Evaluation of Illinois Energy Now Building Operator Certification® Program

June 2011 through May 2012

Prepared for:

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Prepared by:

ADM Associates, Inc.
3239 Ramos Circle
Sacramento, CA 95827
916.363.8383

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Contact:

Donald Dohrmann, Ph.D., Principal
775.825.7079
dohrmann@admenergy.com

Prepared by:

Steven Keates, P.E.
916.363.8383
steven@admenergy.com

Brian Harold
916.363.8383
brian.h@admenergy.com

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Executive Summary

This report presents the results of the impact and process evaluations of the Building Operator Certification® Program (BOC), which is administered by the Midwest Energy Efficiency Alliance (MEEA) under a license provided by the Northwest Energy Efficiency Council, and which receives program support and tuition rebate funding from the Department of Commerce and Economic Opportunity (DCEO). This report presents the results the evaluation of program activity occurring during the period June 2011 through May 2012, defined as electric program year four and natural gas program year one (EPY4/GPY1).

The main features of the evaluation approach are as follows:

- Data used to perform the evaluation were collected through review of program materials, interviews with MEEA staff members, and surveys and follow-up conversations with BOC participants.
- An approach based on review of the Illinois Statewide Technical Reference Manual (TRM), savings databases, and work papers was used to quantify savings associated with energy efficiency projects implemented by BOC participants as a result of program participation.
- In order to estimate free ridership and program net savings, survey-based analysis methods were applied to the data collected through a survey of BOC participants and facility operators.
- Relevant MEEA staff members were interviewed to provide information for the process evaluation.

The savings impact estimation process included a review of the energy efficiency measure information obtained through the participant survey effort as well as follow-up interviews with the appropriate participant and facility management staff members. The evaluators referred to sources listed in Table ES-1 in order to estimate savings for each measure type.

Table ES-1 Sources Referenced for Savings Calculations

Measure Category	*Energy Savings Sources*
Lighting Controls	Illinois Statewide TRM
Lighting	Illinois Statewide TRM
VSD	Illinois Statewide TRM
Economizer	Ohio TRM
Cooling System Maintenance	DEER eQUEST models for baseline usage. SDG&E Work Papers by Sisson and Associates, Inc. (S&A) EM&V Study for energy savings.
Heating System Maintenance	Illinois Statewide TRM

Measure Category	*Energy Savings Sources*
Appliance Coil Cleaning	SDG&E Work Papers by Sisson and Associates, Inc. (S&A) EM&V Study for energy savings.

Table ES-2 presents the net savings associated with sampled participants for each measure and maintenance category that achieved net savings within the sampled participant group.

Table ES-2 Net Savings by Measure for Participant Sample

Measure Category	*Total Sampled Net Savings (Adjusted for Partial FR)*		
	kWh	*kW*	*Therms*
Lighting Controls	235,989.68	70.07	0.00
Lighting	36,725.50	7.09	0.00
VSD	200,658.25	65.07	0.00
Economizer	29,614.00	-5.16	69.68
Cooling System Maintenance	10,558.56	8.99	0.00
Heating System Maintenance	0.00	0.00	441.54
Appliance Coil Cleaning	471.25	0.07	0.00
Total	514,017.24	146.14	511.22

The sample savings shown above were then extrapolated to the population of BOC participants who received a tuition rebate from DCEO during EPY4/GPY1. Savings were extrapolated based on utility service provider. Table ES-3 presents the net kWh savings by utility for the Building Operator Certification® Program during EPY4/GPY1. It should be noted that because some participants were serviced by non-EEPS electric utilities such as municipal utilities, electric savings generated through these participants were not attributed to the BOC Program.

Table ES-3 Summary of Net kWh Savings for BOC Program

Utility	*Realized Net kWh Savings*
Ameren	287,849.66
ComEd	1,343,298.40
Total	1,631,148.06

Table ES-4 presents the program's EPY4/GPY1 net kW savings by utility.

Table ES-4 Summary of Net kW Savings for BOC Program

Utility	*Realized Net kW Savings*
Ameren	81.84
ComEd	381.90
Total	463.74

Table ES-5 presents the program's EPY4/GPY1 net natural gas savings by utility. It should be noted that because some participants were serviced by non-EEPS natural gas utilities such as municipal utilities, natural gas savings generated through these participants were not attributable to the BOC Program.

Table ES-5 Summary of Net Therms Savings for BOC Program

Utility	*Realized Net Therm Savings*
Ameren	1,001.99
Nicor	167.00
Peoples	477.14
North Shore	47.71
Total	1,693.84

The total net energy savings of the Building Operator Certification® Program during EPY4/GPY1 are summarized in Table ES-6. During this period, net energy savings attributable to the program totaled 1,631,148.06 kWh, 463.74 kW, and 1,693.84 Therms.

Table ES-6 Summary of Net Savings from EPY4/GPY1 Projects

Savings Level	*Total Net Savings**		
	kWh	*kW*	*Therms*
Per Participant	19,037.68	5.41	18.93
Extrapolated to EPY4/GPY1 Participants	1,631,148.06	463.74	1,693.84

*Adjusted for partial free ridership. Extrapolated savings totals do not include savings that were attributable to non-EEPS utilities such as municipalities.

The following section presents a summary of key findings from the process and impact evaluations of the Building Operator Certification (BOC) Program. These conclusions and recommendations are based on a combination of research activities including participant surveys, interviews with program staff, and reviews of program tracking data, documentation, and prior evaluation reports.

The following is a summary of key conclusions from the evaluation of BOC Program EPY4/GPY1 activity:

- Limited Program Savings Impacts: The savings estimation procedure determined that although participants reported implementing a wide range of projects after their participation

in the BOC training, the total net savings impacts resulting from these projects were lower than program expectations. Chapter 2 and Chapter 3 provide further discussion of the savings impacts for EPY4/GPY1 and summarize the potential obstacles to increased program savings levels.

- BOC Influence: Based on the savings impact analysis, it is apparent that the Building Operator Certification training led to the implementation of a significant number of energy efficiency measures and maintenance-related energy efficiency improvements. However, a substantial number of these measures were incentivized by a utility-implemented energy efficiency program, and therefore are not claimable by the BOC Program. Therefore, the net savings attributable to the program do not account for the value of the program as a "gateway" to participation in utility-implemented programs.
- Measure Exclusion: During the savings estimation process, some measures were identified as having very low or no potential savings for participant facilities. These mainly included maintenance measures such as motor maintenance, where participant feedback suggested that the change in maintenance practices was not sufficient to warrant quantification and attribution of savings. While it is likely beneficial to educate program participants about facility improvements even when they may not result in energy savings, these measures and practices will not generally result in measurable program savings impacts.
- Program Satisfaction: Overall, the participant surveys showed that participants were generally pleased with their program experiences. The majority of course feedback was positive, and many of the respondents provided commentary that praised the BOC classes for their relevance, effectiveness, and structure. The results suggest that the BOC Program has been very well-received by participants, and that participant satisfaction has either been maintained or improved since prior program years.
- Participant Perspectives on Course Structure: Participants provided several suggestions regarding the overall operation, structure, and delivery of the BOC training courses. MEEA feedback suggests that these and other participant recommendations are being continually considered, and that changes to program structure may be implemented in the upcoming program years in order to address these areas.
- Quality Assurance and Participant Satisfaction: Quality assurance processes are integrated into the program to ensure program standards are met and feedback is both elicited and managed. A MEEA staff member attends at least one class session to observe both the students and the instructor. Students also complete post course and final overall evaluations. This assists in ensuring participant satisfaction and identifying any continued trends in the participant perspective that may require attention in future program years.
- Barriers to Program Participation: The primary barrier to participation, as identified by MEEA program staff, is the time required to attend and participate in the course. Employers typically understand the value in the certification and most often want their staff to participate, but feedback suggests that it is difficult for interested parties to take the necessary

time off, paid or unpaid. The BOC course requires participants to dedicate 74 hours, 64 of which are in-class while the other 10 are on-site at their facility.

The following is a summary of key recommendations from the EPY4/GPY1 evaluation of the BOC Program:

- Consider and Plan for External Project Incentive Activity: It may be possible for DCEO to share the savings associated with projects that receive incentives from utilities or other energy efficiency programs. The feasibility of this savings attribution structure is dependent upon discussions and cooperation between DCEO and relevant utilities or other parties, and may require program design or incentive changes in order to effectively allocate savings and costs so as to maximize the overall net social benefit.
- Consider Implementing Real-time Project Tracking: Although project tracking is performed to some degree under the program currently, it is for the most part conducted anonymously, which does not allow the data to be linked with specific participants. A real-time project tracking procedure would provide evaluators and DCEO staff with records of projects with potentially claimable savings rather than requiring full reliance on a retrospective survey approach to identify program savings.
- Continue or Increase Course Evaluation Procedure: The currently-administered MEEA course evaluation is given to participants on the last day of training. This practice of administering the course evaluation forms shortly after the course is completed increases the likelihood that participants will be able to recall their experiences and accurately reflect upon their perspectives of the program. If further insight into the ongoing participant experience is desired, it may be useful to provide similar course evaluations at a midpoint during the BOC training program in order to compare participant activity and perspectives over time, although a year-to-year comparison is likely sufficient.
- Separate Course Evaluation into Implementation Component and Assessment Component: It may be useful to administer a separate project tracking form during the in-class assessments so that evaluators and program staff can follow up with participants regarding their project activity. This may be helpful in informing the savings assessment procedure and would be separate from the evaluation documentation in order to preserve participant privacy and reduce response biases.
- Consider Implementation of Electronic Components: It may be useful to provide an online course participation option for some participants for any portion of the course that could feasibly be taught outside of the classroom. If this option is not favorable, it may be beneficial to allow participants to record their class-related work and project progress through an electronic-based system. This would allow for easier record-keeping and may benefit staff members and evaluators in reviewing the evaluation and project data that may be provided by participants.

1. Introduction

This report presents the results of the process evaluation of the Building Operator Certification® Program offered by the Illinois Department of Commerce and Economic Opportunity (DCEO). This report presents results of activity during the period June 2011 through May 2012.

1.1 Description of Program

The Building Operator Certification® Program (BOC Program) is a nationally recognized, competency based training and education program for building operators. DCEO provides funds for program administration, instructor fees and travel, training coordination fees and travel, marketing and outreach, and tuition rebates for program graduates. The program is administered in partnership with the Midwestern Energy Efficiency Alliance (MEEA), which administers a regional program in eight states through a license from the BOC copyright holder, the Northwest Energy Efficiency Council (NEEC).

The Illinois Department of Commerce and Economic Opportunity (DCEO) and MEEA launched the Building Operator Certification (BOC) Program in Illinois in 2003. The current DCEO program cycle began in June 2011 and the BOC program will operate throughout the three-year program cycle.

Program participants attend the courses and complete projects to receive Level I or Level II certification. Level I certification requires the completion of seven courses for 74 hours of instructional time and five projects. Course topics include:

- Building systems overview;
- Energy conservation techniques;
- HVAC system and controls;
- Efficient lighting fundamentals;
- Operation and maintenance practices for sustainable buildings;
- Indoor environmental quality; and
- Facility electrical systems.

Level I Course topics for Level II certification include:

- Preventative maintenance and troubleshooting;
- Advanced electrical diagnostics;
- HVAC troubleshooting and maintenance; and
- HVAC controls and optimization.

During the June 2011 through May 2012 period, 122 participants completed the Building Operator Certification® Program and received a tuition rebate through DCEO.

Table 1-1 displays the number of Level I and Level II graduates.

Table 1-1 Building Operator Certification Graduates

Certification Level	*Number of Graduates*
Level I	112
Level II	7
Level I and Level II	3
Total	122*

*For purposes of savings extrapolation, participants who attended both Level I and Level II of the BOC training were treated as separate participants, because they received a tuition rebate for each level.

MEEA is responsible for managing the grant from DCEO, marketing the program, and facilitating the course. Once NEEC approves the application and the certification is official, MEEA will provide the rebate for the course.

The majority of the course material is technical foundations, and is provided by NEEC. MEEA will work with instructors to create the portion of the course content that is specific to the region, i.e. weather impacts and utility program specifics. Some instructors are involved with the advisory committee that determines the strategic direction of the program, including the certification standards, course content, and future program scope. Eligibility requirements for BOC instructors include:

- Instructors must have teaching experience and technical expertise in the course topic area for which they apply. NEEC evaluates applications for both instruction and industry experience.
- 3+ years of experience providing instruction to working professionals in the field(s) of commercial building energy management, facility management, building engineering, operations and maintenance, or a closely related field.
- 2+ years of employment in the field or industry related to the training topic(s) for which the applicant is seeking qualification (e.g., HVAC systems, electrical systems, indoor air quality, etc.)
- Bachelor's Degree. Work experience may be substituted.

The program is publicized through trade publications, and through associations and industry groups such as ASHRAE and the State Board of Education.

1.2 Impact Evaluation Approach

The overall objective for the impact evaluation of the BOC Program was to estimate the electrical and natural gas savings that resulted from participating in the program and receiving a tuition rebate through DCEO. Additionally, the impact evaluation excludes savings achieved through projects for which the operator received an incentive through another DCEO program.

