, with low turndown, variable speed drive and a new control package. Natural gas savings is the result of a reduction in ventilation airflow and related heating requirements.

Building D:

This project will involve the installation of carbon monoxide and nitrogen oxide sensors in a below ground parking garage to control exhaust and make-up air handlers. The intent of the controls is to reduce the amount of outside air being brought into the parking garage which will result in a reduction of heating energy use. The make-up air handler is deigned to heating incoming outside air to a temperature of 55^{o}F. Originally the fans operated 24/7 at a constant full speed.

Building E:

The customer made HVAC controls improvements to the existing building automation system (BAS). The HVAC controls improvements include: allowing VAV box flow to be reduced, supply air, static pressure, and water loop temperature resets, and schedule changes.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented equipment nameplates, took screenshots of the control system, and obtained flue gas combustion test documentation from commissioning of the new hardware.

Building A:

Standard Incentives

For the Storage Water Heater incentives, Illinois TRM Version 2.0, Section 4.3.1 Storage Water Heater was used. The facility installed water heaters that have thermal efficiency of 92%. Per TRM's definition, the thermal efficiency is greater than 88% and the installed equipment are high efficiency storage water heater. The high efficiency units have deemed annual natural gas savings of 251 Therms/year/unit.

Custom Incentives

Energy savings were calculated using engineering equation and outdoor temperature during unoccupied hours.

$$Sensible\ Heat\ Savings\ (Btuh) = 1.08\ \times \left(T_{setpoint} - T_{outdoor}\right) \times \left(CFM_{base} - CFM_{as\_built}\right)$$

Where:

1.08 = Conversion Factor, 1.08 min/hour x Btu/ft^3 °F

$T_{setpoint}$ = Heating system temperature setpoint, 70 °F

$T_{outdoor}$ = Outside air temperature based on TMY3 weather data (°F)

CFM_{base} = Baseline ventilation airflow rate, 17,309 CFM

CFM_{as_built} = As built ventilation airflow rate, 8,054 CFM

The HVAC system keeps neutral pressure inside, the system bring equal amount of outside air as the amount of air ventilated out. The total gas savings is calculated as follows,

$$Gas\ Savings\ (Therms) = \frac{\sum_{hour=1}^{8760} Sensible\ Heat\ Savings}{Heating\ System\ Efficiency\ \times 100{,}000}$$

Where:

Heating System Efficiency= Heating System Efficiency, 83%

100,000 = Conversion Factor, 100,000 Btuh/therm

Building B:

Custom Incentives

The logs were used to determine boiler loading bins which were used in the calculation of the as-built boiler plant efficiency. Baseline boiler plant efficiency calculations were provided by the contractor.

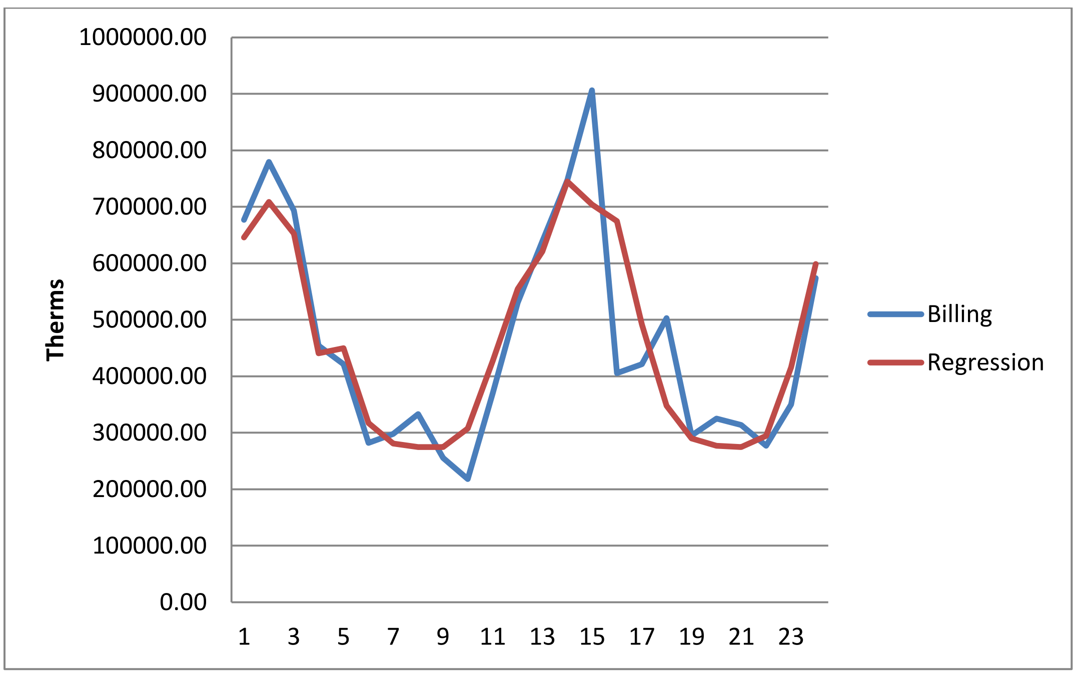
The as-built boiler plant efficiency was calculated using a Department of Energy boiler efficiency calculator in conjunction with combustion reports provided by the site. To calculate savings, a linear regression was performed using baseline boiler plant consumption billing data as the dependent variable and actual monthly heating degree days as the dependent variable, which resulted in an R^2 value of 0.788 and the following regression formula:

$$Therms = 411.9*HDD_{65} + 274,568.2$$

Where:

HDD65	= monthly heating degree days with 65F base temp
274,568.2	= base consumption independent of weather

Billing Data vs. Linear Regression



The regression formula was applied to TMY3 monthly heating degree day data to determine typical monthly baseline consumption. The following formula was used to determine typical as-built consumption:

$$Therms_{as\text{-}built} = Therms_{base} * eff_{base} / eff_{as\text{-}built}$$

Where:

$Therms_{as\text{-}built}$	= Annual Therms consumption of the as-built boilers
$Therms_{base}$	= Annual Therms consumption of the baseline boilers

Eff_{base} = Thermal efficiency of the baseline boilers

$Eff_{as\text{-}built}$ = Thermal efficiency of the as-built boilers

Savings is the difference between typical annual baseline and as-built consumption.

Building C:

Custom Incentives

A multiple linear regression model was used to calculate savings. NOAA weather data was downloaded and used to create several independent variables such as temperature, degree days, and others. The dependent variable, Therms consumed per month, was obtained from billing data. The regression model was applied to typical weather in TMY3 format to create pre-retrofit consumption, and post-retrofit consumption was calculated using efficiency values from flue gas measurements. The savings is the difference between the pre and post consumption totals. A Technical Resource Manual (TRM) calculation was completed to support the regression, and the two calculations are in reasonable agreement.

Monthly Boiler Natural Gas Savings

Month	*Baseline*	*As-Built*	*Savings*
Jan	447,007	429,814	17,193
Feb	380,613	365,974	14,639
Mar	350,929	337,432	13,497
Apr	288,896	277,785	11,111
May	236,821	227,712	9,108
Jun	207,948	199,950	7,998
Jul	204,892	197,011	7,880
Aug	193,481	186,039	7,442
Sep	207,635	199,649	7,986
Oct	270,898	260,479	10,419
Nov	331,761	319,001	12,760
Dec	435,971	419,203	16,768
Total			136,802

Building D:

Custom Incentives

Engineering calculations were used to calculate the natural gas savings due to the reduced supply and exhaust flows. Typical weather for the area (TMY3 format) was used to determine the hourly heating requirement for the make-up air handler. The temperature data was combined with the new ventilation schedule to calculate savings. The hourly heating requirement is calculated using the following equation:

$$Therms = \frac{1.08 \times CFM \ \times (T_{db,setpoint} - T_{db,OA})}{100{,}000 \times Eff}$$

Where:

Therms	= Hourly Therm consumption of the make-up air handler
CFM	= Flow rate of the incoming air
$T_{db,OA}$	= Dry-bulb temperature of the outside air
$T_{db,setpoint}$	= Dry-bulb temperature setpoint of the discharge air, 55^{o}F
Eff	= Efficiency of the heating system

The hourly flow for the above equations was informed using the following flow profile:

Daily Fan Speed Profile for MUAH

Hour	*% Fan Speed*
0:00	30%
1:00	30%
2:00	30%
3:00	30%
4:00	30%
5:00	50%
6:00	80%
7:00	100%
8:00	100%
9:00	90%
10:00	100%
11:00	100%
12:00	100%
13:00	100%
14:00	90%
15:00	100%
16:00	100%
17:00	80%
18:00	50%

Hour	*% Fan Speed*
19:00	30%
20:00	30%
21:00	30%
22:00	30%
23:00	30%

Building E:

Custom Incentives

Energy savings were calculated using DEER prototypical eQuest modeling. ADM used a DEER prototypical hospital to replicate the energy usage of the facility. The prototypical model's usage was normalized to square footage, and the square footage of the actual building was used to determine realized savings.

Two models were constructed (baseline and as-built). The as-built model included all of the HVAC controls improvements, and the baseline model removed all the improvements. The baseline and as-built models were run using TMY3 weather data for the region. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Normalized Annual Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	*595,889*	*595,889*	*0*	*0*	*0*	*0*
Miscellaneous Equipment	*663,600*	*663,600*	*0*	*71*	*71*	*0*
Heating	*0*	*0*	*0*	*37,236*	*4,320*	*32,917*
Cooling	*305,892*	*178,667*	*127,224*	*0*	*0*	*0*
Heat Rejection	*7,186*	*5,077*	*2,109*	*0*	*0*	*0*
Pumps	*177,926*	*83,933*	*93,993*	*0*	*0*	*0*
Fans	*256,082*	*123,498*	*132,584*	*0*	*0*	*0*
Domestic Hot Water	*0*	*0*	*0*	*14,451*	*14,410*	*41*
Total	**2,006,574**	**1,650,665**	**355,910**	**51,758**	**18,800**	**32,958**

Measure-level Gross Savings Results

Building A:

Standard Incentives

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

Annual Gas Savings for Storage Water Heaters

Measure	*Measure Metrics*					*Annual Gross Therms Savings*	
	Program Type	*Measure Type*	*Qty.*	*Tank Size*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	Gas,High Efficiency	4	80 gallons	Education – Primary/Secondary	224	1,004
Total						224	1,004

Custom Incentives

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

Annual Gas Savings for Ventilation Reduction

Temperature Range	*Hours*	*CFM_{base}*	*CFM_{as_built}*	*Annual Gross Therms Savings*	
				Ex Ante	*Ex Post*
-20 to -16	2	17,309	8,054	21	21
-15 to -11	15	17,309	8,054	110	149
-10 to -6	16	17,309	8,054	254	151
-5 to -1	14	17,309	8,054	466	122
0 to 4	47	17,309	8,054	729	387
5 to 9	52	17,309	8,054	872	392
10 to 14	98	17,309	8,054	1,145	693
15 to 19	131	17,309	8,054	1,474	821
20 to 24	109	17,309	8,054	2,133	629
25 to 29	212	17,309	8,054	3,003	1,101
30 to 34	224	17,309	8,054	3,839	1,023
35 to 39	355	17,309	8,054	2,639	1,398
40 to 44	346	17,309	8,054	1,581	1,161
45 to 49	406	17,309	8,054	1,066	1,149
50 to 54	488	17,309	8,054	0	1,047
55 to 59	326	17,309	8,054	0	521
60 to 64	332	17,309	8,054	0	298
65 to 70	410	17,309	8,054	0	89
>70	797	17,309	8,054	0	0
TOTAL	**4,380**			**19,332**	**11,152**

Building B:

Custom Incentives

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

Annual Therms Savings for Efficient Boilers

Measure	*Measure Metrics*		*Annual Gross kWh Savings*	
	Baseline Plant Efficiency	*As-built Plant Efficiency*	*Ex Ante*	*ADM Calculated Ex Post*
Steam Boilers	72.6%	88. 7%	859,063	1,030,286
Total			*859,063*	*1,030,286*

Building C:

Custom Incentives

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

Annual Therms Savings for Efficient Boilers

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
Boilers Burners and Controls	531,035	136,802
Total	*531,035*	*136,802*

Building D:

Custom Incentives

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

Annual Therms Savings for Efficient Boilers

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
Garage MUAH Controls	10,348	13,944
Total	*10,348*	*13,944*

Building E:

Custom Incentives

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

Annual kWh Savings for HVAC Controls Improvements

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
HVAC Controls Improvements	-	355,910
Total	-	355,910

Annual Therms Savings for HVAC Controls Improvements

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
Above Code Renovations	31,059	32,958
Total	31,059	32,958

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	*Location*	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
			Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Standard	Building A	Storage Water Heater	224	1,004	448%	15,060
Subtotal			224	1,004	448%	15,060
Custom	Building A	Ventilation Reduction	17,131	11,153	65%	167,296
	Building B	Steam Boilers	859,063	1,030,286	120%	20,605,717[23]
	Building C	Boilers Burners and Controls	531,035	136,802	26%	2,736,040[24]
	Building D	Garage MUAH Controls	10,348	13,944	135%	209,154[25]
	Building E	Above Code Renovations	31,059	32,958	106%	494,371
Subtotal			1,448,636	1,225,144	85%	24,212,578
Total			***1,448,860***	***1,226,147***	***85%***	***24,227,638***

[23] California DEER 2008 EUL expects boiler life span of 20 years
[24] California DEER 2008 EUL expects boiler life span of 20 years
[25] California DEER 2008 EUL expects DCV Control life span of 15 years

Verified Electric Savings/Realization Rates

Incentive Type	*Location*	*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	Building E	Above Code Renovations	-	355,910	N/A	10.00	5,338,649[26]
Total			***-***	***355,910***	***N/A***	***10.00***	***5,338,649***

The project level realization rate is 85%.

Building A has a 70% realization rate, due to different approaches used for storage water heater and different temperature profile used for ventilation reduction. The storage water heater measure falls under TRM methodology and a deemed Therms savings is given regardless of the size or efficiency of the installed unit. Ventilation reduction during unoccupied hours is calculated using TMY3 weather data for Midway airport. The main difference between the ex-ante and ex post calculations is the number of hours per temperature bin. ADM cannot verify the source of temperature bin used in ex ante savings estimation. A comparison of the ex-ante and ex-post hours can be seen in the following table:

Unoccupied Hours at Different Temperature Bin

Temperature Bin	-18	-13	-8	-3	2	7	12	17	22	27	32	37	42	47	52	57	62	65	>70	TOTAL
Ex Post (TMY3)	2	15	16	14	47	52	98	131	109	212	224	355	346	406	488	326	332	410	797	4,380
Ex Ante	2	11	27	53	89	115	164	231	369	580	839	664	469	385	0	0	0	0	0	3,998

For the Building B NORESCO provided a report showing ex ante energy savings. The report indicates that boiler logs and plant efficiency calculations were used to determine the consumption of the baseline boiler plant; however, the determination of as-built plant efficiency is unclear, and it was calculated two months before the commissioning of the boilers, so any calculations would have lacked as-built boiler usage data. ADM calculated the as-built plant efficiency using boiler logs and weather data. The realization rate for this project is 120%.

For Building C the electric realization rate of 26% can be attributed the ex-ante calculation technique, which estimated savings at 1 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 5% reduction in facility Therm usage. For

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a boiler efficiency upgrade bumping the combustion efficiency from 80% to around 83%, one would only expect an efficiency increase of around 4%. Both the normalized billing regression and a secondary Illinois TRM V2.0 approach predict realization rates just below 30%.

At Building D the natural gas realization rate of 135% can be attributed the ex-ante calculation using a single average speed and outside air temperature. ADM opted to calculate the annual energy savings by summing the hourly energy savings for an entire year based on hourly flow and temperature data. It was felt that this method is much more accurate than a single data point.

At Building E the ex post found realized electric savings from the reduction in load on the electric HVAC equipment. The ex ante analysis only accounted for gas heating savings. The 106% verified natural gas realization rate is due to the ex post using simulation. The ex ante analysis used a bin calculation which doesn’t account for interactive effects like a simulation model does.

Name C-18

Executive Summary

Application C-18 received custom incentives from Illinois DCEO for VAV air handler unit scheduling, minimum outside air position reduction, and reducing exhaust fan operating hours at their facility. The natural gas realization rate is 66%.

Project Description

Three measures were selected; however, only two measures were completed as a result of a retro-commissioning study conducted at the site. The first measure completed was reducing variable air handler units operating hours by 6 hours. The second measure completed reduced the air handler units minimum fan speed. A third measure to reduce exhaust fan operating hours was not implemented by the site.

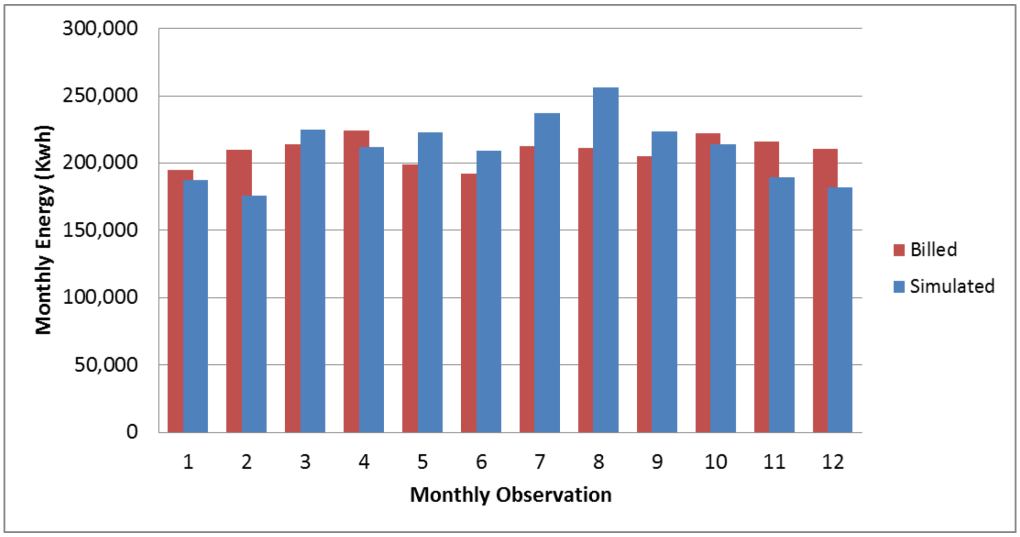
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the retro-commissioning 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.

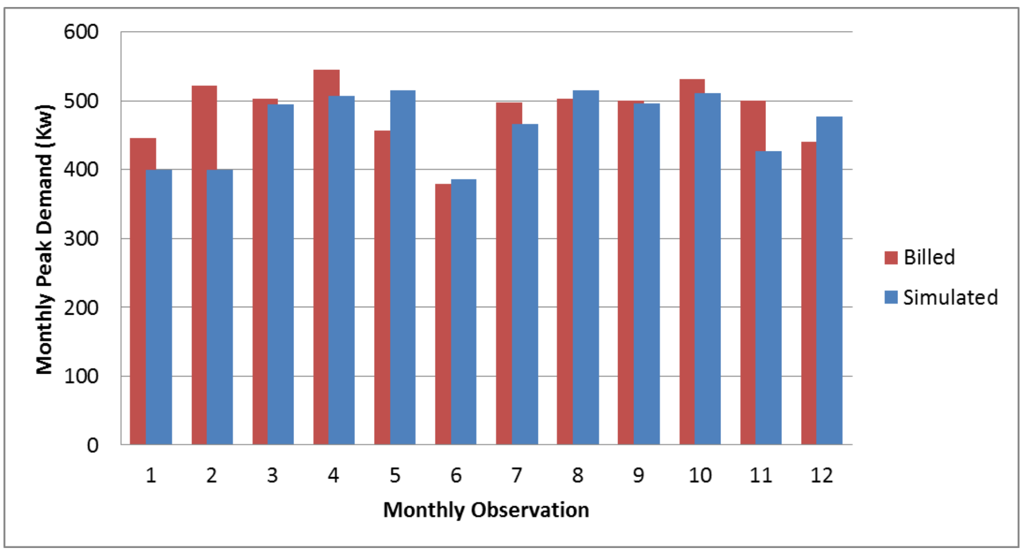
Custom Incentives

Energy savings were calculated using an eQuest model of the fine arts center. ADM compiled a model of the baseline facility using the details and construction documents collected during the on-site M&V visit. Upon completion of the initial model, a custom weather file was created using 2012 NOAA weather data for the Coles County area. Using this weather file and 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:

2012 Monthly kWh Calibration



2012 Monthly kW Calibration



Upon calibration of the baseline eQuest model, an as-built model was created with the implemented retro-commissioning measures installed. Once the as-built model was completed, the baseline and as-built models were run using Decatur 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 Electrical Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*
Lighting	*513,952*	*513,952*	*0*
Misc. Equipment	*50,669*	*50,669*	*0*
Heating	*0*	*0*	*0*
Cooling	*764,327*	*660,861*	*103,467*
Heat Rejection	*30,492*	*25,182*	*5,309*
Pumps	*622,906*	*617,144*	*5,762*
Fans	*488,880*	*302,653*	*186,227*
Exterior	*0*	*0*	*0*
Total	**2,471,226**	**2,170,460**	**300,766**

As-Built Vs. Baseline Annual Natural Gas Energy Consumption

End-Use	*Baseline Therms*	*As-Built Therms*	*Annual Therms Savings*
Lighting	*0*	*0*	*0*
Misc. Equipment	*0*	*0*	*0*
Heating	*196,531*	*144,971*	*51,559*
Cooling	*0*	*0*	*0*
Heat Rejection	*0*	*0*	*0*
Pumps	*0*	*0*	*0*
Fans	*0*	*0*	*0*
Exterior	*0*	*0*	*0*
DHW	*6,147*	*6,149*	*-2*
Total	**196,531**	**144,971**	**51,557**

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 Retro-Commissioning

Measure	*Annual Gross Therms Savings*	
	*Ex Ante**	*ADM Calculated Ex Post*
Reduce AHU operating hours	47,600	28,564
Reduce exhaust fan operating hours	9,400	0
Reduce AHU minimum VAV settings	21,000	22,993
Total	78,000	51,557

*The ex ante measure level values don't match the claimed total; therefore, they were adjusted to reflect the claimed total.

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	AHUs, Fans	-	300,766	-	28.7	1,503,825
Total		***-***	***300,766***	***-***	***28.7***	***1,503,825***

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	Reduce AHU operating hours	47,600	28,564	60%	142,820[27]
Custom	Reduce exhaust fan operating hours	9,400	0	0%	0
Custom	Reduce AHU minimum VAV settings	21,000	22,993	109%	114,965
Total		***78,000***	***51,557***	***66%***	***257,785***

The project has an overall natural gas realization rate of 66%. The 66% verified natural gas realization rate is due to the site not fully implementing all of the measures. The AHUs scheduling measure was to reduce the operation of the air handlers at night by 6 hours; however, three air handler units were setback fewer than 6 hours. This resulted in a 60% realization for that measure. If all the AHUs were setback 6 hours, the realization rate would have been 100%. The exhaust fan measure was not implemented by the site. The minimum VAV setting measure has a realization rate greater than 100% because of its interaction with the scheduling measure. All the AHUs were not setback the full 6 hours, so more energy savings were realized because of the increased post operating hours.

The project also realized electric saving. The ex ante did not claim any electric savings; therefore, the savings is captured, but without the realization rate.

[27] The lifetime savings were calculated by multiplying typical first year savings by the expected useful life of 5 years. http://cx.lbl.gov/documents/2009-assessment/lbnl-cx-cost-benefit.pdf

Name C-19

Executive Summary

Application C-19 received custom incentives from Illinois DCEO for upgrading from pneumatic controls to a DDC control system with occupancy based HVAC controls. The electric realization rate for this project is 66%, and the natural gas realization rate is 127%.

Project Description

The facility converted their existing pneumatic HVAC control system to Direct Digital Controls (DDC) in order to increase the energy efficiency of their facility. With the addition of the DDC system, the HVAC system that once operated 24/7, regardless of occupancy, was able to be scheduled to only operate during periods of occupancy. The DDC system also allowed for the addition of static pressure resets, temperature setbacks, discharge temperature resets, and economizer optimization.

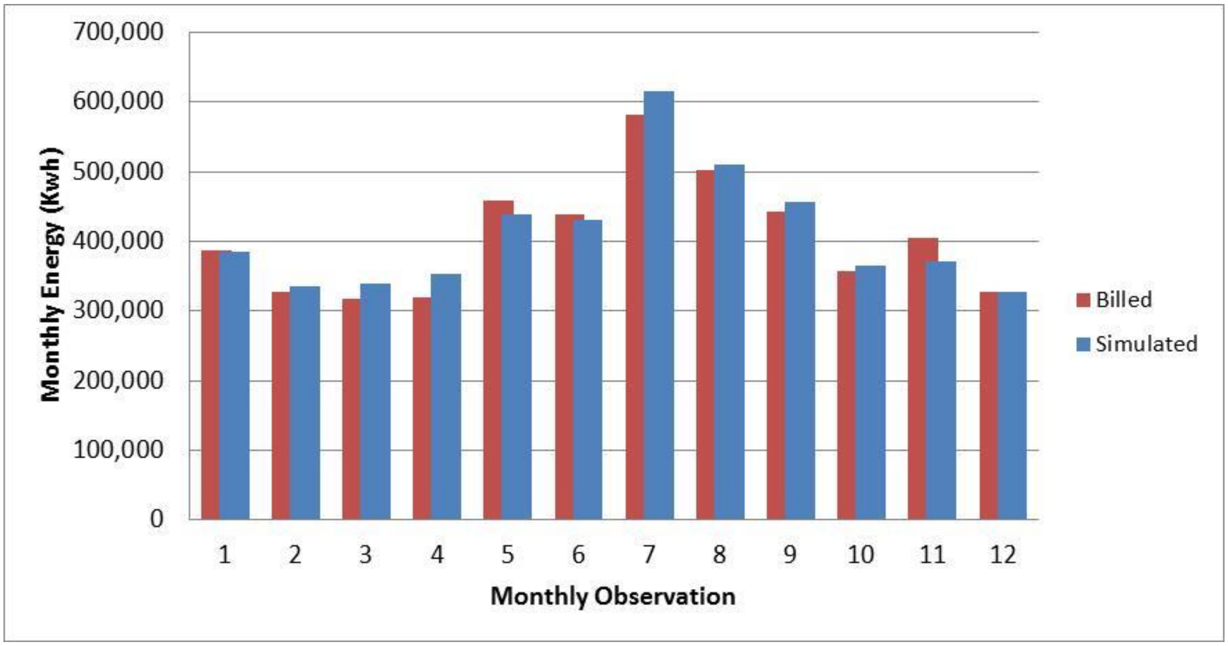
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the new DDC system and control strategies had been implemented. To verify the energy savings for the measures, ADM field staff documented equipment nameplates, construction documents, and mechanical schedules. ADM also interviewed site contacts concerning 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 facility using details and construction documents collected during the on-site M&V visit and provided in the project application. Upon completion of the initial model, a custom weather file was created using 2013 NOAA weather data for the Rockford, IL area. Using this weather file and billing data for the facility, ADM was able to ensure that the model's energy load shape matched that of the bills within a normalized mean biased error of 2%. The results of this calibration effort can be seen below:

2013 Monthly kWh Calibration



Upon completion of the calibration for the baseline eQuest model, an as-built model was created using information from the as-built Sequence of Operations (SOOs) provided by the site contacts and details collected through the EMS interface. The SOOs detail the control strategies being used by the building's new DDC system. Once the as-built model was completed, the baseline and as-built models were run using Rockford, IL 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 Electrical Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*
Lighting	*1,370,562*	*1,370,562*	*0*
Misc. Equipment	*947,352*	*947,352*	*0*
Heating	*631,846*	*337,189*	*294,657*
Cooling	*1,015,342*	*566,135*	*449,207*
Heat Rejection	*0*	*0*	*0*
Pumps	*119,579*	*116,721*	*2,858*
Fans	*408,847*	*197,503*	*211,344*
Exterior	*491,585*	*491,585*	*0*
Total	**4,985,113**	**4,027,047**	**958,066**

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	*130,853*	*40,969*	*89,884*
Cooling	*0*	*0*	*0*
Heat Rejection	*0*	*0*	*0*
Pumps	*0*	*0*	*0*
Fans	*0*	*0*	*0*
Exterior	*0*	*0*	*0*
Total	**130,853**	**40,969**	**89,884**

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for DDC Retrofit

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
DDC Retrofit	1,457,551	958,066
Total	1,457,551	958,066

Annual Therms Savings for DDC Retrofit

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
DDC Retrofit	70,547	89,884
Total	70,547	89,884

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	DDC Retrofit	1,457,551	958,066	66%	102.55	14,370,990
Total		***1,457,551***	***958,066***	***66%***	***102.55***	***14,370,990***

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 Retrofit	70,547	89,884	127%	1,348,260
Total		***70,547***	***89,884***	***127%***	***1,348,260***

The project has an overall electrical realization rate of 66% and a natural gas realization rate of 127%. The 66% verified electric realization rate is due to the ex-ante Trane Trace model not being calibrated to annual bills. It can be concluded that the over estimation in baseline energy consumption by the ex-ante model resulted in an overestimation in energy savings.

Name S-29

Executive Summary

Application S-29 received standard incentives from Illinois DCEO for installation of a high efficiency boiler and boiler controls. The natural gas realization rate is 51%.

Project Description

The customer installed (2) new high efficiency boilers and boiler controls. The installed boilers have an efficiency of 92% AFUE.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verity the installed equipment, ADM field staff documented unit nameplates and collected information about the controls.

Standard Incentives

Energy savings were calculated according to the Errata Corrected Illinois TRM Version 3.0.

For the boilers, TRM Section 4.4.10 High Efficiency Boiler was used.

NATURAL GAS ENERGY SAVINGS

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

Where:

EFLH	= Equivalent Full Load Hours for heating (see table)
Capacity	= Nominal Heating 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)	= Efficent Boiler Efficiency Rating use actual value

For the boiler controls, Section 4.4.4 Boiler Lockout/Reset Controls was used.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = Binput * SF * EFLH / (100)$$

Where:

Binput	= Boiler Input Capacity (kBTU)
	= custom
SF	= Savings factor
	= 8% or custom

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

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	*Program Type*	*Boiler Capacity (BTUH)*	*Base Boiler Type*	*Efficient Measure*	*Zone*	*Building Type*	*Annual Gross Therms Savings*		
							Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Boiler	RF	4,000,000	Hot Water ≥300,000 & ≤2,500,000 Btu/h	92%	2 (Chicago)	Religious Facility	4,395	10,807	9,942
Total							4,395	10,807	9,942

Annual Therms Savings for Boiler Controls

Measure	*Program Type*	*Boiler Capacity (kBTUH)*	*Zone*	*Building Type*	*Annual Gross Therms Savings*		
					Ex Ante	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
Boiler Lockout/ Reset Controls	RF	4,000	2 (Chicago)	Religious Facility	20,256	6,628	5,302
Total					20,256	6,628	5,302

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 Boiler	4,395	9,942	226%	198,840
Standard	Boiler Lockout/ Reset Controls	20,256	5,302	26%	106,048
Total		***24,651***	***15,244***	***62%***	***304,888***

The total 62% verified natural gas realization rate is due to the low realization rate for boiler controls. The ex ante uses 0.32 Therms per square foot. The assumptions and values used in the ex ante are unknown, so definitive conclusions cannot be made. Typically, using savings values normalized to square footage can have a large amount of uncertainty. The square footage of the building is not the correct value to use, and that’s typically what is done.

Name S-30, S-31, & S-32

Executive Summary

Applications S-30, S-31, & S-32 received Standard incentives from Illinois-DCEO for retrofitting their parking garage lighting. The realization rate for this project is 97%.

Project Description

The customer retrofitted the following:

S-30:

- (278) MH fixtures with (278) LED fixtures

S-31:

- (279) MH fixtures with (279) LED fixtures

S-32:

- (54) MH pole lamps with (54) LED pole lamps

Methodology for Estimating Gross Savings.

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.4 was used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
S-30 TOS/NC/RF - LED Bulbs and Fixtures	234	116.8	8766	1	283,952	285,610
S-31 TOS/NC/RF - LED Bulbs and Fixtures	234	116.8	8766	1	284,973	286,638
S-32 TOS/NC/RF - LED Bulbs and Fixtures	510	160.2	4903	1	117,855	92,614
Total					686,780	664,862

Project-level Gross Savings Results

The tables shown below present the verified gross savings for projects S-30, S-31, and S-32.

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	LED Bulbs and Fixtures	283,952	285,610	101%	32.58	1,140,356
	LED Bulbs and Fixtures	284,973	286,638	101%	32.70	1,144,458
	LED Bulbs and Fixtures	117,855	92,614	79%	0.00	661,122
Total		***686,780***	***664,862***	***97%***	***65.28***	***2,945,936***

The overall realization rate for the three projects is 97%. Project S-32 has a low realization rate because the ex ante savings estimate was based on the fixtures being on 24/7. However, the M&V site visit revealed that the fixtures are installed on the top of the parking garage in an open air location and are only on during non-daylighting hours.

Name C-20

Executive Summary

Application C-20 received custom incentives from Illinois DCEO for installation of DDC controls. The electric realization rate for this project is 88%, and the natural gas realization rate is 99%.

Project Description

The customer installed new DDC controls. The installed controls prevent simultaneous heating and cooling that occurred with the old system.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented equipment nameplates and controls strategies.

Custom Incentives

Energy savings were calculated using temperature bin analysis.

Local TMY3 weather data was used to generate 2 degree temperature bins. The bins range from -10°F to 100°F. Heating and cooling profiles were assigned to the bins. ADM utilized the same heating and cooling profiles as the ex ante analysis. The cooling profile was used to calculate cooling demand for each bin. The cooling demand was calculated using the total cooling system capacity and cooling efficiency. In order to calculate the cooling energy usage for each bin, system operating hours were estimated for each bin. Total cooling energy was equal to the cooling demand multiplied by operating hours. Operating hours were calculated using a utilization factor and the number of hours in each bin. The utilization factor was determined using the ratio of total cooling runtime hours to total system runtime hours. Heating energy usage was found using the same method. Heating energy was calculated using the assumed heating profile, system operating hours, utilization factor, and total heating capacity.