The M&V approach includes the following main features:

- Selection of representative sample of program participants;
- Telephone interviews to identify participants who implemented energy efficiency measures for which they did not receive an incentive;
- Telephone verification of claimed measures at sampled sites; and
- Site level savings extrapolation to program level savings.

1.2.1 Data Collection Procedures

A sample of participants in the BOC Program for EPY4/GPY1 was contacted by telephone to ascertain what energy efficiency measures they have implemented since attending the training program. Participants were also asked questions to determine the probability that they were free riders (i.e., that they would have attended the training without the rebate or that they would have implemented the measures without the training) and questions related to the process evaluation.

Follow-up telephone interviews were conducted for those participants who stated they implemented energy efficiency measures for which they did not receive an incentive from another DCEO program.

1.2.2 Data Collection and Estimation of Sample Site Gross Savings

During the follow-up telephone interviews, savings analysis staff accomplished three tasks:

- First, the implementation status of all measures referred to by interviewed participants was verified. Evaluation staff members verified that the energy efficiency measures were indeed installed and that they still function properly.
- Second, ADM staff members collected information regarding any details necessary for savings calculation. Data were collected based on the measure input requirements of the data sources being referenced for the particular measure.
- Third, ADM staff members interviewed the contact personnel at a facility to obtain additional information on the project, such as project timing and other background details in order to further inform the savings estimation process.

1.3 Process Evaluation Approach

This section presents the key tasks that were included in the process evaluation for the program year.

1.3.1 Review Program Documentation

At the start of the process evaluation effort, the evaluators reviewed documentation and data for the BOC Program. This involved working with DCEO and MEEA staff to identify and obtain relevant documents for review.

In addition, the evaluators reviewed participant tracking records. These data were used for several purposes.

- Preliminary analysis of the characteristics of the participant populations, to be used for planning purposes and provide an increased understanding of program participation;
- Developing sample frames for the participant population; and
- Extracting information about participant facility types and the types of businesses represented by program participants.

1.3.2 Conduct Program Staff Interviews

The evaluators conducted interviews with MEEA program management staff. The general purpose of these interviews was to understand the intent of the programs, how the programs operate, and areas of concern that staff may have about the training programs.

More specifically, topics addressed by these in-depth interviews included:

- How the program is organized;
- Type and level of marketing activities;
- How prospective trainees enroll in courses;
- Perspectives on the characteristics of the participants or potential participants;
- Strengths and weaknesses of the program;
- Areas where the program may need to be changed or strengthened;
- Anticipated changes to the program; and
- Visions for what the types of training could be sponsored through the program in the future.

Information obtained through these interviews was used to develop an understanding of program operation, identify trends in program performance, and further inform the impact evaluation of the program.

1.3.3 Conduct Participant Surveys

The evaluators collected data from BOC Program participants to support the process evaluation. The goal of these surveys was to obtain a detailed understanding of the participant perspective of the BOC Program, the process involved in participants' making the decision to attend training, participants' perceptions of the process, the effect of the training programs on participants' knowledge and behavior, and the benefits the participants perceive.

The sample design was developed using program participation data provided by DCEO. For this survey effort, the evaluators used the 90% confidence level with a ±10 percent accuracy for determining the sample size. In total, 35 BOC participants responded to the participant survey.

The content of the interview guide focused on the following issues:

- Awareness of the program;
- Motivations for participating in the program;
- Factors that influenced the participant to enroll in the program;

- Participant satisfaction with the program;
- Participant suggestions for program improvement;
- Whether the participant has engaged in energy efficient practices since participating in the program;
- Whether the participant made additional energy efficient purchases since participating in the program; and
- Firmographics and demographics.

The results from the participant survey are used to inform both the process and impact components of the evaluation. The evaluators use information provided by participants to identify potential energy saving projects and follow-up with facilities as needed in order to collect necessary project details. Additionally, the participant survey provides insight into the participant perspective, allowing the evaluators to identify trends in program performance and any issues regarding program structure, operation, and delivery that may require attention.

1.4 Organization of Report

This report on the impact and process evaluation of the Building Operator Certification® Program for the period June 2011 through May 2012 is organized as follows:

- Chapter 2 presents and discusses the methods used for estimating savings for measures installed under the program.
- Chapter 3 presents and discusses the methods used for and results obtained from estimating net savings the program.
- Chapter 4 presents and discusses the results obtained from the process evaluation of the program.
- Chapter 5 presents evaluation conclusions and recommendations for the program.
- Appendix A provides a copy of the questionnaire used for the participant survey.
- Appendix B presents tabulated results from the participant survey.

2. Savings Calculation Methodology

This chapter addresses the estimation of kWh, peak kW, and Therm reductions resulting from measures implemented in facilities of participants that obtained tuition rebates from DCEO for participating in the Building Operator Certification® Program in electric program year four and natural gas program year one (EPY4/GPY1) during the period of June 2011 through May 2012. Section 2.1 through Section 2.3 describe the steps taken to identify energy saving projects, select the appropriate data reference sources, and calculate the resulting energy savings. Chapter 3 describes the net savings estimation methodology and presents the total EPY4/GPY1 net savings for the program.

2.1 Review of Participant Survey Responses

The participant survey administered to BOC training participants served as the initial source for data regarding projects implemented during EPY4/GPY1. Participants provided information related to measures installed and equipment changes implemented after participating in the training program, along with any available inputs such as measure type, facility square footage, and other details. The evaluators reviewed these results and identified all projects that would potentially generate savings for EPY4/GPY1 of the program.

For any projects that did not have sufficient inputs or where more detail was required, the evaluation staff contacted facility operators or the appropriate equipment contractor for the facility in order to obtain the necessary information.

2.2 Selection of Data Sources for Savings Calculation

Upon completion of the data collection process, the evaluators performed a desk review of the available data and determined the optimal savings calculation methodology (such as referring to the Illinois TRM). The evaluators referred to several sources in order to estimate savings for each measure type. This process included referring to the Illinois TRM for deemed savings values and stipulated savings calculations, as well as reviewing deemed savings databases and work papers as necessary for certain measures. The data sources referenced during the EPY4/GPY1 savings estimation process are listed in Table 2-1 below.

Table 2-1 Sources Referenced for Savings Calculations

Measure Category	*Energy Savings Sources*
Lighting Controls	Illinois Statewide TRM
Lighting	Illinois Statewide TRM
VSD	Illinois Statewide TRM
Economizer	Ohio TRM

Measure Category	*Energy Savings Sources*
Cooling System Maintenance	DEER eQUEST models for baseline usage. SDG&E Work Papers by Sisson and Associates, Inc. (S&A) EM&V Study for energy savings.
Heating System Maintenance	Illinois Statewide TRM
Appliance Coil Cleaning	SDG&E Work Papers by Sisson and Associates, Inc. (S&A) EM&V Study for energy savings.

2.3 Savings Methodologies by Measure

The following section lists each measure type, along with the formula or deemed savings determination used during the impact evaluation procedure:

2.3.1 Occupancy Sensor Lighting Controls Savings

The energy savings associated with lighting occupancy sensors were quantified using the deemed calculations shown in the Illinois Statewide TRM. The calculations are as follows:

Electric Energy Savings

$$\Delta kWh = KWControlled * Hours * ESF * WHFe$$

Summer Coincident Peak Demand Savings

$$\Delta kW = KW_{controlled} * WHF_d * (CFbaseline - CFos)$$

Where,

$Kw_{Controlled}$ = Total lighting load connected to the control in kilowatts. Savings shown are savings per control. The total connected load per control should be collected from the participant or the default values presented below used;

Lighting Control Type	*Default kw controlled*
Wall mounted occupancy sensor	0.350[1]
Remote mounted occupancy sensor	0.587[2]
Fixture mounted sensor	0.073[3]

Hours = total operating hours of the controlled lighting circuit before the lighting controls are installed. This number should be collected from the participant. Average

[1] Goldberg et al, State of Wisconsin Public Service Commission of Wisconsin, Focus on Energy Evaluation, Business Programs, Incremental Cost Study, KEMA, October 28, 2009
[2] Ibid
[3] Efficiency Vermont TRM 2/19/2010

hours of use per year are provided in the TRM for each building type if participant-specific information is not collected. If unknown buidling type, the evaluators used the provided 'Miscellaneous' value.

ESF = Energy Savings factor (represents the percentage reduction to the operating Hours from the non-controlled baseline lighting system).

Lighting Control Type	*Energy Savings Factor*[4]
Wall or Ceiling-Mounted Occupancy Sensors	41% or custom
Fixture Mounted Occupancy Sensors	30% or custom

WHF_e = Waste heat factor for energy to account for cooling energy savings from efficient lighting is provided in the Reference Table in Section 4.5 of the TRM for each building type. If building is un-cooled, the value is 1.0.

WHF_d = Waste Heat Factor for Demand to account for cooling savings from efficient lighting in cooled buildings is provided in the Reference Table in Section 4.5 of the TRM. If the building is un-cooled WHFd is 1.

CFbaseline = Baseline Summer Peak Coincidence Factor for the lighting system without Occupancy Sensors installed selected from the Reference Table in Section 4.5 of the TRM for each building type. If the building type is unknown, the evaluators used the 'Miscellaneous' value of 0.66.

CFos = Retrofit Summer Peak Coincidence Factor. This factor is 0.15 for the lighting system with Occupancy Sensors installed, of building type.[5]

Natural Gas Energy Savings

$\Delta Therms = \Delta KWH^* - IFTherms$

Where,

IFTherms = Lighting-HVAC Integration Factor for gas heating impacts; this factor represents the increased gas space heating requirements due to the reduction of waste heat rejected by the efficient lighting and provided in the Reference Table in Section 4.5 of the TRM by buidling type.

2.3.2 Daylight Controls Savings

The energy savings associated with daylight controls were quantified using the deemed calculations shown in the Ohio TRM. The Illinois Statewide TRM does not have deemed calculations for daylight controls. The calculations are as follows:

[4] Kuiken, Tammy eta al, State of Wisconsin/Public Service Commission of Wisconsin, Focus on Energy Evaluation, Business Programs, Deemed Savings Manual V1.0, PA Consulting Group and KEMA, March 22, 2010 pp 4-192-194.

[5] Coincidence Factor Study Residential and Commercial Industrial Lighting Measures, RLW Analytics, Spring 2007. Note, the connected load used in the calculation of the CF for occupancy sensor lights includes the average ESF.

Energy Savings

$\Delta kWh = kWcontrolled * HOURS * (1 + IFkWh) * ESF$

Where,

kWcontrolled = total lighting load connected to the control in kilowatts

= Actual installed

HOURS = total operating hours of the controlled lighting before the lighting controls are installed.

2.3.3 High Performance T8 Lighting Savings

The energy savings associated with T8 light retrofit were quantified using the deemed calculations shown in the Illinois Statewide TRM. The calculations are as follows:

Electric Energy Savings

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

Summer Coincident Demand Savings

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

Where,

$Watts_{base}$ = Input wattage of the existing system which depends on the baseline fixture configuration (number and type of lamp) and number of fixtures.

WattsEE = New Input wattage of EE fixture which depends on new fixture configuration (number of lamps) and ballast factor and number of fixtures.

Hours = Average hours of use per year as provided by the participant or selected from the Reference Table in Section 4.5 of the TRM, Fixture annual operating hours.

WHFe = Waste heat factor for energy to account for cooling energy savings from efficient lighting is selected from the Reference Table in Section 4.5 of the TRM for each building type. If building is un-cooled, the value is 1.0.

WHFd = Waste Heat Factor for Demand to account for cooling savings from efficient lighting in cooled buildings is selected from the Reference Table in Section 4.5 of the TRM for each building type. If the building is not cooled WHFd is 1.

ISR = In Service Rate or the percentage of units rebated that get installed.

CF= Summer Peak Coincidence Factor for measure is selected from the Reference Table in Section 4.5 of the TRM for each building type.

Natural Gas Energy Savings

ΔTherms[6] = (((WattsBase-WattsEE)/1000) * ISR * Hours *- IFTherms

Where,

IFTherms = Lighting-HVAC Integration Factor for gas heating impacts; this factor represents the increased gas space heating requirements due to the reduction of waste heat rejected by the efficient lighting. The Reference Table in Section 4.5 of the TRM displays this value for each building type.

2.3.4 CFL Energy Savings

The energy savings associated with CFLs were quantified using the deemed calculations shown in the Ohio TRM. The Illinois Statewide TRM does not contain deemed calculations for CFLs. The calculations are as follows:

ΔkWH = (WATTSbase – WATTSee) * HOURS * (1 + WHFe) / 1000

Where,

WATTSbase = connected wattage of the baseline fixtures

= Actual wattage of the existing equipment for early replacement application.

WATSSee = connected wattage of the high efficiency fixtures

= Actual wattage of the efficient equipment for early replacement application.

HOURS = total operating hours of the lighting.

WHFe = lighting-HVAC Interaction Factor for energy; this factor represents the reduced electric space cooling requirements due to the reduction of waste heat rejected by the efficient lighting.

= 0.095 (interior fixtures), 0.000 (exterior fixtures)

ΔkW = (WATTSbase – WATTSee) * CF * (1 + WHFd) / 1000

Where,

WHFd = lighting-HVAC waste heat factor for demand; this factor represents the reduced electric space cooling requirements due to the reduction of waste heat rejected by the efficient lighting.