Energy savings were realized from changing the pre/post heating and cooling profiles. The changes in the profiles were the results of installing DDC controls to eliminate simultaneous heating and cooling.

NATURAL GAS ENERGY SAVINGS

$$\Delta Therms = Capacity * Heating\ Utilization\ Factor * Operating\ Hours * (Pre\ Heating\ Profile\ \% - Post\ Heating\ Profile\ \%) / 100{,}000$$

Where:

Capacity = Nominal Heating Input Capacity Boiler Size (btuh)

Heating Utilization Factor = the ratio of heating runtime to total system runtime hours

= heating runtime / total system runtime

Operating Hours	= Runtime hours for each temperature bin
Pre Heating Profile %	= Percent of heating needed during temperature bin before DDC controls
Post Heating Profile %	= Percent of heating needed during temperature bin after DDC controls
100,000	= BTUs to Therms conversion

ELECTRIC ENERGY SAVINGS

ΔkWH = Capacity * 12 / Cooling EER * Cooling Utilization Factor * Operating Hours * (Pre Cooling Profile % – Post Cooling Profile %)

Where:

Capacity	= Nominal Cooling Input Capacity (tons)
Cooling Utilization Factor	= the ratio of cooling runtime to total system runtime hours
	= cooling runtime / total system runtime
Operating Hours	= Runtime hours for each temperature bin
Pre Cooling Profile %	= Percent of cooling needed during temperature bin before DDC controls
Post Cooling Profile %	= Percent of cooling needed during temperature bin after DDC controls
Cooling EER	= Cooling Energy Efficiency Ratio
12	= EER to kW/ton Conversion

SUMMER COINCIDENT PEAK DEMAND SAVINGS

Summer peak demand savings are assumed to be zero because the cooling profile is 100% pre and post during the peak.

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for DDC Controls

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
DDC Controls	14,296	12,643
Total	14,296	12,643

Annual Therms Savings for DDC Controls

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
DDC Controls	652	647
Total	652	647

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	DDC Controls	14,296	12,643	88%	0	189,644 [28]
Total		***14,296***	***12,643***	***88%***	***0***	***189,644***

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	652	647	99%	9,705
Total		**652**	***647***	***99%***	***9,705***

The 88% verified electric realization rate is due to differences in weather data and cooling efficiency. The ex ante did not use TMY3 weather data. ADM also used the correct cooling efficiency per manufacturer spec sheets.

The 99% verified natural gas realization rate is only slightly lower due to the use of TMY3 weather data.

[28] 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-33

Executive Summary

Application S-33 received Standard incentives from Illinois DCEO for lighting installed in a parking garage facility. The realization rate for this project is 100%.

Project Description

S-33 replaced (413) MH fixtures with LED fixtures in the open-air parking garage area. During the site visit, ADM also verified that each fixture was equipped with a daylight sensor that dims the light to 50% when there is daylight present.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities. To verify lighting hours, ADM staff interviewed the site contact.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit, TRM section 4.5.4, LED Bulbs and Fixtures, was used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting

Measure					*Annual Gross Therms Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
MH to LED	218	108	8766	1.00	397,967	398,239
Total					397,967	398,239

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	Lighting	397,967	398,239	100%	45.43	1,817,198
Total		397,967	398,239	***100%***	45.43	1,817,198

The realization rate for this project is 100%, which indicates a highly accurate ex ante calculation. ADM also verified the installation of daylight controls, but this measure was not in the application and a Standard incentive was not received.

Name S-34

Executive Summary

Application S-34 received Standard incentives from Illinois DCEO for lighting installed in a parking facility. The realization rate for this project is 98%.

Project Description

S-34 replaced (295) MH fixtures with LED fixtures in the open-air parking garage area, (184) 4’ T8 lamps and ballasts with more efficient T8 lamps and ballasts, and (80) 3’ T8 lamps with more efficient T8 lamps.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities. To verify lighting hours, ADM staff interviewed site contacts.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit, TRM sections 4.5.3 and 4.5.4 were used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated* *Ex Post*
T8 to RWT8	32	25	8766	1.00	14,290	6,136
T8 to RWT8	59	49	3540	1.00		1,345
T8 to RWT8	24	24	8766	1.00	4,659	4,909
MH to LED	218	108	8766	1.00	284,262	284,457
Total					303,211	296,847

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*	*Lifetime Gross Savings* *Ex Post kWh*
Standard	Lighting	303,211	296,847	98%	34.09	4,452,705
Total		***303,211***	***296,847***	***98%***	***34.09***	4,452,705

The ex ante savings estimate slightly overestimated savings. This may be a result of an ex ante assumption that baseline fluorescent fixtures had T12 lamps and therefore had a higher wattage. The actual baseline lamps were T8. The overall realization rate is 98%.

Name S-35

Executive Summary

Application S-35 received standard incentives from Illinois DCEO for installation of a water-cooled chiller, VSDs on HVAC equipment, natural gas boilers, a condensing unit heater, and a tanked natural gas water heater. The electric realization rate for this project is 81% and the natural gas realization rate is 153%

Project Description

The customer installed the following electric equipment:

- (1) 164 ton, water-cooled scroll chiller
- (1) VFD for 7.5 HP constant volume fan
- (2) VFD for 7.5 HP chilled water pump
- (2) VFD for 15 HP chilled/hot water pump

The customer installed the following natural gas equipment:

- (2) 2,000 MBH high efficiency boilers
- (1) condensing unit heater
- (1) 60-gallon high efficiency storage water heater

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operational. To verity the installed equipment, ADM field staff documented photographed equipment, nameplates, and mechanical schedules. The site did not install all of the measures for which they received incentives, however. Several of the VFD measures were redundant or had been neglected. These measures are indicated as having zero ex-post savings in the *Annual kWh Savings for VFDs* table below.

Standard Incentives

Energy savings for the electric chiller were calculated according to the Illinois TRM Version 2.0, Section 4.4.6.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = TONS * [(12/IPLVbase) – (12/IPLVee)] * EFLH$$

Where:

TONS	= actual installed chiller nominal cooling capacity
IPLVbase	= Integrated Part Load Value efficiency of baseline equipment (EER), found in Table 503.2.3(7)
IPLVee	= actual installed IPLV efficiency of high efficiency equipment (EER)
EFLH	= equivalent full load hours

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW_{SSP} = TONS * [(12/PEbase) – (12/PEee)] * CF_{SSP}$$

Where:

PEbase	= peak efficiency of baseline equipment (full load EER), found in Table 503.2.3(7)
PEee	= peak efficiency of efficienc equipment (full load EER)
CFSSP	= summer system peak coincidence factor for commercial cooling
	= 91.3%

Energy savings for the VFDs were calculated according to the Illinois TRM Version 2.0, Section 4.4.17.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected	= 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.

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.

Energy savings for the natural gas boilers were calculated using the Illinois TRM Version 3.0, Section 4.4.10.

NATURAL GAS SAVINGS

$$Therms = EFLH * Capacity * (1/Effbase – 1/Effactual) / 100,000$$

Where:

EFLH	= equivalent full load hours for heating
Capacity	= nominal heating input capacity for efficiency unit
Effbase	= baseline boiler efficiency, dependent on year and boiler type

Effactual = actual thermal efficiency of efficient units

Energy savings for the condensing unit heaters were calculated using the Illinois TRM Version 2.0, Section 4.4.5, which gives a deemed savings of 266 Therms per unit.

Energy savings for the storage water heater were calculated using the Illinois TRM Version 2.0, which gives a deemed savings of 251 Therms for high efficiency storage hot water heaters with greater than 75 MBH capacity.

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 Electric Chiller

Measure	*Measure Metrics*						*Annual Gross Savings*	
	Program Type	*Qty*	*Chiller Size (tons)*	*Chiller Type*	*IPLV EER*	*Peak EER*	*Ex Ante kWh*	*TRM-Calculated Ex Post kWh*
Electric Chiller	TOS	1	164	Water cooled, elec. operated, positive displacement	25.4	21.6	6,335	23,661
Total							6,335	23,661

Annual kWh Savings for VFDs

Measure	*Measure Metrics*					*Annual Gross Savings*	
	Application	*Program Type*	*Type*	*HP*	*Building Type*	*Ex Ante kWh*	*TRM-Calculated Ex Post kWh*
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	7.5	School(K-12)	4,611	5,704
Variable Speed Drives for HVAC	Constant Volume Fan	TOS	HVAC	7.5	School(K-12)	4,611	-
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5	School(K-12)	4,611	4,606
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5	School(K-12)	4,611	-
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5	School(K-12)	4,611	4,606
Variable Speed Drives for HVAC	Chilled Water Pump	TOS	HVAC	7.5	School(K-12)	4,611	-
Variable Speed Drives for HVAC	Chilled/Hot Water Pump	TOS	HVAC	15	School(K-12)	9,222	9,746
Variable Speed Drives for HVAC	Chilled/Hot Water Pump	TOS	HVAC	15	School(K-12)	9,222	-
Variable Speed Drives for HVAC	Chilled/Hot Water Pump	TOS	HVAC	15	School(K-12)	9,222	9,746
Variable Speed Drives for HVAC	Chilled/Hot Water Pump	TOS	HVAC	15	School(K-12)	9,222	-
Variable Speed Drives for HVAC	FC Fan, discharge dampers	TOS	HVAC	.25	School(K-12)	154	-
Variable Speed Drives for HVAC	FC Fan, discharge dampers	TOS	HVAC	.25	School(K-12)	154	-
Variable Speed Drives for HVAC	FC Fan, discharge dampers	TOS	HVAC	.25	School(K-12)	154	-
Total						55,332	34,408

Annual Therms Savings for High Efficiency Boilers

Measure	*Measure Metrics*						*Annual Gross Therms Savings*		
	Program Type	*Qty*	*Boiler btuh*	*Base Boiler type*	*Boiler AFUE*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Boiler	TOS	2	2,000,000	Hot Water ≥300,000 & ≤2,500,000 Btu/h	95.0%	2 (Chicago)	4,035	6,632	6,300
Total							4,035	6,632	6,300

Annual Therms Savings for Condensing Unit Heater

Measure	*Measure Metrics*			*Annual Gross Therms Savings*	
	Program Type	*Qty*	*Heater btuh*	*Ex Ante*	*TRM-Calculated Ex Post*
Condensing Unit Heaters	TOS	1	24,800	266	266
Total				266	266

Annual Therms Savings for Storage Water Heater

Measure	*Measure Metrics*			*Annual Gross Therms Savings*	
	Program Type	*Qty*	*Heater btuh*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	1	120,000	148	251
Total				148	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*	
		Ex Ante kWh	*Ex Post kWh*	*Realization Rate*	*Ex Post Peak kW Reduction*	*Ex Post kWh*	*Ex Post Peak kW Reduction*
Standard	Electric Chiller	6,335	23,661	373%	18.61	473,224	18.61
	Variable Speed Drives for HVAC	65,015	34,408	53%	7.47	516,119	7.47
Total		***71,350***	***58,069***	***81%***	***26.08***	***989,343***	***26.08***

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	4,035	6,300	156%	126,000
	Condensing Unit Heaters	266	266	100%	3,192
	Storage Water Heater	148	251	170%	3,765
Total		***4,449***	***6,817***	***153%***	***132,957***

The overall electric realization rate is 81% and the natural gas realization rate is 153% for this project.

The ex-ante electric savings estimate for electric chillers used a deemed savings of 38.63 kWh per ton for a centrifugal chiller; however, the chiller installed is a scroll/positive displacement chiller. Additional ex ante assumptions are unknown, but the TRM Version 2.0 determines hours of operation based on the air distribution system type and climate zone. This results in a realization rate of 373% for this measure. The ex-ante electric savings estimate for VFDs uses a deemed savings of 270 kWh per controlled HP based on a “school” facility type, but other assumptions are unknown. The Illinois TRM version 2.0 determines hours of operation based on HVAC application and building type and determines energy savings factor based on VFD application. Expected savings were skewed because the site did not install a number of the measures, which were redundant. Had these measures not been included, the realization rate for the VFDs would have been 107%. Including the non-installed redundant measures, the realization rate is 53%.

The ex-ante natural gas savings estimate for high efficiency boilers uses a deemed savings of 1.01 Therms per kBtuh and other assumptions are unknown The Illinois TRM Version 3.0 determines hours of operation based on building type and climate zone. This resulted in a realization rate of 156% for this measure. The ex-ante natural gas savings estimate for storage water heaters uses a deemed savings of 148 Therms per unit for a tank size of 80 gallons; however, the actual installed water heater has a 60-gallon tank, and the Illinois TRM Version 2.0 applies a deemed savings of 251 Therms per unit for units with capacities above 75 kBtuh. The resultant realization rate is 170% for this measure.

Name S-36

Executive Summary

Application S-36 received standard incentives from Illinois DCEO for installation of an automatic door closer on a walk-in freezer. The electric realization rate for this project is 100%.

Project Description

The customer installed an automatic door closer on the freezer used to store perishable food items used by the cafeteria.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented the nameplate of the freezer.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

ELECTRIC ENERGY SAVINGS

The annual energy savings for the installation of an automatic door closer on a walk-in freezer is deemed based upon Section 4.6.1 of the Illinois TRM Version 2.0. The annual deemed savings is 2,307 kWh per year.

SUMMER COINCIDENT PEAK DEMAND SAVINGS

The peak demand savings for the installation of an automatic door closer on a walk-in freezer is deemed based upon Section 4.6.1 of the Illinois TRM Version 2.0. The peak demand deemed savings is .309 kW.

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 Automatic Door Closer

Measure	*Program Type*	*Equipment Type*	*Annual Gross kWh Savings*	
			Ex Ante	*TRM-Calculated Ex Post*
Automatic Door Closer	RF	Walk In Freezer	2,307	2,307
Total			2,307	2,307

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	Automatic Door Closer	2,307	2,307	100%	0.309	18,456
Total		***2,307***	***2,307***	***100%***	***0.309***	***18,456***

The 100% verified electric realization rate is due to the ex-ante analysis and ADM utilizing Illinois TRM Version 2.0 Section 4.6.1 to calculate the energy savings impacts of automatic door closers.

Name C-21

Executive Summary

Application C-21 received custom incentives from Illinois DCEO for installing a ground source heat pump (GSHP) system in their facility. The electric realization rate is 112%, and the natural gas realization rate is 82%.

Project Description

The customer installed a ground source heat pump system complete that replaced a natural gas hot water heating system and added cooling to the facility.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational. ADM collected updated mechanical schedules for the new system as well as a document describing the baseline system.

Custom Incentives

ADM utilized the fuel-switching energy savings methodology guidance that ADM proposed in December 2013.

ELECTRIC ENERGY SAVINGS

Electric energy savings are calculated as the difference in cooling and heating consumption between the as-built ground source heat pump system and an IECC 2012 code-compliant air source heat pump (ASHP) system.

$$\Delta kWh = \Delta kWh_{cool} + \Delta kWh_{heat}$$

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

$$\Delta kWh_{cool} = EFLH_{cool} * Capacity_{cool} * \left(\frac{1}{SEER_{ASHP}} - \frac{1}{SEER_{actual}}\right)$$

$$\Delta kWh_{heat} = EFLH_{heat} * Capacity_{heat} * \left(\frac{1}{HSPF_{ASHP}} - \frac{1}{COP_{part\ load,\ actual}}\right)$$

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

$$\Delta kWh_{cool} = EFLH_{cool} * Capacity_{cool} * \left(\frac{1}{EER_{ASHP}} - \frac{1}{EER_{actual}}\right)$$

$$\Delta kWh_{heat} = EFLH_{heat}/3.412 * Capacity_{heat} * \left(\frac{1}{COP_{ASHP}} - \frac{1}{COP_{actual}}\right)$$

Where:

$EFLH_{cool}$ = Equivalent Full Load Hours for cooling (TRM version 2.0)

$EFLH_{heat}$ = EFLH for heating (TRM version 2.0)

$Capacity_{cool}$ = Cooling Capacity (kBtu/h)

$Capacity_{cool}$ = Heating Capacity (kBtu/h)

$SEER_{ASHP}$ = Seasonal Energy Efficiency Ratio of code ASHP equipment

$SEER_{actual}$ = as-built SEER

$HSPF_{ASHP}$ = Heating Seasonal Performance Factor of code ASHP equipment

$HSPF_{actual}$ = as-built HSPF

EER_{ASHP} = Energy Efficiency Ratio of code ASHP equipment

EER_{actual} = as-built EER

COP_{ASHP} = Coefficient of Performance of code ASHP equipment

COP_{actual} = as-built Coefficient of Performance

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = kBtu/h_{cool} * \left(\frac{1}{EER_{ASHP}} - \frac{1}{EER_{actual}}\right) * CF$$

Where:

CF = Summer System Peak Coincidence Factor (TRM version 2.0)

= 91.3%

NATURAL GAS ENERGY SAVINGS

Natural gas savings are calculated as the difference in consumption between an IECC 2012 code-compliant air source heat pump system and the existing system – in this case, a hot water boiler system.

$$\Delta Therms = Therms_{base} - Therms_{ASHP}$$

Where:

$Therms_{base}$ = existing system consumption, as determined in the ex ante savings calculation

$Therms_{ASHP}$ = code-compliant ASHP consumption,

if cooling capacity <65 kBtu/h:

$$= \left(\sum_{heat\ pump} kBtu/h_{heat} * \left(\frac{1}{HSPF_{ASHP}}\right) * EFLH_{heat}\right) * 3{,}412 \left(\frac{btu}{kWh}\right) * 10^{-5} \left(\frac{therms}{btu}\right)$$

if cooling capacity >65 kBtu/h

$$= \left(\sum_{heat\ pump} \frac{kBtu/h_{heat}}{3.412\ (\frac{btu}{h*W})} * \left(\frac{1}{COP_{ASHP}}\right) * EFLH_{heat} \right) * 3{,}412 \left(\frac{btu}{kWh}\right) * 10^{-5} \left(\frac{therms}{btu}\right)$$

HSPF = Heating Seasonal Performance Factor

COP = Coefficient of Performance

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 Ground Source Heat Pumps

Measure	*Measure Metrics*						*Annual Gross kWh Savings*	
	kBtu/h cool	*EFLH Cool*	*As-Built EER*	*kBtu/h heat*	*EFLH Heat*	*As-Built COP*	*Ex Ante*	*ADM Calculated Ex Post*
Ground Source Heat Pump	3,299	819	17.17	2,553	1069	3.67	177,000	170,839
Total							177,000	170,839

Annual Therms Savings for Ground Source Heat Pumps

Measure	*Measure Metrics*			*Annual Gross Therms Savings*	
	kBtu/h heat	*$HSPF_{ASHP}$*	*EFLH Heat*	*Ex Ante*	*ADM Calculated Ex Post*
Ground Source Heat Pump	2,553	7.7	1069	28,497	23,356
Total				28,497	23,356

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	Ground Source Heat Pumps	177,000	197,961	112%	85.7	2,969,413
Total		***177,000***	***197,961***	***112%***	***85.7***	***2,969,413***

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	Ground Source Heat Pumps	28,497	23,356	82%	350,343
Total		***28,497***	***23,356***	***82%***	***350,343***

The overall electric savings realization rate is 112%, and the overall natural gas savings realization rate is 82%.

The ex ante electric energy savings calculations only considered cooling savings and were calculated as the difference in cooling consumption between a 2012 IECC compliant air cooled chiller (9.562 EER for >150 tons) baseline and the as-built ground source heat pumps. The methodology used by ADM considered 2012 IECC compliant air source heat pumps as the baseline, and calculated both heating and cooling savings resulting from the efficiency difference between the code-compliant ASHP and as-built GSHP systems. The inclusion of electric heating savings accounted for the higher realization rate.

The ex ante natural gas savings were considered to be the savings resulting from the removal of the old hot water boiler system, minus a converted kWh penalty for added heating demand from the ground source heat pumps. The ex post methodology involved a conversion of code-compliant air source heat pump electric energy use to natural gas energy use, and savings were the difference between the existing hot water boiler system and the code-compliant air source heat pump system consumption. The energy usage of the air source heat pump is a larger therms penalty, so the realization rate is lower.

Name C-22

Executive Summary

Application C-22 received custom incentives from Illinois DCEO for ten retro-commissioning measures implemented at their facility. The natural gas realization rate is 185%.

Project Description

The table below provides a summary of the implemented measures completed as a result of a retro-commissioning study conducted at the Library.

Library RCx Measures Summary

Measure/Description
RCxM-1: Equipment Scheduling
RCxM-2: VAV Terminal Box Schedules
RCxM-3: Schedule Equipment for Holidays
RCxM-4: SAT Reset for AHUs 1-4
RCxM-6: Eliminate Simultaneous Heating and Cooling
RCxM-7: CW Temp Reset
RCxM-8: Static Pressure Reset
RCxM-9: Optimal Start/Stop
RCxM-10: Restore Economizer Operation
RCxM-11: Chiller Plant Lockout

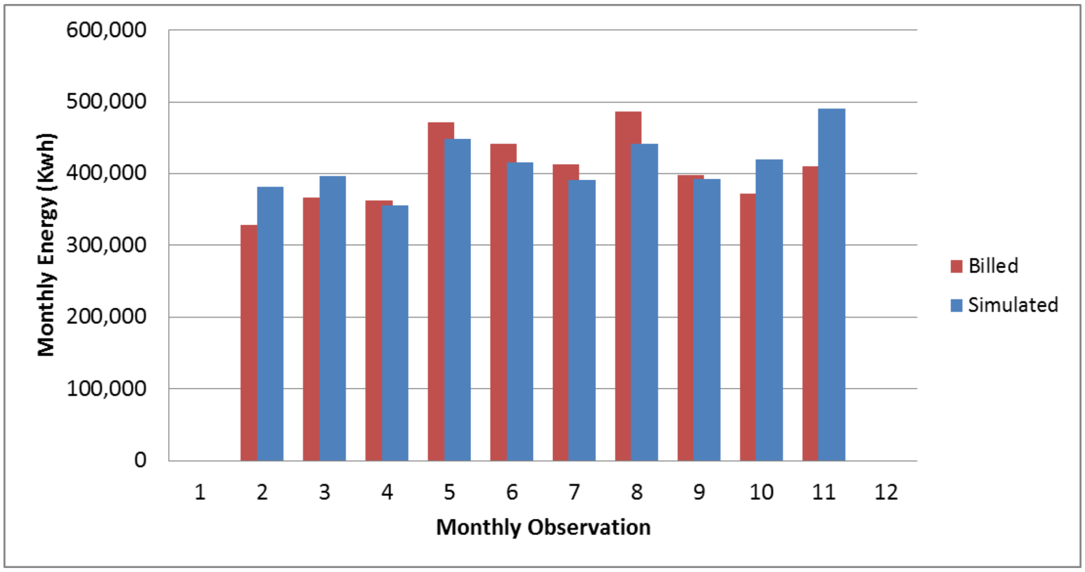
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified the retro-commissioning 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.

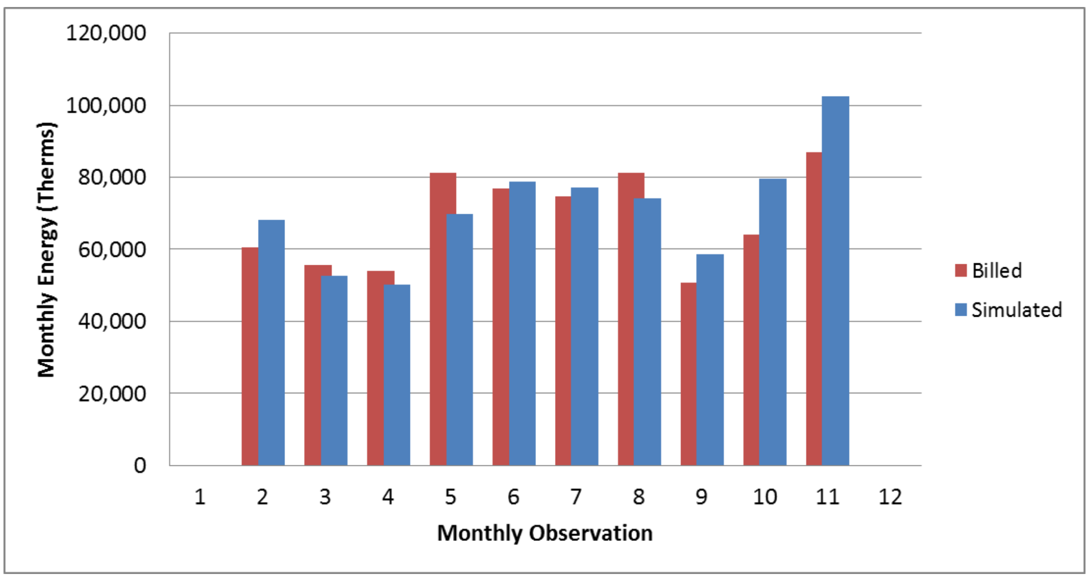
Custom Incentives

Energy savings were calculated using an eQuest model of the fine arts center. ADM compiled a model of the baseline facility using the details and construction documents collected during the on-site M&V visit. Upon completion of the initial model, a custom weather file was created using 2012 NOAA weather data for the Southern Illinois area. Using this weather file and 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:

2012 Monthly kWh Calibration



2012 Monthly Therm Calibration



Upon completion of the calibration for the baseline eQuest model, an as built model was created with the implemented retro-commissioning measures installed. Once the as-built model was completed, the baseline and as-built models were run using Carbondale Southern Illinois 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 Electrical Energy Consumption

End-Use	Baseline kWh	As-Built kWh	Annual kWh Savings
Lighting	*2,532,342*	*2,532,342*	*0*
Misc. Equipment	*455,918*	*455,918*	*0*
Heating	*0*	*0*	*0*
Cooling	*83,477*	*64,865*	*18,612*
Heat Rejection	*143,806*	*58,596*	*85,210*
Pumps	*1,555,941*	*1,325,876*	*230,065*
Fans	*635,388*	*232,784*	*402,604*
Exterior	*0*	*0*	*0*
Sub Total	**5,406,872**	**4,670,381**	**736,491**
Less RCx Program	*Measure 5*	*AHU5 OA*	*15,810*
Total			**720,681**

As-Built Vs. Baseline Annual Natural Gas Energy Consumption

End-Use	Baseline Therms	As-Built Therms	Annual Therms Savings
Lighting	*0*	*0*	*0*
Misc. Equipment	*0*	*0*	*0*
Heating	*316,109*	*24,917*	*291,192*
Cooling	*779,434*	*291,144*	*488,290*
Heat Rejection	*0*	*0*	*0*
Pumps	*0*	*0*	*0*
Fans	*0*	*0*	*0*
Exterior	*0*	*0*	*0*
Sub Total	**1,095,543**	**316,061**	**779,482**
Less RCx Program	*Measure 5*	*AHU5 OA*	*44,412*
Total			**735,070**

Measure-level Gross Savings Results

Custom Incentives

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

Annual Therms Savings for RCx

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
RCx Measures	396,843	735,070
Total	396,843	735,070

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	Retro-Commissioning		720,681			2,767,785
Total			***720,681***			***2,767,785***

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	Retro-Commissioning	396,843	735,070	185%	3,675,350[29]
Total		***396,843***	***735,070***	***185%***	***3,675,350***

The project has an overall natural gas realization rate of 185%. The ex post analysis used calibrated simulation; therefore, there is high certainty in realized savings. The ex ante calculations were not provided. Thus, a comparison of ex ante and ex post savings methodology was not possible.

[29] The lifetime savings were calculated by multiplying typical first year savings by the expected useful life of 5 years. http://cx.lbl.gov/documents/2009-assessment/lbnl-cx-cost-benefit.pdf

Name C-23

Executive Summary

Application C-23 the customer received custom incentives from Illinois DCEO for installation of blowdown heat recovery and oxygen trim combustion controls. The natural gas realization rate for this project is 37%.

Project Description

This project involved the installation of blowdown heat recovery and oxygen trim combustion controls. The intent of the heat recovery is to recover heat from boiler blowdown by using a heat exchanger to preheat boiler makeup water. The oxygen trim controls limit the amount of excess oxygen provided to the burner for combustion.

Methodology for Estimating Gross Savings

During M&V, ADM staff verified the blowdown heat recovery equipment had been installed and was operating. The oxygen trim controls were installed, however, were not controlling the boilers. The site installed the controls but had boiler problems and chose to disable the oxygen trim controls to increase heating reliability through the winter. To verify the installed equipment, ADM received documented recordings of total steam and total makeup steam usage. ADM calculated ex post savings based on the site stating that the controls will be re-commissioned after the peak winter season is over.

Custom Incentives

Engineering calculations were used to calculate the natural gas savings due to the heat recovery. US Dept. of Energy: Advanced Manufacturing Office, Recover Heat from Boiler Blowdown NREL Report No. FS-6A42-52767; DOE/GO-102012-3408 was used to determine the savings for the blowdown heat recovery. The savings were calculated using the following equation:

$$\Delta Therms = Heat\ Recovered_{interpolated} * Capacity_{boiler} * Hours / 100{,}000 / eff_{boiler}$$

Where:

Heat Recovered	= Interpolated result using steam pressure and blowdown rate
Capacity	= Capacity of the boiler
Hours	= Boiler hours of operation
Eff	= Efficiency of the boiler

Because the oxygen trim controls were installed but not operating, no ex-post data was available to verify savings. However, the Illinois Statewide TRM Version 3.0 includes Oxygen Trim Controls for Space Heating Boilers. The savings were calculated using the following equation:

$$\Delta Therms = Ngi * SF * Hours/100$$

Where:

Ngi = Boiler gas input size (kBTU/hr)

SF = Savings Factor (0.87%)

Hours = Boiler 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 Therms Savings for Boiler Measures

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
Blowdown Heat Recovery	45,891	101,794
Oxygen Trim Controls	808,489	217,306
Total	*845,379*	*319,100*

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	Blowdown Heat Recovery	45,891	101,794	222%	1,832,291[30]
Custom	Oxygen Trim Controls	808,379	217,306	27%	3,911,501[30]
Total		***854,379***	***319,100***	***37%***	***5,743,792***

The project level realization rate is 37%. The blowdown heat recovery natural gas realization rate of 222% can be attributed to the ex ante analysis using a conservative blowdown rate. The ex ante calculations used a blowdown rate of 3%; however, the actual blowdown rate was calculated to be 5.2%, taken from logged data at the site. The ex ante calculations also do not appear to account for boiler efficiency, which would further underestimate savings.

The oxygen trim controls natural gas realization rate of 27% can be attributed the ex ante analysis over estimating the savings. ADM used the Illinois Statewide TRM Version 3.0 to calculate savings for the oxygen trim controls. For comparison against the TRM calculated savings, ADM created a billing regression of 2012/13 site billing data against heating and cooling degree days. TMY3 weather data was used in the regressed formula to get weather normalized gas usage. Using the regression and ex ante pre and post efficiencies, a savings estimate was calculated. The savings were within 86% of the TRM savings which substantiates the TRM savings. The ex ante savings claimed the oxygen trim controls measure would save 17% of the site's total weather normalized annual therms usage. This would only be accurate if the boilers were running at full capacity for the entire year; however, the bills show that gas usage rises and falls with weather conditions. The gas bills are also much lower than the ex ante analysis assumes. Thus, the ex ante analysis overestimated the savings because it overestimated the gas usage of the boilers.

Illinois Statewide TRM Version 3.0 life span of 18 years

Name S-37, C-24

Executive Summary

Application S-37, C-24 received Standard incentives from Illinois DCEO for retrofitting lighting in the interior and exterior of their facilities and Standard and Custom incentives for the retro-commissioning of eight buildings along with the installation of seven ground source heat pumps. The realization rates for this project are 86% for electric and 119% for natural gas.

Project Description

The customer retrofitted and/or installed the following:

- Occupancy Sensors
- LED Pole lighting
- LED Parking Lot lighting
- Led wall packs and exterior lighting
- LED lighting
- LED lighting
- CFL fixtures
- Permanent delamping of T12 lamps and installation of high performanceT8s in multiple buildings

In order to reduce energy consumption throughout S-37, C-24 performed retro-commissioning on eight buildings.

The retro-commissioning portion of the project consisted of repairing ill operating control and HVAC systems. Examples of the retro-commissioning repairs are as follows:

- Repair of damper actuators.
- Installation of HVAC occupancy sensors.
- Time of day temperature setbacks.
- Exhaust fan reprogramming.
- Improved building space pressurization to improve temperature and humidity control.
- Demand control ventilation programming.
- Pneumatic controls on air handlers were replaced with direct digital controls.
- Air handler dampers were calibrated, thus improving economizer control.
- Reset minimum outside air dampers on air handlers.

The site also received standard incentives for the installation of seven new 0.75 ton ground source heat pumps.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours, and verified that the RCx measures were completed and the ground source heat pumps had been installed and were operating. ADM also collected sub metering data for each of the buildings involved in the retro-commissioning project.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.1, 4.5.2, 4.5.3, & 4.5.4 were used.

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

ADM estimated the ground source heat pump energy savings according to the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems.

ELECTRIC ENERGY SAVINGS

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool} + \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/SEERbase) – (1/SEERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{cool}) * [(1/HSPFbase) – (1/HSPFee)] * EFLH_{heat}$$

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

$$\Delta kWh = \text{Annual kWh Savings}_{cool} + \text{Annual kWh Savings}_{heat}$$

$$\text{Annual kWh Savings}_{cool} = (kBtu/h_{cool}) * [(1/EERbase) – (1/EERee)] * EFLH_{cool}$$

$$\text{Annual kWh Savings}_{heat} = (kBtu/h_{heat})/3.412 * [(1/COPbase) – (1/COPee)] * EFLH_{heat}$$

Where:

$kBtu/h_{cool}$	= capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/h). = Actual installed
SEERbase	=Seasonal Energy Efficiency Ratio of the baseline equipment; see table below for values.
SEERee	= Seasonal Energy Efficiency Ratio of the energy efficient equipment. = Actual installed
$EFLH_{cool}$	= cooling mode equivalent full load hours
HSPFbase	= Heating Seasonal Performance Factor of the baseline equipment; see table above for values.
HSPFee	= Heating Seasonal Performance Factor of the energy efficient equipment. = Actual installed
$EFLH_{heat}$	= heating mode equivalent full load hours; see table above for default values.
EERbase	= Energy Efficiency Ratio of the baseline equipment; see the table above for values. Since IECC 2006 does not provide EER requirements for air-cooled heat pumps < 65 kBtu/h, assume the following conversion from SEER to EER: EER≈SEER/1.1.
EERee	= Energy Efficiency Ratio of the energy efficient equipment. For air-cooled air conditioners < 65 kBtu/h, if the actual EERee is unknown, assume the following conversion from SEER to EER: EER≈SEER/1.1. = Actual installed

$kBtu/h_{heat}$	= capacity of the heating equipment in kBtu per hour.
	= Actual installed
3.412	= Btu per Wh.
COPbase	= coefficient of performance of the baseline equipment; see table above for values.
COPee	= coefficient of performance of the energy efficient equipment.
	= Actual installed

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = (kBtu/h_{cool}) * [(1/EERbase) – (1/EERee)] *CF$$

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)

Custom Incentives

ELECTRIC ENERGY SAVINGS

Electric energy savings were calculated through the use of a variable degree day billing analysis which was performed for each individual building involved in the retro-commission project. This was accomplished by identifying the pre and post sub metering periods and creating a correlation for each, between the bills and heating/cooling degree days. The correlation creates two weather dependent terms, one being based on cooling degree days and the other heating degree days, along with a constant base energy term for the building. The baseline energy constant represents energy loads within the building that are not weather dependent. The following equation is used to express the annual energy consumption for both the baseline and as-built energy consumption:

$$kWh = m_{CDD} \times CDD + m_{Hdd} \times HDD + B$$

Where:

kWh	= Annual kWh consumption
m_{CDD}	= Cooling Degree Day Coefficient
CDD	= Annual Cooling Degree Days
M_{HDD}	= Heating Degree Day Coefficient
HDD	= Annual Heating Degree Days
B	= Base Energy Constant

NATURAL GAS ENERGY SAVINGS

The same billing analysis method was repeated for buildings with gas end uses to determine the custom natural gas energy savings. This results in a very similar equation however energy consumption is reported in Therms.

$$Therm = m_{CDD} \times CDD + m_{Hdd} \times HDD + B$$

Where:

Therm	= Annual Therm consumption
m_{CDD}	= Cooling Degree Day Coefficient
CDD	= Annual Cooling Degree Days
M_{HDD}	= Heating Degree Day Coefficient
HDD	= Annual Heating Degree Days
B	= Base Energy Constant

Once all baseline/as-built cooling and heating coefficients were determined for each building, TYM3 weather was used to calculate the typical annual savings for each building.

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 Lighting Retrofit

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated Ex Post*
TOS/NC/RF - LED Bulbs and Fixtures	455	116.8	4903	1	108,799	119,390
TOS/NC/RF - LED Bulbs and Fixtures	355	116.8	4903	1	8,304	9,343
TOS/NC/RF - LED Bulbs and Fixtures	210	116.8	4903	1	3,373	3,199
TOS/NC/RF - LED Bulbs and Fixtures	101	52.5	4903	1	9,978	4,518
TOS/NC/RF - LED Bulbs and Fixtures	200	32.2	3540	1.14	7,346	10,547
TOS/NC/RF - LED Bulbs and Fixtures	295	41	3540	1.14	-	10,250
TOS/NC/RF - LED Bulbs and Fixtures	400	160.2	3540	1.14	215,205	195,483
TOS/NC/RF - LED Bulbs and Fixtures	400	160.2	3540	1.14	-	174,193
TOS/NC/RF - LED Bulbs and Fixtures	400	160.2	3540	1.14	-	7,742
Commercial Energy Star Standard CFL			3540	1.14	6,400	20,045
RF - Fluorescent Delamping	33.7	0	3540	1.14	2,983	-
RF - Fluorescent Delamping	33.7	0	3540	1.14	227,345	106,080
RF - Fluorescent Delamping	60.3	0	3540	1.14	11,300	-
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	48	25	3540	1.14	2,019,902	1,558,613
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	48	25	3540	1.14	107,527	59,033
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	57	25	3540	1.14	15,062	17,636
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	48	25	3540	1.14	31,611	16,243
RF - High	48	25	3540	1.14	1,246	93

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated* *Ex Post*
Performance and Reduced Wattage T8 Fixtures and Lamps						
Total					2,776,381	2,312,408

Annual kWh Savings for Lighting Controls

Measure	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated* *Ex Post*
RF - Occupancy Sensor Lighting Controls	100,000	3540	0.41	1.5	165,460	0
RF - Occupancy Sensor Lighting Controls	100,000	3540	0.41	1.5	165,460	0
Total					330,920	0

Annual kWh Savings for Ground Source Heat Pumps

Measure	*Measure Metrics* *Program Type*	*Equipment Type*	*Electric Resistance heat?*	*Qty*	*Cooling Capacity (kBtu/H)*	*Heating Capacity (kBtu/H)*	*SEERee*	*HSPFee*	*Zone*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated* *Ex Post*
GSHP	*NC*	*Ground Source Heat Pump*	*FALSE*	*7*	*9*	*6.7*	*17.6*	*10.58*	*3 (Springfield)*	*4,081*	*695*
Total										4,081	695

Custom Incentives

The tables shown below present the verified gross savings for measures that received standard incentiv6es.

Annual kWh Savings for RCx

Building	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
S A RCx		188,236
F H RCx		82,270
A D RCx		329,267
Gr H RCx		243,878
B I F RCx		613,369
T B H RCx		210,864
D K H RCx		410,287
A R RCx		367,011
Total	2,398,102	2,445,183

Annual Therms Savings for RCx

Building	*Annual Gross Therm Savings*	
	Ex Ante	*ADM Calculated Ex Post*
S A RCx		47,392
F H RCx		72,435
G H RCx		25,584
B I F RCx		45,923
T B H RCx		1,124
D K H RCx		12,145
A R RCx		30,906
Total	198,562	235,509

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	Compact Fluorescent Lamps	6,400	20,045	313%	5.70	93,298
	Fluorescent Delamping	241,628	106,080	44%	22.08	1,166,878
	T8 Fixtures and Lamps	2,175,348	1,651,618	76%	343.78	10,900,677
	LED Bulbs and Fixtures	353,005	534,665	151%	82.89	4,925,025
	Occupancy Controls	330,920	0	0%	0	0
	GSHP	4,081	695	17%	0.70	10,428
Subtotal		*3,111,382*	*2,313,103*	*74%*	*455.15*	*17,096,306*
Custom	RCx	2,398,102	2,445,183	102%	396.30	36,677,748
Subtotal		*2,398,102*	*2,445,183*	*102%*	*396.30*	*36,677,748*
Total		***5,509,484***	***4,758,286***	***86%***	***851.45***	***53,784,483***

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	RCx	198,562	235,509	119%	3,532,632
Total		***198,562***	***235,509***	***119%***	***3,532,632***

The lighting retrofit realization rate is 74%. The occupancy sensors received a 0% realization because they were already claimed in the retro commissioning portion of this project and could not receive energy savings twice. For the delamping measures the ex post analysis verified that only a total of 780 lamps were permanently removed, while the ex ante savings estimate had 1,903 lamps being removed. The installation of high performance T8s was also overestimated in the ex ante savings estimate with a quantity of 34,028, while the ex post verified total quantity installed was 17,794. The CFL measure had a lower ex ante savings estimate (31 kWh per lamp), while the ex post savings analysis using the TRM calculations (96 kWh per lamp) was higher. For seven of the LED measures the ex post savings analysis (ranging from 879 kWh to 1,658 kWh per lamp) was higher than the ex ante savings estimate (294 kWh to 1,511 kWh per lamp. Once the project was completed an updated application with the verified installed quantities would have resulted in a higher realization rate.

The 102% electric realization rate for the retro-commissioning project is due to the ex-ante analysis assuming a prescriptive electric and natural gas savings percentage for retro-commissioning. The ex-ante analysis assumed that the retro-commissioning would save 35% on chilled water consumption and 15% on electricity, and 25% on natural gas consumption. These savings percentages were applied without regard to the actual retro-commissioning items performed in a particular building. The 17% realization rate for the ground source heat pumps can be attributed to the ex-ante analysis entering the incorrect units in the capacity field of the Illinois TRM Version 2.0, Section 4.4.9 Heat Pump Systems calculation methodology. The ex-ante calculations entered the capacity of the installed units in “Tons” instead of “kBtu/hr” this resulted in the savings being multiplied by a factor of 12.

The electric realization rate is 86%.

The 119% verified natural gas realization rate is due to the ex-ante analysis assuming a prescriptive natural gas savings percentage for retro-commissioning. The ex-ante analysis assumed that the retro-commissioning would save 25% on natural gas consumption. This savings percentage was applied without regard to the actual retro-commissioning items performed in a particular building. The ex post analysis accounted for the actual installed measures.

Name S-38

Executive Summary

Application S-38 received standard incentives from DCEO for retrofitting lighting and installation of a high efficiency boiler at their facility. The electric realization rate is 86%, and the natural gas realization rate is 127%.

Project Description

The customer retrofitted and installed the following fixtures:

- (6) 4’1LT12 fixtures with (6) 4’ 1LT8 fixtures
- (314) 4’ 2LT12 fixtures with (314) 4’ 2LT8 fixtures
- (607) 4’ 3LT12 fixtures with (607) 4’ 3LT8 fixtures
- (469) 4’ 4LT12 fixtures with (469) 4’ 4LT8 fixtures
- (13) 4’ 2LT12 U-tube fixtures with (13) 4’ 2LT8 U-tube fixtures
- (251) MH fixtures with (251) 4’ 6LT5HO fixtures
- (21) Incandescent exit signs with (21) LED exit signs

The customer installed a new high efficiency boiler. The installed boiler has an efficiency of 92.7% AFUE.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verity the installed equipment, ADM field staff documented equipment nameplates.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.3, 4.5.5, 4.5.12 was used.

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

Energy savings were calculated according to the Errata Corrected Illinois TRM Version 3.0.

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

NATURAL GAS ENERGY SAVINGS

ΔTherms = EFLH * Capacity * (1/ EfficiencyRating(base) - 1/ EfficiencyRating(actual)) / 100,000

Where:

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

Capacity = Nominal Heating 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

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 Lighting Retrofit

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated Ex Post*
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	40	25	4311	1.23	368,548	477
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	78	49	4311	1.23		48,285
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	128	72	4311	1.23		180,244
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	156	94	4311	1.23		154,187
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	78	49	4311	1.23	827	1,585
RF - T5 Fixtures and Lamps	455	360	4311	1.23	173,940	126,439
RF - Commercial LED Exit Signs	35	2	8766	1.23	4,755	7,472
Total					548,070	518,689

Annual Therms Savings for High Efficiency Boiler

Measure	*Program Type*	*Boiler btuh*	*Base Boiler Type*	*Efficient Measure*	*Zone*	*Building Type*	*Annual Gross Therms Savings* *Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Boiler	RF	1,999,999	Hot Water ≥300,000 & ≤2,500,000 Btu/h	Custom	2 (Chicago)	High School	2,018	2,764	2,562
Total							2,018	2,764	2,562

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	T8 Fixtures and Lamps	369,375	384,778	104%	11.81	3,110,219
	LED Exit	4,755	7,472	157%	0.11	119,553
	T5 Fixtures and Lamps	173,940	126,439	73%	3.88	1,896,582
Total		***548,070***	***518,689***	***95%***	***15.81***	***5,126,354***

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	2,018	2,562	127%	51,244
Total		**2,018**	***2,562***	***127%***	***51,244***

The electric realization rate is 95%. The slightly low realization rate is due to the T5 measure where the ex ante savings estimate applies a 2.15 kWh per connected watt reduced (693 kWh per fixture), where the ex post savings analysis utilized the TRM calculation result in savings of 508 kWh per fixture.

The 127% verified natural gas realization rate is likely due to TRM Version 3.0 using EFLH associated with a high school in climate zone 2. The ex ante uses 2.43 Therms per kBtuh. The assumptions and values used in the ex ante are unknown, so definitive conclusions cannot be made.

Name S-39

Executive Summary

Application S-39 received Standard incentives from Illinois-DCEO for retrofitting their exterior lighting. The realization rate for this project is 139%.

Project Description

The customer retrofitted the following fixtures:

- (1) MH fixture with (1) LED wall pack
- (13) MH fixtures with (11) LED wall packs
- (3) MH fixtures with (3) LED fixtures
- (10) MH fixtures with (10) LED fixtures
- (2) MH fixtures with (2) LED fixtures
- (2) MH fixtures with (2) LED floods
- (16) MH fixtures with (16) LED fixtures
- (2) MH fixtures with (2) LED floods

Methodology for Estimating Gross Savings.

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.4 was used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
TOS/NC/RF - LED Bulbs and Fixtures	295	52.5	4903	1	176	1,189
TOS/NC/RF - LED Bulbs and Fixtures	295	52.5	4903	1	5,604	15,972
TOS/NC/RF - LED Bulbs and Fixtures	188	8.3	4903	1	238	2,643
TOS/NC/RF - LED Bulbs and Fixtures	458	116.8	4903	1	15,506	16,729
TOS/NC/RF - LED Bulbs and Fixtures	458	116.8	4903	1	3,023	3,346
TOS/NC/RF - LED Bulbs and Fixtures	188	18.6	4903	1	1,433	1,661
TOS/NC/RF - LED Bulbs and Fixtures	295	18.6	4903	1	18,940	21,683
TOS/NC/RF - LED Bulbs and Fixtures	458	52.5	4903	1	3,390	3,976
Total					48,309	67,199

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	LED Bulbs and Fixtures	48,309	67,199	139%	0.00	451,315
Total		***48,309***	***67,199***	***139%***	***0.00***	***451,315***

The project level realization rate is 139%. The realization rate is high mainly because the ex ante calculation for LED fixtures and lamps ranged between 79 kWh to 1,695 kWh per fixture, whereas the ex post savings analysis utilized the TRM calculations resulting in savings ranging from 831 kWh to 1,988 kWh per fixture. Also, the ex ante used annual hours of 4368, where the TRM hours for exterior lighting used 4,903 annual hours.

Name C-25

Executive Summary

Application C-25 received custom incentives from Illinois DCEO for installation of efficient burners on boilers. The gas realization rate for this project is 86%.

Project Description

The customer installed new Linkageless burners which operate using forced draft fans and direct spark ignition. They are replacing Todd Burner Assemblies burners installed in the early 1970's.

Methodology for Estimating Gross Savings

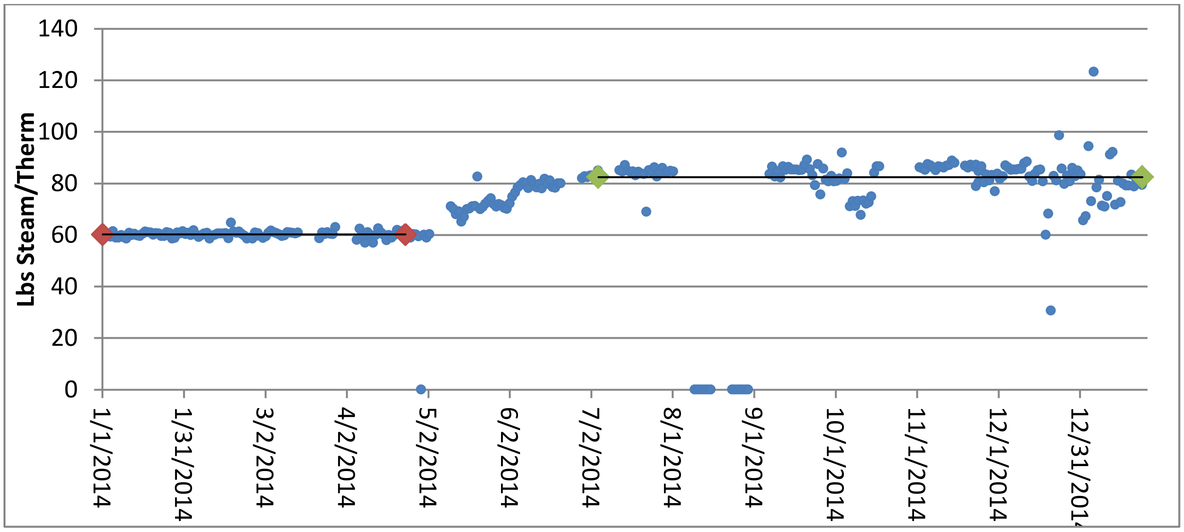
During the M&V visit, ADM staff verified equipment had been installed and was operating. ADM also collected equipment specifications, billing data, and combustion efficiency tests.

Custom Incentives

The facility baseline facility gas consumption documented in bills from December 2011-April 2014 was correlated to a Typical Meteorological Year (TMY3) year using Heating Degree Days (HDD) in a billing regression. The as-built consumption was unable to be correlated to the billing data because not enough winter months have passed since the installation. The as-built regression has three data points from the gas bills for October, November, and December of 2014 which is not enough to normalize the data to a typical year.

The as-built profile was created using a difference in baseline and as-built system efficiencies applied to the TMY gas use profile. The site keeps boiler combustion efficiency logs which are comprised of daily resolution gas use and steam produced. One year of this daily resolution data was collected for 2014, including 5 months of baseline data and 6 months of as-built data. The profile shows level boiler efficiency during the baseline, a period of efficiency change during the construction process, and level efficiency after construction is complete.

Combustion Efficiency Data Pre and Post Retrofit



The as-built gas profile was calculated using the following equation:

$$AsBuilt\ TMY\ Therms = Baseline\ \ TMY\ Therms * \frac{AsBuilt\ therms\ per\ lb\ steam}{Baseline\ therms\ per\ lb\ steam}$$

The savings are the difference between the baseline and as-built profiles. An annual summary of the natural gas savings can be seen in the following table:

Monthly Therms Savings

Month	*HDD*	*Baseline*	*As-Built*	*Savings*
1	1,173	101,399	74,023	27,376
2	914	81,410	59,431	21,979
3	640	60,356	44,061	16,295
4	315	35,312	25,778	9,534
5	79	17,135	12,509	4,626
6	20	12,565	9,173	3,392
7	3	11,248	8,211	3,037
8	13	12,003	8,763	3,241
9	55	15,243	11,127	4,115
10	303	34,345	25,073	9,273
11	667	62,383	45,540	16,842
12	1,000	88,094	64,310	23,784
Total				143,495

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 Burners

Project-level Gross Savings Results

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

Verified Natural Gas Savings/Realization Rates

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
High Efficiency Burners	165,603	143,495
Total	165,603	143,495

Annual Therms Savings for High Efficiency Burners

Incentive Type	*Measure Category*	*Annual Gross Savings*			*Lifetime Gross Savings*
		Ex Ante Therms	*Ex Post Therms*	*Realization Rate*	*Ex Post Therms*
Custom	High Efficiency Burners	165,603	143,495	87%	2,152,422
Total		**165,603**	**143,495**	**87%**	**2,152,422**

The 87% verified gas realization rate is due to the ex-post calculation using measured combustion efficiencies and annualizing the savings to TMY, compared to the ex-ante which used estimated pre/post efficiencies and did not normalize to TMY operation.

Name C-26

Executive Summary

Application C-26 received custom incentives from Illinois DCEO for retrofitting the HVAC system in their facility. The electric realization rate for this project is 60%, and the natural gas realization rate is 92%.

Project Description

The customer retrofitted the HVAC system in SL Building. A new variable air volume system with VFD controlled fans with hot water reheat was installed to replace the old constant volume, multi-zone system.

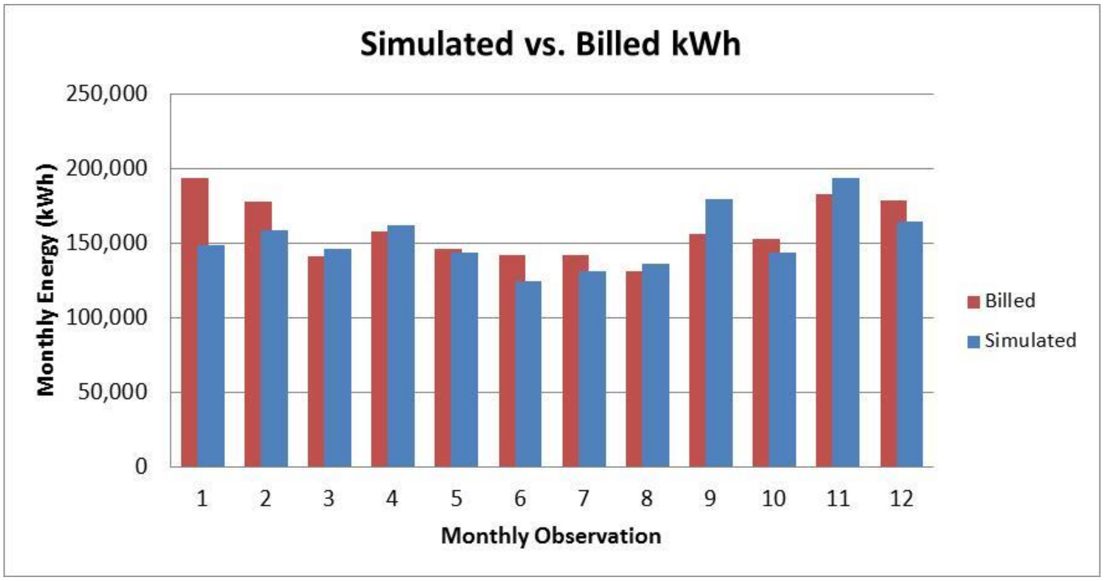
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the new HVAC system had been installed. To verify the energy savings for the retrofit, ADM field staff documented equipment nameplates and mechanical schedules.

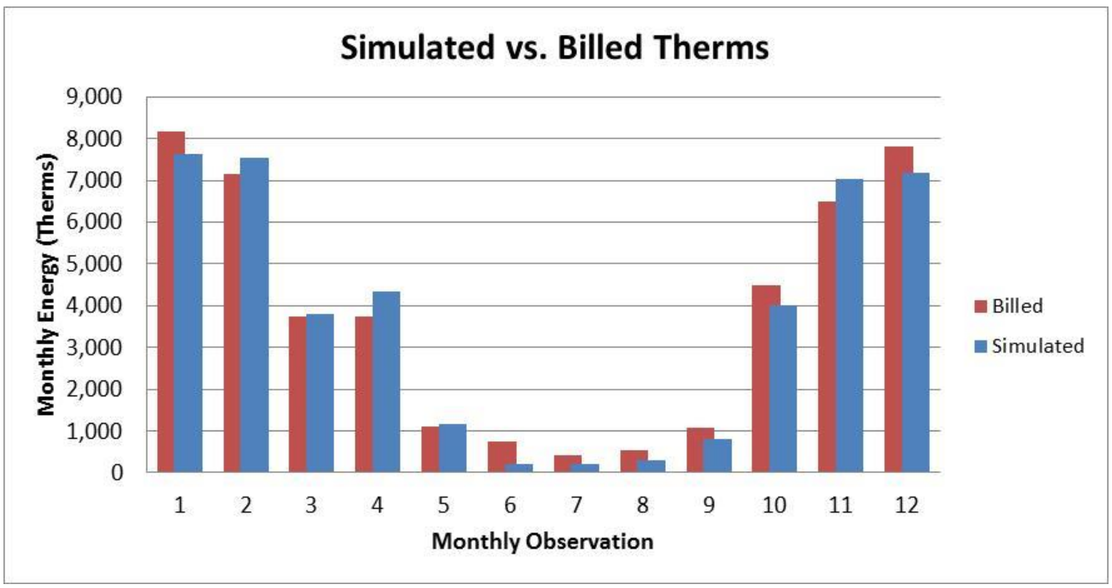
Custom Incentives

Energy savings were calculated using eQuest modeling of the Science Lab Building. ADM compiled a model of the baseline facility. Upon the completion of the initial model, a custom weather file was created using 2012 NOAA weather data for the Chicago Midway area. Using this weather file and billing data for the facility[31], ADM was able to ensure that the model's energy load shape matched that of the bills. The results of this calibration effort can be seen below:

2012 Monthly kWh Calibration



2012 Monthly Therms Calibration



Upon completion of the calibration for the baseline eQuest model, an as-built model was created in which all the system type was changed to VAV and fan VFDs were implemented. Once the baseline model was completed, the baseline and as-built models were run using TMY3 weather data for the region. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	514,581	514,581	0	0	0	0
Miscellaneous Equipment	414,646	414,646	0	0	0	0
Heating	108,147	105,628	2,519	42,550	18,822	23,728
Cooling	100,864	111,706	-10,842	0	0	0
Heat Rejection	16,204	17,818	-1,614	0	0	0
Pumps	36,813	46,250	-9,437	0	0	0
Fans	610,789	264,124	346,665	0	0	0
Domestic Hot Water	0	0	0	3,363	3,369	-6
Total	**1,802,044**	**1,474,753**	**327,291**	**45,913**	**22,191**	**23,722**

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for HVAC Retrofit

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated* *Ex Post*
HVAC Retrofit: VAV & VFDs	548,800	327,291
Total	548,800	327,291

Annual Therms Savings for HVAC Retrofit

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated* *Ex Post*
HVAC Retrofit: VAV & VFDs	25,855	23,722
Total	25,855	23,722

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	HVAC Retrofit	545,800	327,291	60%	28.85	4,909,365[32]
Total		***545,800***	***327,291***	***60%***	***28.85***	***4,909,365***

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 Retrofit	25,855	23,722	92%	355,830
Total		***25,855***	***23,722***	***92%***	***355,830***

The 60% verified electric realization rate is due to differences in analysis approaches. The ex-ante analysis used basic horsepower to kW calculations along with flow and runtime assumptions. The assumptions created large uncertainty. The ex post calibrated simulation used actual building and system information, which created high certainty in realized savings. Thus, the assumptions in the ex-ante analysis over estimated savings.

The 92% verified natural gas realization rate is due to the use of calibrated simulation versus engineering calculations. The discrepancy between the realized and expected savings is much lower for gas because the ex-ante analysis used some of the same system specific information. The ex-ante analysis also used the same TMY3 weather data. The main difference is that the simulation accounts for building interactive effects.

Name S-40

Executive Summary

Application S-40 received Standard incentives from Illinois-DCEO for retrofitting lighting in their Student Center. The realization rate for this project is 290%.

Project Description

The customer retrofitted the following:

- (15) 4’ 4LT12 fixtures with (15) 4’ LED fixtures
- (2) 2’ 2LT12 U-tube fixtures with (2) 2x2 LED fixtures

Methodology for Estimating Gross Savings.

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.4 was used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
TOS/NC/RF - LED Bulbs and Fixtures	164	53.6	3540	1.14	2308	6,683
TOS/NC/RF - LED Bulbs and Fixtures	82	44.9	3540	1.14	103	299
Total					2,411	6,982

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	LED Bulbs and Fixutres	2,411	6,982	290%	1.45	69,035
Total		***2,411***	***6,982***	***290%***	***1.45***	***69,035***

The project level realization rate is 290%. The realization rate is high because the ex ante savings estimate for the LED fixtures ranged from 52 kWh to 154 kWh per fixture, while the ex post savings analysis utilized the TRM calculations ranging from 150 kWh to 446 kWh per fixture. During the M&V site visit the number of fixtures verified was greater than the quantity on the final application provided by the project manager (which appears in this report). The quantity verified did however match the original application and the light survey.

Name S-41

Executive Summary

Application S-41 received standard incentives from Illinois-DCEO for retrofitting the lighting on the exterior of their buildings. The realization rate for this project is 469%.

Project Description

The customer retrofitted the (80) MH with (80) LED wall packs on the exterior of their site.

Methodology for Estimating Gross Savings.

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM section 4.5.4 was used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
TOS/NC/RF - LED Bulbs and Fixtures	95	8.3	4903	1	1,681	7,652
TOS/NC/RF - LED Bulbs and Fixtures	130	18.6	4903	1	9,550	7,101
TOS/NC/RF - LED Bulbs and Fixtures	208	32.2	4903	1		4,310
TOS/NC/RF - LED Bulbs and Fixtures	188	32.2	4903	1		33,611
Total					11,232	52,673

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	LED Bulbs and Fixtures	11,232	52,673	469%	0.00	376,005
Total		***11,232***	***52,673***	***469%***	***0.00***	***376,005***

The project level realization rate is 469%. The realization rate is high because the ex ante savings estimate (93 kWh -154 kWh per fixture) was lower than the ex post savings analysis which utilized the TRM calculations for LED fixtures (425 kWh – 862 kWh per fixture).

Name S-42

Executive Summary

Application S-42 received Standard incentives from Illinois-DCEO for retrofitting their lighting and HVAC. The electric realization rate for this project is 94% and the natural gas realization rate for this project is 100%.

Project Description

The customer retrofitted the following fixtures in their facility:

- (10) Exit signs with (10) LED Exit Signs
- (258) 4’ 2LT8 fixtures with (146) 4’ 2LT5 fixtures
- (80) 4’ 2LT8 fixtures with (57) 4’ 2LT5 fixtures
- (3) Incandescent fixtures with (2) 4’ 2LT5 fixtures
- (12) Incandescent fixtures with (11) 4’ 2LT5 fixtures
- Installation of Occupancy Sensors

The following improvements were installed on the facilities HVAC equipment:

- VSD for HWP 1
- VSD for HWP 2
- VSD for HV-9 Supply Fan
- VSD for HV-10 Supply Fan
- VSD for RT1 Supply Fan
- VSD for RT1 Return Fan
- VSD for RT2 Supply Fan
- VSD for RT2 Return Fan
- (2) VSD for Domestic HW Pumps
- (2) Air-Cooled Chillers in Lead/Lag
- (2) Natural Gas Tanked Water Heaters

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.5 and 4.5.12 were used.

ELECTRIC ENERGY SAVINGS

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

Where:

Wattsbase	= input wattage of the existing system
WattsEE	= new input wattage of EE fixture
WHFe	= 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, Illinois 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

Energy savings for the VFDs were calculated according to the Illinois TRM Version 2.0 Section 4.4.17.

ELECTRIC ENERGY SAVINGS

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

Where:

kWConnected	= 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.

SUMMER COINCIDENT PEAK DEMAND SAVINGS

$$\Delta kW = kWcontrolled * DSF$$

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.

Energy savings for the Chillers were calculated using a custom method. The TRM did not apply for the chillers because the TRM calculations are only applicable when the space is served by a single chiller. This retrofit replaced two chillers operating in a lead/lag configuration. The savings were calculated using an eQuest prototypical model to generate a lead/lag chiller part load profile for secondary schools in Chicago TMY3. The annual chiller load profiles were then determined by calculating the average PLRs for five degree temperature bins.

The following formula was then used to calculate the annual cooling energy savings for each chiller:

$$kWh_{Savings} = Tons \times (kW/ton_{base} - kW/ton_{ee}) \times Hrs$$

Where:

$kWh_{savings}$ = Annual cooling energy savings

Tons = Cooling Capacity, Tons

kW/ton_{base} = Integrated Part Load Value as enforced by code, ASHRAE 90.1-2007

kW/ton_{ee} = Integrated Part Load Value of the newly installed systems

Hrs = Annual hours of operation

NATURAL GAS ENERGY SAVINGS

Energy savings for the Hot Water Heaters were calculated using TRM section 4.3.1. The methodology outlines a deemed Therm savings per water heater for a number of building types. For Secondary Schools the TRM prescribes a 124 Therms savings per water heater annually.

Measure-level Gross Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure	*Measure Metrics*				*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
RF - Commercial LED Exit Signs	23	2	8766	1.23	2,264	2,264
RF - T5 Fixtures and Lamps	72	64	4311	1.23	42,434	48,953
RF - T5 Fixtures and Lamps	83	64	4311	1.23	1,446	1,548
RF - T5 Fixtures and Lamps	83	64	4311	1.23	575	642
RF - T5 Fixtures and Lamps	72	64	4311	1.23	9,814	11,199
Total					56,533	64,606

Annual kWh Savings for Lighting Controls

Measure	*Measure Metrics*				*Annual Gross kWh Savings*	
	kW Controlled	*Hours*	*ESF*	*WHFd*	*Ex Ante*	*TRM-Calculated Ex Post*
RF - Occupancy Sensor Lighting Controls	11,928	4,311	0.41	0.74	25,810	25,932
Total					25,810	25,932

Annual kWh Savings for VSDs

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	Hot Water Pump	RF	HVAC	15 HP	School(K-12)	9,222	10,279
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	15 HP	School(K-12)	9,222	10,279
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	5 HP	School(K-12)	3,074	1,274
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	5 HP	School(K-12)	3,074	1,274
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	20 HP	School(K-12)	12,296	5,087
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	5 HP	School(K-12)	3,074	1,274
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	20 HP	School(K-12)	12,296	0
Variable Speed Drives for HVAC	Forward Curved Fan, with discharge dampers	RF	HVAC	5 HP	School(K-12)	3,074	0
Variable Speed Drives for HVAC	Chilled Water Pump	RF	HVAC	15 HP	School(K-12)	3,074	9,212
Variable Speed Drives for HVAC	Chilled Water Pump	RF	HVAC	15 HP	School(K-12)	3,074	9,212
Total						58,406	38,678

Annual kWh for Electric Chiller

Measure	*Measure Metrics*						*Annual Gross Savings*	
	Program Type	*Qty*	*Chiller Size (tons)*	*Chiller Type*	*IPLV EER*	*Peak EER*	*Ex Ante kWh*	*ADM-Calculated Ex Post*
Chiller Replacement	RF	2	60	Air Cooled Scree	15.3	10.23	3,316	6,129
Total							3,316	6,129

Annual Therms Savings for Storage Water Heater

Measure	*Measure Metrics*			*Annual Gross Therms Savings*	
	Program Type	*Qty*	*Heater btuh*	*Ex Ante*	*TRM-Calculated Ex Post*
Storage Water Heater	TOS	2	120,000	248	248
Total				248	248

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	LED Exit	2,264	2,264	100%	0.03	36,228
Standard	Occupancy Controls	25,810	25,932	100%	0.80	207,455
Standard	T5 Fixtures and Lamps	54,269	62,342	115%	1.91	935,128
Standard	VFDs	58,406	38,678	66%	8.86	718,354
Standard	Chiller Replacement	3,316	6,129	185%	5.14	122,586
Total		***144,065***	***135,345***	***94%***	***16.74***	***2,019,751***

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
Total		***248***	***248***	***100%***	***3,720***

The project level electric realization rate is 94% and the natural gas realization rate is 100%. The lighting measure’s realization rate is high due to the ex post savings analysis utilizing the TRM calculations for the T5 fixtures. The exit signs and occupancy sensors revealed a highly accurate ex ante savings estimate.