= 0.200 (interior fixtures), 0.000 (exterior fixtures)

ΔMMBtu = ΔkWh * IFMMBtu

Where,

[6]This is a negative value because this is an increase in heating consumption due to the efficient lighting.

IFMMBtu = lighting-HVAC Interaction Factor for gas heating impacts; this factor represents the increased gas space heating requirements due to the reduction of waste heat rejected by the efficient lighting.

= -0.0028 (interior fixtures), 0.0000 (exterior fixtures)

2.3.5 VSD Energy Savings

The energy savings associated with Variable Speed Drives (VSD) were quantified using the deemed calculations shown in the Illinois Statewide TRM. The calculations are as follows:

Electric Energy Savings

ΔkWh = kWconnected* Hours * ESF

Where,

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

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

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

Hours = Default hours are provided for HVAC applications which vary by HVAC application and building type.[7] When available, actual hours should be used.

Building Type	*Pumps and fans*
College/University	4216
Grocery	5840
Heavy Industry	3585
Hotel/Motel	6872
Light Industry	2465
Medical	6871
Office	1766
Restaurant	4654
Retail/Service	3438
School(K-12)	2203
Warehouse	3222
Average=Miscellaneous	4103

ESF = Energy savings factor varies by VFD application.

[7]Com Ed Trm June 1, 2010 page 139.

Application	*ESF*[8]
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.[9] 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

2.3.6 Heating Equipment Maintenance: Boiler Tune-up and Oxygen Trim Controls

The energy savings associated with boiler efficiency were quantified using the deemed calculations shown in the Illinois Statewide TRM. The calculations are as follows:

$\Delta Therms = Ngi * SF * EFLH/(Effpre * 100))$

Where,

Ngi = Boiler gas input size (kBTU/hr)

= custom

SF = Savings factor

[8]CL&P and UI Program Savings Documentation for 2008 Program Year. Average is based on an average of hours across all building types. http://www.ctsavesenergy.com/files/Final%202008%20Program%20Savings%20Document.pdf.

[9]Ibid

(Note: Savings factor is the percentage reduction in gas consumption as a result of the tune-up)

= 1.6%[10] or custom

EFLH = Equivalent Full Load Hours for heating[11]

Building Type	*EFLH*				
	Zone 1 (Rockford)	*Zone 2 (Chicago)*	*Zone 3 (Springfield)*	*Zone 4 (Belleville/*	*Zone 5 (Marion)*
Office - High Rise	2,746	2,768	2,656	2,155	2,420
Office - Mid Rise	996	879	824	519	544
Office - Low Rise	797	666	647	343	329
Convenience	696	550	585	272	297
Healthcare Clinic	1,118	1,036	1,029	694	737
Manufacturing Facility	1,116	1,123	904	771	857
Lodging Hotel/Motel	2,098	2,050	1,780	1,365	1,666
High School	969	807	999	569	674
Hospital	2,031	1,929	1,863	1,497	1,800
Elementary	970	840	927	524	637
Religious Facility	1,830	1,657	1,730	1,276	1,484
Restaurant	1,496	1,379	1,291	872	1,185
Retail - Strip Mall	1,266	1,147	1,151	732	863
Retail - Department Store	1,065	927	900	578	646
College/University	373	404	376	187	187
Warehouse	416	443	427	226	232
Unknown	1,249	1,163	1,130	786	910

Effpre = Boiler Combustion Efficiency Before Tune-Up

= 80%[12] or custom

2.3.7 Heating Equipment Maintenance: Steam Trap Service

The energy savings associated with steam trap service were quantified using the deemed calculations shown in the Illinois Statewide TRM. The calculations are as follows:

Energy Savings

$$\Delta Therms = S * (Hv/B) * Hours * A * L / 100{,}000$$

[10]Work Paper WPRRSGNGRO301 Resource Solutions Group "Boiler Tune-Up" which cites Focus on Energy Evaluation Business Programs: Deemed Savings Manual V1.0, PA Consulting, KEMA, March 22, 2010

[11]Equivalent full load hours for heating were developed using eQuest models for various building types averaged across each climate zones for Illinois for the following building types: office, healthcare/clinic, manufacturing, lodging, high school, hospital, elementary school, religious/assembly, restaurant, retail, college and warehouse. eQuest models werer those developed for IL lighting interactive effects.

[12]Work Paper WPRRSGNGRO301 Resource Solutions Group "Boiler Tune-Up" which cites Focus on Energy Evaluation Business Programs: Deemed Savings Manual V1.0, PA Consulting, KEMA, March 22, 2010

Where,

S = Maximum theoretical steam loss per trap

Steam System	*Avg Steam Loss[13] (lb/hr/trap)*
Commercial Dry Cleaners	38.1
Commercial Heating (including Multifamily)LPS	13.8
Industrial Low Pressure, <15 psig	13.8
Industrial Medium Pressure >15 psig < 30 psig	12.7
Steam Trap, Industrial Medium Pressure ≥30 <75 psig	19
Steam Trap, Industrial High Pressure ≥75 <125 psig	67.9
Steam Trap, Industrial High Pressure ≥125 <175 psig	105.8
Steam Trap, Industrial High Pressure ≥175 <250 psig	143.7
Steam Trap, Industrial High Pressure ≥250 psig	200.5

Hv = Heat of vaporization of steam

Steam System	*Heat of Vaporization[14] (Btu/lb)*
Commercial Dry Cleaners	890
Commercial Heating (including Multifamily) LPS	951
Industrial Low Pressure ≤15 psig	951
Industrial Medium Pressure >15 psig < 30 psig	945
Steam Trap, Industrial Medium Pressure ≥30 <75 psig	928
Steam Trap, Industrial High Pressure ≥75 <125 psig	894
Steam Trap, Industrial High Pressure ≥125 <175 psig	868
Steam Trap, Industrial High Pressure ≥175 <250 psig	846
Steam Trap, Industrial High Pressure ≥250 psig	820

[13]Resource Solutions Group "Steam Traps Revision #1" dated August 2011.
[14]Heat of vaporization of steam at the inlet pressure to the steam trap. Implicit assumption that the average boiler nominal pressure where the vaporization occurs, is essentially that same pressure. Reference Resource Solutions Group "Steam Traps Revision #1" dated August 2011.

B = Boiler efficiency
= custom, if unknown 0.8[15]

Hours = Annual operating hours of steam plant

Steam System	*Hours/Yr*[16]	*Zone*
Commercial Dry Cleaners	2,425	
Industrial Low Pressure ≤15 psig	7,752	
Industrial Medium Pressure >15 psig < 30 psig	7,752	
Steam Trap, Industrial Medium Pressure ≥30 <75 psig	7,752	
Steam Trap, Industrial High Pressure ≥75 <125 psig	7,752	
Steam Trap, Industrial High Pressure ≥125 <175 psig	7,752	
Steam Trap, Industrial High Pressure ≥175 <250 psig	7,752	
Steam Trap, Industrial High Pressure ≥250 psig	7,752	
Industrial Medium Pressure >15 psig < 30 psig	7,752	
Steam Trap, Industrial Medium Pressure ≥30 <75 psig	7,752	
Commercial Heating (including Multifamily)LPS[17]	4,272	1 (Rockford)
	4,029	2 (Chicago O'Hare)
	3,406	3 (Springfield)
	2,515	4 (Belleville)
	2,546	5 (Marion)

A = Adjustment factor
= 50%[18]

This factor is to account for reducing t(he maximum theortical steam flow (S) to the average steam flow (the Enbridge factor).

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

[15]California Energy Commission Efficiency Data for Steam Boilers as sited in Resource Solutions Group "Steam Traps Revision #1" dated August 2011.
[16]Resource Solutions Group "Steam Traps Revision #1" dated August 2011, which references Enbridge service territory data and kW Engineering study.
[17]Since commercial LPS reflect heating systems, Hours/yr are equivalent to HDD55 zone table
[18]Enbridge adjustment factor used as referenced in Resource Solutions Group "Steam Traps Revision #1" dated August 2011 and DOE Federal Energy Management Program Steam Trap Performance Assessment.

that were actually leadking and needed replaceing. A custom value can be utilized if a supported by an evaluation.

Steam System	*%*[19]
Commercial Dry Cleaners	27%
Industrial Low Pressure ≤15 psig	16%
Industrial Medium Pressure >15 psig	16%
Commercial Heating (including Multifamily) LPS	27%

2.3.8 Cooling System Maintenance: Condenser Coil Cleaning

The energy savings associated with condenser coil cleaning for packaged and split air conditioning units were quantified using the deemed calculations shown in the Illinois Statewide TRM. The calculations are as follows:

Electric Energy Savings

The measure has a deemed savings which applies to all building types and air conditioning unit size and equals an average value of 878 kWh a year.[20]

Summer Coincident Peak Demand Savings

The measure has a deemed savings which applies to all building types and air conditioning unit size and equals an average value 0.39 kW a year.[21]

2.3.9 Cooling System Maintenance: Cooling Tower Service

The energy savings associated with cooling tower service were calculated from DEER eQUEST models and deemed energy savings found in a S&A EM&V study. The study stated the savings as 6.5% reduction in annual energy usage and 3.25% peak load reduction. The DEER eQUEST models were used to determine the baseline cooling tower energy usage of typical buildings. The energy usage was normalized and used to determine the savings for each different location.

2.3.10 Cooling System Maintenance: Chiller Bundle Cleaning

The energy savings associated with chiller bundle cleaning were calculated from DEER eQUEST models and deemed energy savings found in a S&A EM&V study. The study stated the savings as 6.5% reduction in annual energy usage and 3.25% peak load reduction. The DEER eQUEST models were used to determine the baseline chiller energy usage of typical buildings. The energy usage was normalized and used to determine the savings for each different location.

2.3.11 Other Maintenance: Refrigerator Coil Cleaning

The energy savings associated with refrigerator coil cleaning for were calculated from deemed calculations found in a SDG&E work paper. The calculations are as follows:

[19]Dry cleaners survey data as referenced in Resource Solutions Group "Steam Traps Revision #1" dated August 2011.
[20]Ibid.
[21]Act on Energy Commercial Technical Reference Manual No. 2010-4. These deemed values should be compared to PY evaluation and revised as necessary.

Electric Energy Savings

The measure has a deemed savings which applies to all reach-in refrigerators and equals an average value of 94.25 kWh a year.

Summer Coincident Peak Demand Savings

The measure has a deemed savings which applies to all reach-in refrigerators and equals an average value 0.022 kW a year.

2.3.12 Air Conditioning System: Chilled and Condenser Water Reset

The energy savings associated with chilled and condenser water reset were quantified using the deemed calculations shown in the Ohio TRM. The Illinois Statewide TRM does not have deemed calculations for this measure. The calculations are as follows:

Energy Savings

$\Delta kWh = TONS \times \Delta kWhton$

Where,

TONS = the rated capacity of the unit controlled by the economizer.

ΔkWhton = the kWh savings per ton, this depends on whether the chiller is air-cooled or water-cooled.

Summer Coincident Peak Demand Savings

$\Delta kW = TONS \times \Delta kWton \times CF$

Where,

ΔkWton = the kW savings per ton, this depends on whether the chiller is air-cooled or water-cooled.

CF = the summer coincident peak factor, or 0.74.

Fossil Fuel Impact Descriptions and Calculation

$\Delta MMBtu = TONS \times \Delta MMBtuton$

Where,

ΔMMBtuton = the natural gas savings per ton, this depends on whether the chiller is air-cooled or water-cooled.

System Type	*City*	*ΔkWhton*	*ΔkWton*	*ΔMMBtuton*
Air-Cooled Chiller with Constant Volume Reheat	Akron	17	-0.009	0.11
	Cincinnati	13	-0.009	0.11
	Cleveland	13	-0.012	0.08
	Columbus	13	-0.011	0.1
	Dayton	14	-0.037	0.12
	Mansfield	19	-0.028	0.16
	Toledo	16	0.006	0.12
Air-Cooled Chiller with Variable Air Volume Reheat	Akron	10	-0.011	0.04
	Cincinnati	10	-0.01	0.04
	Cleveland	11	-0.012	0.03
	Columbus	11	-0.01	0.07
	Dayton	11	-0.009	0.05
	Mansfield	11	-0.012	0.04
	Toledo	11	0.011	0.07
Water-Cooled Chiller with Constant Volume Reheat	Akron	38	0.004	0.11
	Cincinnati	31	-0.012	0.11
	Cleveland	34	-0.008	0.08
	Columbus	31	0.004	0.1
	Dayton	34	-0.016	0.12
	Mansfield	41	-0.015	0.16
	Toledo	36	0.004	0.12
Water-Cooled Chiller with Variable Air Volume Reheat	Toledo	29	0.059	0.07
	Akron	27	0.004	0.04
	Cincinnati	26	-0.002	0.04
	Cleveland	28	-0.008	0.03
	Columbus	27	0.003	0.07
	Dayton	29	-0.015	0.05
	Mansfield	29	-0.004	0.04

2.3.13 Economizer on Air Handler

The energy savings associated with installing a new economizer on an air handler is deemed in DEER. The savings are deemed according to building type, climate zone, and vintage. California climate zone 16 was used for Chicago area buildings since both are in ASHRAE's climate zone 5.