The low realization rate for the VFDs is due to the ex-ante claiming savings for VFDs on an air handler that does not exist therefore VFDs could not be installed. The high realization rate for the chillers is due to ADM utilizing a temperature bin calculation to determine savings as the TRM is only capable of calculating savings for a single chiller when there are no other chillers being utilized.

Name S-43

Executive Summary

Application S-43 received standard incentives from Illinois DCEO for installation of (2) new hot water boilers, (1) air-cooled chiller, (6) VFDs for pumps and fans, and for retrofitting lighting in their facility. The electric realization rate for this project is 104%, and the natural gas realization rate is 150%.

Project Description

The customer retrofitted the following fixtures:

- (24) Exit Signs with (24) LED Exit Signs
- (2) exterior wall packs with (2) LED wall packs
- (4) 4’ 1LT8 fixtures with (2) LED fixtures
- (173) 4’ 2LT8 fixtures with (136) 4’ 2L T5 fixtures
- (54) 4’ 3LT8 fixtures with (46) 4’ 2LT5 fixtures
- (9) 4’ 3LT8 fixtures with (12) LED fixtures
- (97) 4’ 4LT8 fixtures with (136) 4’ 1LT5 fixtures
- (224) 4’ 4LT8 fixtures with (139) 4’ 2LT5 fixtures
- (63) 4’ 4LT8 fixtures with (125) LED fixtures
- (23) Incandescent fixtures with (8) 4’ 2LT5 fixtures
- (4) Incandescent fixtures with (3) LED fixtures
- Installation of Occupancy Sensors

The customer installed (2) new boilers, but only one is used at a time. The installed boilers have an efficiency of 92% AFUE. The 120-ton air-cooled chiller has an IEER of 15.7. VFDs were installed on several motors—two hot water pumps previously ran at constant speed, two boiler circulation pumps, of which only one is used at any given time, and a supply and return fan for a new AHU that was designed with VFDs. The previous AHU used a constant volume fan.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM field staff documented equipment nameplates and BMS screenshots.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.4, 4.5.5, 4.5.10, and 4.5.12 were used.

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

ADM estimated energy savings for the new chiller according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.6 Electric Chiller.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = TONS * ((12/IPLVbase) – (12/IPLVee))* EFLH$$

Where:

TONS	= chiller nominal cooling capacity in tons (note: 1 ton = 12,000 Btu/h)
12	= conversion factor to express Integrated Part Load Value (IPLV) EER in terms of kW per ton

IPLVbase	= efficiency of baseline equipment expressed as Integrated Part Load Value EER. Dependent on chiller type.
IPLVee	= efficiency of high efficiency equipment expressed as Integrated Part Load Value EER
EFLH	= equivalent full load hours dependent on location

For the VFDs, energy savings were calculated according to the TRM Version 2.0, Section 4.4.16 Variable Speed Drives for HVAC.

ELECTRIC ENERGY SAVINGS

$$\Delta kWH = kWconnected * Hours * ESF$$

Where:

kWConnected = 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

$$\Delta kW = kWconnected * DSF$$

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

Application	DSF
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 boilers, energy savings were calculated according to the TRM Version 3.0 (errata corrected), Section 4.4.10 High Efficiency Boilers.

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

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 Lighting Retrofit

Measure	*Existing Wattage*	*Efficient Wattage*	*Hours*	*WHFe*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated Ex Post*
RF - Commercial LED Exit Signs	23	2	8766	1.23	5,434	5,456
TOS/NC/RF - LED Bulbs and Fixtures	182.9	52.5	4903	1	1,019	1,279
RF - T5 Fixtures and Lamps	114	32	4311	1.23	26,894	35,728
RF - T5 Fixtures and Lamps	114	64	4311	1.23	110,759	88,234
RF - T5 Fixtures and Lamps	59	64	4311	1.23	4,942	4,481
RF - T5 Fixtures and Lamps	59	64	4311	1.23	18,325	7,970
RF - T5 Fixtures and Lamps	88	64	4311	1.23	13,829	9,587
TOS/NC/RF - LED Bulbs and Fixtures	128	53.6	4311	1.23	727	2,698
TOS/NC/RF - LED Bulbs and Fixtures	54.3	32.2	4311	1.23	652	639
TOS/NC/RF - LED Bulbs and Fixtures	38	44.9	4311	1.23	93	330
TOS/NC/RF - LED Bulbs and Fixtures	134	32.2	4311	1.23	5,902	23,421
Total					188,576	179,823

Annual kWh Savings for Lighting Controls

Measure	*kW Controlled*	*Hours*	*ESF*	*WHFd*	*Annual Gross kWh Savings* *Ex Ante*	*TRM-Calculated Ex Post*
RF - Occupancy Sensor Lighting Controls	1,064	4,311	0.41	1.23	2,313	2,313
RF - Occupancy Sensor Lighting Controls	14,336	4,311	0.41	1.23	31,828	31,167
Total					34,141	33,480

Annual kWh Savings for the High Efficiency Chiller

Measure	*Measure Metrics*							*Annual Gross Savings*	
	Qty	*Chiller Size (tons)*	*Chiller Type*	*Zone*	*Building Type*	*As-Built IPLV EER*	*Baseline IPLV EER*	*Ex Ante kWh*	*TRM-Calculated Ex Post kWh*
Electric Chiller	1	120	Air Cooled	2 (Chicago)	High School	15.7	11.3	7,655	29,139
Total								7,655	29,139

Annual kWh Savings for VFDs

Measure						*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*TONS/HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Hot Water Pump	TOS	HVAC	7.5 HP	School(K-12)	9,222	5,139
Variable Speed Drives for HVAC	Hot Water Pump	TOS	HVAC	7.5 HP	School(K-12)	3,689	5,139
Variable Speed Drives for HVAC	Hot Water Pump	TOS	HVAC	3 HP	School(K-12)	615	2,044
Variable Speed Drives for HVAC	Hot Water Pump	TOS	HVAC	3 HP	School(K-12)	615	-
Total						14,140	12,323

Annual Therms Savings for High Efficiency Boilers

Measure							*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	RF	2,500,000	Hot Water ≥300,000 & ≤2,500,000 Btu/h	AFUE 92%	2 (Chicago)	High School	4,035	6,579	6,053
Total							4,035	6,579	6,053

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	Air Cooled Chillers	7,655	29,139	381%	21.15	582,780
	Variable Speed Drives for HVAC	14,140	12,323	87%	-	184,843
	LED Bulbs and Fixtures	8,393	28,367	338%	0.83	235,190
	LED Exit	5,434	5,456	100%	0.08	87,293
	Occupancy Controls	34,141	33,480	98%	1.03	267,841
	Solar Light Tubes	174,749	146,000	84%	4.48	2,189,998
Total		*244,512*	*254,765*	*104%*	*27.57*	*3,547,945*

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	4,035	6,053	150%	121,050
Total		*4,035*	*6,053*	*150%*	121,050

The 104% verified electric realization rate is a result of several factors. The occupancy sensor realization rate is slightly low because one measure in the ex ante savings estimate for connected wattage was 14,640, while the ex post revealed the actual connected wattage of 14,336. The LED measures are high because the ex ante savings estimate per fixture (47 kWh to 510 kWh) was lower than the ex post savings analysis that utilized the TRM calculations per fixture (187 kWh to 639 kWh). The T5 measure was low because the ex ante savings estimate per fixture (135 kWh to 797 kWh) was higher than the ex post savings TRM analysis (59kWh to 635 kWh). The exit sign measure had a highly accurate ex ante calculation. For the chiller, the TRM Version 2.0 provides EFLH values based on climate zone and building type. The ex ante prescriptive savings are 127.4 kWh per ton based on building type, but the other assumptions used for this value are unknown. For the VFDs, the TRM Version 2.0 provides hours of use and energy savings factors based on building type and VFD application, respectively. The ex ante prescriptive savings for VFDs are 270 kWh per horsepower, which is likely based on average energy savings factors for pumps and fans.

The 150% natural gas realization rate results from several factors. The ex post savings utilized EFLH associated with a high school in climate zone 2 (Chicago), provided in the TRM Version 3.0. Additionally, the boilers have a larger input capacity than claimed in the ex ante (2,500 kBtuh vs. 2,000 kBtuh, each). The ex ante prescriptive savings are 2.43 Therms per kBtuh. The assumptions and values used in the ex ante are unknown, so definitive conclusions cannot be made. It should be noted that the boilers are not typically used simultaneously. They fire up at the same time, but when the hot water system reaches set point, they modulate down so that only one boiler runs for the remainder of the operating period.

Name C-27

Executive Summary

Application C-27 received custom incentives from Illinois DCEO for installation of three new high efficiency rooftop units and programmable thermostats to allow the units to setback during unoccupied periods. The electric realization rate for this project is 146% and the natural gas realization rate is 97%.

Project Description

The customer installed three new roof top package units replacing RTU-5, RTU-5A, and RTU-7. These RTUs serve laboratory space and supply 100% outside air while maintaining temperature and humidity for the spaces. The units were replaced based on recommendations from a SEDAC audit, as it was determined that the original units were 15 years old and the heating efficiency of the units had dropped dramatically. In order to increase the overall HVAC efficiency of the facility three new purposed built RTUs were installed with a heating efficiency of 80% and a high turndown ratio of 12:1. Along with the installation of the new RTUS, programmable thermostats were also installed to allow the temperature setpoints of both the lab and office space to setback during unoccupied hours.

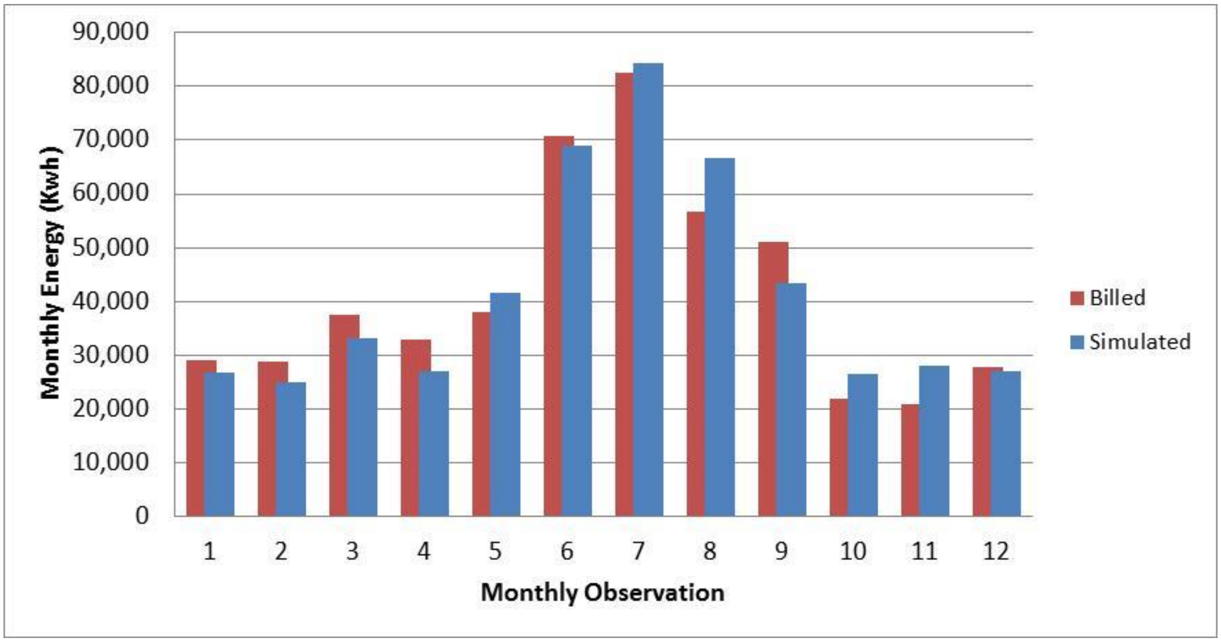
Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. ADM also collected site specific construction details, mechanical schedules, and building temperature setpoints.

Custom Incentives

Energy savings were calculated through the use of a site specific eQuest model, calibrated to annual billing and sub-metering data. Using site specific details collected during the M&V visit, a baseline eQuest model was compiled with the existing RTUs in place and a constant 24/7 heating and cooling setpoint. Using utility electric and natural billing data, the model was calibrated for the 2012 year. In order to assure the most accurate calibration, ADM also created a custom weather file using 2012 NOAA weather data for the closest weather station, Midway International Airport. The results of the calibration can be seen below:

2012 Monthly kWh Calibration



Upon completion of the calibration for the baseline eQuest model, an as-built model was created through the use of parametric runs in which the efficiencies of the three retrofitted RTUs were changes to that of the new RTUs and the temperature setback schedules were put in place. Once the as-built model was completed, the baseline and as-built models were run using TMY3 weather data for the region. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	*84,581*	*84,581*	*0*	*0*	*0*	*0*
Misc. Equipment	*76,526*	*76,526*	*0*	*0*	*0*	*0*
Heating	*0*	*0*	*0*	*122,380*	*91,579*	*30,801*
Cooling	*142,891*	*96,910*	*45,981*	*0*	*0*	*0*
Heat Rejection	*0*	*0*	*0*	*0*	*0*	*0*
Pumps	*1,562*	*1,562*	*0*	*68,132*	*44,239*	*23,893*
Fans	*161,683*	*161,150*	*533*	*0*	*0*	*0*
Exterior	*0*	*0*	*0*	*0*	*0*	*0*
Total	**467,243**	**420,729**	**46,514**	**190,512**	**135,818**	**54,694**

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for New RTUs and Thermostats

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
RTUs & Thermostats	31,472	46,514
Total	31,472	46,514

Annual Therms Savings for New RTUs and Thermostats

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
RTUs & Thermostats	56,588	54,694
Total	56,588	54,694

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	RTUs & Thermostats	31,472	46,514	148%	11.25	697,710
Total		***31,472***	***46,514***	***148%***	***11.25***	***697,710***

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	RTUs & Thermostats	56,588	54,694	97%	820,410
Total		***56,588***	***54,694***	***97%***	***820,410***

The 148% verified electric realization rate and 97% verified natural gas realization rate can be attributed to the differences in ex-ante and ex-post modeling methodologies as well as site verified operational setpoints. The ex-ante analysis relied on an IES Virtual Environment model, while ADM relied on eQuest for simulation as the ex-ante model was not made available for review.

Name S-44

Executive Summary

Application S-44 received Standard incentives from Illinois-DCEO for retrofitting their lighting. The realization rate for this project is 237%.

Project Description

The customer retrofitted the following fixtures:

- (28) Incandescent lamps with (28) CFL lamps
- (16) Incandescent lamps with (16) CFL lamps
- (75) Incandescent fixtures with (75) CFL fixtures
- (1753) 4' 2LT12 lamps with (1753) 4' 2LT8 lamps
- (886) 4' 4LT12 lamps with (886) 4' 2LT8 lamps
- (1772) Permanent T12 lamp removal
- (21) 4' 1LT12 lamps with (21) 4' 1LT8 lamps
- (32) HPS fixtures with (32) 4' 2LT8 fixtures
- (419) 2' 2LT12 U-tube fixtures with (419) 2' 3LT8 fixtures
- (25) 2' 2LT12 lamps with (25) 2' 2LT8 lamps

Methodology for Estimating Gross Savings.

During the M&V visit, ADM staff verified equipment had been installed and was operating. To verify the installed equipment, ADM staff documented fixture quantities and interviewed the site contact to verify operating hours.

Standard Incentives

Energy savings were calculated according to the Illinois TRM Version 2.0.

For the lighting retrofit TRM sections 4.5.1, 4.5.2, and 4.5.3 were used.

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 Savings Results

Standard Incentives

The table shown below presents the verified gross savings for measures that received standard incentives.

Annual kWh Savings for Lighting Retrofit

Measure					*Annual Gross kWh Savings*	
	Existing Wattage	*Efficient Wattage*	*Hours*	*WHFe*	*Ex Ante*	*TRM-Calculated Ex Post*
Commercial Energy Star Standard CFL			8766		3,567	7,847
Commercial Energy Star Standard CFL			8766		2,038	3,217
Commercial Energy Star Standard CFL			8766		2,308	66,254
RF - Fluorescent Delamping	33.7	0	8766	1	303,177	523,474
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	82	49	8766	1	480,231	507,104
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	164	49	8766	1		893,168
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	40	25	8766	1		2,761
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	82	72	8766	1	50,273	36,730
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	57	49	8766	1	-	1,753
RF - High Performance and Reduced Wattage T8 Fixtures and Lamps	232	49	8766	1	22,195	51,334
Total					863,788	2,093,642

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	Compact Fluorescent Lamp	7,912	77,318	977%	3.44	61,825
	Fluorescent Delamping	303,177	523,474	173%	59.72	5,758,214
	T8 Fixtures and Lamps	552,699	1,492,850	270%	170.30	10,180,361
Total		***863,788***	***2,093,642***	***242%***	***233.45***	***16,000,400***

The project level realization rate is 237%. The realization rate is high because the ex ante savings estimate for CFLs (31 kWh – 127 kWh per fixture) was lower than the ex post savings analysis that utilized the TRM calculations for CFLs (201 kWh - 883 kWh per fixture). The TRM savings calculation for permanent delamping (295 kWh per lamp) was higher than the ex ante savings estimate (171 kWh per lamp). Also, for two of the T8 measures the ex ante savings estimate (181 kWh – 694 kWh per fixture) was lower than the ex post TRM savings (527 kWh – 1,604 kWh per fixture).

Name S-45

Executive Summary

Application S-45 received standard incentives from Illinois DCEO for installing high efficiency boilers and HVAC VSDs at their facility. The natural gas realization rate is 54%, and the electric realization rate is 254%.

Project Description

The participant installed (2) 1,600 MBH HydroTherm boilers to replace (1) Burnham 4FW-240 and (1) Burnham 4FW-180 boilers with 1,800 MBH and 1,205 MBH input capacities, respectively. The latter has been retained as back-up. The participant also installed VSDs to control (2) existing 7.5 HP hot water pumps of unknown efficiency.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the equipment was installed and operational and documented equipment nameplate data.

Standard Incentives

NATURAL GAS ENERGY SAVINGS

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.10 High Efficiency Boiler.

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

Where:

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

Capacity = Nominal Heating 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

ELECTRIC ENERGY SAVINGS

ADM estimated energy savings resulting from VSD measures according to the Illinois TRM Version 2.0, Section 4.4.16 Variable Speed Drives for HVAC.

$$\Delta kWh = kWconnected * Hours * ESF$$

Where:

kWConnected = 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.

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	*Qty*	*Boiler btuh*	*Base Boiler type*	*Boiler AFUE*	*Zone*	*Ex Ante*	*TRM-Calculated Ex Post*	*TRM-Calculated (Errata Corrected) Ex Post*
High Efficiency Boiler	RF	2	1,600,000	Hot Water ≥300,000 & ≤2,500,000 Btu/h	92.5%	2 (Chicago)	7,776	4,541	4,200
Total							7,776	4,541	4,200

Annual kWh Savings for VSDs

Measure						*Annual Gross kWh Savings*	
	Application	*Program Type*	*Type*	*TONS/HP*	*Building Type*	*Ex Ante*	*TRM-Calculated Ex Post*
Variable Speed Drives for HVAC	Hot Water Pump	RF	HVAC	7.5 HP	School(K-12)	4,050	10,279
Total						4,050	10,279

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 Boiler	7,776	4,200	54%	84,000
Total		*7,776*	*4,200*	*54%*	*84,000*

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	4,050	10,279	254%	0.00	154,180
Total		*4,050*	*10,279*	*254%*	*0.00*	*154,180*

The ex ante natural gas savings estimate is calculated using a deemed savings of 2.43 therms per kBtuh based on a “school” facility type, but the assumptions applied to this savings value are unknown. The Illinois TRM version 3.0 determines EFLH based on building type and climate zone and applies a baseline boiler efficiency rating based on year and boiler type. This results in an ex post savings of 1.31 therms per kBtuh. The natural gas realization rate is 54%

The ex ante electric savings estimate uses a deemed savings of 270 kWh per controlled HP based on a “school” facility type, but other assumptions are unknown. The Illinois TRM version 2.0 determines hours of operation based on HVAC application and building type and determines energy savings factor based on VFD application. This results in a savings of 685 kWh per controlled HP. The electric realization rate is 254%.

Name C-28

Executive Summary

Application C-28 received custom incentives from Illinois DCEO for installation of new steam traps. The natural gas realization rate for this project is 154%.

Project Description

The customer replaced failed and leaking steam valves with new units to reduced natural gas consumption due to steam being lost from the system.

Methodology for Estimating Gross Savings

ADM staff reviewed site audit documentation showing the location of all replaced valves and the operating status of the original valves. From this reviewed, it was determined that the replacement type followed the custom survey methodology described in the Illinois TRM V2.0 in which savings for each valve is calculated individually as opposed to a mass replacement methodology with a penalizing factor.

Custom Incentives

Energy savings for the steam trap replacement were calculated according to the Illinois TRM Version 2.0 Section 4.4.16 Steam Trap Replacement or Repair.

NATURAL GAS ENERGY SAVINGS

$$\Delta therm = S * (Hv/B) * Hours * A * L / 100{,}000$$

Where:

S = Maximum theoretical steam loss per trap

Hv = Heat of vaporization of steam

B = Boiler efficiency

= custom, if unknown 0.8

Hours = Annual operating hours of steam plant

A = Adjustment factor

= 50%

L = Leaking & blow-thru

L is 1.0 when applied to the replacment of an individual leaking trap. If a number of steam traps are replaced and the system has not been audited, the leaking and blow-thru is applied to reflect the assumed percentage of steam traps that were actually leadking and needed replaceing. A custom value can be utilized if a supported by an evaluation.

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 Steam Trap Replacements

Measure	*Measure Metrics*					*Annual Gross Therms Savings*	
	Program Type	*Replacement Type*	*#*	*Steam System*	*Zone*	*Ex Ante*	*ADM Calculated Ex Post*
Steam Trap Replacement	RF	Custom Survey	123	Industrial Low Pressure <15 psig	2 (Chicago)		78,209
Steam Trap Replacement	RF	Custom Survey	10	Industrial Medium Pressure >15 psig < 30 psig	2 (Chicago)		5,815
Steam Trap Replacement	RF	Custom Survey	5	Steam Trap, Ind Med Pressure ≥30 <75 psig	2 (Chicago)		4,271
Steam Trap Replacement	RF	Custom Survey	39	Steam Trap, Ind High Pressure ≥125 <175 psig	2 (Chicago)		173,526
Steam Trap Replacement	RF	Custom Survey	4	Steam Trap, Ind High Pressure ≥175 <250 psig	2 (Chicago)		23,560
Total						185,012	285,381

Project-level Gross Savings Results

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

Verified Therms 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	Steam Trap Replacement	185,012	285,381	154%	1,712,288
Total		***185,012***	***285,381***	***154%***	***1,712,288***

The 154% verified natural gas realization rate is due to the ex-ante analysis utilizing the “Mass Replacement” portion of the calculation methodology laid forth by Section 4.4.16 of the Illinois TRM Version 2.0. The method applies a penalization factor to the potential savings as it assumes that not all of the replaced stream traps were leaking or failed. However, during the project review ADM was provided with a steam trap audit report that detailed the location and the condition of the steam valves to be replaced. Due to availability of this information, ADM opted to focus on only the valves that were being replaced due to failure and used the “Custom Survey” methodology which resulted in a higher natural gas savings and higher level of certainty in the analysis.

Name C-29

Executive Summary

Application C-29 received custom incentives from Illinois DCEO for installation of DDC controls. The electric realization rate for this project is 138%.

Project Description

The customer installed new DDC controls allowing for variable volume air flow control, variable hydronic flow, reduced outdoor air rates, demand control ventilation, and dual enthalpy economizer control.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified equipment had been installed and was operating. ADM also collected site specific construction details, mechanical schedules, and the Sequence of Operation (SOO) for the new DDC control system.

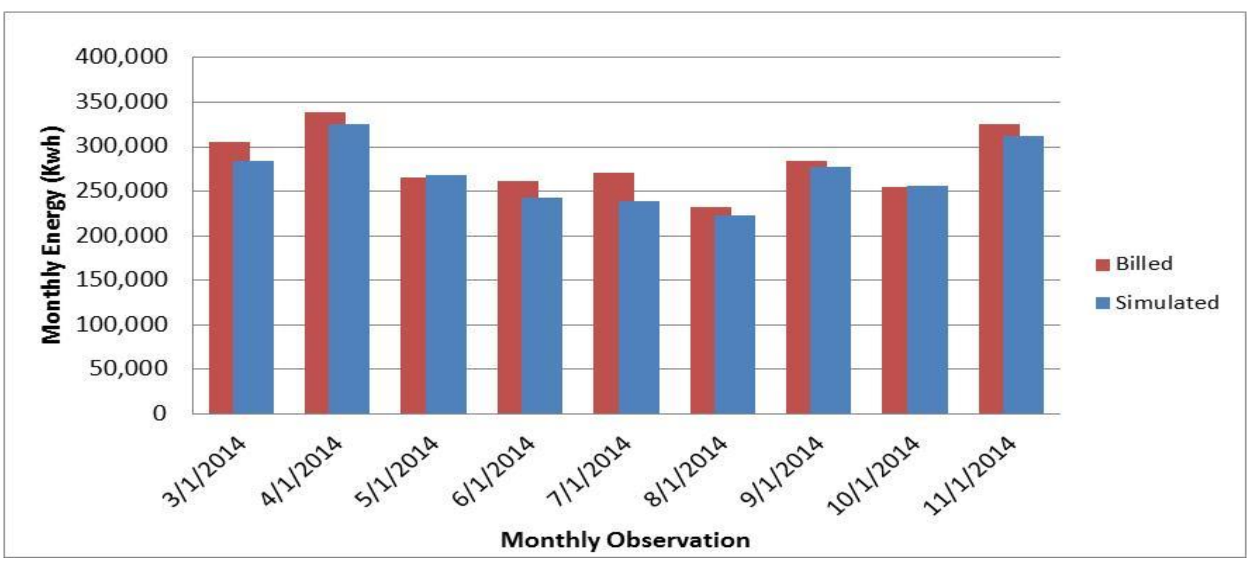
Custom Incentives

Energy savings were calculated through the use of a site specific eQuest model, calibrated to annual billing and sub-metering data.

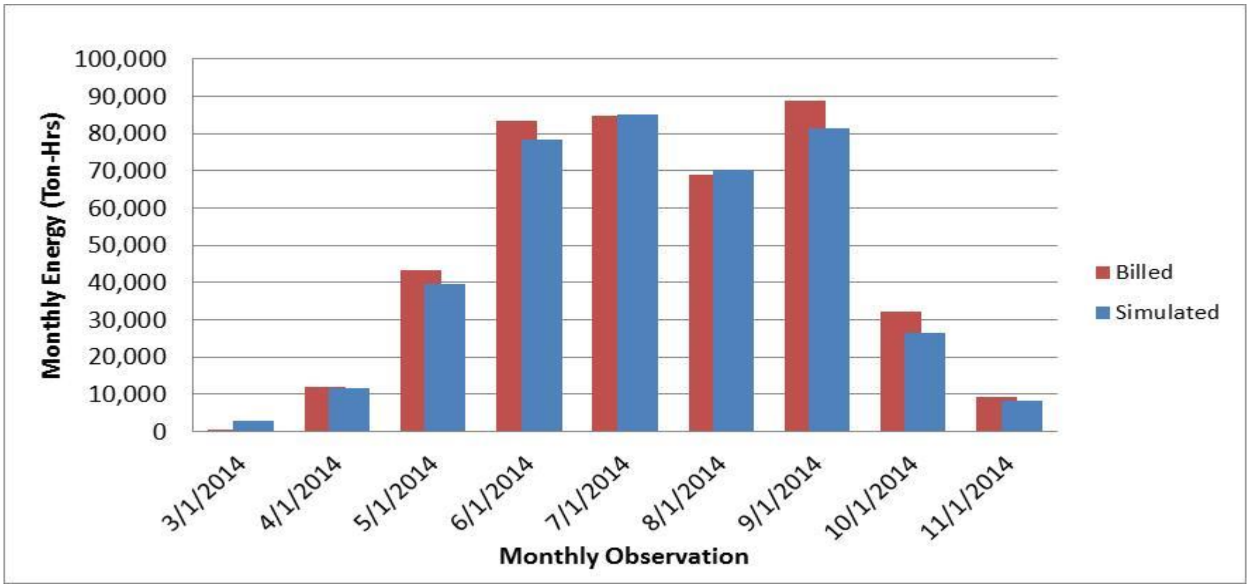
Using site specific details collected during the M&V visit, an as-built eQuest model was compiled with the DDC control system operating as described in the SOO. Using provided electric and hydronic sub metering data, the model was calibrated for the 2014 year. In order to assure the most accurate calibration, ADM also created a custom weather file using 2014 NOAA weather data for the closest weather station.

The results of the calibration can be seen below:

2014 Monthly kWh Calibration



2014 Monthly Chilled Water Calibration



Upon completion of the calibration for the as-built eQuest model, a baseline model was created through the use of parametric runs in which all of the controls features offered by the new system were removed. Once the baseline model was completed, the baseline and as-built models were run using TMY3 weather data for the region. The typical year annual savings is the difference between the two models' annual consumption and can be seen below:

As-Built Vs. Baseline Annual Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*	*Baseline Therms*	*As-Built Therms*	*Annual Therm Savings*
Lighting	*1,666,262*	*1,666,262*	*0*	*0*	*0*	*0*
Miscellaneous Equipment	*751,714*	*751,714*	*0*	*0*	*0*	*0*
Heating	*29,773*	*21,669*	*8,104*	*116,825*	*69,132*	*47,692*
Cooling	*517,814*	*306,422*	*211,392*	*32,701*	*23,800*	*8,901*
Heat Rejection	*0*	*0*	*0*	*0*	*0*	*0*
Pumps	*114,298*	*36,224*	*78,074*	*0*	*0*	*0*
Fans	*1,362,035*	*719,547*	*642,488*	*0*	*0*	*0*
Exterior	*147,312*	*147,312*	*0*	*0*	*0*	*0*
Total	**4,589,208**	**3,649,150**	**940,058**	**149,526**	**92,932**	**56,594**

It should be noted that a large portion of the Therms savings comes from space cooling as the facility utilizes a large absorption chiller for providing chiller water.

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for DDC Controls

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
DDC Controls	680,519	940,058
Total	680,519	940,058

Annual Therms Savings for DDC Controls

Measure	*Annual Gross Therms Savings*
	ADM Calculated Ex Post
DDC Controls	56,594
Total	56,594

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*
Custom	DDC Controls	680,519	940,058	138%	181.72	14,100,870 [33]	181.72
Total		***680,519***	***940,058***	***138%***	***181.72***	***14,100,870***	***181.72***

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	-	56,594	-	848,904
Total		**-**	***56,594***	-	848,904

The 138% verified electric realization rate is due to the ex-ante analysis utilizing a Trane Trace model which appeared to not be fully calibrated to the building's sub meter resulting in an under estimation of energy savings.

The project also produced gas savings that did not receive an incentive. This therm savings is captured, but without a realization rate.

Name S-46

Executive Summary

Application S-46 received standard incentives from Illinois DCEO for the repair and re-commissioning of (40) variable air volume boxes that had failed in order to reduce reheat. The realization rate for this project is 35% for natural gas.

Project Description

In order to reduce the reheat energy consumption of the VAV system, the facility repaired and re-commissioned (40) VAV boxes. Many of the boxes had failed in the full flow positions along with the reheat hot water valves not operating properly.

Methodology for Estimating Gross Savings

During the M&V visit, ADM staff verified that the re-commissioning and repair measures were completed and the VAV boxes were operating as intended.

Standard Incentives

Natural gas energy savings were calculated through the use of a variable degree day billing analysis as neither the Illinois TRM Version 2.0 nor Version 3.0 provides energy savings calculation methodologies to determine savings for the fore mentioned measures.

NATURAL GAS ENERGY SAVINGS

The billing analysis was completed by identifying the pre and post billing periods and creating a correlation for each, between the natural gas bills and heating/cooling degree days. The correlation creates two weather dependent terms, one being based on cooling degree days and the other heating degree days, along with a constant base energy term for the building. The baseline energy constant represents energy loads within the building that are not weather dependent. The following equation is used to express the annual natural gas energy consumption for both the baseline and as-built energy consumption:

$$Therm = m_{CDD} \times CDD + m_{Hdd} \times HDD + B$$

Where:

Therm	= Annual Therm Consumption
m_{CDD}	= Cooling Degree Day Coefficient
CDD	= Annual Cooling Degree Days
M_{HDD}	= Heating Degree Day Coefficient
HDD	= Annual Heating Degree Days
B	= Base Energy Constant

Once the baseline/as-built cooling and heating coefficients were determined, TYM3 weather was used to calculate the typical annual savings for the repair and re-commissioning of the VAV boxes.

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 VAV Box Re-Commissioning

Measure	*Annual Gross Therm Savings*	
	Ex-Ante	*ADM Calculated Ex Post*
VAV Box Re-Commissioning	11,200	3,906
Total	11,200	3,906

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	VAV Box Re-Commissioning	11,200	3,906	35%	58,585
Total		***11,200***	***3,906***	***35%***	***58,585***

The 35% verified natural gas realization rate is due to the ex-ante savings being based on standard incentives for HVAC Tune-Up to Reduce Reheat. From the documentation it appears that a 30% deemed savings was applied to the annual bills. It was also discovered that the billing data used in the ex-ante estimations does not match the bills that ADM received which were provided by the utility company.

Name N-4

Executive Summary

Application N-4 received custom incentives from Illinois DCEO for above-code construction of a new 37,030 ft^2 facility. The electric realization rate for this project is 59%, and the natural gas realization rate is 92%.

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 were 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 police station:

ASHRAE 90.1-2007 Vs As-Built Construction Details

Parameter	*ASHRAE 90.1-2007*	*As-Built*
Roof U-Factor	*U-0.048*	*U-0.037 & U-0.039*
Wall U-Factor	*U-0.090*	*U-0.080, U-0.036 & U-0.060*
Window U-Factor	*U-0.045*	*U-0.029*
Window SHGC	*0.40*	*0.38*
Lighting (LPD)	*1.00 w/ft²*	*0.79 w/ft²*
Air Side HVAC	*System 5: Package VAV w/HW Reheat*	*VAV w/HW Reheat*
Fan Control	*Constant & Inlet Guide Vanes*	*VFDs*
Cooling Efficiency	*2.8 COP & 3.5 COP*	*2.8 COP*
Heating Efficiency	*75%*	*95%*
DHW Efficiency	*80%*	*96%*
CHW & HW Pump Control	*Constant*	*VFDs*

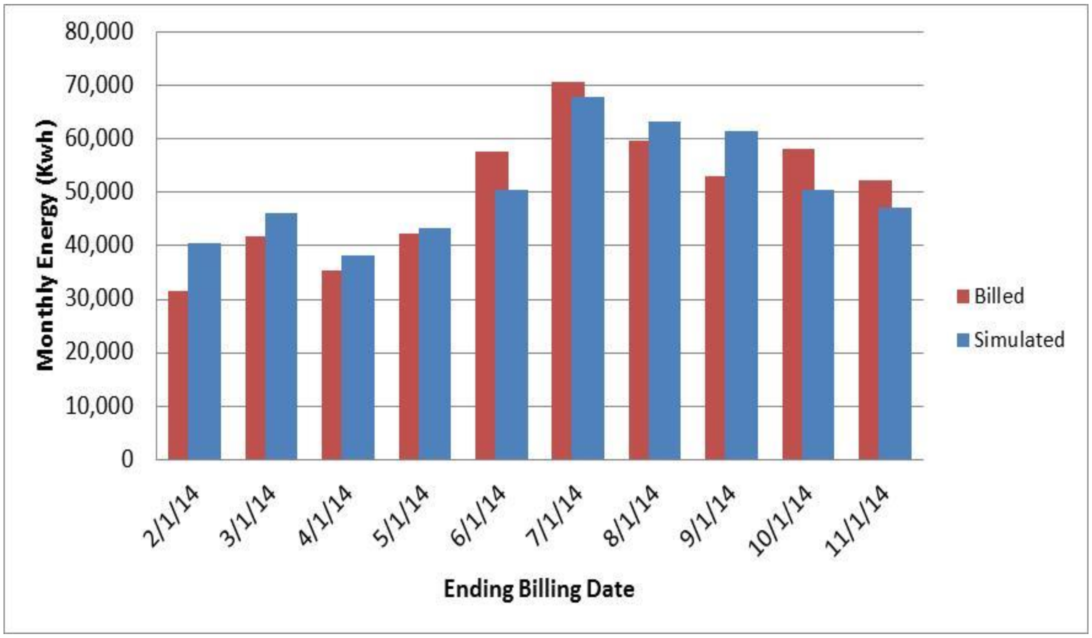
Methodology for Estimating Gross Savings

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 police department. ADM compiled a model of the as-built facility using the details and construction documents collected during the on-site M&V visit. 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 and billing data for the facility, ADM ensured that the model's energy load shape matched that of the bills, within a normalized mean biased error of 1%. The results of this calibration effort can be seen below:

2014 Monthly kWh Calibration



Upon completion of the calibration for the as-built eQuest model, a baseline model was created with ASHRAE 90.1-2007 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 Electrical Energy Consumption

End-Use	*Baseline kWh*	*As-Built kWh*	*Annual kWh Savings*
Lighting	*239,871*	*189,498*	*50,373*
Misc. Equipment	*118,927*	*118,927*	*0*
Heating	*4,165*	*12,853*	*-8,688*
Cooling	*222,339*	*124,817*	*97,522*
Heat Rejection	*0*	*0*	*0*
Pumps	*17,327*	*28,072*	*-10,745*
Fans	*179,786*	*123,729*	*56,057*
Exterior	*5,308*	*5,308*	*0*
Total	**787,723**	**603,204**	**184,519**

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	*45,234*	*30,911*	*14,323*
Cooling	*0*	*0*	*0*
Heat Rejection	*0*	*0*	*0*
Pumps	*0*	*0*	*0*
Fans	*0*	*0*	*0*
Exterior	*0*	*0*	*0*
Total	**45,234**	**30,911**	**14,323**

It should be noted that the negative kWh heating savings are due to the as-built model having electric resistance heating for one of the air handlers, while the baseline code required minimum is gas heating. Also, the negative kWh pumping savings are due to the baseline system being a packaged VAV, with no chilled water requirements and associated pumping power, while the as-built system is a VAV system that does use chilled water.

Measure-level Gross Savings Results

Custom Incentives

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

Annual kWh Savings for Above Code Renovations

Measure	*Annual Gross kWh Savings*	
	Ex Ante	*ADM Calculated Ex Post*
Above Code Construction	311,828	184,519
Total	311,828	184,519

Annual Therms Savings for Above Code Renovations

Measure	*Annual Gross Therms Savings*	
	Ex Ante	*ADM Calculated Ex Post*
Above Code Construction	15,575	14,323
Total	15,575	14,323

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	Above Code Construction	311,828	184,519	59%	41.24	2,767,785[34]
Total		***311,828***	***184,519***	***59%***	***41.24***	***2,767,785***

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	Above Code Construction	15,575	14,323	92%	214,845[35]
Total		***15,575***	***14,323***	***92%***	***214,845***

The project has an overall electrical realization rate of 59% and a natural gas realization rate of 92%. The 59% verified electric realization rate is due to the ex-ante eQuest model not being calibrated to annual bills. The ex-ante as-built model consumes 1,050,385 kWh annually using TMY3 weather compared to ADM's eQuest model that consumes 603,204 kWh using the same weather file. This means the ex-ante's eQuest model consumes approximately 74% more than the facility should consume during a typical year. This over estimation of annual energy consumption explains the higher energy savings claimed by the ex-ante analysis.

Name C-30

Executive Summary

Application C-30 received custom incentives from Illinois DCEO for tuning up boilers at an aggregation of their facilities. The natural gas realization rate is 95%.

Project Description

The customer had boiler tune-ups at an aggregation of their facilities.

Methodology for Estimating Gross Savings

ADM received a final report from Energy Resources Center at University of Illinois for the aggregation, which was used for a desktop review of savings.

Custom Incentives

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.2 Space Heating Boiler Tune-up.

NATURAL GAS ENERGY SAVINGS

$$\Delta \text{therms} = \text{Ngi} * \text{SF} * \text{EFLH}/100$$

Where:

Ngi =Boiler gas input size (kBtu/hr) = custom value

SF = Savings factor (% reduction in gas consumption)

= 1.6% or custom

EFLH = Equivalent full load hours for heating

Measure-level Gross Savings Results

Custom Incentives

The table shown below presents the verified gross savings for each school in the aggregation.

Annual Therms Savings for the following locations:

Location	Measure Metrics			Annual Gross Therms Savings	
	Total Input Capacity	EFLH	Normalized Savings Factor	Ex Ante	ADM Calculated Ex Post
A E, L M	5,040	840	1.95%	826	826
A E S	8,746	840	1.70%	1,249	1,249
B M & S A	16,738	840	1.05%	1,476	1,476
B E	2,070	840	0.00%	0	0
C E	9,056	840	-1.26%	94	-959
C E C	12,556	840	3.05%	3,217	3,217
D W E	8,370	840	-0.30%	0	-211
D M M	8,159	840	-1.15%	443	-787
E P E	3,610	840	0.90%	273	273
F E	10,186	840	1.03%	881	881
F H S E G	12,544	807	-0.20%	0	-202
G E J W V	8,370	840	0.00%	141	0
H A H	6,277	840	0.50%	264	264
K P H S	33,474	807	7.15%	19,315	19,315
L E	10,460	840	0.15%	132	132
L E	12,552	840	6.00%	6,326	6,326
N E	8,370	840	3.60%	2,531	2,531
N M S A	7,532	840	2.45%	1,550	1,550
O I H S	12,246	807	1.50%	1,482	1,482
O E S W J	4,185	840	1.40%	492	492
O P E	5,126	840	2.40%	1,033	1,033
R E	5,231	840	1.60%	703	703
S	2,700	840	0.10%	23	23
So	4,980	840	1.40%	586	586
T H S	31,383	807	3.73%	9,455	9,455
Total				*52,491*	*49,654*

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	Boiler Tune-up	52,491	49,654	95%	148,961
Total		***52,491***	***49,654***	***95%***	***148,961***

The ex ante savings calculation used the algorithm from the Illinois TRM Version 3.0; however, the boiler tune-ups that resulted in a net loss of efficiency were excluded from the calculation, resulting in a higher expected savings. The losses were a result of changes made to the boilers' operation by the contractor to keep them operational, prevent future damage that would result from improper existing conditions, to match manufacturers' minimum specifications, etc. The realization rate for this project is 95%.

Name C-31

Executive Summary

Application C-31 received custom incentives from Illinois DCEO for tuning up boilers at an aggregation of their facilities. The natural gas realization rate is 90%.

Project Description

The customer had boiler tune-ups at an aggregation of their facilities.

Methodology for Estimating Gross Savings

ADM received a final report from Energy Resources Center at University of Illinois for the aggregation, which was used for a desktop review of savings.

Custom Incentives

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.2 Space Heating Boiler Tune-up.

NATURAL GAS ENERGY SAVINGS

$$\Delta\text{therms} = \text{Ngi} * \text{SF} * \text{EFLH}/100$$

Where:

Ngi =Boiler gas input size (kBtu/hr) = custom value

SF = Savings factor (% reduction in gas consumption)

= 1.6% or custom

EFLH = Equivalent full load hours for heating provided in Section 4.4

Measure-level Gross Savings Results

Custom Incentives

The table shown below presents the verified gross savings for each school in the aggregation.

Annual Therms Savings for Space Heating Boiler Tune-up

Location	Measure Metrics			Annual Gross Therms Savings	
	Total Input Capacity	EFLH	Normalized Savings Factor	Ex Ante	ADM Calculated Ex Post
A T C H S	2,000	807	0.00%	0	0
A P E	12,556	840	1.35%	1,424	1,424
B E A	12,563	840	0.70%	738	738
B E S H S	12,544	807	0.70%	709	709
B E	6,696	840	2.40%	1,350	1,350

Location	Measure Metrics			Annual Gross Therms Savings	
	Total Input Capacity	EFLH	Normalized Savings Factor	Ex Ante	ADM Calculated Ex Post
B E	11,660	840	0.75%	735	735
C E A	12,554	840	1.50%	1,582	1,582
C M E	3,348	840	3.00%	844	844
D E C S	10,462	840	1.20%	1,055	1,055
D	4,184	840	1.00%	351	351
D E	4,000	840	0.95%	319	319
D V A H S	52,912	807	3.29%	14,588	14,043
E O K E S	3,920	840	0.40%	132	132
H E S J	8,368	840	0.95%	879	668
H M H S	32,011	807	0.72%	1,972	1,864
L R G C	10,500	840	3.85%	3,396	3,396
M A A	8,370	840	0.55%	562	387
N E J A.	6,696	840	2.80%	1,575	1,575
N H A	6,000	840	1.95%	983	983
P M E	5,858	840	0.50%	246	246
P E A	11,873	840	0.26%	257	257
T E	51,600	840	0.65%	2,817	2,817
Th	10,500	840	-0.35%	88	-309
Wa	1,300	840	0.95%	104	104
W E H	10,100	840	0.95%	1,145	806
H P A H S	12,830	807	1.30%	1,346	1,346
J C P W	34,697	807	0.60%	1,680	1,680
K E A	15,000	840	3.40%	4,284	4,284
M E	6,000	840	0.10%	126	50
M E J E	3,000	840	1.90%	479	479
Mo	3,000	840	0.00%	0	0
O K E	850	840	1.40%	100	100
P E	6,000	840	0.30%	151	151
Se	12,624	840	-3.10%	318	-3,287
W C S	5,250	840	2.70%	1,191	1,191
B A M S	798	840	0.00%	0	0

Location	Measure Metrics			Annual Gross Therms Savings	
	Total Input Capacity	EFLH	Normalized Savings Factor	Ex Ante	ADM Calculated Ex Post
B E	3,600	840	0.00%	0	0
B B R A.	5,415	840	0.00%	0	0
B A S E S	2,000	840	0.60%	101	101
B C H	6,000	840	0.00%	0	0
C M A B	6,000	807	-0.10%	145	-48
D E	25,000	840	0.90%	1,890	1,890
F	5,230	840	0.00%	0	0
K C P	6,278	807	1.40%	709	709
N T A	12,000	840	0.75%	1,008	756
P C C	6,276	807	0.50%	253	253
P M E A	10,714	840	1.28%	1,147	1,147
S C A H S	14,000	840	3.15%	3,704	3,704
S S M	12,554	840	0.00%	0	0
T E L M S	12,556	840	3.00%	3,164	3,164
W M E	6,277	840	0.50%	264	264
Total				*59,911*	*54,009*

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	Boiler Tune-up	59,911	54,009	90%	162,027
Total		***59,911***	***54,009***	***90%***	***162,027***

The ex ante savings calculation used the algorithm from the Illinois TRM Version 3.0; however, the boiler tune-ups that resulted in a net loss of efficiency were excluded from the calculation, resulting in a higher expected savings. The losses were a result of changes made to the boilers' operation by the contractor to keep them operational, to prevent future damage that would result from improper existing conditions, to match manufacturers' minimum specifications, etc. The realization rate for this project is 90%.

Name C-32

Executive Summary

Application C-32 received custom incentives from Illinois DCEO for tuning up boilers at an aggregation of their facilities. The natural gas realization rate is 96%.

Project Description

The customer had boiler tune-ups at an aggregation of their facilities.

Methodology for Estimating Gross Savings

ADM staff visited AFAHS and verified equipment specs and that the equipment was operational by documenting unit nameplates and interviewing facility staff. A final report from Energy Resources Center at University of Illinois for the aggregation was provided with project documentation and used for a desktop review of savings.

Custom Incentives

ADM estimated energy savings according to the Errata Corrected Illinois TRM Version 3.0, Section 4.4.2 Space Heating Boiler Tune-up.

NATURAL GAS ENERGY SAVINGS

$$\Delta\text{therms} = \text{Ngi} * \text{SF} * \text{EFLH}/100$$

Where:

Ngi =Boiler gas input size (kBtu/hr) = custom value

SF = Savings factor (% reduction in gas consumption)

= 1.6% or custom

EFLH = Equivalent full load hours for heating provided in Section 4.4

Measure-level Gross Savings Results

Custom Incentives

The table shown below presents the verified gross savings for each school in the aggregation.

Annual Therms Savings for Space heating Boiler Tune-up

Location	Measure Metrics			Annual Gross Therms Savings	
	Total Input Capacity	EFLH	Normalized Savings Factor	Ex Ante	ADM Calculated Ex Post
A E A H	6,000	807	0.95%	460	460
A E B	4,185	840	0.10%	35	35
C C E E S	4,638	840	5.70%	2,221	2,221
D E	7,200	840	7.41%	4,483	4,483

Location	Measure Metrics			Annual Gross Therms Savings	
	Total Input Capacity	EFLH	Normalized Savings Factor	Ex Ante	ADM Calculated Ex Post
E E	15,212	840	1.95%	2,493	2,493
R C A H S	20,736	807	2.14%	3,585	3,585
To	12,000	840	4.85%	4,885	4,885
To B	6,000	840	3.10%	1,562	1,562
P E S A	4,500	840	5.55%	2,098	2,098
A E	5,100	840	2.50%	1,071	1,071
B E	8,370	840	2.55%	1,793	1,793
B E	10,205	840	0.68%	583	583
B E C C	5,792	840	4.71%	2,291	2,291
B E	8,370	840	1.70%	1,195	1,195
C E	12,556	840	1.20%	1,266	1,266
C E A	2,070	840	4.70%	817	817
C E E S	2,070	840	3.50%	609	609
C E	10,282	840	1.25%	1,080	1,080
C M S T A	6,000	840	1.50%	756	756
Da	10,000	840	0.95%	798	798
D A F A	12,556	840	-2.80%	0	-2,953
D P E	8,500	840	3.36%	2,402	2,402
E E	16,626	840	2.85%	3,977	3,977
F P E	3,600	840	1.55%	469	469
F E	10,200	840	7.70%	6,597	6,597
G E M	4,000	840	2.05%	689	689
G E	8,370	840	2.35%	1,652	1,652
G E S	51,600	840	3.15%	13,653	13,653
H E N	16,738	840	2.30%	3,234	3,234
H F P A	6,000	840	2.53%	1,273	1,273
H E	6,000	840	1.50%	756	756
H E	4,000	840	1.00%	336	336
I C H	6,000	840	1.10%	554	554
J M A V	8,370	840	3.00%	2,109	2,109
K E J D.	5,000	840	0.95%	399	399

Location	Measure Metrics			Annual Gross Therms Savings	
	Total Input Capacity	EFLH	Normalized Savings Factor	Ex Ante	ADM Calculated Ex Post
L A	9,000	840	0.00%	416	0
L R H	4,500	840	2.60%	983	983
L E	4,000	840	3.00%	1,008	1,008
L C P	55,997	807	0.29%	1,756	1,317
M E	5,000	840	1.40%	588	588
M F M	10,462	840	0.95%	835	835
M D E	4,000	840	0.30%	101	101
N M S E	4,185	840	-0.70%	0	-246
N E	8,370	840	0.15%	105	105
O T E	6,000	840	1.30%	655	655
Og	11,509	840	2.35%	2,276	2,276
O E A	5,000	840	2.15%	903	903
P E	4,000	840	3.75%	1,260	1,260
P E A	4,000	840	0.75%	252	252
P C C H S	20,922	807	1.10%	1,857	1,857
R E	4,500	840	4.35%	1,644	1,644
R H E	4,980	840	0.90%	376	376
R H S	4,184	807	1.50%	506	506
R C B	1,980	840	4.20%	699	699
S E	7,200	840	2.48%	1,497	1,497
S E	10,200	840	1.55%	1,328	1,328
S C A	18,829	840	0.33%	527	527
S E	10,970	840	0.70%	645	645
S O H S	2,700	840	0.55%	125	125
S E A A	5,000	840	1.20%	504	504
S M	160	840	1.30%	17	17
S A E	6,276	840	2.60%	1,371	1,371
J W E	62,764	840	0.40%	2,109	2,109
H E	6,000	840	5.10%	2,570	2,570
G R L E S	5,700	840	3.35%	1,603	1,603
Total				*100,698*	*96,644*

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	Boiler Tune-up	100,698	96,644	96%	289,932
Total		***100,698***	***96,644***	***96%***	***289,932***

The ex ante savings calculation used the algorithm from the Illinois TRM Version 3.0; however, the boiler tune-ups that resulted in a net loss of efficiency were excluded from the calculation, resulting in a higher expected savings. The losses were a result of changes made to the boilers' operation by the contractor to keep them operational, to prevent future damage that would result from improper existing conditions, to match manufacturers' minimum specifications, etc. The realization rate for this project is 96%.

Appendix B: Survey Instrument for Custom Standard Survey

1. According to our records, you completed a [PROJECT TYPE] at the [LOCATION] location. We would like you to answer some questions about your decision making and experience with the program in implementing this project.

   Do you recall this project?

   ( ) Yes
   ( ) No *(Thank and terminate interview)*

2. What was your role in the decision making process to implement the [PROJECT TYPE]?

   ( ) Main decision maker
   ( ) Assisted with the decision
   ( ) Was not part of the decision process *(If checked, skip to 4A, 4B, then 4C)*

   4A. Who was the main decision maker? If multiple people were responsible for the decision, please provide the name of the person you think is most knowledgeable about the decision making process to implement the energy efficient equipment.

   4B. What is this person's telephone number?

   4C. What is this person's email address?

   (Thank and terminate interview)

3. What is your job title or role?

   ( ) Facilities Manager
   ( ) Energy Manager
   ( ) Other facilities management/maintenance position
   ( ) Chief Financial Officer
   ( ) Other financial/administrative position
   ( ) Proprietor/Owner
   ( ) President/CEO
   ( ) Manager
   ( ) Other *(please specify)*

4. Regarding your organization's decision to participate in the incentive program, who initiated the discussion about the incentive opportunity? Would you say…

   ( ) Your organization initiated it
   ( ) Your vendor or contractor initiated it
   ( ) The idea arose in discussion between your organization and your vendor or contractor
   ( ) A program representative from DCEO, SEDAC, ERC, or MEEA initiated it
   ( ) Some other way *(please specify)*
   ( ) Don't Know

5. Has your organization purchased any energy efficient equipment in the last three years for which you did not apply for a financial incentive through an energy efficiency program?
   ( ) Yes, purchased energy efficient equipment but did not apply for incentive.
   ( ) No, no additional equipment was purchased by organization.
   ( ) No, an incentive was applied for.
   ( ) Don't know

The next questions are about your decision to implement the energy efficient [EQUIPMENT], as opposed to either implementing equipment that is not energy efficient or by not completing the project at all.

6. Did a Public Sector Energy Efficiency Program or other DCEO representative, including SEDAC, MEEA, or ERC, recommend that you implement the energy efficient [EQUIPMENT TYPE]?
   ( ) Yes *(If checked, go to 8A)*
   ( ) No
   ( ) Don't know

   8A. If the Public Sector Energy Efficiency Program representative had not recommended implementing the energy efficient project, how likely is it that you would have implemented it anyway?
   ( ) Definitely would have
   ( ) Probably would have
   ( ) Probably would not have
   ( ) Definitely would not have
   ( ) Don't know

7. How important was your previous experience with the DCEO programs in making your decision to implement the energy efficient [EQUIPMENT TYPE]?
   ( ) Very important
   ( ) Somewhat important
   ( ) Only slightly important
   ( ) Not at all important
   ( ) Don't know

8. Would you have been financially able to implement the energy efficient [EQUIPMENT TYPE] without the financial incentive or grant from the Public Sector Energy Efficiency Program?
   ( ) Yes
   ( ) No
   ( ) Don’t know

Now please think about the action you would have taken with regard to the implementation of this project if the DCEO program had not been available.

9. If the financial incentive or grant from the Public Sector Energy Efficiency Program had not been available, how likely is it that you would have implemented the energy efficient [EQUIPMENT TYPE] anyway?
   - ( ) Definitely would have
   - ( ) Probably would have
   - ( ) Probably would not have
   - ( ) Definitely would not have
   - ( ) Don't know

10. Using a likelihood scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely", if the DCEO program had not been available, what is the likelihood that you would have implemented exactly the same project?

11. Without the program, when do you think you would have implemented this project? Would you say…
   - ( ) At the same time
   - ( ) Earlier
   - ( ) Later *(If checked, go to 13A)*
   - ( ) Never
   - ( ) Don't know

13A. How much later would you have implemented this project? Would you say…
   - ( ) Within 6 months?
   - ( ) 6 months to 1 year later
   - ( ) 1 - 2 years later
   - ( ) 2 - 3 years later
   - ( ) 3 - 4 years later
   - ( ) 4 or more years later
   - ( ) Don't know

12. How did the availability of information and financial incentives or grants through the Public Sector Energy Efficiency Program affect the quantity (or number of units) or scope of the [EQUIPMENT TYPE] that you implemented? Did you implement more energy efficiency measures than you otherwise would have without the program?
   - ( ) Yes *(If checked, go to 14A)*
   - ( ) No, program did not affect quantity purchased and installed
   - ( ) Don't know

14A. What part of the [EQUIPMENT TYPE] would you not have implemented without the program?

13. How did the availability of information and financial incentives or grants through the Public Sector Energy Efficiency Program affect the level of energy efficiency you chose for the [EQUIPMENT TYPE]? Did you choose equipment that was more energy efficient than you otherwise would have chosen because of the program?
    ( ) Yes *(If checked, go to 15A)*
    ( ) No, program did not affect level of efficiency chosen for equipment
    ( ) Don't know

    15A. How much more efficient [EQUIPMENT TYPE] did you install? (i.e., "xx% more efficient")

14. When did you first learn about DCEO's Program? Was it BEFORE or AFTER you first began to THINK about implementing the [EQUIPMENT TYPE]?
    ( ) Before
    ( ) After
    ( ) Don't know

15. When did you DECIDE to implement the [EQUIPMENT TYPE]? Was it before or after you learned about DCEO's incentive Program?
    ( ) Before
    ( ) After
    ( ) Don't know

16. And when did your organization decide to commit the funding to implement the [EQUIPMENT TYPE]? Was it before or after you learned about DCEO's incentive program?
    ( ) Before
    ( ) After
    ( ) Don't know

17. Did you work with a contractor or vendor that helped you with the choice of this equipment?
    ( ) Yes
    ( ) No
    ( ) Don't know

18. Did you also use a design or consulting engineer?
    ( ) Yes
    ( ) No
    ( ) Don't know

19. Does [PUBLIC ENTITY] have a utility account manager?
    ( ) Yes *(If checked, go to 21A)*
    ( ) No
    ( ) Don't know

21A. Did your electric or natural gas utility account manager assist you with the project that you implemented through the program?

( ) Yes

( ) No
( ) No, don’t have a utility account manager
( ) Don’t know

20. Before participating in the Public Sector Energy Efficiency Program, had you implemented any equipment or measure similar to the energy efficient [EQUIPMENT TYPE] at this facility?
( ) Yes
( ) No
( ) Don't know

21. Did you have plans to implement the energy efficient [EQUIPMENT TYPE] that you implemented through the program at this facility before participating in the Public Sector Energy Efficient Program?
( ) Yes *(If checked, go to 23A, 23B, 23C)*
( ) No
( ) Don't know

23A. For about how long did you have plans to implement these measures prior to finding out about the program?
( ) Less than 6 months
( ) 6-12 months
( ) 1-2 years
( ) 3-5 years
( ) More than 5 years
( ) Don't know

23B. Did your plans specify which specific energy efficiency measures you were going to implement?
( ) Yes
( ) No, it was more of a general plan
( ) Don't know

23C. Would you have gone ahead with this planned implementation even if you had not participated in the program?
( ) Yes
( ) No
( ) Don't know

The next questions ask you to rate the importance of the program as well as other factors that might have influenced your decision to implement this measure. Think of the degree of importance as being shown on a scale with equally spaced units from 0 to 10, where 0 means not at all important and 10 means extremely important. Now using this scale please rate the importance of each of the following in your decision to implement the measure at this time.

22. How important in your decision to implement the project was *the age or condition of the old equipment?*
23. How important in your decision to implement the project was *availability of the DCEO incentive?*
24. How important in your decision to implement the project was *other public funding you received?*
25. *(Only ask if DCEO or SEDAC provided information to implement)* How important in your decision to implement the project was *information provided through the technical assistance you received from DCEO or Smart Energy Design Assistance Center staff?*
26. (*Only ask if worked with vendor or contractor*) How important in your decision to implement the project was *recommendation from an equipment vendor or contractor that helped you with the choice of the equipment?*
27. How important in your decision to implement the project was *previous experience with this type of equipment?*
28. How important in your decision to implement the project was *the recommendation from a DCEO program staff person?*
29. How important in your decision to implement the project was *information from program or DCEO marketing materials?*
30. *(Only ask if worked with design or consulting engineer)* How important in your decision to implement the project was *a recommendation from a design or consulting engineer?*
31. How important in your decision to implement the project was *standard practice in the public sector?*
32. *(Only ask if they had an electric utility account manager)* How important in your decision to implement the project was *endorsement or recommendation by an electric utility account manager?*
33. How important in your decision to implement the project was *governmental or organizational policy or guidelines?*
34. How important in your decision to implement the project was *payback on the investment?*
35. Were there any other factors we haven't discussed that were important in your decision to implement this [EQUIPMENT TYPE]?

( ) Yes *(Please explain) (If checked, go to 38)*
( ) No
( ) Don’t Know

36. Using the same zero to 10 scale, how would you rate the importance of this factor?

[DISPLAY IF Q22, Q27, Q30, Q31, Q33, OR Q34 =8,9, OR 10; ELSE SKIP TO Q56]

Thinking about this differently, I would like you to compare the importance of the program with the importance of other factors in implementing the [EQUIPMENT TYPE].

You mentioned that the following other factors were important:

[DISPLAY ITEMS RATED >8]

Age or condition of old equipment,

Equipment Vendor recommendation

Previous experience with this measure

Recommendation from a design or consulting engineer

Standard practice in the public sector

Governmental or organizational policy or guidelines

Payback on investment

Other factor

37. If you were given a TOTAL of 100 points that reflect the importance in your decision to implement the [EQUIPMENT TYPE], and you had to divide those 100 points between the program and other factors, how many points would you give to the importance of the program?

38. And how many points would you give to other factors?

[DISPLAY IF Q37>69 AND ALL OF Q23, Q25, Q28, Q29, AND Q32=0,1,2,3, ELSE SKIP TO Q68]

39. You just gave [Q37 RESPONSE] points to the importance of the program, we would interpret that to mean that the program was quite important to your decision to implement this equipment. Earlier, when you were asked about the importance of individual elements of the program you entered some answers that would imply that they were not that important to you. Just to make sure your responses are recorded properly, we have a couple questions to ask you.

40. When asked about THE AVAILABILITY OF THE PROGRAM INCENTIVE, you gave a rating of [Q23 RESPONSE] out of ten, indicating that the program incentive was not that important to you. Can you tell me why?

41. When I asked you about THE INFORMATION PROVIDED THROUGH THE TECHNICAL ASSISTANCE, you gave a rating of [Q25 RESPONSE] out of ten, indicating that the information provided was not that important to you. Can you tell me why?

42. When I asked you about THE RECOMMENDATION FROM A DCEO PROGRAM STAFF PERSON, you gave a rating of [Q28 RESPONSE] out of ten, indicating that the information provided was not that important to you. Can you tell me why?

43. When asked about THE INFORMATION from DCEO's MARKETING MATERIALS, you gave a rating of [Q29 RESPONSE] out of ten, indicating that this information from the program or utility marketing materials was not that important to you. Can you tell me why?

44. When asked about THE ENDORSEMENT or RECOMMENDATION by YOUR UTILTY ACCOUNT MANAGER, you gave a rating of [Q32 RESPONSE] out of ten, indicating that this Account manager endorsement was not that important to you. Can you tell me why?

[DISPLAY IF Q37<31 AND ANY ONE OF (Q23, Q25, Q28, Q29, OR Q32=8,9,10) ELSE SKIP TO Q68]

45. You just gave [Q37 RESPONSE] points to the importance of the program. We would interpret that to mean that the program was not very important to your decision to implement this equipment. Earlier, when you were asked about the importance of individual elements of the program you gave some answers that would imply that they were important to you. Would you explain why the program was not very important in your decision to implement this project?

[DISPLAY Q48 IF MSAME=1]

46. Our records show that [ORGANIZATION] also received an incentive from the DCEO for [NSAME] [EQUIPMENT TYPE] project(s) at other locations.

    Was it a single decision to complete all of those projects for which you received an incentive from the program or did each project go through its own decision process?
    - ( ) Single Decision
    - ( ) Each project went through its own decision process
    - ( ) Other, specify
    - ( ) Don't know

[DISPLAY Q47 IF FSAME=1 ELSE SKIP TO 50]

47. Our records show that [ORGANIZATION] also received an incentive from DCEO for a [FDESC] project at [LOCATION].

Was the decision making process for the project the same as for the project we have been talking about?

( ) Same decision making process
( ) Different decision making process
( ) Other, specify
( ) Don’t know

The next few questions are about how your experience with program may have influenced other decisions you have made about energy-using equipment.

48. Because of your experience with the incentive program, have you bought, or are you likely to buy, energy efficient equipment without applying for a financial incentive or rebate?
    ( ) Yes, have already bought non-incentivized efficiency equipment because of the experience with the program. *(If checked, go to 52-60)*
    ( ) Yes, likely to buy efficiency equipment because of the experience with the program. *(If checked, go to 51)*
    ( ) No
    ( ) Don't know

49. We’d like to call you in a few months for a very short follow-up about other efficiency purchases, if that would be alright. Please provide us with the best person to contact and their phone number.

50. Did your organization use, or is it planning to use, the incentive dollars that you already received from DCEO to purchase this additional energy efficient equipment?
    ( ) Yes
    ( ) No
    ( ) Don’t know

51. Has or will your organization apply for additional incentives for the purchase of this additional equipment?
    ( ) Yes
    ( ) No
    ( ) Don’t know

52. What energy efficient equipment did you purchase?

53. What motivated you to purchase this equipment?

54. Have you installed the equipment?
    ( ) Yes *(If checked, go to 56A)*
    ( ) No

( ) Don’t know

56A.In what month and year did you install that equipment?

55. Was this equipment installed, or will it be installed, at the same facility (or facilities) as where the incentive project was completed?
( ) Yes
( ) No *(If checked, go to 57A)*
( ) Don't know

57A. Where was (or will be) the equipment installed?