2.3.14 Measures with Negligible Energy Savings

Additionally, some measures were determined to have negligible savings impacts or impacts that could not be verified or quantified. While some of these measures may have behavioral or procedural impacts for a facility, these measure types did not qualify for quantified energy

savings. The measures and maintenance that were cited by participants but did not qualify for savings impacts included:

Motors

- Motor lubrication and belt alignment: These are beneficial maintenance practices, but they do not typically generate verifiable energy savings.

Electric Panel Maintenance

- Thermal analysis and connection tightening: These are beneficial maintenance practices, but they do not typically generate verifiable energy savings.

Ventilation Maintenance

- Sensor calibration: This is a useful maintenance practice, but this does not generate savings unless continued issues are discovered or the sensor calibration was previously performed infrequently, which was not the case for the relevant participants.
- Filter replacement frequency: This would only have potential savings if the filters were previously replaced infrequently, which was not the case for the relevant participants.
- Economizer testing: This is a useful practice, but this does not generate savings unless an economizer is repaired during the process.

Water heating Maintenance

- Water treatment: This may benefit a facility in ways other than generating energy savings, but this would not typically result in quantifiable energy impacts.

3. Estimation of Net Savings

This chapter reports the results from estimating the net impacts of the Building Operator Certification (BOC) Program during EPY4/GPY1, where net savings represents the portion of gross savings achieved by program participants that can be attributed to the effects of the program.

As the savings calculation methodology was based on responses received from the participant survey and required follow-up calls with participants who reported implementing measures, the evaluators determined net savings levels prior to contacting participants for follow-up data collection. This allowed the evaluators to contact only those participants who indicated that they had implemented a project, and who were not determined to be full free riders. As the savings calculation methodology did not involve following up with participants who were identified as full free riders, the evaluation focused exclusively on net savings rather than a net vs. gross savings approach.

Additionally, evaluation of energy efficiency incentive programs typically involves a discussion or calculation of savings spillover. However, the Building Operator Certification training is structured so that any net savings associated with training participants are attributable to the program, and are not further incentivized by the BOC, MEEA, or DCEO. There is no distinction between net realized savings and spillover savings for this type of program.

3.1 Procedures Used To Estimate Net Savings

For the BOC Program, the evaluators assessed the net savings attribution of each measure by assessing whether the Building Operator Certification training influenced the implementation of the measure.

Net savings analysis for training programs would typically involve determining whether a participant had plans and intentions to attend the training independent of program support such as tuition rebates. However, for the purposes of the BOC evaluation, it was determined that the DCEO provides multiple forms of financial and non-financial support that are instrumental to the operation of the BOC program.

Thus, even if a participant states that he or she would have attended the training without receiving the DCEO tuition rebate, it is not possible to determine whether the DCEO was indirectly influential in the participants' decision making. For example, MEEA staff stated that some BOC training courses would not have taken place, or would have had to limit enrollment, if the DCEO had not provided financial and non-financial support to the program structure.

The evaluators determined that while the DCEO tuition rebate is likely an important factor in participant decision making, its importance to participants would not be considered for the purposes of the net savings analysis. Thus, savings from the action of a participant are attributable to the program as long as the participant would not have taken the same energy saving action without attending the BOC training.

In order to assess this factor, "Building Operator Certification training influence on project implementation", participant survey respondents were asked the following:

> "How likely would you have been to implement the [energy efficiency project] if you had not attended the course?"

If the respondent answered "Definitely would have implemented" for the question regarding likelihood to implement the project in the absence of the BOC Program, this indicated that the project was unrelated to participation in the BOC Program and would not be attributed to net program savings. This is represented by "N/A" in Table 3-1.

For responses other than "Definitely would have…" for the questions above, free ridership was assigned based on the values displayed in Table 3-1.

Table 3-1 Free Ridership Scores for Survey Variable Responses

Likelihood of Implementation without Program	*Free Ridership Score*
Definitely would have implemented without program	100%
Probably would have implemented without program	50%
Probably would not have implemented without program	33%
Definitely would not have implemented without program	0%

Additionally, in order to prevent double counting of savings across programs, participants were asked if they received an incentive for the energy saving project implemented. If they did, these savings are not attributed to the BOC program.

The data used to assign free ridership and net savings scores were collected through a participant survey of 35 program participants for projects completed during or after participant attendance of various BOC training courses in EPY4/GPY1.

In order to conduct an efficient and accurate savings estimation process, free ridership rates were initially calculated on the participant level based on responses to net-to-gross questions contained within the participant survey instrument. Savings were then calculated for participants who met the following criteria:

1. The participant reported implementing one or more energy efficiency measure or maintenance improvements at their facilities since attending the Building Operator Certification training;

2. The participant did not receive incentives from DCEO or any utilities for implementing the indicated measure or maintenance projects; and
3. The participant received a free ridership rating of less than 100%.

Based on these criteria, savings estimates were not calculated for any projects that represented a net-to-gross ratio of 0, or for any projects that were associated with an external incentive from DCEO or a utility energy efficiency program.

3.2 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 Building Operator Certification (BOC) Program during EPY4/GPY1.

Twenty-three out of the 35 surveyed participants indicated that they implemented a project because of their completion of the BOC training courses. Of these 23, 20 said that they did not receive separate utility incentive for at least one project. Thus, 15 of the surveyed participants reported projects whose savings are at least partially attributable to the program.[22]

Although savings were calculated only for projects whose savings are at least partially attributable to the DCEO BOC Program, the following table presents the number of reported projects by measure type and maintenance category. The first column displays project counts for those projects that were determined to have potential net savings. The second column displays the number of BOC influenced projects for which the participant said that they did not receive a separate incentive from another energy efficiency program. As determining net savings for the DCEO BOC Program involves taking into account the influence of the BOC training, savings were calculated based on the projects identified in the "Net Projects" column of the table.

Table 3-2 Reported Projects by Measure Type and Influence Level

Measure/Maintenance Type	Number of Projects	
	BOC Training Influenced	Net Projects (BOC Training Influenced + Did not receive project incentive)
Lighting Controls	16	7
Lighting	14	3
Motors	1	1
VSD	7	5
Compressed Air	1	-
EMS	2	2

[22] Several of these participants were associated with partial free ridership, meaning that while their energy savings are at least partially attributable to the DCEO BOC Program and tuition rebate, the savings are multiplied by their overall net-to-gross ratio in order to determine net savings.

Measure/Maintenance Type	Number of Projects	
	BOC Training Influenced	Net Projects (BOC Training Influenced + Did not receive project incentive)
Heating System	3	2
Air Conditioning	3	2
Economizer	4	3
Other Equipment	1	-
Cooling Maintenance	8	8
Heating Maintenance	8	8
Motor Maintenance	10	10
Compressed Air Maintenance	2	2
Electrical Panel Maintenance	5	5
Ventilation Maintenance	4	4
Other Maintenance	4	4
N	23	20

It should be noted that the above values are based solely on responses gathered through the participant survey effort, and do not necessarily reflect the number of projects that achieved savings through the verification and measurement effort. Some of the above projects, such as the EMS measures, were determined to have been installed prior to the participant enrolling in the BOC training, or had not yet been installed at the time of the follow-up verification telephone call. The evaluators conducted follow-up verification and data collection with each participant in order to ensure that the measures cited during the survey effort were accurately recorded and were associated with BOC Program influences.

Table 3-3 displays the distribution of responses to the discussed net-to-gross indicator. The table presents the percentage of total projects that were associated with each response. Participants indicated the likelihood of implementation without BOC training for each type of project, which allows for a measure-level breakdown of net-to-gross ratios for each participant. This table indicates that the majority of cited projects were associated with a level of full or partial free ridership under the net-to-gross methodology discussed above.

Table 3-3 Distribution of Net-to-Gross Respondents for Cited Projects

Associated Free Ridership Score	*Associated Free Ridership Score*	*Percentage of Claimed Projects (N = 142)*
Definitely would have implemented without program	100%	26%
Probably would have implemented without program	50%	26%
Probably would not have implemented without program	33%	35%
Definitely would not have implemented without program	0%	13%

3.2.1 Discussion of Net-to-Gross Findings

This section summarizes a few key discussion points related to the findings outlined above. These topics may be useful to consider for future years of designing and operating the DCEO component of the Building Operator Certification® Program.

- BOC Project Influence: Based on the above tables, it is apparent that the Building Operator Certification training is leading to a significant number of measure and maintenance-related energy efficiency improvements. The training itself appears to be associated with a fairly high number of total projects, which suggests that the content and structure of the BOC courses is effectively engaging and informing program participants. However, these results indicate that a substantial number of the claimed projects were associated with either an external utility or DCEO incentive.
- External Project Incentive Activity: As mentioned in the prior year's evaluation report, it may be possible for DCEO to share the savings associated with projects that receive incentives from utilities or other energy efficiency programs, although this would require an agreement between the involved parties. This arrangement may involve tracking which BOC participants proceed to participate in other incentive programs as a result of their BOC participation, and then dividing the resulting project savings between the other program(s) and the BOC Program. The feasibility of this savings attribution structure is dependent upon discussions and cooperation among DCEO and any relevant utilities or other parties, and may require program design or incentive changes in order to effectively distribute savings and costs.

3.3 Net Savings Summary

Table 3-4 presents the sampled net savings, by measure, for each measure and maintenance category that achieved net savings within the sampled participant group. Lighting controls were associated with the largest portion of savings, followed by variable speed drives (VSD) and lighting retrofits.

Table 3-4 Net Savings by Measure for Participant Sample

Measure Category	*Total Sampled Net Savings (Adjusted for Partial FR)*		
	kWh	*kW*	*Therms*
Lighting Controls	235,989.68	70.07	0.00
Lighting	36,725.50	7.09	0.00
VSD	200,658.25	65.07	0.00
Economizer	29,614.00	-5.16	69.68
Cooling System Maintenance	10,558.56	8.99	0.00
Heating System Maintenance	0.00	0.00	441.54
Appliance Coil Cleaning	471.25	0.07	0.00
Total	514,017.24	146.14	511.22

It should be noted that due to interactive effects as per the Illinois TRM calculation methodology, the lighting and lighting controls measures installed through the program resulted in increased natural gas consumption within the participant sample. Specifically, per TRM calculation methodology, these measures resulted in an overall natural gas consumption increase of 3,365.05 Therms across participant sample facilities. This increase in natural gas consumption was not included in the savings totals for the program, as the lighting controls and lighting measures were implemented for the purposes of electric savings. Further detail regarding the lighting controls calculation methodology, including the formula resulting in increased natural gas consumption, may be found in section 2.3.1.

The total savings shown above were then extrapolated to represent the population of BOC participants who received a tuition rebate from DCEO during EPY4/GPY1. Of the 20 sampled BOC participants who were associated with potential net savings through the program, the evaluators were able to contact and verify savings with 12 facilities. As the remaining eight participants could not be reached for verification, the evaluators did not assign a savings value to these facilities and instead did not count them as part of the sample size. Thus, the total sample size was reduced from 35 participants to 27 participants and then extrapolated to represent the full rebated participant population.

According to program documentation, there were 126 rebated graduates of the BOC program during this period. Savings were extrapolated based on the distribution of utility service providers among the participant population. Table 3-5and Table 3-6 present the percentage of BOC participants serviced by each electric and gas utility during EPY4/GPY1. These proportions were applied to the net savings value in order to develop savings by utility.

Table 3-5 Distribution of Natural Gas Utilities Among BOC Participants

Utility	*Percentage of Total Participants*
Ameren	42%
Nicor	7%
Peoples	20%
North Shore	2%
Other/None	29%
Total	100%

Table 3-6 Distribution of Electric Utilities Among BOC Participants

Utility	*Percentage of Total Participants*
Ameren	12%
ComEd	56%
Other	32%
Total	100%

Table 3-7 presents the net kWh savings by utility for the Building Operator Certification® Program during EPY4/GPY1. It should be noted that because some participants were serviced by non-EEPS electric utilities such as municipal utilities, electric savings generated through these participants were not attributable to the BOC Program investor utilities.

Table 3-7 Summary of Net kWh Savings for BOC Program

Utility	*Realized Net kWh Savings*
Ameren	287,849.66
ComEd	1,343,298.40
Total	1,631,148.05

Table 3-8 presents the net kW savings by utility for the Building Operator Certification® Program during EPY4/GPY1..

Table 3-8 Summary of Net kW Savings for BOC Program

Utility	*Realized Net kW Savings*
Ameren	81.84
ComEd	381.90
Total	463.74

Table 3-9 presents the net natural gas savings by utility for the Building Operator Certification® Program during GPY1. It should be noted that because some participants were serviced by non-EEPS natural gas utilities such as municipal utilities, natural gas savings generated through these participants were not attributable to the BOC Program investor utilities.

Table 3-9 Summary of Net Therms Savings for BOC Program

Utility	*Realized Net Therm Savings*
Ameren	1,001.99
Nicor	167.00
Peoples	477.14
North Shore	47.71
Total	1,693.84

As with the sampled population, the extrapolated savings from lighting and lighting controls measures also resulted in increased natural gas consumption for the participant population. This increase from interactive effects is not shown in the table above, but is estimated to be a 15,703.59 Therms increase across all utilities (including non-participating utilities such as municipalities). These interactive effects do not affect the savings totals attributed to natural gas utilities participating in the BOC Program, but should be noted. Further detail regarding the lighting controls calculation methodology, including the formula resulting in increased natural gas consumption, may be found in section 2.3.1.