56. How important was your experience with the program to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Only slightly important
( ) Not at all important
( ) Don't know

57. How important was your past participation in any programs offered by DCEO to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Only slightly important
( ) Not at all important
( ) Don't know

58. Why didn’t you apply for or receive incentives for the additional energy efficiency measures?
Didn't know whether equipment qualified for financial incentives
Equipment did not qualify for financial incentives
Too much paperwork for the financial incentive application
Financial incentive was insufficient
Didn't have time to complete paperwork for financial incentive application
Didn't know about financial incentives until after equipment was purchased
Other reason (please describe)
Don’t know

59. How satisfied or dissatisfied are you with:

	Very Dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very Satisfied	Not sure
a. the steps you had to take to get through the	1	2	3	4	5	98

program						
b. the amount of time it took to get your rebate or incentive	1	2	3	4	5	98
c. the range of equipment that qualifies for incentives	1	2	3	4	5	98
d. the program, overall	1	2	3	4	5	98

[Display if 61 a-d is very dissatisfied or dissatisfied]

60. Please describe the ways in which you were not satisfied with the aspects of the program mentioned above?

61. What type facility is the [LOCATION]?
    ( ) Airport
    ( ) Community College
    ( ) Correctional Facility
    ( ) K-12 School
    ( ) Public Library
    ( ) Medical Facility
    ( ) Municipal Facility
    ( ) Park District Facility
    ( ) Police or Fire Station
    ( ) Public Works Facility
    ( ) State University
    ( ) Wastewater Treatment Facility
    ( ) Other (Please specify)

62. Does your organization pay the full cost of the natural gas bill?
    ( ) Yes
    ( ) No *(If checked, go to 64A)*
    ( ) Don’t know

64A. How are natural gas costs paid for?

63. Does your organization pay the full cost of the electric bill?
    ( ) Yes
    ( ) No *(If checked, go to 65A)*
    ( ) Don’t know

65A. How are electricity costs paid for?

64. Do you have any other comments that you would like to relay to DECO about energy efficiency in public entities, or about their programs?

Appendix C: Custom and Standard 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 A. 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.

4. What was your role in the decision making process to implement the [PROJECT TYPE]?	*Response*	*(n=268)*	*Percent of Respondents*
	Main decision maker	135	50%
	Assisted with the decision	133	50%
	Was not part of the decision making process	0	0%

4. What is your job title or role?	*Response*	*(n=268)*	*Percent of Respondents**
	Facilities Manager	48	18%
	Energy Manager	4	1%
	Other facilities management/maintenance position	17	6%
	Chief Financial Officer	13	5%
	Other financial/administrative position	17	6%
	Proprietor/Owner	0	0%
	President	8	3%
	Manager	18	7%
	Other	142	53%

6. Regarding your organization's decision to participate in the incentive program, who initiated the discussion about the incentive opportunity? Would you say…	*Response*	*(n=267)*	*Percent of Respondents**
	Your organization initiated it	89	33%
	Your vendor or contractor initiated it	71	27%
	The idea arose in discussion between your organization and your vendor or contractor	54	20%
	A program representative from DCEO, SEDAC, ERC, or MEEA initiated it	26	10%
	Some other way	22	8%
	Don't know	5	2%

7. Has your organization purchased any energy efficient equipment in the last three years for which you did not apply for a financial incentive through an energy efficiency program?	*Response*	*(n=268)*	*Percent of Respondents*
	Yes, purchased energy efficient equipment but did not apply for incentive.	85	32%
	No, no additional equipment was purchased by organization.	102	38%
	No, an incentive was applied for.	44	16%
	Don't know	37	14%

8. Did a Public Sector Energy Efficiency Program or other DCEO representative, including SEDAC, MEEA, or ERC, recommend that you implement the energy efficient [EQUIPMENT TYPE]?	*Response*	*(n=265)*	*Percent of Respondents*
	Yes	87	33%
	No	140	53%
	Don't know	38	14%

	Response	*(n=87)*	*Percent of Respondents*
9. If the Public Sector Energy Efficiency Program representative had not recommended implementing the energy efficient project, how likely is it that you would have implemented it anyway?	Definitely would have implemented	17	20%
	Probably would have implemented	35	40%
	Probably would not have implemented	22	25%
	Definitely would not have implemented	6	7%
	Don't know	7	8%

	Response	*(n=267)*	*Percent of Respondents*
10. How important was your previous experience with the DCEO programs in making your decision to implement the energy efficient [EQUIPMENT TYPE]?	Did not have experience with the programs before this project	79	30%
	Very important	120	45%
	Somewhat important	38	14%
	Only slightly important	8	3%
	Not at all important	9	3%
	Don't know	13	5%

	Response	*(n=8)*	*Percent of Respondents**
11. Would you have been financially able to implement the energy efficient [EQUIPMENT TYPE] without the financial incentive or grant from the Public Sector Energy Efficiency Program?	Yes	78	29%
	No	152	57%
	Don't know	38	14%

	Response	*(n=268)*	*Percent of Respondents*
12. If the financial incentive or grant from the Public Sector Energy Efficiency Program had not been available, how likely is it that you would have implemented the energy efficient [EQUIPMENT TYPE] anyway?	Definitely would have implemented	27	10%
	Probably would have implemented	75	28%
	Probably would not have implemented	117	44%
	Definitely would not have implemented	41	15%
	Don't know	8	3%

	Response	*(n=268)*	*Percent of Respondents*
13. Using a likelihood scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely", if the DCEO program had not been available, what is the likelihood that you would have implemented exactly the same project?	0	50	19%
	1	16	6%
	2	43	16%
	3	30	11%
	4	22	8%
	5	26	10%
	6	17	6%
	7	16	6%
	8	17	6%
	9	7	3%
	10	24	9%

	Response	*(n=267)*	*Percent of Respondents*
14. Without the program, when do you think you would have implemented this project? Would you say…	At the same time	47	18%
	Earlier	0	0%
	Later	126	47%
	Never	45	17%
	Don't know	49	18%

	Response	*(n=126)*	*Percent of Respondents*
15. How much later would you have implemented this project? Would you say…	Within 6 months	0	0%
	6 months to 1 year later	15	12%
	1 - 2 years later	42	33%
	2 - 3 years later	22	17%
	3 - 4 years later	20	16%
	4 or more years later	18	14%
	Don't know	9	7%

	Response	*(n=263)*	*Percent of Respondents*
16. How did the availability of information and financial incentives or grants through the Public Sector Energy Efficiency Program affect the quantity (or number of units) or scope of the [EQUIPMENT TYPE] that you implemented? Did you implement more energy efficiency measures than you otherwise would have without the program?	Yes	123	47%
	No, program did not affect quantity purchased and implemented	108	41%
	Don't know	32	12%

	Response	*(n=267)*	*Percent of Respondents*
18. How did the availability of information and financial incentives or grants through the Public Sector Energy Efficiency Program affect the level of energy efficiency you chose for the [EQUIPMENT TYPE]? Did you choose equipment that was more energy efficient than you otherwise would have chosen because of the program?	Yes	106	40%
	No, program did not affect level of efficiency chosen for equipment	124	46%
	Don't know	37	14%

	Response	*(n=268)*	*Percent of Respondents*
20. When did you first learn about DCEO's Program? Was it BEFORE or AFTER you first began to THINK about implementing the [EQUIPMENT TYPE]?	Before	179	67%
	After	82	31%
	Don't know	7	3%

21. When did you DECIDE to implement the [EQUIPMENT TYPE]? Was it before or after you learned about DCEO's incentive Program?	*Response*	*(n=266)*	*Percent of Respondents*
	Before	57	21%
	After	204	77%
	Don't know	5	2%

22. And when did your organization decide to commit the funding to implement the [EQUIPMENT TYPE]? Was it before or after you learned about DCEO's incentive program?	*Response*	*(n=267)*	*Percent of Respondents*
	Before	48	18%
	After	217	81%
	Don't know	2	1%

23. Did you work with a contractor or vendor that helped you with the choice of this equipment?	*Response*	*(n=268)*	*Percent of Respondents*
	Yes	248	93%
	No	18	7%
	Don't know	2	1%

24. Did you also use a design or consulting engineer?	*Response*	*(n=266)*	*Percent of Respondents*
	Yes	91	34%
	No	163	61%
	Don't know	12	5%

25. Does [PUBLIC ENTITY] have a utility account manager?	*Response*	*(n=264)*	*Percent of Respondents*
	Yes	53	20%
	No	184	70%
	Don't know	27	10%

26. Did your electric or natural gas utility account manager assist you with the project that you implemented through the program?	*Response*	*(n=53)*	*Percent of Respondents*
	Yes	24	45%
	No	27	51%
	No, don't have a utility account manager	1	2%
	Don't know	1	2%

27. Before participating in the Public Sector Energy Efficiency Program, had you implemented any equipment or measure similar to the energy efficient [EQUIPMENT TYPE] at this facility?	*Response*	*(n=267)*	*Percent of Respondents*
	Yes	109	41%
	No	135	51%
	Don't know	23	9%

28. Did you have plans to implement the energy efficient [EQUIPMENT TYPE] that you implemented through the program at this facility before participating in the Public Sector Energy Efficient Program?	*Response*	*(n=267)*	*Percent of Respondents*
	Yes	74	28%
	No	174	65%
	Don't know	19	7%

29. For about how long did you have plans to implement these measures prior to finding out about the program?	*Response*	*(n=74)*	*Percent of Respondents*
	Less than 6 months	19	26%
	6-12 months	18	24%
	1-2 years	21	28%
	3-5 years	9	12%
	More than 5 years	3	4%
	Don't know	4	5%

30. Did your plans specify which specific energy efficiency measures you were going to implement?	*Response*	*(n=74)*	*Percent of Respondents*
	Yes	18	24%
	No, it was more of a general plan	55	74%
	Don't know	1	1%

31. Would you have gone ahead with this planned implementation even if you had not participated in the program?	*Response*	*(n=72)*	*Percent of Respondents*
	Yes	58	81%
	No	9	13%
	Don't know	5	7%

32. How important in your decision to implement the project was the age or condition of the old equipment?	*Response*	*(n=267)*	*Percent of Respondents*
	0	14	5%
	1	1	0%
	2	2	1%
	3	6	2%
	4	5	2%
	5	34	13%
	6	19	7%
	7	27	10%
	8	45	17%
	9	18	7%
	10	93	35%
	Don't know	1	0%
	Not Applicable	2	1%

	Response	*(n=266)*	*Percent of Respondents*
33. How important in your decision to implement the project was availability of the DCEO incentive?	0	6	2%
	1	3	1%
	2	3	1%
	3	8	3%
	4	6	2%
	5	21	8%
	6	13	5%
	7	12	5%
	8	36	14%
	9	27	10%
	10	128	48%
	Don't know	2	1%
	Not Applicable	1	0%

	Response	*(n=267)*	*Percent of Respondents*
34. How important in your decision to implement the project was other public funding you received?	0	59	22%
	1	6	2%
	2	12	4%
	3	7	3%
	4	5	2%
	5	24	9%
	6	10	4%
	7	15	6%
	8	16	6%
	9	9	3%
	10	58	22%
	Don't know	6	2%
	Not Applicable	40	15%

	Response	*(n=0)*	*Percent of Respondents*
35. How important in your decision to implement the project was information provided through the technical assistance you received from DCEO or Smart Energy Design Assistance Center staff?	0	0	-
	1	0	-
	2	0	-
	3	0	-
	4	0	-
	5	0	-
	6	0	-
	7	0	-
	8	0	-
	9	0	-
	10	0	-
	Don't know	0	-
	Not Applicable	0	-

	Response	*(n=245)*	*Percent of Respondents*
36. How important in your decision to implement the project was recommendation from an equipment vendor or contractor that helped you with the choice of the equipment?	0	9	4%
	1	4	2%
	2	3	1%
	3	5	2%
	4	6	2%
	5	18	7%
	6	24	10%
	7	34	14%
	8	35	14%
	9	38	16%
	10	67	27%
	Don't know	1	0%
	Not Applicable	1	0%

	Response	*(n=265)*	*Percent of Respondents*
37. How important in your decision to implement the project was previous experience with this type of equipment?	0	42	16%
	1	8	3%
	2	14	5%
	3	8	3%
	4	9	3%
	5	32	12%
	6	12	5%
	7	25	9%
	8	33	12%
	9	12	5%
	10	32	12%
	Don't know	7	3%
	Not Applicable	31	12%

	Response	*(n=262)*	*Percent of Respondents*
38. How important in your decision to implement the project was the recommendation from a DCEO program staff person?	0	42	16%
	1	12	5%
	2	8	3%
	3	8	3%
	4	4	2%
	5	28	11%
	6	13	5%
	7	20	8%
	8	25	10%
	9	19	7%
	10	36	14%
	Don't know	7	3%
	Not Applicable	40	15%

	Response	*(n=265)*	*Percent of Respondents*
39. How important in your decision to implement the project was information from program or DCEO marketing materials?	0	37	14%
	1	6	2%
	2	11	4%
	3	20	8%
	4	9	3%
	5	42	16%
	6	17	6%
	7	29	11%
	8	24	9%
	9	11	4%
	10	29	11%
	Don't know	10	4%
	Not Applicable	20	8%

	Response	*(n=90)*	*Percent of Respondents*
40. How important in your decision to implement the project was a recommendation from a design or consulting engineer?	0	4	4%
	1	1	1%
	2	0	0%
	3	2	2%
	4	2	2%
	5	8	9%
	6	12	13%
	7	14	16%
	8	17	19%
	9	12	13%
	10	18	20%
	Don't know	0	0%
	Not Applicable	0	0%

	Response	*(n=264)*	*Percent of Respondents*
41. How important in your decision to implement the project was standard practice in the public sector?	0	38	14%
	1	5	2%
	2	14	5%
	3	18	7%
	4	10	4%
	5	50	19%
	6	18	7%
	7	18	7%
	8	23	9%
	9	11	4%
	10	19	7%
	Don't know	28	11%
	Not Applicable	12	5%

	Response	*(n=22)*	*Percent of Respondents*
42. How important in your decision to implement the project was endorsement or recommendation by an electric utility account manager?	0	5	23%
	1	1	5%
	2	1	5%
	3	2	9%
	4	1	5%
	5	2	9%
	6	0	0%
	7	3	14%
	8	3	14%
	9	1	5%
	10	1	5%
	Don't know	1	5%
	Not Applicable	1	5%

	Response	*(n=267)*	*Percent of Respondents*
43. How important in your decision to implement the project was governmental or organizational policy or guidelines?	0	50	19%
	1	10	4%
	2	17	6%
	3	13	5%
	4	9	3%
	5	39	15%
	6	19	7%
	7	16	6%
	8	21	8%
	9	8	3%
	10	30	11%
	Don't know	16	6%
	Not Applicable	19	7%

	Response	*(n=266)*	*Percent of Respondents*
44. How important in your decision to implement the project was payback on the investment?	0	8	3%
	1	0	0%
	2	2	1%
	3	1	0%
	4	2	1%
	5	17	6%
	6	14	5%
	7	29	11%
	8	38	14%
	9	29	11%
	10	123	46%
	Don't know	2	1%
	Not Applicable	1	0%

45. Were there any other factors we haven't discussed that were important in your decision to implement this [EQUIPMENT TYPE]?	*Response*	*(n=264)*	*Percent of Respondents*
	Yes	37	14%
	No	211	80%
	Don't know	16	6%

46. Using the same zero to 10 scale, how would you rate the importance of this factor?	*Response*	*(n=35)*	*Percent of Respondents*
	0	0	0%
	1	0	0%
	2	0	0%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	7	20%
	8	5	14%
	9	4	11%
	10	19	54%
	Don't know	0	0%
	Refused	0	0%

47. If you were given a TOTAL of 100 points that reflect the importance in your decision to implement the [EQUIPMENT TYPE], and you had to divide those 100 points between the program and other factors, how many points would you give to the importance of the program?	*(n=268)*	
	Average	62.9

48. And how many points would you give to other factors?	*(n=262)*	
	Average	38.0

56. Was it a single decision to complete all of those projects for which you received an incentive from the program or did each project go through its own decision process?	*Response*	*(n=78)*	*Percent of Respondents*
	Single Decision	36	46%
	Each project went through its own process	40	51%
	Other	1	1%
	Don't know	1	1%

57. Was the decision making process for the project the same as for the project we have been talking about?	*Response*	*(n=82)*	*Percent of Respondents*
	Same decision making process	77	94%
	Different decision making process	3	4%
	Other	0	0%
	Don't know	2	2%

58. Because of your experience with the incentive program, have you bought, or are you likely to buy, energy efficient equipment without applying for a financial incentive or rebate?	*Response*	*(n=267)*	*Percent of Respondents*
	Yes, have already bought non-incentivized efficiency equipment because of the experience with the program.	34	13%
	Yes, likely to buy efficiency equipment because of the experience with the program.	127	48%
	No	76	28%
	Don't know	30	11%

60. Did your organization use, or is it planning to use, the incentive dollars that you already received from DCEO to purchase this additional energy efficient equipment?	*Response*	*(n=160)*	*Percent of Respondents*
	Yes	44	28%
	No	76	48%
	Don't know	40	25%

61. Has or will your organization apply for additional incentives for the purchase of this additional equipment?	*Response*	*(n=161)*	*Percent of Respondents*
	Yes	96	60%
	No	19	12%
	Don't know	46	29%

64. Have you installed the equipment?	*Response*	*(n=33)*	*Percent of Respondents*
	Yes	29	88%
	No	4	12%
	Don't know	0	0%

66. Was this equipment installed, or will it be installed, at the same facility (or facilities) as where the incentive project was completed?	*Response*	*(n=33)*	*Percent of Respondents*
	Yes	23	70%
	No	9	27%
	Don't know	1	3%

68. How important was your experience with the program to your decision to implement the additional energy efficiency measures?	*Response*	*(n=34)*	*Percent of Respondents*
	Very important	17	50%
	Somewhat important	9	26%
	Only slightly important	6	18%
	Not at all important	1	3%
	Don't know	1	3%

69. How important was your past participation in any programs offered by DCEO to your decision to implement the additional energy efficiency measures?	*Response*	*(n=34)*	*Percent of Respondents*
	Very important	16	47%
	Somewhat important	12	35%
	Only slightly important	2	6%
	Not at all important	2	6%
	Don't know	2	6%

	Response	*(n=34)*	*Percent of Respondents*
70. Why didn't you apply for or receive incentives for the additional energy efficiency measures?	Didn't know whether equipment qualified for financial incentives	11	32%
	Equipment did not qualify for financial incentives	8	24%
	Too much paperwork for the financial incentive application	1	3%
	Financial incentive was insufficient	0	0%
	Didn't have time to complete paperwork for financial incentive application	3	9%
	Didn't know about financial incentives until after equipment was purchased	3	9%
	Other reason	8	24%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	Response	*(n=264)*	*Percent of Respondents*
71a. How satisfied or dissatisfied are you with: the steps you had to take to get through the program?	Very Satisfied	110	42%
	Satisfied	124	47%
	Neither Satisfied nor Dissatisfied	20	8%
	Dissatisfied	2	1%
	Very Dissatisfied	5	2%
	Not sure	3	1%
	Average		4.3

	Response	*(n=264)*	*Percent of Respondents*
71b. How satisfied or dissatisfied are you with: the amount of time it took to get your rebate or incentive?	Very Satisfied	129	49%
	Satisfied	101	38%
	Neither Satisfied nor Dissatisfied	23	9%
	Dissatisfied	5	2%
	Very Dissatisfied	4	2%
	Not sure	2	1%
	Average		4.3

	Response	*(n=263)*	*Percent of Respondents*
71c. How satisfied or dissatisfied are you with: the range of equipment that qualifies for incentives?	Very Satisfied	92	35%
	Satisfied	126	48%
	Neither Satisfied nor Dissatisfied	28	11%
	Dissatisfied	2	1%
	Very Dissatisfied	4	2%
	Not sure	11	4%
	Average		4.2

	Response	*(n=262)*	*Percent of Respondents*
71d. How satisfied or dissatisfied are you with: the program, overall?	Very Satisfied	157	60%
	Satisfied	93	35%
	Neither Satisfied nor Dissatisfied	3	1%
	Dissatisfied	0	0%
	Very Dissatisfied	4	2%
	Not sure	5	2%
	Average		4.6

	Response	*(n=264)*	*Percent of Respondents*
73. What type facility is the [LOCATION]?	Airport	4	2%
	Community College	8	3%
	Correctional Facility	2	1%
	K-12 School	59	22%
	Public Library	16	6%
	Medical Facility	1	0%
	Municipal Facility	41	16%
	Park District Facility	24	9%
	Police or Fire Station	26	10%
	Public Works Facility	15	6%
	State University	4	2%
	Wastewater Treatment Facility	11	4%
	Other	53	20%

	Response	*(n=260)*	*Percent of Respondents*
74. Does your organization pay the full cost of the natural gas bill?	Yes	215	83%
	No	27	10%
	Don't know	18	7%

	Response	*(n=263)*	*Percent of Respondents*
76. Does your organization pay the full cost of the electric bill?	Yes	211	80%
	No	37	14%
	Don't know	15	6%

Appendix D: Survey Instrument for New Construction Survey

1. Name of public entity

2. Your name (please correct if necessary)

3. What was your role in making the decision to implement the energy efficiency measures in the new construction project completed through the program?
   ( ) Main decision maker
   ( ) Assisted with the decision to implement the measure
   ( ) Was not part of the decision process (If checked, go to 3A)

   3A. Who was the main decision maker? If multiple people were responsible for the decision, please provide the name of the person you think is most knowledgeable about the decision making process for implementing the energy efficiency measures in the new construction process.

   3B. What is this person's telephone number?

   3C. What is this person's email address?

4. What are the sources your organization relies on for information about energy efficient equipment, materials and design features? (Check all that apply)
   ( ) A DCEO Representative
   ( ) The DCEO Website
   ( ) Utility representatives
   ( ) Brochures or advertisements
   ( ) Trade associations or business groups you belong to
   ( ) Trade journals or magazines
   ( ) Friends and colleagues
   ( ) Representatives of the Smart Energy Design Assistance Center (SEDAC)
   ( ) Representative of the Energy Resource Center (ERC)
   ( ) Architects, engineers or energy consultants
   ( ) Equipment vendors or building contractors
   ( ) Other (please describe)
   ( ) Don’t know

5. Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements? (Check all that apply)
   ( ) An energy management plan (If checked, go to 5A)
   ( ) A designated staff member responsible for energy tracking and energy efficiency
   ( ) Policies that incorporate energy efficiency in operations and procurement
   ( ) Active training of staff
   ( ) None
   ( ) Other (please specify)
   ( ) Don’t know

5A. Does your energy management plan include goals for energy savings?
( ) Yes (If checked, go to 5B)
( ) No
( ) Don't know

5B. Could you describe the goals specified in your energy management plan?

5C. How does your organization decide to incorporate energy efficient equipment or design features into new construction projects?
( ) Made by one or two key people
( ) Made by a group or committee
( ) Based on staff recommendations to a decision maker
( ) Made in some other way
( ) Don’t know

6. In your organization, how long does it typically take to get approval for new construction projects?

7. What barriers does your organization face in developing energy efficient new construction projects? (Select all that apply)
( ) Insufficient funding for energy efficiency
( ) Lack of information on energy efficient equipment and design features
( ) Approval processes that slow or make incorporating energy efficiency difficult
( ) Incentive program time requirements
( ) Other (please specify)
( ) Don’t know

8. Is your organization able to utilize incentive or grant payments you receive for energy efficiency improvements or are the payments placed in a general fund?
( ) We are able to use the incentive payments for additional facility improvements, including additional energy efficiency improvements
( ) Incentive payments return to the facility general operating fund
( ) Incentive payments go into the state general revenue fund
( ) Other (please specify)
( ) Don’t know

9. How important are incentive payments from the DCEO for your decision making regarding implementing energy efficient equipment or design features?
( ) Very important
( ) Somewhat important
( ) Only slightly important
( ) Not important at all
( ) Don't know

10. How important is advice and/or recommendations received from DCEO for your decision making regarding implementing energy efficient equipment or design features?
( ) Very important

( ) Somewhat important
( ) Only slightly important
( ) Not important at all
( ) Don't know

11. Which financial methods does your organization typically use to evaluate energy efficiency investments? (Select all that apply)
    ( ) Initial Cost
    ( ) Simple payback (If checked, go to 11A)
    ( ) Internal rate of return (If checked, go to 11B)
    ( ) Life cycle cost (If checked, go to 11C)
    ( ) None of these
    ( ) Don't know

    11A. What payback length of time do you normally require in order to proceed with an energy efficiency project? Please provide either a specific value or an estimated range.

    11B. What rate of return do you normally require in order to proceed with an energy efficiency project? Please provide either a specific value or an estimated range.

    11C. What discount rate do you normally apply when determining life cycle costs? Please provide either a specific value or an estimated range.

12. Has your organization undertaken any energy efficient new construction projects in the last three years for which you did not apply for a financial incentive through an energy efficiency program?
    ( ) Yes, undertook energy efficient construction projects but did not apply for incentive. (If checked, go to 12A)
    ( ) No energy efficient construction projects were undertaken.
    ( ) No, an incentive was applied for. (If checked, go to 12B)
    ( ) Don't know

12A. Why didn't you apply for a financial incentive for that project?
    ( ) Didn't know whether project qualified for financial incentives
    ( ) Didn't know about financial incentives until after project was completed
    ( ) Didn't have time to complete paperwork for financial incentive application
    ( ) Too much paperwork for the financial incentive application
    ( ) Financial incentive was insufficient
    ( ) Other (please specify)
    ( ) Don't know

12B. Did you receive all of your incentives for these past energy efficient projects?
    ( ) Yes
    ( ) No
    ( ) Don't know

13. How did you learn of the New Construction Program? (Select all that apply)
    ( ) From a New Construction Program Representative

( ) A DCEO representative mentioned it
( ) The DCEO Website
( ) From a utility representative
( ) Brochures or advertisements
( ) Trade association or business group you belong to
( ) Trade journal or magazine
( ) Friend or colleague
( ) From a representative of the Smart Energy Design Assistance Center (SEDAC)
( ) From a representative of the Energy Resource Center (ERC)
( ) An architect, engineer or energy consultant
( ) Equipment vendor or building contractor
( ) Attended a conference workshop or seminar
( ) Past experience with the program
( ) An energy service company
( ) Other (please specify)
( ) Don’t know

14. When did you learn of the New Construction Program?
( ) Before planning the project
( ) During the project planning and concept phase
( ) Once construction documents were completed but prior to beginning construction
( ) Once construction had begun but before completion of construction
( ) After construction was completed
( ) Some other time (please specify)
( ) Don't know

15. Before participating in the New Construction Program, had you completed new construction projects with similar levels of energy efficiency?
( ) Yes
( ) No
( ) Don’t know

16. For the project you completed through the New Construction Program, did you have plans to build to the same efficiency level prior to participating in the program?
( ) Yes (If checked, go to 16A)
( ) No
( ) Don’t know

16A. How long before finding out about the New Construction program did you have plans to complete the new construction project? Did you have plans for…
( ) Less than 6 months
( ) 6 months to less than a year
( ) 1 year to less than 2 years
( ) 2 years to less than 5 years
( ) 5 or more years
( ) Don't know

16B. Did your plans specify the design features related to the level of energy efficiency for the building?
( ) Yes
( ) No
( ) Don’t know

16C. Would you have gone ahead with the same design specifications if you had not participated in the program?
( ) Yes
( ) No
( ) Don’t know

17. Did you have experience with DCEO energy efficiency programs prior to participating in the New Construction Program?
( ) Yes (If checked, go to 17A)
( ) No
( ) Don’t know

17A. How important was previous experience with the DCEO programs in making your decision to build to this efficiency level?
( ) Very important
( ) Somewhat important
( ) Only slightly important
( ) Not at all important
( ) Don't know

18. Did you receive any advice or recommendations from the DCEO or another program representative regarding energy efficiency design features for this project?
( ) Yes (If checked, go to 18A)
( ) No
( ) Don’t know

18A. If the program representative had not recommended the design features, how likely is it that you would have built to the same efficiency level anyway?
( ) Definitely would have built to the same level
( ) Probably would have built to the same level
( ) Probably would not have built to the same level
( ) Definitely would not have built to the same level
( ) Don't know

19. Did you receive any advice or recommendations from the Smart Energy Design Assistance Center (SEDAC) regarding energy efficiency design features for this project?
( ) Yes
( ) No
( ) Don’t know

19A. If the SEDAC representative had not recommended the design features, how likely is it that you would have built to the same efficiency level anyway?
( ) Definitely would have built to the same level
( ) Probably would have built to the same level
( ) Probably would not have built to the same level
( ) Definitely would not have built to the same level
( ) Don't know

20. Would you have been financially able to build to this efficiency level without the financial incentive from the New Construction Program?
( ) Yes
( ) No
( ) Don’t know

21. If the financial incentive from the New Construction Program had not been available, how likely is it that you would have built to the same level of efficiency anyway?
( ) Definitely would have built to the same level
( ) Probably would have built to the same level
( ) Probably would not have built to the same level
( ) Definitely would not have built to the same level
( ) Don't know

22. How did the availability of information and financial incentives through the New Construction Program affect the quantity (or number of units) of energy efficient equipment or design features that you implemented in the project? Did you incorporate more energy efficient equipment or design features than you otherwise would have without the program?
( ) Yes (If checked, go to 22A)
( ) No, Program did not affect quantity purchased and installed
( ) Don’t know

22A. Which additional energy efficient equipment or design features did you implement?

23. How did the availability of information and financial incentives through the New Construction Program affect the level of energy efficiency you built to? Did you build to a higher level of efficiency than you otherwise would have because of the program?
( ) Yes (If checked, go to 23A)
( ) No, program did not affect the level of efficiency.
( ) Don’t know

23A. Without the program, to what level of efficiency would you have built to?
( ) A lower energy efficiency level, but still above code
( ) Built to code
( ) Other (please specify)
( ) Don’t know

24. How did the availability of information and financial incentives through the New Construction Program affect the timing of the energy efficient new construction project? Did you complete the project earlier than you otherwise would have without the program?
    ( ) Yes
    ( ) No, program did not affect the timing of the project
    ( ) Don’t know

    24A. When would you otherwise have completed the project? Would you have done it in…
    ( ) Less than 6 months
    ( ) 6 months to less than a year
    ( ) 1 year to less than 2 years
    ( ) 2 years to less than 5 years
    ( ) 5 or more years
    ( ) Don't know

25. Did the implementation of the efficiency measures go smoothly?
    ( ) Yes
    ( ) For the most part (If checked, go to 25A)
    ( ) No (If checked, go to 25A)
    ( ) Don't know

    25A. Please explain in what ways project implementation did not go smoothly.

26. Did the energy efficiency measures you adopted for this project meet your expectations?
    ( ) My expectations were exceeded
    ( ) My expectations were met
    ( ) My expectations were mostly met (If checked, go to 26A)
    ( ) My expectations were not met (If checked, go to 26A)
    ( ) Don't know

    26A. Please explain in what ways the energy efficiency measures did not meet your expectations.

27. Did you have any problems with the application process?
    ( ) Yes (If checked, go to 27A)
    ( ) No
    ( ) Don't know

    27A. What problems did you have?

28. Do you feel you got a quality installation of the efficiency measures?
    ( ) Yes
    ( ) For the most part (If checked, go to 28A)
    ( ) No (If checked, go to 28A)
    ( ) Don't know

    28A. Please explain in what ways you did not receive a quality installation.

29. Did the incentive agreement that you received meet your expectations?

( ) Yes
( ) No (If checked, go to 29A)
( ) Don't know

29A. Please explain in what ways the incentive you received did not meet your expectations.

30. Did anyone from the New Construction Program or other DCEO or SEDAC representative come to this facility to do a pre-inspection?
( ) Yes (If checked, go to 30A, 30B, 30C)
( ) No
( ) Don't know

30A. Who performed the inspection?

30B. What did the pre-inspection consist of?

30C. Did anything change in the project design as a result of the pre-inspection?
( ) Yes (If checked, go to 30D)
( ) No
( ) Don't know

30D. Please explain the way in which the project design changed as a result of the pre-inspection.

31. Did anyone from the New Buildings Program or other DCEO or SEDAC representative come to this facility to do a post-inspection?
( ) Yes (If checked, go to 31A, 31B, 31C)
( ) No
( ) Don't know

31A. Who performed the inspection?

31B. What did the post-inspection consist of?

31C. Did anything change in the incentive amount as a result of the post-inspection?
( ) Yes (If checked, go to 31D)
( ) No
( ) Don't know

31D. Please explain how the incentive amount changed as a result of the post-inspection.

32. Were there any issues receiving the incentive check?
( ) Yes (If checked, go to 32A)
( ) No
( ) Don't know

32A. Please describe the issues you had with receiving the incentive check.

33. Was the incentive amount what you expected?
( ) Yes (If checked, go to 33A)

( ) No
( ) Don't know

33A. Please explain how the incentive amount differed from what you expected.

34. Since participating in the New Construction Program, have you implemented any additional energy efficiency measures similar to those you implemented through the program that you did not apply or receive an incentive for?
( ) Yes (If checked, go to 34A-34F)
( ) No
( ) Don't know

34A. Did the additional energy efficiency measures result in the same or higher level of efficiency improvement as the measures implemented through the program?
( ) Yes, they were the same or higher efficiency
( ) No
( ) Don't know

34B. Were these additional measures implemented at the same facility (or facilities) as the new construction project completed through the program?
( ) Yes
( ) No; Where was the equipment installed? (please specify)
( ) Don't know

34C. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?
( ) Yes (If checked, go to 34C1)
( ) No
( ) Don't know

34C1. How important was the recommendation from a program staff member or contractor to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Neutral
( ) Somewhat unimportant
( ) Not important
( ) Don't know

34D. How important was your experience with the program or the energy efficient design features implemented through the program to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Neutral
( ) Somewhat unimportant
( ) Not important
( ) Don't know

34E. How important was your participation in any past programs offered by DCEO to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Neutral
( ) Somewhat unimportant
( ) Not important
( ) Don't know

34F. Why didn't you apply for or receive financial assistance or incentives for those items?
( ) Didn't know about financial incentives
( ) Didn't know whether the measures qualified for financial incentives
( ) Financial incentive was insufficient
( ) No financial incentive was offered
( ) Too much paperwork for the financial incentive application
( ) For some other reason (please describe)
( ) Don't know

35. Since participating in the program, have you implemented any other energy efficiency equipment that was not similar to what you implemented through the program and that you did not apply or receive an incentive for?
( ) Yes
( ) No
( ) Don't know

35A. What energy efficient equipment did you implement?

35B. Was this equipment installed at the same facility (or facilities) as the energy efficiency measures that you received an incentive for?
( ) Yes
( ) No; Where was the equipment installed? (please specify)
( ) Don't know

35C. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?
( ) Yes
( ) No
( ) Don't know

35C1. How important was the recommendation from a program staff member or contractor to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Neutral
( ) Somewhat unimportant
( ) Not important
( ) Don't know

35D. How important was your experience with the program or the energy efficient equipment or design features implemented through the program to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Neutral
( ) Somewhat unimportant
( ) Not important
( ) Don't know

35E. How important was your participation in any past programs offered by DCEO to your decision to implement the additional energy efficiency measures?
( ) Very important
( ) Somewhat important
( ) Neutral
( ) Somewhat unimportant
( ) Not important
( ) Don't know

35F. Why didn't you apply for or receive financial assistance or incentives for those items?
( ) Didn't know about financial incentives
( ) Didn't know whether the measures qualified for financial incentives
( ) Financial incentive was insufficient
( ) No financial incentive was offered
( ) Too much paperwork for the financial incentive application
( ) For some other reason (please specify)
( ) Don't know

36. How would you rate your satisfaction with the following - *Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied?*
( ) Performance of the equipment installed
( ) Savings on your monthly bill
( ) Incentive amount
( ) The effort required for the application process
( ) Information provided by your contractor
( ) Quality of the work conducted by your contractor
( ) Information provided by DCEO
( ) Information provided by Smart Energy Design Assistance Center (SEDAC)
( ) Information provided by the Energy Resource Center (ERC)
( ) The elapsed time until you received the incentive
( ) Overall program experience

36L. (If very dissatisfied or somewhat dissatisfied for any) Please describe in what ways you were not satisfied with the program.

37. Do you have any other comments that you would like to relay to DCEO about energy efficiency in public entities or about their programs?

Appendix E: New Construction 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 C. 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*
3. What was your role in making the decision to implement the energy efficiency measures in the new construction project completed through the program?	Main decision maker	2	29%
	Assisted with the decision to implement the measure	5	71%
	Was not part of the decision process	0	0%

	Response	*(n=7)*	*Percent of Respondents**
4. What are the sources your organization relies on for information about energy efficient equipment, materials and design features? (Do not read list. Check all that apply)	A DCEO Representative	1	14%
	The DCEO Website	3	43%
	Utility representatives	5	71%
	Brochures or advertisements	1	14%
	Trade associations or business groups you belong to	1	14%
	Trade journals or magazines	1	14%
	Friends and colleagues	0	0%
	Representatives of the Smart Energy Design Assistance Center (SEDAC)	3	43%
	Representative of the Energy Resource Center (ERC)	2	29%
	Architects, engineers or energy consultants	7	100%
	Equipment vendors or building contractors		
	Other	0	0%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	Response	*(n=7)*	*Percent of Respondents**
5. Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements at this facility? (Read list. Check all that apply)	An energy management plan	2	29%
	A designated staff member responsible for energy tracking and energy efficiency	4	57%
	Policies that incorporate energy efficiency in operations and procurement	4	57%
	Active training of staff	6	86%
	None	0	0%
	Other	0	0%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

5a. Does your energy management plan include goals for energy savings?	*Response*	*(n=2)*	*Percent of Respondents*
	Yes	1	50%
	No	0	0%
	Don't know	1	50%

5C. How does your organization decide to incorporate energy efficient equipment or design features into new construction projects?	*Response*	*(n=6)*	*Percent of Respondents*
	Made by one or two key people	1	17%
	Made by a group or committee	2	33%
	Based on staff recommendations to a decision maker	2	33%
	Made in some other way	1	17%
	Don't know	0	0%

6. In your organization, how long does it typically take to get approval for new construction projects?	*Average Number of Months, (n=7)*	
	Average Months	8.0

7. What barriers does your organization face in developing energy efficient new construction projects? (Do not read list. Use as possible prompts. Select all that apply)	*Response*	*(n=7)*	*Percent of Respondents**
	Insufficient funding for energy efficiency	5	71%
	Lack of information on energy efficient equipment and design features	0	0%
	Approval processes that slow or make incorporating energy efficiency difficult	2	29%
	Incentive program time requirements	2	29%
	Other	0	0%
	Don't know	1	14%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

8. Is your organization able to utilize incentive or grant payments you receive for energy efficiency improvements or are the payments placed in a general fund? (Do not read list. Use as possible prompts.)	*Response*	*(n=7)*	*Percent of Respondents*
	We are able to use the incentive payments for additional facility improvements, including additional energy efficiency improvements	4	57%
	Incentive payments return to the facility general operating fund	1	14%
	Incentive payments go into the state general revenue fund	0	0%
	Other	1	14%
	Don't know	1	14%

9. How important are incentive payments from the DCEO for your decision making regarding implementing energy efficient equipment or design features? Would you say...(Read list)	*Response*	*(n=7)*	*Percent of Respondents*
	Very important	7	100%
	Somewhat important	0	0%
	Only slightly important	0	0%
	Not important at all	0	0%
	Don't know	0	0%

10. How important is advice and/or recommendations received from DCEO for your decision making regarding implementing energy efficient equipment or design features? Would you say... (Read list)	*Response*	*(n=7)*	*Percent of Respondents*
	Very important	5	71%
	Somewhat important	2	29%
	Only slightly important	0	0%
	Not important at all	0	0%
	Don't know	0	0%

11. Which financial methods does your organization typically use to evaluate energy efficiency investments? (Read list. Select all that apply)	*Response*	*(n=7)*	*Percent of Respondents**
	Initial Cost	6	86%
	Simple payback	6	86%
	Internal rate of return	2	29%
	Life cycle cost	2	29%
	None of these	0	0%
	Don’t know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

11A. What payback length of time do you normally require in order to proceed with an energy efficiency project? Please provide either a specific value or an estimated range.	*Average Number of Years, (n=5)*	
	Average Years	5.2

11B. What rate of return do you normally require in order to proceed with an energy efficiency project? Please provide either a specific value or an estimated range.	*Average Rate of Return, (n=1)*	
	Average	50%

11C. What discount rate do you normally apply when determining life cycle costs? Please provide either a specific value or an estimated range.	*Average Discount Rate, (n=1)*	
	Average	6%

12. Has your organization undertaken any energy efficient new construction projects in the last three years for which you did not apply for a financial incentive through an energy efficiency program? (Do not read list)	*Response*	*(n=7)*	*Percent of Respondents*
	Yes, undertook energy efficient construction projects but did not apply for incentive.	2	29%
	No energy efficient construction projects were undertaken.	1	14%
	No, an incentive was applied for.	3	43%
	Don't know	1	14%

12a. Why didn't you apply for a financial incentive for that project?	*Response*	*(n=2)*	*Percent of Respondents*
	Didn't know whether project qualified for financial incentives	0	0%
	Didn't know about financial incentives until after project was completed	1	50%
	Didn't have time to complete paperwork for financial incentive application	0	0%
	Too much paperwork for the financial incentive application	0	0%
	Financial incentive was insufficient	0	0%
	Other	1	50%
	Don't know	0	0%

12b. Did you receive all of your incentives for these past energy efficient projects?	*Response*	*(n=3)*	*Percent of Respondents*
	Yes	3	100%
	No	0	0%
	Don't know	0	0%

	Response	*(n=7)*	*Percent of Respondents**
13. How did you learn of the New Construction Program? (Do not read list. Select all that apply)	From a New Construction Program Representative	1	14%
	A DCEO representative mentioned it	0	0%
	The DCEO Website	4	57%
	From a utility representative	2	29%
	Brochures or advertisements	0	0%
	Trade association or business group you belong to	1	14%
	Trade journal or magazine	0	0%
	Friend or colleague	1	14%
	From a representative of the Smart Energy Design Assistance Center (SEDAC)	2	29%
	From a representative of the Energy Resource Center (ERC)	0	0%
	An architect, engineer or energy consultant	5	71%
	Equipment vendor or building contractor	2	29%
	Attended a conference workshop or seminar	2	29%
	Past experience with the program	1	14%
	An energy service company	0	0%
	Other	0	0%
	Don't know	0	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	Response	*(n=7)*	*Percent of Respondents*
14. When did you learn of the New Construction Program? Was it...(Read list)	Before planning the project	1	14%
	During the project planning and concept phase	3	43%
	Once construction documents were completed but prior to beginning construction	1	14%
	Once construction had begun but before completion of construction	0	0%
	After construction was completed	1	14%
	Some other time	0	0%
	Don't know	1	14%

15. Before participating in the New Construction Program, had you completed new construction projects with similar levels of energy efficiency?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	4	57%
	No	2	29%
	Don't know	1	14%

16. For the project you completed through the New Construction Program, did you have plans to build to the same efficiency level prior to participating in the program?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	4	57%
	No	1	14%
	Don't know	2	29%

16A. How long before finding out about the New Construction program did you have plans to complete the new construction project? Did you have plans for…	*Response*	*(n=4)*	*Percent of Respondents*
	Less than 6 months	0	0%
	6 months to less than a year	0	0%
	1 year to less than 2 years	2	50%
	2 years to less than 5 years	1	25%
	5 or more years	0	0%
	Don't know	1	25%

16B. Did your plans specify the design features related to the level of energy efficiency for the building?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	3	75%
	No	0	0%
	Don't know	1	25%

16C. Would you have gone ahead with the same design specifications if you had not participated in the program?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	4	100%
	No	0	0%
	Don't know	0	0%

17. Did you have experience with DCEO energy efficiency programs prior to participating in the New Construction Program?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	6	86%
	No	1	14%
	Don't know	0	0%

17a. How important was your previous experience with the DCEO programs in making your decision to build to this efficiency level? Would you say...(Read list)	*Response*	*(n=6)*	*Percent of Respondents*
	Very important	2	33%
	Somewhat important	3	50%
	Only slightly important	0	0%
	Not at all important	1	17%
	Don't know	0	0%

18. Did you receive any advice or recommendations from the DCEO or another program representative regarding energy efficiency design features for this project?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	3	43%
	No	2	29%
	Don't know	2	29%

	Response	*(n=3)*	*Percent of Respondents*
18a. If the program representative had not recommended the design features, how likely is it that you would have built to the same efficiency level anyway? Would you say...(Read list)	Definitely would have built to the same level	0	0%
	Probably would have built to the same level	2	67%
	Probably would not have built to the same level	1	33%
	Definitely would not have built to the same level	0	0%
	Don't know	0	0%

	Response	*(n=7)*	*Percent of Respondents*
19. Did you receive any advice or recommendations from the Smart Energy Design Assistance Center (SEDAC) regarding energy efficiency design features for this project?	Yes	4	57%
	No	1	14%
	Don't know	2	29%

	Response	*(n=4)*	*Percent of Respondents*
19a. If the SEDAC representative had not recommended the design features, how likely is it that you would have built to the same efficiency level anyway?(Read list)	Definitely would have built to the same level	1	25%
	Probably would have built to the same level	2	50%
	Probably would not have built to the same level	1	25%
	Definitely would not have built to the same level	0	0%
	Don't know	0	0%

	Response	*(n=7)*	*Percent of Respondents*
20. Would you have been financially able to build to this efficiency level without the financial incentive from the New Construction Program?	Yes	4	57%
	No	1	14%
	Don't know	2	29%

	Response	(n=7)	Percent of Respondents
21. If the financial incentive from the New Construction Program had not been available, how likely is it that you would have built to the same level of efficiency anyway?(Read list)	Definitely would have built to the same level	2	29%
	Probably would have built to the same level	2	29%
	Probably would not have built to the same level	1	14%
	Definitely would not have built to the same level	0	0%
	Don't know	2	29%

22. How did the availability of information and financial incentives through the New Construction Program affect the quantity (or number of units) of energy efficient equipment or design features that you implemented in the project? Did you incorporate more energy efficient equipment or design features than you otherwise would have without the program?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	2	29%
	No, Program did not affect quantity purchased and installed	2	29%
	Don't know	3	43%

23. How did the availability of information and financial incentives through the New Construction Program affect the level of energy efficiency you built to? Did you build to a higher level of efficiency than you otherwise would have because of the program?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	2	29%
	No, program did not affect the level of efficiency.	3	43%
	Don't know	2	29%

23a. Without the program, to what level of efficiency would you have built?(Read list)	*Response*	*(n=2)*	*Percent of Respondents*
	A lower energy efficiency level, but still above code	1	50%
	Built to code	1	50%
	Other	0	0%

24. How did the availability of information and financial incentives through the New Construction Program affect the timing of the energy efficient new construction project? Did you complete the project earlier than you otherwise would have without the program?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	0	0%
	No, program did not affect the timing of the project	6	86%

24A. When would you otherwise have completed the project? Would you have done it in…	*Response*	*(n=0)*	*Percent of Respondents*
	Less than 6 months	0	0%
	6 months to less than a year	0	0%
	1 year to less than 2 years	0	0%
	2 years to less than 5 years	0	0%
	5 or more years	0	0%
	Don't know	0	0%

25. Did the implementation of the efficiency measures go smoothly?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	6	86%
	For the most part	0	0%
	No	0	0%
	Don't know	1	14%

26. Did the energy efficiency measures you adopted for this project meet your expectations? Would you say...(Read list)	*Response*	*(n=7)*	*Percent of Respondents*
	My expectations were exceeded	3	43%
	My expectations were met	4	57%
	My expectations were mostly met	0	0%
	My expectations were not met	0	0%
	Don't know	0	0%

27. Did you have any problems with the application process?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	0	0%
	No	6	86%
	Don't know	1	14%

28. Do you feel you got a quality installation of the efficiency measures?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	7	100%
	No	0	0%
	Don't know	0	0%

29. Did the incentive agreement that you received meet your expectations?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	6	86%
	No	0	0%
	Don't know	1	14%

30. Did anyone from the New Construction Program or other DCEO or SEDAC representative come to this facility to do a pre-inspection?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	2	29%
	No	1	14%
	Don't know	4	57%

30C. Did anything change in the project design as a result of the pre-inspection?	*Response*	*(n=2)*	*Percent of Respondents*
	Yes	0	0%
	No	2	100%
	Don't know	0	0%

31. Did anyone from the New Buildings Program or other DCEO or SEDAC representative come to this facility to do a post-inspection?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	0	0%
	No	2	29%
	Don't know	5	71%

31C. Did anything change in the incentive amount as a result of the post-inspection?	*Response*	*(n=0)*	*Percent of Respondents*
	Yes	0	0%
	No	0	0%
	Don't know	0	0%

32. Were there any issues receiving the incentive check?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	0	0%
	No	5	71%
	Don't know	2	29%

33. Was the incentive amount what you expected?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	6	86%
	No	0	0%
	Don't know	1	14%

34. Since participating in the New Construction Program, have you implemented any additional energy efficiency measures similar to those you implemented through the program that you did not apply or receive an incentive for?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	1	14%
	No	4	57%
	Don't know	2	29%

34A. Did the additional energy efficiency measures result in the same or higher level of efficiency improvement as the measures implemented through the program?	*Response*	*(n=1)*	*Percent of Respondents*
	Yes, they were the same or higher efficiency	1	100%
	No	0	0%
	Don't know	0	0%

34B. Were these additional measures implemented at the same facility (or facilities) as the new construction project completed through the program?	*Response*	*(n=1)*	*Percent of Respondents*
	Yes	0	0%
	No; Where was the equipment installed?	1	100%
	Don't know	0	0%

34C. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?	*Response*	*(n=1)*	*Percent of Respondents*
	Yes	1	100%
	No	0	0%
	Don't know	0	0%

34C1. How important was the recommendation from a program staff member or contractor to your decision to implement the additional energy efficiency measures?	*Response*	*(n=1)*	*Percent of Respondents*
	Very important	1	100%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important	0	0%
	Don't know	0	0%

34D. How important was your experience with the program or the energy efficient design features implemented through the program to your decision to implement the additional energy efficiency measures?	*Response*	*(n=1)*	*Percent of Respondents*
	Very important	1	100%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important	0	0%
	Don't know	0	0%

34E. How important was your participation in any past programs offered by DCEO to your decision to implement the additional energy efficiency measures?	*Response*	*(n=1)*	*Percent of Respondents*
	Very important	1	100%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important	0	0%
	Don't know	0	0%

34F. Why didn't you apply for or receive financial assistance or incentives for those items?	*Response*	*(n=1)*	*Percent of Respondents*
	Didn't know about financial incentives	1	100%
	Didn't know whether the measures qualified for financial incentives	0	0%
	Financial incentive was insufficient	0	0%
	No financial incentive was offered	0	0%
	Too much paperwork for the financial incentive application	0	0%
	For some other reason	0	0%
	Don't know	0	0%

35. Since participating in the program, have you implemented any other energy efficiency equipment that was not similar to what you implemented through the program and that you did not apply or receive an incentive for?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	0	0%
	No	5	71%
	Don't know	2	29%

35B. Was this equipment installed at the same facility (or facilities) as the energy efficiency measures that you received an incentive for?	*Response*	*(n=0)*	*Percent of Respondents*
	Yes	0	0%
	No; Where was the equipment installed?	0	0%
	Don't know	0	0%

35C. Did a recommendation from a program staff member or contractor influence your decision to implement the additional measures?	*Response*	*(n=0)*	*Percent of Respondents*
	Yes	0	0%
	No	0	0%
	Don't know	0	0%

35C1. How important was the recommendation from a program staff member or contractor to your decision to implement the additional energy efficiency measures?	*Response*	*(n=0)*	*Percent of Respondents*
	Very important	0	0%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important	0	0%
	Don't know	0	0%

35D. How important was your experience with the program or the energy efficient equipment or design features implemented through the program to your decision to implement the additional energy efficiency measures?	*Response*	*(n=0)*	*Percent of Respondents*
	Very important	0	0%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important	0	0%
	Don't know	0	0%

35E. How important was your participation in any past programs offered by DCEO to your decision to implement the additional energy efficiency measures?	*Response*	*(n=0)*	*Percent of Respondents*
	Very important	0	0%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important	0	0%
	Don't know	0	0%

	Response	*(n=0)*	*Percent of Respondents*
35F. Why didn't you apply for or receive financial assistance or incentives for those items?	Didn't know about financial incentives	0	0%
	Didn't know whether the measures qualified for financial incentives	0	0%
	Financial incentive was insufficient	0	0%
	No financial incentive was offered	0	0%
	Too much paperwork for the financial incentive application	0	0%
	For some other reason	0	0%
	Don't know	0	0%

	Response	*(n=7)*	*Percent of Respondents**
36a. How would you rate your satisfaction with the performance of the equipment installed?	Very Satisfied	2	29%
	Satisfied	3	43%
	Neither Satisfied nor Dissatisfied	1	14%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don't know	1	14%
	Average		4.2

	Response	*(n=7)*	*Percent of Respondents**
36b. How would you rate your satisfaction with the savings on your monthly bill?	Very Satisfied	2	29%
	Satisfied	2	29%
	Neither Satisfied nor Dissatisfied	0	0%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don't know	3	43%
	Average		4.5

	Response	*(n=7)*	*Percent of Respondents**
36c. How would you rate your satisfaction with the incentive amount?	Very Satisfied	5	71%
	Satisfied	2	29%
	Neither Satisfied nor Dissatisfied	0	0%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don't know	0	0%
	Average		4.7

36d. How would you rate your satisfaction with the effort required for the application process?	*Response*	*(n=7)*	*Percent of Respondents**
	Very Satisfied	3	43%
	Satisfied	3	43%
	Neither Satisfied nor Dissatisfied	0	0%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don’t know	1	14%
	Average		4.5

36e. How would you rate your satisfaction with the information provided by your contractor?	*Response*	*(n=7)*	*Percent of Respondents**
	Very Satisfied	1	14%
	Satisfied	3	43%
	Neither Satisfied nor Dissatisfied	2	29%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don’t know	1	14%
	Average		3.8

36f. How would you rate your satisfaction with the quality of the work conducted by your contractor?	*Response*	*(n=7)*	*Percent of Respondents**
	Very Satisfied	1	14%
	Satisfied	4	57%
	Neither Satisfied nor Dissatisfied	2	29%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don’t know	0	0%
	Average		3.9

	Response	(n=7)	Percent of Respondents*
36g. How would you rate your satisfaction with the information provided by DCEO?	Very Satisfied	3	43%
	Satisfied	3	43%
	Neither Satisfied nor Dissatisfied	1	14%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don’t know	0	0%
	Average		4.3

	Response	(n=7)	Percent of Respondents*
36h. How would you rate your satisfaction with the information provided by Smart Energy Design Assistance Center (SEDAC)?	Very Satisfied	5	71%
	Satisfied	1	14%
	Neither Satisfied nor Dissatisfied	0	0%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don’t know	1	14%
	Average		4.8

	Response	(n=7)	Percent of Respondents*
36i. How would you rate your satisfaction with the information provided by the Energy Resource Center (ERC)?	Very Satisfied	1	14%
	Satisfied	1	14%
	Neither Satisfied nor Dissatisfied	0	0%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don’t know	5	71%
	Average		4.5

	Response	(n=7)	Percent of Respondents*
36j. How would you rate your satisfaction with the elapsed time until you received the incentive?	Very Satisfied	3	43%
	Satisfied	3	43%
	Neither Satisfied nor Dissatisfied	0	0%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don’t know	1	14%
	Average		4.5

36k. How would you rate your satisfaction with the overall program experience?	*Response*	*(n=7)*	*Percent of Respondents**
	Very Satisfied	5	71%
	Satisfied	2	29%
	Neither Satisfied nor Dissatisfied	0	0%
	Dissatisfied	0	0%
	Very Dissatisfied	0	0%
	Don't know	0	0%
	Average		4.7

Appendix F: Survey Instrument for Municipal Non Participant

1. What is your job title?

   ( ) Manager

   ( ) Facilities manager

   ( ) Energy manager

   ( ) Other facilities management/maintenance position

   ( ) Chief financial officer

   ( ) Other financial / administrative position

   ( ) Other:

   ( ) Public works director

   ( ) Public works staff

2. Which of the following, if any, does your organization have in place? (Select all that apply)

   ( ) A person or persons responsible for monitoring or managing energy usage

   ( ) Defined energy saving goals

   ( ) Carbon reduction goals

   ( ) A specific policy requiring that energy efficiency be considered when purchasing equipment

   ( ) Other policies or procedures regarding energy efficiency or use (please describe):

3. What sources, if any, does your organization use to learn about ways to save energy? (Please select all that apply)

   ( ) Our regional planning agency

   ( ) The Metropolitan Mayors Caucas

   ( ) The Illinois DCEO

   ( ) The Smart Energy Design Assistance Center

   ( ) The Energy Resources Center

   ( ) Other associations for local governments

   ( ) Contractors, vendors, or energy services providers

   ( ) Journals or trade magazines

( ) Your gas and / or electric utility

( ) Some other source (Please explain):

( ) We have not sought information about energy efficiency from any source

( ) Don't know

4. Does your organization have a franchise agreement with its natural gas service provider that covers part or all of the cost of its natural gas service?

( ) Yes, the agreement covers all of the natural gas cost

( ) Yes, the agreement covers part of the natural gas cost *(if selected go to Q5)*

( ) No, we pay the full cost of natural gas service

( ) No, we do not have natural gas service

( ) Don't know

5. What part of your organization's natural gas costs does it pay? Does it pay the cost for certain facilities or does it pay a share of the overall costs? Please explain.

6. Does your organization have a franchise agreement with its electric service provider that covers part or all of the cost of its electricity service?

( ) Yes, the agreement covers all of the electricity cost

( ) Yes, the agreement covers part of the electricity cost *(if selected go to Q7)*

( ) No, we pay the full cost of electricity service

( ) Don't know

7. What part of your organization's electricity costs does it pay? Does it pay the cost for certain facilities or does it pay a share of the overall costs? Please explain.

8. Before this survey, were you aware that DCEO offers incentives to help you increase the energy efficiency of your organization?

( ) Yes *(if selected go to Q9, Q10, and Q11)*

( ) No

9. Has your organization applied for or received an incentive from DCEO for installing energy saving equipment?

( ) Yes

( ) No

( ) Don't know

10. Which of the following services and incentives are you aware of?

	Aware of	Not aware of
Incentives for equipment that reduces natural gas consumption	( )	( )
Incentives for equipment that reduces electricity consumption	( )	( )
Retro-commissioning studies and facility audits that identify ways to save energy and are provided at no cost	( )	( )
Incentives to incorporate energy efficient design features into new construction and building rehabilitation	( )	( )

11. Do you have a clear sense of where to get more information about DCEO incentive programs?

( ) Yes

( ) No

( ) Don't know

12. Were you aware that the Metropolitan Mayors Caucus offers services to help local government agencies plan energy saving projects and apply for grants funded through DCEO's Energy Now Programs?

( ) Yes *(if selected show Q27)*

( ) No

13. Below are a number of potential needs that your organization might have for completing an energy saving project that receives a DCEO incentive. For each, please indicate how critical each would be to enable your organization to complete a DCEO incentive project.

	0 - Not all important to completing a project	1	2	3	4 - Critical to completing a project	Don't know
Help understanding what DCEO incentive options are available and what equipment qualifies	( )	( )	( )	( )	( )	( )
Help assessing energy savings potential for projects	( )	( )	( )	( )	( )	( )
Help identifying specific types of equipment or building features that would reduce our energy use	( )	( )	( )	( )	( )	( )
Financial assistance to reduce the cost of energy efficient equipment	( )	( )	( )	( )	( )	( )
Assistance with finding ways of financing projects through loans or other mechanisms	( )	( )	( )	( )	( )	( )
Assistance with completing paperwork to receive financial incentives	( )	( )	( )	( )	( )	( )

Help prioritizing energy efficiency projects in our organization	( )	( )	( )	( )	( )	( )

14. How important would each of the following be to your organization's decision to purchase equipment that saved energy?

	Not at all important	Slightly important	Somewhat important	Very important	Don't know
The initial cost of the efficient equipment compared to less efficient options	( )	( )	( )	( )	( )
The payback period for the investment in the more efficient equipment	( )	( )	( )	( )	( )
The availability of external grant or incentive funds	( )	( )	( )	( )	( )
The age or condition of the existing equipment	( )	( )	( )	( )	( )

The amount that our utility costs would be reduced through saving energy	( )	( )	( )	( )	( )

15. Earlier you indicated that your organization does not pay the full cost of its electricity or natural gas service.

    Would you say this arrangement makes getting approvals for energy efficiency projects....

    ( ) A lot more difficult

    ( ) Somewhat more difficult

    ( ) Slightly more difficult

    ( ) It has no effect on project approvals

    ( ) Don't know

16. Does your organization have any plans to replace equipment or modify building features in the coming two years?

    ( ) Yes *(if selected go to Q17 and Q18)*

    ( ) No

    ( ) Don't know

17. What equipment or building features do these plans involve? (Select all that apply)

    ( ) Data center or IT equipment

    ( ) Exterior lighting or lighting controls

    ( ) Food preparation / kitchen equipment

    ( ) Heating, cooling, HVAC

    ( ) Insulation (ceiling, attic or wall)

    ( ) Interior lighting or lighting controls

    ( ) Motors or motor controls

    ( ) Refrigeration or freezing

( ) Water heating equipment

( ) Windows

( ) Other:

( ) Don't know

18. Will any of those replacement or upgrades exceed energy efficiency standards, building codes, or otherwise result in energy savings?

( ) Yes *(if selected go to Q19)*

( ) No

( ) Don't know *(if selected go to Q19)*

19. How likely are you to apply for a DCEO incentive for those replacements or upgrades?

( ) Very likely

( ) Somewhat likely *(if selected go to Q20)*

( ) Not very likely *(if selected go to Q20)*

( ) Not at all likely *(if selected go to Q20)*

( ) Don't know *(if selected go to Q20)*

20. Why might you not apply for a DCEO incentive? (Select all that apply)

( ) Don't know how to apply for incentives from DCEO

( ) The incentives are too low to be worth the effort of applying

( ) The project is too small to be worth the effort of applying

( ) Not applicable- Energy management firm or property manager will make decision

( ) Don't know enough about the incentives that are available

( ) For some other reason (please explain):

( ) Not sure

21. If your organization completed an energy saving project and received a DCEO incentive, would the incentive be returned to the department or budget used to fund the project or would it return to a general fund?

( ) The incentive would go to the department or budget that funded the project

( ) The incentive would go to a general fund

( ) Neither of these *(if selected go to Q22)*

( ) Don't know

22. What would happen to the incentive payment?
23. Not including DCEO, has your organization received any grants or incentives from any other external organization such as an Energy Efficiency Conservation Block Grant or a grant though the Illinois Clean Energy Community Foundation for an energy saving project?

    ( ) Yes *(if selected go to Q24)*

    ( ) No

    ( ) Don't know

24. What organization did you receive a grant or incentive from for an energy saving project?
25. How effective do you think each of the following is for providing information about DCEO's incentive programs to local governments like yours?

	Very effective	Somewhat effective	Slightly effective	Not at all effective	Don't know
Email	( )	( )	( )	( )	( )
Phone calls from program representatives	( )	( )	( )	( )	( )
Presentations at events or conferences	( )	( )	( )	( )	( )
Newsletter	( )	( )	( )	( )	( )
Website updates	( )	( )	( )	( )	( )
In person visits	( )	( )	( )	( )	( )

26. 26) Do you have any suggestions for how DCEO could improve its programs in order to facilitate the participation of local governments like yours?
27. Do you have any suggestions for how the Metropolitan Mayors Caucus could improve its services to help local governments complete energy efficiency projects?
28. Including your location, how many facilities does your organization own or lease?