The total net energy savings of the Building Operator Certification® Program during EPY4/GPY1 are summarized in Table 3-10. During this period, net energy savings totaled 1,102,376.40 kWh, 311.23 kW, and 1,693.84 Therms.

Table 3-10 Summary of Net Savings from EPY4/GPY1 Projects

Savings Level	*Total Net Savings**		
	kWh	*kW*	*Therms*
Per Participant	19,037.68	5.41	18.93
Extrapolated to EPY4/GPY1 Participants	1,631,148.06	463.74	1,693.84

*Adjusted for partial free ridership. Extrapolated savings totals do not include savings that were attributable to non-EEPS utilities such as municipalities.

3.3.1 Discussion of Net Savings Results

The net savings calculated for EPY4/GPY1 of the DCEO Building Operator Certification incentive program are lower than those estimated during prior program years. This may be due to several effects, including:

- Differences in Savings Methodology: For EPY4/GPY1, the evaluators primarily referred to the Illinois TRM for measure savings calculations rather than establishing energy usage baselines for specific facility types. This allows for precise measurements of actual energy savings within each facility rather than establishing general assumptions based on participant business sectors and other reported characteristics. TRM calculations for specific measures may result in lower average savings than the previous methods used in prior years. Additionally, the TRM incorporates energy factors such as interactive effects for lighting and lighting controls, which may increase gas usage.
- Measure Exclusion: During the savings estimation process, some measures were identified as having very low or no potential savings for participant facilities. These mainly included maintenance measures such as motor maintenance, where participant feedback suggested that the change in maintenance practices was not sufficient to justify a quantified savings amount. Additionally, some of the listed maintenance measures were determined to have very minor or no effects on overall facility energy use and did not qualify for savings. The methods used to determine savings for individual measures are described in Chapter 2.
- Net-to-Gross Methodology: Based on the net-to-gross methodology defined for EPY4/GPY1, a significant portion of the projects cited by participants were excluded from the net savings total. Some participants indicated that certain projects would have occurred even without the influence of the BOC Program. Additionally, at least one participant initially identified several projects through the participant survey, but upon receiving a follow-up call this participant reported that the project had been completed before the facility staff member(s) attended BOC training. Savings such as these cannot be attributed to DCEO or the BOC.

4. Process Evaluation

This chapter discusses results of the Building Operator Certification® Program process evaluation for electric program year four and natural gas program year one. The purpose of the process evaluation is to assess the program and tuition rebate structure offered by DCEO from a structural, operational, and managerial perspective in order to identify program strengths, weaknesses, and opportunities. This evaluation is based upon analysis of program structure and surveys with BOC participants, interviews with MEEA staff members, and an assessment of internal documents such as participant-directed internal course evaluations.

This chapter begins with a summary and discussion of the results from the EPY4/GPY1 BOC participant survey, followed by a review of internal course evaluations completed by BOC participants. The chapter concludes by highlighting and discussing the outcomes of in-depth interviews conducted with MEEA staff members who are responsible for managing the BOC Program.

4.1 Evaluation Objectives

The purpose of the process evaluation is to examine program operations and results throughout the program operating year, and to identify potential program improvements that may prospectively increase program efficiency or effectiveness in terms of participation and satisfaction levels. This process evaluation was designed to document the operations and delivery of the Building Operator Certification® Program during electric program year four and natural gas program year one (EPY4/GPY1). Figure 4-1 provides an overview of the evaluation process, including the research activities performed.

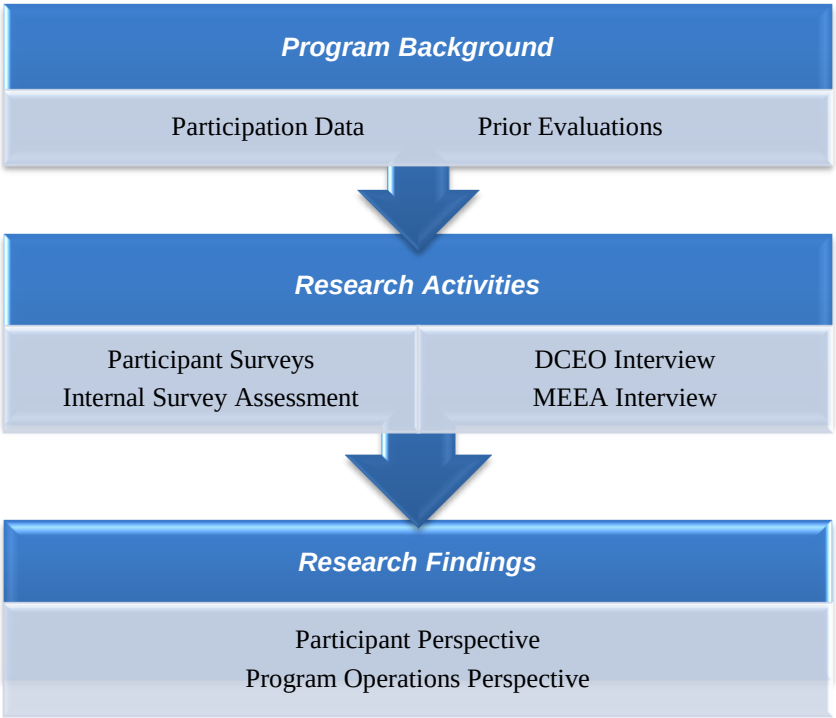


Figure 4-1 Process Evaluation Overview

Key research questions to be addressed by this evaluation of EPY4/GPY1 activity include:

> *Is the Building Operator Certification® Program using its available resources in a way that sufficiently supports program operation, growth, and performance?*
>
> *Is the Building Operator Certification® Program effectively engaging participants and meeting their energy efficiency and educational needs?*
>
> *Did the Building Operator Certification® Program respond to previous recommendations obtained through prior evaluation efforts?*
>
> *Did the Building Operator Certification® Program reduce barriers to increased energy efficiency project implementation?*

During the evaluation, data and information from several sources are analyzed to achieve the stated research objectives. Insight into the participant perspective on the program is developed from a telephone survey of BOC training participants, as well as an assessment of the internal course evaluations administered to training participants. The internal organization and operational efficiency of program delivery is examined through analysis of interviews conducted with MEEA staff, as well as a review of program documentation such as promotional literature and participant tracking data.

4.2 Summary of Primary Data Collection

- Participant surveys: Participant surveys serve as the foundation for understanding the participant perspective. The participant surveys provide participant feedback and insight regarding participant experiences with the Building Operator Certification® Program. Respondents report on their satisfaction with the program, detail their motivations and the factors affecting their decision making process, and provide recommendations related to improving the program. For EPY4/GPY1 of the Building Operator Certification® Program evaluation, 35 program participants responded to the participant telephone survey.
- Interviews with MEEA staff members: Interviews with MEEA staff members provide insight into various aspects of the program and its organization. MEEA staff members also provide information regarding recent organizational and procedural improvements that have been implemented in order to enhance program efficiency and effectiveness. For EPY4/GPY1 of the Building Operator Certification® Program evaluation, the evaluators conducted in-depth interviews with two staff members from MEEA who were directly involved with managing and operating the BOC Program.

4.3 Participant Outcomes

A telephone survey was conducted to collect data about participant decision-making, preferences, and opinions of the Building Operator Certification (BOC) Program. In electric program year four and natural gas program year one (EPY4/GPY1), 126 course participants received a DCEO rebate, successfully completed the training, and received the associated certification. In total, 35 participants responded to the telephone survey.

It is important to the note that, while the survey results discussed below are used as inputs for the calculation of estimated free ridership, participant responses to individual survey items do not, in isolation from additional factors, infer specific levels of net savings. The net savings chapter of this report details the methodology used to estimate total net savings based on survey response data, while this chapter provides a qualitative discussion of participant responses.

4.3.1 Participant Characteristics

Survey respondents represented a wide range of facility types. As shown in Table 4-1, 43% of respondents reported belonging to offices, most commonly mid-rise offices (20% of total respondents). The remaining respondents reported a range of other facility types including hospitals, apartment buildings, and mixed use facilities (such as office complexes with banquet rooms or restaurants).

Table 4-1 Respondent Facility Types

	Response	*Percentage of Respondents (N = 35)*
What is your facility type?	Office - Mid Rise	20%
	Office - Low Rise	14%
	Mixed use	11%
	Hospital	9%
	Office - High Rise	9%
	Other	9%
	Apartment/Condominium	9%
	College/University	6%
	Elementary	6%
	Heavy Industry	3%
	Retail - Department Store	3%
	School (K-12)	3%

Survey respondents were asked a series of questions related to their current employment positions such as job titles and length of employment in their current role. As shown in the figure below, 34% of respondents stated that they were facilities operations managers. Thirty-two percent of respondents reported that they were involved in an engineering role, such as engineering manager or specialist engineer.

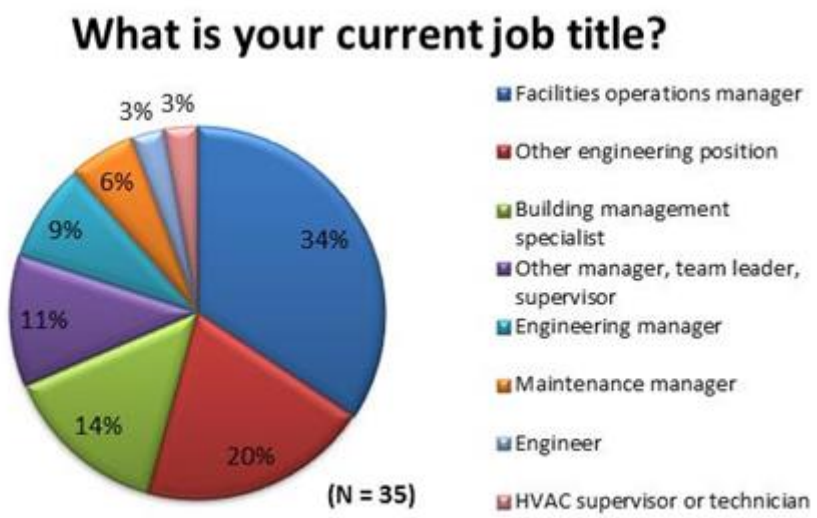


Figure 4-2 Participant Reported Current Job Titles

When asked how long they had worked in this role, respondents provided a wide range of responses, ranging from two to 36 years. The average was approximately 11 years, and some respondents explained that they had changed companies or specific positions fairly recently, but that they had worked in their specific industry for many years. This suggests that BOC

participants are fairly experienced in their roles and industries, and that they are likely very familiar with the equipment, processes, and options for their facilities.

Respondents were also asked about the number of building operator staff in their facilities. On average, respondents reported that their facilities had between five and six such staff members. When asked how many of these staff members had completed either Level 1 or both Level 1 and Level 2 of BOC training, respondents reported that an average of half of their building operator staff had done this.

Existing Energy Efficiency Policies or Procedures

In order to gauge participants' prior and current organizational structures with regard to energy efficiency, survey respondents were asked about various energy efficiency policies or procedures that may be in place at their facilities. As shown in Table 4-2, the majority of respondents reported that they have a staff member who is responsible for energy efficiency improvements, while 40% indicated that they have policies incorporating energy efficiency into operations and procurement processes. Another 40% of respondents stated that they use active training of staff that incorporates energy efficiency content.

Table 4-2 Existing Energy Efficiency Policies and Procedures

	Response	*Percent of Respondents (n=35)*
Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements?	An energy management plan	37%
	A staff member responsible for energy and energy efficiency	54%
	Policies that incorporate energy efficiency in operations and procurement	40%
	Active training of staff	40%
	Other (please specify)	14%
	Don't know	6%

More than one-third of respondents (37%) reported having an energy management plan, and these participants were asked to provide details regarding the specific goals of these plans. Ten respondents provided information about their facilities' energy management goals. These explanations were primarily qualitative in nature, with only two respondents reporting specific annual energy reduction targets (of between 3% and 5% in the next year). One respondent indicated that their facility recently joined an initiative to reduce energy consumption by 20% over the course of five years. Overall, respondents explained that their energy management goals were centered around incremental and continued energy reduction over time, either on a monthly

or annual basis. Several of the respondents stated that their goals related to specific equipment types such as reducing HVAC or fan system energy usage. Specific commentary related to energy management plans includes:

> *"Buildings identified as high consumption energy users are monitored and rated. On these "scorecard buildings" we're directed to take steps to reduce energy systems."*

> *"We want to raise our Energy Star® rating; currently it is 89."*

> *"[The plan is to] have energy cost savings and enhance the productivity and performance of the new equipment put in."*

> *"[We plan to have] about 3%-5% cuts every year of electric use and natural gas use. [Also] better preventative maintenance procedures and better tracking of the energy [use]."*

4.3.2 Program Awareness and Information Channels

BOC participants were first asked a series of questions to gain insight into general program and rebate awareness and to gauge participant interaction with various marketing and information channels.

Figure 4-3 displays participant responses regarding how they learned about the BOC incentive program. The percentages are the percentages of respondents. The most common way BOC participants learned about the available tuition incentive was through BOC Program representatives. Several of these respondents reported that they had not learned of the incentive until they had already enrolled in the class, or until their BOC instructor provided them with information about the DCEO rebate program. Twenty-six percent of respondents reported learning about the BOC incentive from friends or colleagues, and several of these respondents explained that their supervisor had informed them of the training program and rebate.

Additionally, 14% of respondents explained that they had learned about the BOC training and incentive when they inquired about the ComEd Retro-Commissioning Program. In order to remain eligible for the ComEd program, facilities must be willing to send one staff member to Building Operator Certification training. All three of these methods of learning about the BOC incentive are likely representative of indirect marketing effects rather than direct marketing efforts, as they are typically related to word-of-mouth marketing.

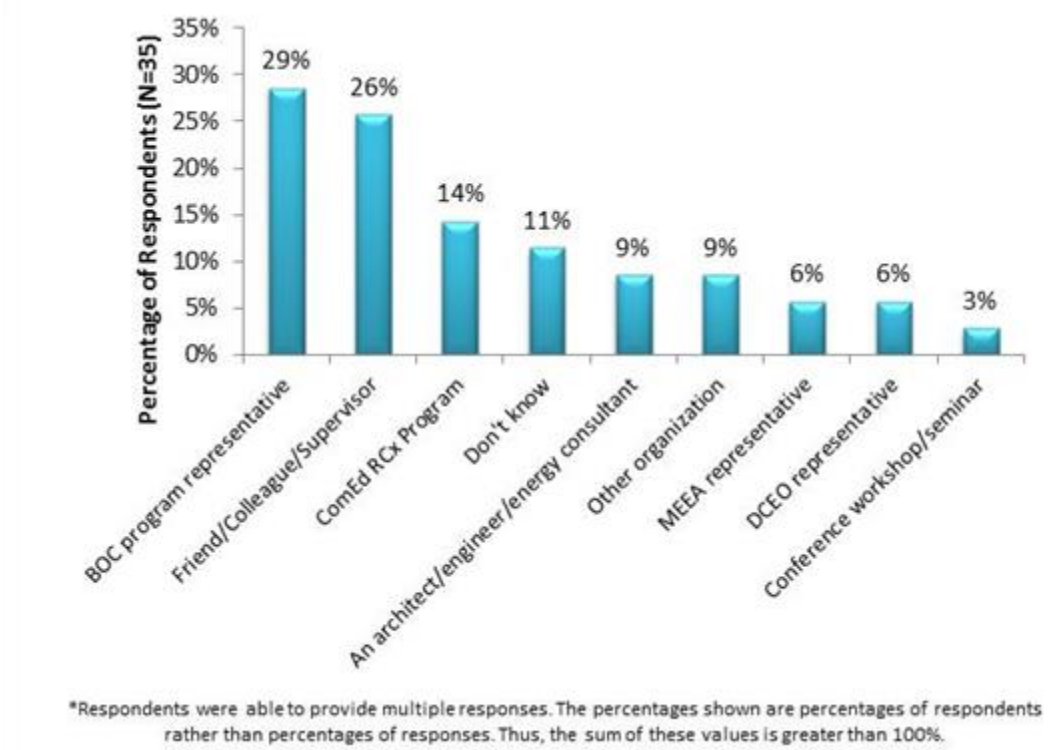


Figure 4-3 How Participants Learned about the BOC Tuition Rebate

Several additional response options were provided for this survey question, although some options were not chosen by any respondents. The methods of learning about the BOC Program that were not cited by any respondents include:

- The DCEO website;
- Brochures or advertisements;
- Trade associations or business groups;
- Trade journals or magazines;
- Smart Energy Design Assistance Center (SEDAC) representative;
- Energy Resource Center (ERC) representative; and
- Equipment vendors or building contractors.

Participants were also asked about the information sources that their organizations typically rely on for information regarding energy efficiency (including energy efficient practices, equipment, materials, and design features). The following figure displays the distribution of results, where respondents were able to provide multiple responses. The most commonly cited information source used by respondents was equipment vendors and building contractors, followed by trade journals and magazines. Relatively fewer respondents indicated that they rely on friends and colleagues, brochures or advertisements, and DCEO representatives for this type of information. When compared with the results regarding how participants learned about the BOC incentive, it

is apparent that many participants are learning about the incentive through channels that they do not typically use. For example, while 26% of respondents reported learning about the BOC incentive through friends and colleagues, only 11% indicated that they regularly rely on these individuals for energy efficiency information. Similarly, one-third of the respondents indicated that they mainly refer to vendors and contractors for this type of information, but none of the respondents reported learning about the BOC incentive through this source.

This suggests that while participants and potential participants of the BOC training likely learn about energy efficiency opportunities from multiple sources, these sources may not be fully aligned with BOC Program marketing channels. While equipment vendors and building contractors likely have existing working relationships with many participants, they may not be likely to inform building operators or potential participants of training opportunities such as the BOC Program.

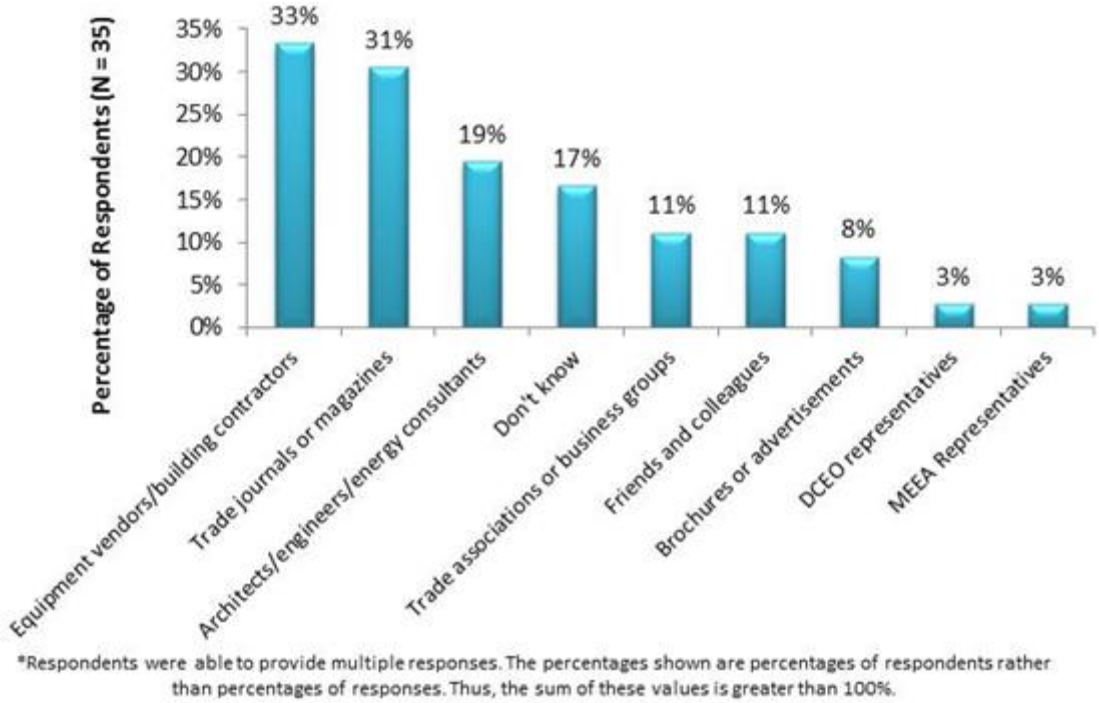
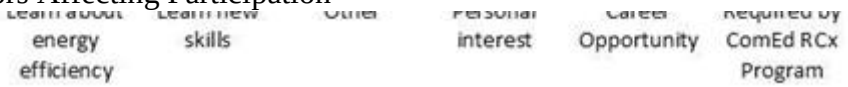


Figure 4-4 Information Sources Typically Used by Participants

Prior Awareness of BOC Training

Respondents were then asked whether they had already been aware of the BOC training course when they became aware of the BOC tuition rebate offered by DCEO. Forty percent of respondents reported that they were aware of the BOC course before learning of the tuition rebate opportunity. This includes the respondents who previously indicated that they learned about the tuition rebate during a BOC course or as a result of applying to participate. The remaining 60% of respondents indicated that they learned about the BOC course and DCEO tuition incentive at the same time. These results suggest that a substantial percentage of participants may not have become aware of the BOC course if there had not been an associated incentive, as the availability of the rebate likely increased the amount of promotion and overall awareness of the course.

4.3.3 Factors Affecting Participation



nts cited several shown in Figure *4-5*. The most common reason for participating was to learn about energy efficiency; this factor was cited by more than half of the respondents. The next most common response was that the respondent wanted to learn new skills related to energy efficiency. Nearly one-quarter of respondents stated that they had taken the course to pursue personal interests, and 20% of respondents indicated that the BOC training was associated with a career opportunity. Five respondents (14%) stated that they participated in order to satisfy a requirement of the ComEd Retro-Commissioning Program. This further supports the findings from other portions of the survey, where participants cited the ComEd Program as a primary factor in their interactions with the BOC Program. Typically, participants who enroll in training or incentive programs based on external requirements are less likely to be directly influenced by direct program marketing and incentive offerings, such as the DCEO tuition rebate. However, it is possible that these individuals have been cross-influenced by multiple factors, or that one factor (such as MEEA BOC marketing leading the participant to learn about the ComEd Program, leading the participant to enroll in the BOC Program).

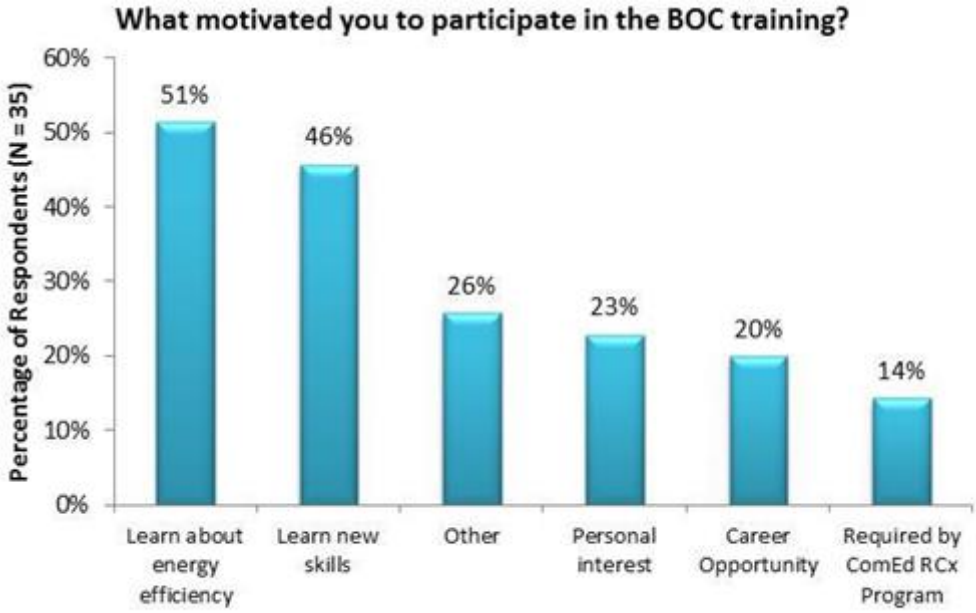


Figure 4-5 Participant Motivations to Enroll in BOC Course

Additionally, 26% of respondents stated other motivations, and provided further details. These stated motivations include:

- Encouragement from the Illinois Department of Transportation
- Wanted to provide support for the facility engineering staff
- The BOC was required by a third-party consultant to the participating organization
- The tuition rebate, because it allowed multiple staff members to attend the training

Tuition Rebate Importance

When asked about the importance of the DCEO tuition rebate in the decision to participate in the BOC training, participants mainly stated that the rebate was fairly important. As shown in Figure 4-6, nearly three-quarters (72%) of participants reported that the tuition rebate was either very important or somewhat important. These results suggest that the DCEO tuition rebate is directly influencing participant decision making, which supports overall program design and incentive structure.