29. Approximately what percent of your organization's facilities are owned as opposed to leased? Would you say that you own…

    ( ) 0% - 25%

    ( ) 26%-50%

    ( ) 51%-75%

    ( ) 75%-100%

    ( ) Don't know

30. Does your organization receive electricity delivery service from ComEd or Ameren Illinois?

    ( ) ComEd

    ( ) Ameren

    ( ) Neither

    ( ) Don't know

31. Does your organization receive natural gas delivery service from Nicor, Peoples Gas, North Shore Gas, or Ameren Gas?

    ( ) Nicor

    ( ) Peoples Gas

    ( ) North Shore Gas

    ( ) Ameren Gas

    ( ) None of these

    ( ) Don't know

Appendix G: Municipal Survey Responses

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=23)*	*Percent of Respondents*
1. What is your job title?	Manager	12	52%
	Facilities manager	0	0%
	Energy manager	0	0%
	Other facilities management/maintenance position	0	0%
	Chief financial officer	2	9%
	Other financial / administrative position	1	4%
	Public works director	3	13%
	Public works staff	1	4%
	Other	4	17%

	Response	*(n=9)*	*Percent of Respondents **
2. Which of the following, if any, does your organization have in place?	A person or persons responsible for monitoring or managing energy usage	4	44%
	Defined energy saving goals	0	0%
	Carbon reduction goals	1	11%
	A specific policy requiring that energy efficiency be considered when purchasing equipment	0	0%
	Other policies or procedures regarding energy efficiency or use (please describe)	5	56%

**Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.*

	Response	*(n=1)*	*Percent of Respondents*
3. What sources, if any, does your organization use to learn about ways to save energy?	Our regional planning agency	6	27%
	The Metropolitan Mayors Caucas	9	41%
	The Illinois DCEO	12	55%
	The Smart Energy Design Assistance Center	2	9%
	The Energy Resources Center	0	0%
	Other associations for local governments	9	41%
	Contractors, vendors, or energy services providers	9	41%
	Journals or trade magazines	7	32%
	Your gas and / or electric utility	15	68%
	Some other source (Please explain)	2	9%
	We have not sought information about energy efficiency from any source	0	0%
	Don't know	1	5%

**Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.*

4. Does your organization have a franchise agreement with its natural gas service provider that covers part or all of the cost of its natural gas service?	*Response*	*(n=23)*	*Percent of Respondents*
	Yes, the agreement covers all of the natural gas cost	9	39%
	Yes, the agreement covers part of the natural gas cost	7	30%
	No, we pay the full cost of natural gas service	0	0%
	No, we do not have natural gas service	0	0%
	Don't know	2	9%

6. Does your organization have a franchise agreement with its electric service provider that covers part or all of the cost of its electricity service?	*Response*	*(n=23)*	*Percent of Respondents*
	Yes, the agreement covers all of the electricity cost	6	26%
	Yes, the agreement covers part of the electricity cost	12	52%
	No, we pay the full cost of electricity service	0	0%
	Don't know	1	4%

8. Before this survey, were you aware that DCEO offers incentives to help you increase the energy efficiency of your organization?	*Response*	*(n=23)*	*Percent of Respondents*
	Yes	16	70%
	No	7	30%

9. Has your organization applied for or received an incentive from DCEO for installing energy saving equipment?	*Response*	*(n=16)*	*Percent of Respondents*
	Yes	9	56%
	No	4	25%
	Don't know	3	19%

10a. Which of the following services and incentives are you aware of? - Incentives for equipment that reduces natural gas consumption	*Response*	*(n=16)*	*Percent of Respondents*
	Aware of	7	44%
	Not aware of	9	56%

10b. Which of the following services and incentives are you aware of? - Incentives for equipment that reduces electricity consumption	*Response*	*(n=16)*	*Percent of Respondents*
	Aware of	14	88%
	Not aware of	2	13%

10c. Which of the following services and incentives are you aware of? - Retro-commissioning studies and facility audits that identify ways to save energy and are provided at no cost	*Response*	*(n=14)*	*Percent of Respondents*
	Aware of	9	64%
	Not aware of	5	36%

10d. Which of the following services and incentives are you aware of? - Incentives to incorporate energy efficient design features into new construction and building rehabilitation	*Response*	*(n=16)*	*Percent of Respondents*
	Aware of	13	81%
	Not aware of	3	19%

11. Do you have a clear sense of where to get more information about DCEO incentive programs?	*Response*	*(n=16)*	*Percent of Respondents*
	Yes	9	56%
	No	4	25%
	Don't know	3	19%

12. Were you aware that the Metropolitan Mayors Caucus offers services to help local government agencies plan energy saving projects and apply for grants funded through DCEO's Energy Now Programs?	*Response*	*(n=23)*	*Percent of Respondents*
	Yes	13	57%
	No	10	43%

13a. How critical was help understanding what DCEO incentive options are available and what equipment qualifies to enabling your organization to complete a DCEO incentive project?	*Response*	*(n=23)*	*Percent of Respondents*
	4 - Critical to completing a project	7	30%
	3	6	26%
	2	1	4%
	1	4	17%
	0 - Not all important to completing a project	4	17%
	Don't know	1	4%

13b. How critical was help assessing energy savings potential for projects to enabling your organization to complete a DCEO incentive project?	*Response*	*(n=23)*	*Percent of Respondents*
	4 - Critical to completing a project	6	26%
	3	3	13%
	2	5	22%
	1	2	9%
	0 - Not all important to completing a project	5	22%
	Don't know	2	9%

13c. How critical was help identifying specific types of equipment or building features that would reduce your energy use to enabling your organization to complete a DCEO incentive project?	*Response*	*(n=23)*	*Percent of Respondents*
	4 - Critical to completing a project	6	26%
	3	7	30%
	2	1	4%
	1	2	9%
	0 - Not all important to completing a project	6	26%
	Don't know	1	4%

13d. How critical was financial assistance to reduce the cost of energy efficient equipment to enabling your organization to complete a DCEO incentive project?	*Response*	*(n=23)*	*Percent of Respondents*
	4 - Critical to completing a project	10	43%
	3	2	9%
	2	2	9%
	1	3	13%
	0 - Not all important to completing a project	4	17%
	Don't know	2	9%

13f. How critical was assistance with finding ways of financing projects through loans or other mechanisms to enabling your organization to complete a DCEO incentive project?	*Response*	*(n=23)*	*Percent of Respondents*
	4 - Critical to completing a project	5	22%
	3	3	13%
	2	6	26%
	1	2	9%
	0 - Not all important to completing a project	6	26%
	Don't know	1	4%

13g. How critical was assistance with completing paperwork to receive financial incentives to enabling your organization to complete a DCEO incentive project?	*Response*	*(n=23)*	*Percent of Respondents*
	4 - Critical to completing a project	2	9%
	3	7	30%
	2	4	17%
	1	2	9%
	0 - Not all important to completing a project	6	26%
	Don't know	2	9%

13h. How critical was help prioritizing energy efficiency projects in our organization to enabling your organization to complete a DCEO incentive project?	*Response*	*(n=23)*	*Percent of Respondents*
	4 - Critical to completing a project	3	13%
	3	4	17%
	2	2	9%
	1	4	17%
	0 - Not all important to completing a project	8	35%
	Don't know	2	9%

14a. How important was the initial cost of the efficient equipment compared to less efficient options?	*Response*	*(n=23)*	*Percent of Respondents*
	Very important	15	65%
	Somewhat important	4	17%
	Slightly important	2	9%
	Not at all important	1	4%
	Don't know	1	4%

14b. How important was the payback period for the investment in the more efficient equipment	*Response*	*(n=23)*	*Percent of Respondents*
	Very important	16	70%
	Somewhat important	2	9%
	Slightly important	2	9%
	Not at all important	1	4%
	Don't know	2	9%

14c. How important was the availability of external grant or incentive funds	*Response*	*(n=23)*	*Percent of Respondents*
	Very important	13	57%
	Somewhat important	7	30%
	Slightly important	0	0%
	Not at all important	2	9%
	Don't know	1	4%

	Response	*(n=23)*	*Percent of Respondents*
14d. How important was the age or condition of the existing equipment?	Very important	9	39%
	Somewhat important	10	43%
	Slightly important	1	4%
	Not at all important	3	13%
	Don't know	0	0%

	Response	*(n=22)*	*Percent of Respondents*
14e. How important was the amount that our utility costs would be reduced through saving energy?	Very important	14	64%
	Somewhat important	6	27%
	Slightly important	0	0%
	Not at all important	2	9%
	Don't know	0	0%

	Response	*(n=23)*	*Percent of Respondents*
15. Earlier you indicated that your organization does not pay the full cost of its electricity or natural gas service. Would you say this arrangement makes getting approvals for energy efficiency projects....	A lot more difficult	0	0%
	Somewhat more difficult	5	22%
	Slightly more difficult	1	4%
	It has no effect on project approvals	6	26%
	Don't know	11	48%

	Response	*(n=23)*	*Percent of Respondents*
16. Does your organization have any plans to replace equipment or modify building features in the coming two years?	Yes	12	52%
	No	9	39%
	Don't know	2	9%

	Response	*(n=12)*	*Percent of Respondents*
17. What equipment or building features do these plans involve?	Data center or IT equipment	5	42%
	Exterior lighting or lighting controls	7	58%
	Food preparation / kitchen equipment	0	0%
	Heating, cooling, HVAC	9	75%
	Insulation (ceiling, attic or wall)	2	17%
	Interior lighting or lighting controls	7	58%
	Motors or motor controls	1	8%
	Refrigeration or freezing	0	0%
	Water heating equipment	1	8%
	Windows	4	33%
	Other: ____________________________	0	0%
	Don't know	0	0%

	Response	*(n=12)*	*Percent of Respondents*
18. Will any of those replacement or upgrades exceed energy efficiency standards, building codes, or otherwise result in energy savings?	Yes	8	67%
	No	0	0%
	Don't know	4	33%

	Response	*(n=12)*	*Percent of Respondents*
19. How likely are you to apply for a DCEO incentive for those replacements or upgrades?	Very likely	7	58%
	Somewhat likely	3	25%
	Not very likely	0	0%
	Not at all likely	1	8%
	Don't know	1	8%

	Response	*(n=5)*	*Percent of Respondents*
20. Why might you not apply for a DCEO incentive?	Don't know how to apply for incentives from DCEO	0	0%
	The incentives are too low to be worth the effort of applying	2	40%
	The project is too small to be worth the effort of applying	1	20%
	Not applicable- Energy management firm or property manager will make decision	0	0%
	Don't know enough about the incentives that are available	1	20%
	For some other reason	3	60%
	Not sure	0	0%

21. If your organization completed an energy saving project and received a DCEO incentive, would the incentive be returned to the department or budget used to fund the project or would it return to a general fund?	*Response*	*(n=23)*	*Percent of Respondents*
	The incentive would go to the department or budget that funded the project	6	26%
	The incentive would go to a general fund	11	48%
	Neither of these	1	4%
	Don't know	5	22%

23. Not including DCEO, has your organization received any grants or incentives from any other external organization such as an Energy Efficiency Conservation Block Grant or a grant though the Illinois Clean Energy Community Foundation for an energy saving project?	*Response*	*(n=23)*	*Percent of Respondents*
	Yes	4	17%
	No	14	61%
	Don't know	5	22%

25a. How effective do you think email is for providing information about DCEO's incentive programs to local governments like yours?	*Response*	*(n=22)*	*Percent of Respondents*
	Very effective	12	55%
	Somewhat effective	6	27%
	Slightly effective	3	14%
	Not at all effective	0	0%
	Don't know	1	5%

25b. How effective do you think phone calls from program representatives are for providing information about DCEO's incentive programs to local governments like yours?	*Response*	*(n=20)*	*Percent of Respondents*
	Very effective	2	10%
	Somewhat effective	5	25%
	Slightly effective	4	20%
	Not at all effective	7	35%
	Don't know	2	10%

25c. How effective do you think presentations at events or conferences are for providing information about DCEO's incentive programs to local governments like yours?	*Response*	*(n=21)*	*Percent of Respondents*
	Very effective	7	33%
	Somewhat effective	6	29%
	Slightly effective	5	24%
	Not at all effective	1	5%
	Don't know	2	10%

25d. How effective do you think a newsletter is for providing information about DCEO's incentive programs to local governments like yours?	*Response*	*(n=20)*	*Percent of Respondents*
	Very effective	5	25%
	Somewhat effective	4	20%
	Slightly effective	5	25%
	Not at all effective	3	15%
	Don't know	3	15%

25e. How effective do you think website updates are for providing information about DCEO's incentive programs to local governments like yours?	*Response*	*(n=20)*	*Percent of Respondents*
	Very effective	3	15%
	Somewhat effective	2	10%
	Slightly effective	9	45%
	Not at all effective	4	20%
	Don't know	2	10%

25f. How effective do you think in person visits are for providing information about DCEO's incentive programs to local governments like yours?	*Response*	*(n=21)*	*Percent of Respondents*
	Very effective	2	10%
	Somewhat effective	6	29%
	Slightly effective	5	24%
	Not at all effective	5	24%
	Don't know	3	14%

29. Approximately what percent of your organization's facilities are owned as opposed to leased? Would you say that you own…	*Response*	*(n=21)*	*Percent of Respondents*
	0% - 25%	0	0%
	26%-50%	0	0%
	51%-75%	1	5%
	75%-100%	19	90%

30. Does your organization receive electricity delivery service from ComEd or Ameren Illinois?	*Response*	*(n=21)*	*Percent of Respondents*
	ComEd	20	95%
	Ameren	0	0%
	Neither	1	5%
	Don't know	0	0%

	Response	*(n=21)*	*Percent of Respondents*
31. Does your organization receive natural gas delivery service from Nicor, Peoples Gas, North Shore Gas, or Ameren Gas?	Nicor	17	81%
	Peoples Gas	0	0%
	North Shore Gas	4	19%
	Ameren Gas	0	0%
	None of these	0	0%
	Don't know	0	0%

Appendix H: Trade Ally Survey Instrument

1. Approximately how many employees work at your firm? *(Do not read to respondents)*
   - ( ) 1 to 4 employees
   - ( ) 5 to 9 employees
   - ( ) 10 to 19 employees
   - ( ) 20 to 99 employees
   - ( ) 100 to 499 employees
   - ( ) 500 or more employees
   - ( ) Don't know

2. How would you characterize your type of business? *(Do not read to respondents)*
   - ( ) Architect
   - ( ) Contractor - Electrical
   - ( ) Contractor - Mechanical
   - ( ) Distributor
   - ( ) Engineer
   - ( ) Manufacturer
   - ( ) Manufacturer representative
   - ( ) Vendor/Retailer
   - ( ) Other (*please specify*)

3. Do you typically provide services to public sector entities, private sector entities, or both?
   - ( ) Typically to public sector entities
   - ( ) Typically to private sector entities
   - ( ) Both public and private sector entities
   - ( ) Other (*please specify*)

Trade Ally Program Benefits and Training

4. We would like to know about the potential benefits of being a registered DCEO trade ally to you and your firm. Using a scale of very beneficial, somewhat beneficial, not at all beneficial, please indicate how beneficial the program is for each of the following:

	Very beneficial	Somewhat beneficial	Not at all beneficial	Don’t know
Broadening your public sector customer base				
Increasing your sales				
As a source of information on new technologies or measures that could save energy for your customers				
Increasing your sales				

5. Have you or someone at your company attended one of the ERC hosted training webinars for DCEO Trade Allies?
   ( ) Yes, I have attended (*go to* 6)
   ( ) Someone else at my company attended (*skip to 14*)
   ( ) No (*skip to 14*)
   ( ) Don't know (*skip to 14*)

6. How many webinars have you attended?
   ( ) __________
   ( ) Don't know

7. Which of the following topics did the training cover?

	Yes	No	Don't know
General application requirements			
Navigating the Trade Ally Program website			
Qualifying equipment			
Calculating savings and incentives			
M&V requirements			
How to sell the benefits of energy efficiency			
Don't know			

8. How clear was the information presented in the training you received? Would you say…
   ( ) Very clear *(skip to 10)*
   ( ) Somewhat clear *(skip to 10)*
   ( ) Somewhat unclear (*go to* 9)
   ( ) Very unclear (go to 9)
   ( ) Don't know *(skip to 10)*

9. What information was unclear?

10. Would you say that the level of detail provided in the training was about right, too detailed, or not detailed enough?
    ( ) About right
    ( ) Too detailed

( ) Not detailed enough
( ) Don't know

11. Would you say that the length of the training was about right, too long, or not long enough?
( ) About right
( ) Too long
( ) Not long enough
( ) Don't know

12. Where there any topics not covered in the training that you think should have been covered?
( ) Yes *(go to 13)*
( ) No *(skip to 14)*
( ) Don't know

13. What topics would you have liked to seen covered?

14. Have you or someone else at the company attended one or more regional DCEO Trade Ally Rally?
( ) Yes, I have attended *(go to 16)*
( ) Someone else at my company has attended *(skip to 18)*
( ) No *(skip to 18)*
( ) Don't know *(skip to 19)*

15. How useful was the rally for getting updates on the DCEO incentive programs? Would you say…
( ) Very useful
( ) Somewhat useful
( ) Not very useful
( ) Don't know

16. Thinking about your experience at the trade ally rallies, how beneficial was the rally for each of the following? Please answer by stating whether it was "very beneficial", "somewhat beneficial", or "not at all beneficial".

	Very beneficial	Somewhat beneficial	Not at all beneficial	Don't know
a. Providing an opportunity to network with other trade allies				
b. Providing an opportunity to meet with potential public sector clients				

17. Do you have any suggestions for how to improve the trade ally rallies?

18. Why have you not attended a rally? *(Do not read to respondents)*
( ) Location is not convenient
( ) Did not know about the rallies

( ) Did not think attending would be useful
( ) Other *(please specify)*
( ) Don’t know

Application Process

Now we would like to know a little bit about your experience completing DCEO incentive projects.

19. Have you completed or assisted in the completion of any DCEO public sector energy efficiency incentive projects in the last year?
    ( ) Yes *(go to 20)*
    ( ) No *(skip to 29)*
    ( ) Don’t know *(skip to 29)*

20. Which DCEO programs were these projects completed through? *(Select all that apply)*
    ( ) DCEO Custom or Standard Incentive Programs
    ( ) DCEO New Construction Program
    ( ) DCEO Retro-commissioning Program
    ( ) DCEO Boiler Tune-up Program
    ( ) Don’t know

21. Approximately how many projects have you completed or assisted in completing that received incentives from a DCEO program in the last year?

22. Are there any aspects of the application process that you would recommend be modified?
    ( ) Yes *(go to 23)*
    ( ) No *(go to 24)*
    ( ) Don’t know *(go to 24)*

23. In what ways would you recommend the application process be changed?

24. Have you sought any assistance from program staff for incentive projects you were working on?
    ( ) Yes *(go to 25)*
    ( ) No *(skip to 29)*
    ( ) Don’t know *(skip to 29)*

25. With whom did you speak?
    ( ) DCEO staff
    ( ) Smart Energy Design Assistance Center (SEDAC) or 360 Energy Group staff
    ( ) Energy Resources Center (ERC) staff
    ( ) Other *(please specify)*
    ( ) Don't know

26. What did you need help with? *(Do not read to respondents)(Select all that apply)*

( ) General program information
( ) Questions about how to complete an incentive application
( ) Check on the status of an incentive application
( ) Questions about the Trade Ally Network
( ) Questions about using DCEO's or the Illinois Energy Now name or logo in promoting the program
( ) Questions about qualifying equipment
( ) Other (*please specify)*
( ) Don't know

27. Did you get the assistance that you needed?
( ) Yes *(skip to 29)*
( ) No *(go to 28)*
( ) Don't know *(skip to 29)*

28. What additional help would you have liked?

Barriers to Participation

29. Do you actively market the DCEO energy efficiency incentive programs to your public sector clients?
( ) Yes *(go to 30)*
( ) No *(skip to 32)*
( ) Don't know

30. Why do you not market the incentive programs?

31. What works best to encourage your public sector clients to consider an energy saving project? (*Probes if needed: facility audits, the incentives, estimating savings, case studies, other)*

32. What percentage of your clients that completed DCEO incentive projects were aware of the incentives before you mentioned it to them? *(Do not read to respondents)*
( ) 0%-9%
( ) 10%-19%
( ) 20%-29%
( ) 30%-39%
( ) 40%-49%
( ) 50%-59%
( ) 60%-69%
( ) 70%-79%
( ) 80%-89%
( ) 90%-100%
( ) Don't know

33. Now, think about the jobs you completed for public sector clients in the last year. What percentage of those jobs did you propose an energy saving project that could qualify for the DCEO incentives? *(Do not read to respondents)*
    ( ) 0%-9%
    ( ) 10%-19% (*go to 34*)
    ( ) 20%-29% (*go to 34*)
    ( ) 30%-39% (*go to 34*)
    ( ) 40%-49% (*go to 34*)
    ( ) 50%-59% (*go to 34*)
    ( ) 60%-69% (*go to 34*)
    ( ) 70%-79% (*go to 34*)
    ( ) 80%-89% (*go to 34*)
    ( ) 90%-100% (*go to 34*)
    ( ) Don't know

34. And in about what percentage of those jobs did the client agree to most of the incentive qualifying equipment that you proposed? *(Do not read to respondents)*
    ( ) 0%-9% (*go to 35 and 36, then skip to 40*)
    ( ) 10%-19% (*go to 35, 36, and 37*)
    ( ) 20%-29% (*go to 35, 36, and 37*)
    ( ) 30%-39% (*go to 35, 36, and 37*)
    ( ) 40%-49% (*go to 35, 36, and 37*)
    ( ) 50%-59% (*go to 35, 36, and 37*)
    ( ) 60%-69% (*go to 35, 36, and 37*)
    ( ) 70%-79% (*go to 35, 36, and 37*)
    ( ) 80%-89% (*go to 35, 36, and 37*)
    ( ) 90%-100% (*skip to 37*)
    ( ) Don't know

35. For those clients that didn't agree to install most of the incentive qualifying equipment, what reasons did they give? *(Do not read to respondents. Select all that apply.)*
    ( ) Cost of energy efficient equipment
    ( ) Age or operating condition of existing equipment
    ( ) Uncertainty about potential energy savings
    ( ) Other

36. In what ways, if any, did the reasons they gave relate to the size or type of public sector organization?

37. For those public sector clients that accepted most of the qualifying equipment that you proposed, what percentage applied for a DCEO incentive? *(Do not read to respondents)*
    ( ) 0%-9% (*go to 38 and 39*)

( ) 10%-19% (*go to 38 and 39*)
( ) 20%-29% (*go to 38 and 39*)
( ) 30%-39% (*go to 38 and 39*)
( ) 40%-49% (*go to 38 and 39*)
( ) 50%-59% (*go to 38 and 39*)
( ) 60%-69% (*go to 38 and 39*)
( ) 70%-79% (*go to 38 and 39*)
( ) 80%-89% (*go to 38 and 39*)
( ) 90%-100%
( ) Don't know

38. For those clients that didn't apply for a DCEO incentive for the qualifying equipment, what reasons did they give? *(Do not read to respondents. Select all that apply.)*
( ) Paperwork or qualifications burdensome
( ) Could not meet program time requirements
( ) Other

39. In what ways, if any, did the reasons they gave relate to the size or type of public sector organization?

40. Have you proposed or discussed any energy saving incentive projects with clients at facilities owned or leased by Illinois State Agencies?
( ) Yes
( ) No
( ) Don't know

41. Are there any challenges to completing incentive projects that are unique to state owned or leased facilities?

42. Is there anything that DCEO could do to improve their programs so that more incentive projects are completed?

Market Impacts

43. Has your involvement in the DCEO energy efficiency incentive programs affected the types of equipment or services that you provide?
( ) Yes *(go to 42)*
( ) No
( ) Don't know

44. In what ways has your involvement in the incentive programs affected the types of equipment or services that you provide? *(Do not read to respondents. Select all that apply.)*
( ) Offer more energy efficient equipment or services
( ) Offer new types of energy efficient equipment or services

( ) Recommend equipment that qualifies for program
( ) Help customers identify energy saving opportunities
( ) Other

Satisfaction with Programs

45. Except for a couple of closing remarks, we'll close with a few satisfaction questions to get an idea of your overall experience with program processes.

Please answer whether you are very dissatisfied, some dissatisfied, neither dissatisfied nor satisfied, satisfied, or very satisfied with each of the following . . .

	Very satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied	Don't know
a. the program application process						
b. the range of measures and products for which DCEO offers incentives						
c. the level of incentives offered						
d. the DCEO incentive programs overall						

[Go to 46 if any = somewhat dissatisfied or very dissatisfied]

46. Please describe why you were not satisfied with the programs.

47. Do you have any suggestions on how DCEO could better support its trade allies?

48. Do you have any suggestions for how DCEO could improve its energy efficiency programs?

Appendix I: Trade Ally Survey Responses

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=99)*	*Percent of Respondents*
1. Approximately how many employees work at your firm?	1 to 4 employees	33	33%
	5 to 9 employees	12	12%
	10 to 19 employees	15	15%
	20 to 99 employees	22	22%
	100 to 499 employees	9	9%
	500 or more employees	5	5%
	Don't know	3	3%

	Response	*(n=99)*	*Percent of Respondents*
2. How would you characterize your type of business?	Architect	3	3%
	Contractor - Electrical	16	16%
	Contractor - Mechanical	8	8%
	Distributor	13	13%
	Engineer	6	6%
	Manufacturer	14	14%
	Manufacturer representative	2	2%
	Vendor/Retailer	0	0%
	Other	37	37%

	Response	*(n=99)*	*Percent of Respondents*
3. Do you typically provide services to public sector entities, private sector entities, or both?	Typically to public sector entities	10	10%
	Typically to private sector entities	8	8%
	Both public and private sector entities	80	81%
	Other	1	1%

	Response	*(n=99)*	*Percent of Respondents*
4a. Using a scale of very beneficial, somewhat beneficial, not at all beneficial, please indicate how beneficial the program is for each of the following: Broadening your public sector customer base.	Very beneficial	34	34%
	Somewhat beneficial	33	33%
	Not at all beneficial	24	24%
	Don't know	8	8%

4c. Using a scale of very beneficial, somewhat beneficial, not at all beneficial, please indicate how beneficial the program is for each of the following: increasing your sales.	*Response*	*(n=99)*	*Percent of Respondents*
	Very beneficial	31	31%
	Somewhat beneficial	27	27%
	Not at all beneficial	29	29%
	Don't know	12	12%

4d. Using a scale of very beneficial, somewhat beneficial, not at all beneficial, please indicate how beneficial the program is for each of the following: as a source of information on new technologies or measures that could save energy for your customers.	*Response*	*(n=99)*	*Percent of Respondents*
	Very beneficial	40	40%
	Somewhat beneficial	41	41%
	Not at all beneficial	14	14%
	Don't know	4	4%

5. Have you or someone at your company attended one of the ERC hosted training webinars for DCEO Trade Allies?	*Response*	*(n=99)*	*Percent of Respondents*
	Yes, I have attended	65	66%
	Someone else at my company attended	1	1%
	No	30	30%
	Don't know	3	3%

6. How many webinars have you attended?	*Response*	
	Average webinars attended	2.65

7a. Which of the following topics did the training cover: General application requirements?	*Response*	*(n=65)*	*Percent of Respondents*
	Yes	55	85%
	No	3	5%
	Don't know	7	11%

7b. Which of the following topics did the training cover: Navigating the Trade Ally Program website?	*Response*	*(n=65)*	*Percent of Respondents*
	Yes	36	55%
	No	24	37%
	Don't know	5	8%

7c. Which of the following topics did the training cover: Qualifying equipment?	*Response*	*(n=65)*	*Percent of Respondents*
	Yes	41	63%
	No	17	26%
	Don't know	7	11%

7d. Which of the following topics did the training cover: Calculating savings and incentives?	*Response*	*(n=64)*	*Percent of Respondents*
	Yes	42	66%
	No	12	19%
	Don't know	10	16%

7e. Which of the following topics did the training cover: M&V requirements?	*Response*	*(n=65)*	*Percent of Respondents*
	Yes	25	38%
	No	29	45%
	Don't know	11	17%

7. Which of the following topics did the training cover: How to sell the benefits of energy efficiency?	*Response*	*(n=65)*	*Percent of Respondents*
	Yes	28	43%
	No	27	42%
	Don't know	10	15%

8. How clear was the information presented in the training you received? Would you say…	*Response*	*(n=65)*	*Percent of Respondents*
	Very clear	48	74%
	Somewhat clear	15	23%
	Somewhat unclear	0	0%
	Very unclear	0	0%
	Don’t know	2	3%

10. Would you say that the level of detail provided in the training was about right, too detailed, or not detailed enough?	*Response*	*(n=65)*	*Percent of Respondents*
	About right	59	91%
	Too detailed	1	2%
	Not detailed enough	3	5%
	Don't know	2	3%

11. Would you say that the length of the training was about right, too long, or not long enough?	*Response*	*(n=65)*	*Percent of Respondents*
	About right	60	92%
	Too detailed	1	2%
	Not detailed enough	2	3%
	Don't know	2	3%

12. Were there any topics not covered in the training that you think should have been covered?	*Response*	*(n=65)*	*Percent of Respondents*
	Yes	9	14%
	No	46	71%
	Don't know	10	15%

	Response	*(n=99)*	*Percent of Respondents **
14. Have you or someone else at the company attended one or more regional DCEO Trade Ally Rally?	Yes, I have attended	57	58%
	Someone else at my company has attended	1	1%
	No	39	39%
	Don't know	2	2%

	Response	*(n=56)*	*Percent of Respondents*
15. How useful was the rally for getting updates on the DCEO incentive programs? Would you say…	Very useful	41	73%
	Somewhat useful	13	23%
	Not very useful	2	4%
	Don’t know	0	0%

	Response	*(n=57)*	*Percent of Respondents*
16a. Thinking about your experience at the trade ally rallies, how beneficial was the rally for each of the following: Providing an opportunity to network with other trade allies?	Very beneficial	38	67%
	Somewhat beneficial	13	23%
	Not at all beneficial	6	11%
	Don't know	0	0%

	Response	*(n=57)*	*Percent of Respondents*
16b. Thinking about your experience at the trade ally rallies, how beneficial was the rally for each of the following: Providing an opportunity to meet with potential public sector clients?	Very beneficial	22	39%
	Somewhat beneficial	24	42%
	Not at all beneficial	10	18%
	Don't know	1	2%

	Response	*(n=40)*	*Percent of Respondents*
18. Why have you not attended a rally?	Location is not convenient	7	18%
	Did not know about the rallies	7	18%
	Did not think attending would be useful	2	5%
	Other	24	60%
	Don’t know	0	0%

	Response	*(n=99)*	*Percent of Respondents*
19. Have you completed or assisted in the completion of any DCEO public sector energy efficiency incentive projects in the last year?	Yes	45	45%
	No	51	52%
	Don't know	3	3%

20. Which DCEO programs were these projects completed through?	*Response*	*(n=45)*	*Percent of Respondents **
	DCEO Custom or Standard Incentive Programs	26	58%
	DCEO New Construction Program	7	16%
	DCEO Retro-commissioning Program	14	31%
	DCEO Boiler Tune-up Program	9	20%
	Don't know	4	0%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

21. Approximately how many projects have you completed or assisted in completing that received incentives from a DCEO program in the last year?	*Response (n=45)*	
	Average projects completed	27

22. Are there any aspects of the application process that you would recommend be modified?	*Response*	*(n=45)*	*Percent of Respondents*
	Yes	21	47%
	No	23	51%
	Don't know	1	2%

24. Have you sought any assistance from program staff for incentive projects you were working on?	*Response*	*(n=44)*	*Percent of Respondents*
	Yes	24	55%
	No	20	45%
	Don't know	0	0%

25. With whom did you speak?	*Response*	*(n=24)*	*Percent of Respondents*
	DCEO staff	17	71%
	Smart Energy Design Assistance Center (SEDAC) or 360 Energy Group staff	1	4%
	Energy Resources Center (ERC) staff	1	4%
	Other	3	13%

	Response	*(n=24)*	*Percent of Respondents **
26. What did you need help with?	General program information	8	33%
	Questions about how to complete an incentive application	8	33%
	Check on the status of an incentive application	2	8%
	Questions about the Trade Ally Network	0	0%
	Questions about using DCEO's or the Illinois Energy Now name or logo in promoting the program	1	4%
	Questions about qualifying equipment	10	42%
	Other	8	33%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	Response	*(n=24)*	*Percent of Respondents*
27. Did you get the assistance that you needed?	Yes	24	100%
	No	0	0%
	Don't know	0	0%

	Response	*(n=99)*	*Percent of Respondents*
29. Do you actively market the DCEO energy efficiency incentive programs to your public sector clients?	Yes	70	71%
	No	25	25%
	Don't know	4	4%

	Response	*(n=70)*	*Percent of Respondents*
32. What percentage of your clients that completed DCEO incentive projects were aware of the incentives before you mentioned it to them?	0%-9%	11	16%
	10%-19%	4	6%
	20%-29%	8	11%
	30%-39%	3	4%
	40%-49%	2	3%
	50%-59%	12	17%
	60%-69%	2	3%
	70%-79%	3	4%
	80%-89%	3	4%
	90%-100%	9	13%
	Don't know	13	19%

	Response	(n=99)	Percent of Respondents
33. Now, think about the jobs you completed for public sector clients in the last year. What percentage of those jobs did you propose an energy saving project that could qualify for the DCEO incentives?	0%-9%	16	16%
	10%-19%	2	2%
	20%-29%	1	1%
	30%-39%	2	2%
	40%-49%	0	0%
	50%-59%	1	1%
	60%-69%	1	1%
	70%-79%	2	2%
	80%-89%	3	3%
	90%-100%	38	38%
	Don't know	33	33%

	Response	(n=50)	Percent of Respondents
34. And in about what percentage of those jobs did the client agree to most of the incentive qualifying equipment that you proposed?	0%-9%	5	10%
	10%-19%	0	0%
	20%-29%	0	0%
	30%-39%	2	4%
	40%-49%	1	2%
	50%-59%	8	16%
	60%-69%	1	2%
	70%-79%	4	8%
	80%-89%	4	8%
	90%-100%	24	48%
	Don't know	1	2%

	Response	(n=25)	Percent of Respondents *
35. For those clients that didn't agree to install most of the incentive qualifying equipment, what reasons did they give?	Cost of energy efficient equipment	15	63%
	Age or operating condition of existing equipment	0	0%
	Uncertainty about potential energy savings	3	13%
	Other	14	58%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	Response	*(n=44)*	*Percent of Respondents*
37. For those public sector clients that accepted most of the qualifying equipment that you proposed, what percentage applied for a DCEO incentive?	0%-9%	3	7%
	10%-19%	0	0%
	20%-29%	0	0%
	30%-39%	1	2%
	40%-49%	0	0%
	50%-59%	1	2%
	60%-69%	0	0%
	70%-79%	1	2%
	80%-89%	2	5%
	90%-100%	33	75%
	Don't know	3	7%

	Response	*(n=1)*	*Percent of Respondents* *
38. For those clients that didn't apply for a DCEO incentive for the qualifying equipment, what reasons did they give?	Paperwork or qualifications burdensome	0	0%
	Could not meet program time requirements	0	0%
	Other	1	4%

*Since respondents were able to select more than one response, the sum of the percentages in the table above can exceed 100%.

	Response	*(n=99)*	*Percent of Respondents*
40. Have you proposed or discussed any energy saving incentive projects with clients at facilities owned or leased by Illinois State Agencies?	Yes	36	36%
	No	57	58%
	Don't know	6	6%

	Response	*(n=99)*	*Percent of Respondents*
43. Has your involvement in the DCEO energy efficiency incentive programs affected the types of equipment or services that you provide?	Yes	29	29%
	No	65	66%
	Don't know	5	5%

	Response	*(n=29)*	*Percent of Respondents*
44. In what ways has your involvement in the incentive programs affected the types of equipment or services that you provide?	Offer more energy efficient equipment or services	7	24%
	Offer new types of energy efficient equipment or services	10	34%
	Recommend equipment that qualifies for program	3	10%
	Help customers identify energy saving opportunities	2	7%
	Other	7	24%
	Help customers identify energy saving opportunities	0	0%

	Response	*(n=99)*	*Percent of Respondents*
45a. Please answer whether you are very dissatisfied, some dissatisfied, neither dissatisfied nor satisfied, satisfied, or very satisfied with each of the following: the program application process.	Very Satisfied	30	30%
	Satisfied	42	42%
	Neither Satisfied nor Dissatisfied	16	16%
	Dissatisfied	5	5%
	Very Dissatisfied	1	1%
	Don't know / Not applicable	5	5%
	Average		4.0

	Response	*(n=99)*	*Percent of Respondents*
45b. Please answer whether you are very dissatisfied, some dissatisfied, neither dissatisfied nor satisfied, satisfied, or very satisfied with each of the following: the range of measures and products for which DCEO offers incentives.	Very Satisfied	46	46%
	Satisfied	34	34%
	Neither Satisfied nor Dissatisfied	8	8%
	Dissatisfied	2	2%
	Very Dissatisfied	5	5%
	Don't know / Not applicable	4	4%
	Average		4.2

	Response	*(n=99)*	*Percent of Respondents*
45c. Please answer whether you are very dissatisfied, some dissatisfied, neither dissatisfied nor satisfied, satisfied, or very satisfied with each of the following: the level of incentives offered.	Very Satisfied	30	30%
	Satisfied	55	56%
	Neither Satisfied nor Dissatisfied	5	5%
	Dissatisfied	2	2%
	Very Dissatisfied	3	3%
	Don't know / Not applicable	4	4%
	Average		4.1

	Response	*(n=99)*	*Percent of Respondents*
45d. Please answer whether you are very dissatisfied, some dissatisfied, neither dissatisfied nor satisfied, satisfied, or very satisfied with each of the following: the DCEO incentive programs overall.	Very Satisfied	41	41%
	Satisfied	46	46%
	Neither Satisfied nor Dissatisfied	6	6%
	Dissatisfied	2	2%
	Very Dissatisfied	0	0%
	Don't know / Not applicable	4	4%
	Average		4.3