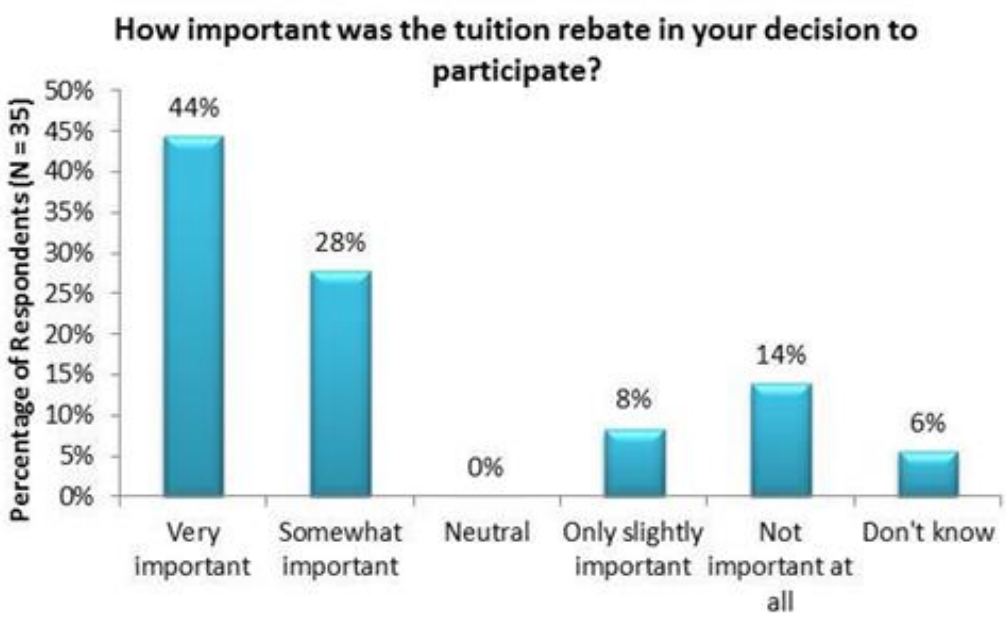


Figure 4-6 Importance of DCEO Incentive in Decision to Participate

4.3.4 Participant Actions Following BOC Training

Respondents were asked if any energy efficiency improvements had been made to their facilities since they attended the BOC course. This individual question relates only to the timing of projects, and does not yet take into account free ridership levels or whether the participant received a separate incentive for the energy efficiency improvements. Thus, respondents provided information about any energy efficiency improvement since the program, even if the BOC Program did not influence the implementation.

Respondents were asked about a wide range of measures and maintenance activities that may have generated electric or natural gas savings. The equipment and other measures addressed by this portion of the survey include:

- Lighting;
- Lighting controls;
- Air conditioning;
- Economizer;
- Heating system;
- Cooling system;
- Motors;
- Energy Management System (EMS); and
- Variable Speed Drive (VSD).

The maintenance activities addressed by this portion of the survey include:

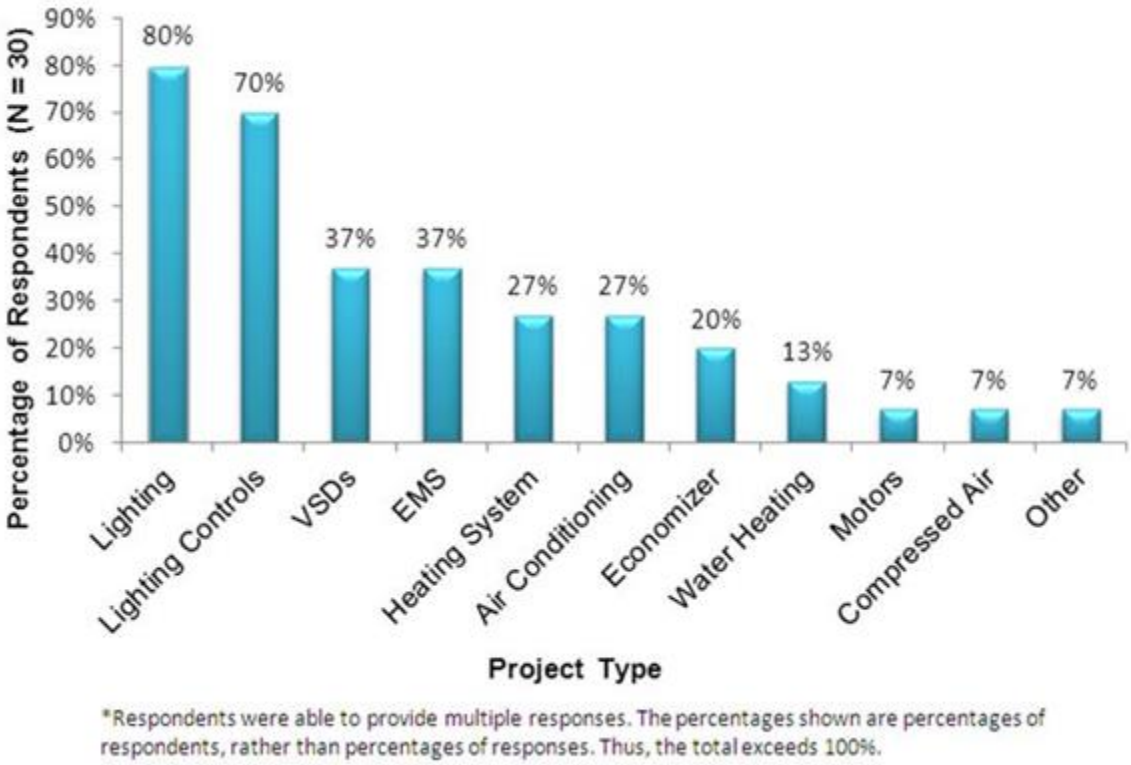
- Electric panel maintenance;
- Heating system maintenance;
- Cooling system maintenance;
- Ventilation maintenance;
- Compressed air maintenance; and
- Motor maintenance.

Additionally, respondents were given the opportunity to provide details about any equipment implementations or maintenance activities that do not fall under these listed categories.

Energy Efficient Equipment Implementation

Eighty-six percent of survey respondents (30 of 35) indicated that they had purchased and installed new equipment since participating in the BOC courses. Figure 4-7 displays the types of projects that were cited by these respondents. The most commonly reported projects involved energy efficiency lighting and lighting controls measures, which were cited by 80% and 70% of these respondents, respectively. This was followed by variable speed drives and energy management systems, which were each cited by 37% of respondents. Approximately one-quarter of respondents reported implementing an air conditioner or heating system following BOC training, and few respondents reported installing water heaters, compressed air improvements, or energy efficient motors. As lighting is a commonly implemented measure and typically involves a more straightforward implementation process than some of the other possible measure types, commercial and industrial facilities may be more likely to complete these types of projects in general.

It should be noted that the information presented below presents all measures reported by BOC participant survey respondents, regardless of whether they were influenced by the BOC training or the associated tuition rebate. The savings impact chapter of this report presents net savings for the BOC Program, taking into account BOC training influence, tuition rebate influence on attendance, and whether the participant received a separate incentive for implementing their energy efficiency project(s).



*Respondents were able to provide multiple responses. The percentages shown are percentages of respondents, rather than percentages of responses. Thus, the total exceeds 100%.

Figure 4-7 Energy Efficiency Implementations Following BOC Training

Maintenance Improvements and Changes

Forty-six percent of respondents (16 of 35) indicated that they had implemented one or more maintenance improvement at their facility since participating in the BOC training. For each listed maintenance category, respondents were asked to indicate whether they perform this activity differently (such as adding a new step to the equipment cleaning process), more frequently (such as maintaining equipment every six months rather than every year), or both since participating in the BOC training program. Figure 4-8 displays the distribution of maintenance activities cited by this subset of 16 respondents, showing whether they reported a frequency change or a methodology change in their maintenance. The most commonly reported maintenance activity was an increase in motor maintenance frequency, which was cited by 63% of these respondents. This was followed by increased cooling and heating system maintenance, cited by 50% and 44% of this respondent subset, respectively. Overall, the maintenance activities cited by respondents were mainly related to increased maintenance frequency rather than methodological changes.

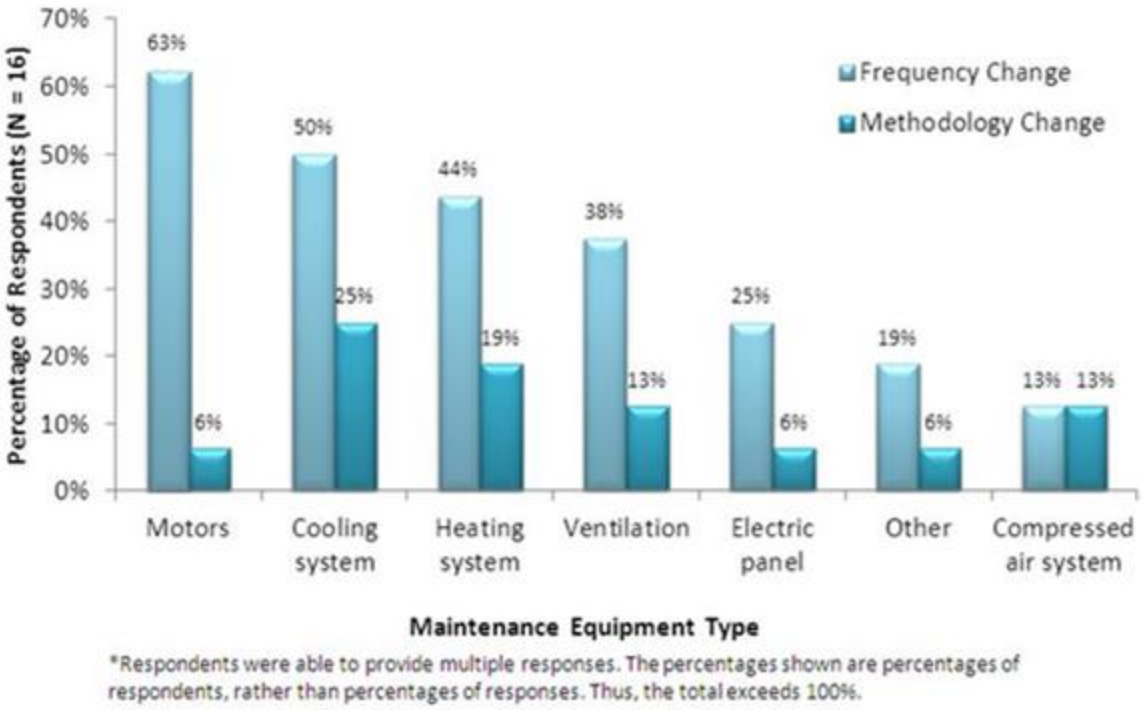


Figure 4-8 Maintenance Changes Following BOC Training

Respondents who indicated implementing either a new maintenance activity or energy efficiency equipment project were asked to provide further details about these actions in order to inform the impact evaluation process. These details included specific equipment types, square footage of relevant facility space, and in-depth descriptions of maintenance behaviors. Additionally, the survey included several subcategories for each maintenance type. For example if a respondent reported a change in cooling system maintenance, he or she was asked whether this maintenance related to water treatment, cooling towers, condensers, sensor calibration, or other aspects of the cooling system. The information provided by respondents was incorporated into the savings estimation process, which is further detailed in the impact evaluation chapter of this report.

Other Energy Efficiency Activities

Respondents were also asked about other activities related to energy efficiency that may have occurred at their facilities. These activities included implementing an energy budget, recording energy use, and setting and achieving energy savings goals. Participants provided information about which of these had occurred prior to participating in the BOC course, and which had occurred only after participating in the BOC course. Figure 4-9 displays the results. Forty percent of respondents reported that they had set energy savings goals prior to participating in the BOC training, and 31% of respondents indicated that they had achieved these goals before participating in the program. Twenty percent of respondents stated that they had only started recording their facilities' energy use after attending BOC training, while more than one-third of respondents reported that they had done this prior to the training. Overall, the results suggest that a significant portion of BOC participants had already implemented one or more energy saving

behaviors before participating in the BOC Program. However, the presence of these behaviors among respondents increased by an average of 50% after attending the BOC courses, suggesting that the program may have successfully motivated participants to implement specific energy saving or energy monitoring initiatives.

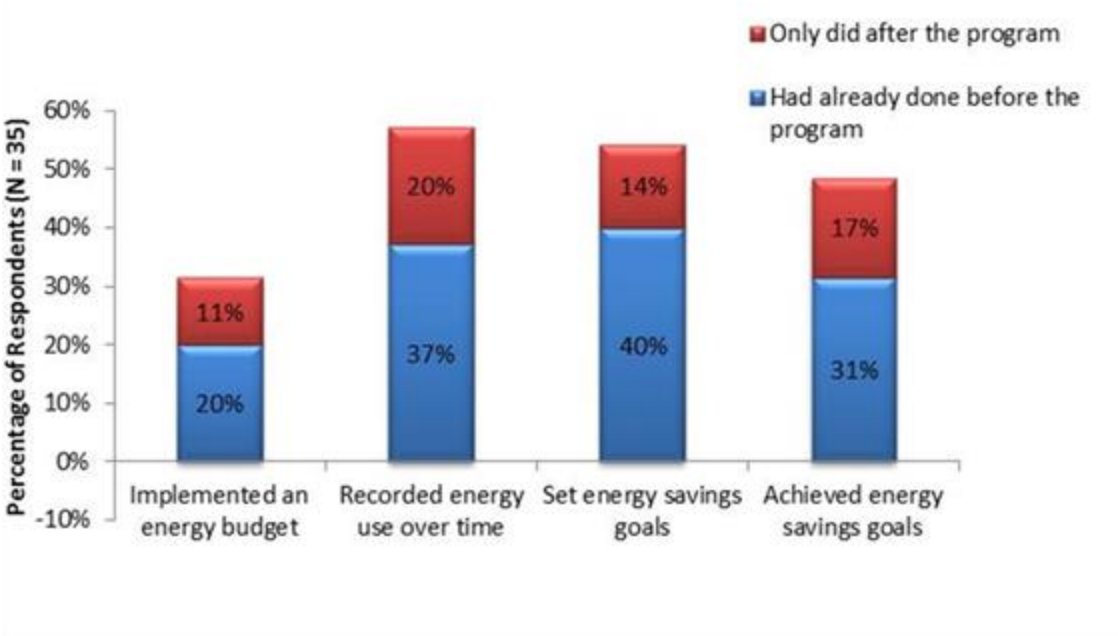


Figure 4-9 Procedural Energy Efficiency Activities Completed by Participants

Participation in Other DCEO Programs

When asked if they had participated in any other DCEO energy efficiency programs, only one of the 35 survey respondents stated that they had done this. This respondent reported that the BOC training was very important in their decision to participate in the additional DCEO program(s). These results suggest that while a small percentage of participants proceed to participate in DCEO programs following their BOC courses, the information provided by the BOC Program may lead to increased participant interest in other energy efficiency programs.

4.3.5 Participant Satisfaction with the Program

Respondents were asked about their levels of satisfaction with selected aspects of the course, aspects of the financial incentive, and their overall program experience. Responses were provided on a scale of 1 to 5 where 1 was very dissatisfied and 5 was very satisfied. Table 4-3 shows participant satisfaction by each selected program element. Overall, participants reported high satisfaction levels for all program elements, most notably with the course instructors and course schedule. Respondents provided fewer instances of "very satisfied" responses for program elements involving the tuition rebate, although this is likely due to some participants indicating that they were not involved with the rebate process. As some BOC participants were sent to the training courses by their organizations, they may not have been involved in the tuition payment process. All of the survey respondents were either satisfied or very satisfied with their overall

BOC Program experience, and none of the respondents indicated dissatisfaction with any of the program elements.

Table 4-3 Participant Satisfaction Ratings by Program Element

Element of Program Experience	*Satisfaction Rating (N = 35)*					
	Very Satisfied (5)	*Satisfied (4)*	*Neither Satisfied nor Dissatisfied (3)*	*Dissatisfied (2)*	*Very Dissatisfied (1)*	*Don't know*
Course instructors	69%	29%	3%	-	-	-
Course schedule	63%	34%	3%	-	-	-
Overall BOC Program experience	63%	37%	-	-	-	-
Tuition rebate application process	57%	31%	3%	-	-	9%
Tuition rebate amount	57%	31%	3%	-	-	9%
Time elapsed to receive tuition rebate	40%	29%	3%	-	-	29%

These results are fairly consistent with prior surveys conducted for BOC participants from EPY3 of the program. Participants have consistently reported high satisfaction levels with their overall experience in the BOC Program, as well as with specific program elements. These results across program years suggest that the BOC Program is sufficiently addressing participant needs and interests, and is operated effectively overall from the participant perspective.

As there were no reported instances of dissatisfaction with the program experience, respondents did not provide recommendations for improving the program or suggest any changes for future BOC Program years. Participants who were surveyed during EPY3 reported that they would like program changes such as shorter intervals between courses, additional course location options, and more hands-on activities during training sessions. Although not all of these suggested changes were implemented for EPY4/GPY1, these prior issues were not mentioned by EPY4/GPY1 program participants.

Usefulness of Particular BOC Courses

Participants were then asked whether they found any of the courses they attended through the BOC to be particularly useful. Nearly all of the respondents (92%) reported that they had found at least one of the courses very useful and provided further details regarding their opinions of these courses. Eight of the 35 respondents explained that all of the BOC courses had been very useful and informative, or that they had learned at least one actionable recommendation from each course they attended. Specific courses or subject matter cited as particularly useful by survey respondents include:

- Lighting (cited by nine respondents)
- HVAC (cited by eight participants)
- Electrical systems (cited by five respondents)
- Energy management (cited by four respondents)

Several participating survey respondents provided further details regarding why they benefited or learned from particular BOC courses. Some of these respondents stated that specific courses have allowed them to implement energy saving projects in their facilities, while others explained that a specific course subject had refreshed their knowledge about a specific area of facility management. Specific commentary regarding course usefulness includes:

> *"I was in general maintenance and the [electricity and plumbing courses] enhanced my job knowledge and made me more aware of functions of the building."*

> *"The HVAC course [was useful], because that's something I don't have in my background or expertise. It definitely helped increase my knowledge of air quality and air control."*

> *"After going through the course we decided to switch the metal halides in the gyms for T-5's."*

> *"The boiler operations and electric energy portions [were useful], because of the facts about newer technology that we can utilize now and in the future to drastically cut bills."*

> *"We have applied every course in every way that we could in our building."*

The responses and open-ended commentary received from respondents indicates that participants have gained valuable information and insight into the operations and management of their facilities; respondents reported that they were able to focus on the BOC content that was most relevant or useful to their particular facilities and employment roles. Additionally, as the survey was administered several months after the courses were completed and the majority of respondents were able to recall the specific course content that had been useful to them, it is likely that the BOC courses are successfully providing participants with lasting knowledge and skills.

Respondents were then asked whether they thought that any particular BOC course was not useful. Ten of the respondents (29%) reported that they had found at least one course to not be very useful, and provided details regarding these opinions. Five of these participants explained that some of the content in several of the courses was not relevant to their particular employment role, or that their facility could not benefit from some of the subject matter discussed in a particular course. Additionally, three of these participants reported that one of the courses had involved information that was too difficult to understand, or that they did not have enough basic knowledge about some subjects in order to benefit from some topics.

These results do not suggest any specific problems or a need for course restructuring, as it would not be feasible to tailor each course to each participant's needs. It is likely that participants will continue to focus on the courses and content that is most relevant to their facilities and roles, and while some topics may not benefit a small number of individuals, the course format and structure are likely generally effective for the majority of participants.

4.3.6 Participant Recommendations and Overall Impressions

Overall, the participant surveys showed that participants were generally pleased with their program experiences. The majority of course feedback was positive, and many of the respondents provided commentary that praised the BOC classes for their relevance, effectiveness, and structure. Most of the respondents who provided feedback for program incentives indicated that the financial support was valuable and influential in their decision to participate. Additionally, the majority of respondents cited specific courses or topics that had been particularly useful to them in their current employment roles, or explained that they had been able to implement specific energy saving initiatives as a result of new information learned through BOC training.

Respondents provided few instances of dissatisfaction with the BOC training program and for the most part did not indicate any systematic or major issues with program structure, management, or operation. These results suggest that the BOC Program has been very well-received by participants, and that participant satisfaction has either been maintained or improved since prior program years.

4.4 Review of Internal Course Evaluations

The evaluators conducted a review of the internal course evaluation documentation completed by participants in BOC training classrooms. This review is designed to identify any trends and issues mentioned by BOC participants, and to evaluate the overall structure and design of the course evaluations. Overall, the evaluators reviewed all available course evaluation forms; these covered a range of BOC courses that were administered in several locations. The following section presents key findings from this review and discusses the overall characteristics of the evaluation documents.

4.4.1 Overall Course Evaluation Structure

Participants were asked to complete evaluation forms for each of the BOC courses they attended. Additionally, participants were asked to complete a final evaluation form regarding the training program as a whole. The individual course evaluation forms provide course information including course title, instructor, location, and course date. The evaluation portion of these forms includes sections for an overall class evaluation and an evaluation of the course instructor. Finally, the evaluation form includes a section for open-ended comments from course participants regarding additional suggested improvements to the course overall. Many participants used this section to provide praise for the courses and instructors, with specific commentary including:

"[The course provided] great information about how to calculate and price energy use."

"[The] KEMA/ComEd incentive discussion was very informative."

"[The course] covered a lot of material not covered in other HVAC classes."

"[It was a] great program, very informative, excellent speaker, no change necessary."

"Good useful information and tools to help energy conservation."

The final course evaluation form provides participants with an opportunity to rate the training program as a whole. This form seeks to gain participants' perspectives on the benefits and overall effectiveness of BOC training. Additionally, the final evaluation form allows participants to identify any energy efficiency projects they have implemented since beginning BOC training, and asks participants whether they perceive any barriers to participating in the training program. Finally, this form includes a section for participants to provide their general thoughts and any suggested improvements to the program and its courses.

4.4.2 Evaluation Document Comparison

One of the internal survey forms requested course evaluations for two BOC classes. As this survey was limited to one page, it did not include an open-ended section for participants to provide feedback regarding their class experiences. It may be useful to include open-ended questions on each internal survey, as participants may have useful or interesting comments or recommendations regarding their experiences.

Some internal BOC survey documents were structured differently than others. For example, the End of Training evaluation form asked participants to rate their course experiences on a scale from "Excellent" to "Poor", while overall course evaluations provided statements and asked participants to rate their level of agreement with the statement (from "Strongly agree" to "Strongly disagree". Participants appeared to respond actively to each type of evaluation format, although it may be easier to compare results among courses if the evaluation forms are standardized in their content and use identical response scales.

4.4.3 Findings Related to Course Attendance

When asked what they thought would be the best ways to recruit new participants to the program, participants most commonly indicated that educating management about the program would be an effective recruitment method. Relatively few respondents recommended instituting BOC training as a requirement for building operators and other staff.

During the course evaluations, participants were asked whether they perceive any barriers to participating in the BOC training. Participants most commonly stated that cost and time were the primary participation barriers. Additionally, many participants indicated that a lack of program awareness is likely a major participation barrier. This is consistent with participants' recommendations to educate facility management about the BOC, as they may currently be unaware of the training or the associated tuition incentive.

Participants were also asked whether they perceived any barriers to operational and maintenance energy efficiency improvements in facilities. Participants most commonly cited financial considerations as the source of implementation barriers, followed by the time required to implement such projects. Several participants also noted that a lack of support from management staff is likely a barrier to implementation.

4.4.1 BOC Suggestions and Recommendations

Participants were given the opportunity to provide suggestions and recommended changes for future BOC training courses. Many participants indicated that the program was effective and that they did not have any relevant recommendations. However, some participants provided comments related to course content additions or structural modifications that may benefit participants in future BOC training programs.

Some of these recommendations were related to the content and level of information provided throughout BOC training. Several participants provided commentary indicating that they would like the courses to include more information about specific measures, or that they are interested in a particular measure that was not covered during the classes. Examples of these comments include:

"[The] HVAC course had too much basic information"

"[I would prefer] more info on VFDs."

"[I] Could use more guidance on highlighting."

Several participants also provided recommendations related to program operation and structure, such as class length, materials distribution, and specific aspects of the course materials such as handouts. One participant stated that the courses could be shortened to half-day trainings rather than full-day sessions. Specific commentary regarding program structural recommendations includes:

"[The courses] could be shortened to 1/2 day classes."

"Hand out next class material at preceding class."

"Could you make the graphs and charts in [the] book larger? The print in the graphs and charts is too small."

Finally, a small percentage of participants reflected upon their experiences with the BOC training by stating recommendations that may apply to participant organizations and participant facilities. Several of these comments expressed a desire for more widespread BOC training in general, with some participants indicating that they would like BOC training to be administered to managerial staff and other members of their organization. Examples of these types of comments include:

"Make BOC mandatory for commercial buildings."

"Management should also attend [BOC training] to be a complete team."

Overall, the course evaluations appear to be gathering useful and candid information from participants regarding their experiences with the BOC training and any projects that they may have implemented as a result of the training. Maintaining the use of course evaluation materials will allow program staff and program evaluators to continue gauging overall program satisfaction and compare results with those obtained through the independent participant survey. Additionally, administering the course evaluation forms shortly after the course is completed increases the likelihood that participants will be able to recall their experiences and accurately reflect upon their perspectives of the program. It may be useful to provide similar course evaluations at a midpoint during the BOC training program in order to compare participant activity and perspectives over time, although a year-to-year comparison is likely sufficient.

As the course evaluations are administered anonymously, it is not possible to gather information regarding participant project activity and then use this in the savings calculation stage of the program evaluation. It may be useful to administer a separate project tracking form that requests participant names and addresses so that evaluators and program staff can follow up with participants regarding their project activity. This may be helpful in informing the savings assessment procedure and would be separate from the evaluation documentation in order to preserve participant privacy and reduce response biases.

4.5 Program Operations Perspective

This section summarizes the core findings of in-person interviews that were conducted with Midwest Energy Efficiency Alliance (MEEA) staff members involved with the BOC Program for the purposes of developing structural, operational, and internal program management perspectives. MEEA administers the Building Operator Certification (BOC) program, through a license from the program's developer and copyright holder, the Northwest Energy Efficiency Council (NEEC). Therefore, MEEA is responsible for managing the grant from DCEO, marketing the program, and facilitating course operations.

In order to gather information regarding the operational efficiency and program delivery process for the Building Operator Certification® Program, in-depth telephone interviews were conducted with two key MEEA staff members. Interview questions were designed to provide insight into MEEA's role, course content and structure, participation requirements and barriers, as well as quality assurance mechanisms. Additionally, MEEA provided written responses to follow up questions regarding the organization's response to previous evaluation recommendations.

4.5.1 Summary of Interview Findings

Key trends and issues addressed by in-depth interview respondents include:

- Program Awareness: Greater awareness of the BOC program exists in the Northern Illinois, ComEd service territory. MEEA staff indicated that in the downstate region, which is predominately Ameren Service territory, there appears to be less program interest and awareness. In central and southern Illinois, BOC training courses take longer to fill and often operate with fewer students than courses in the Chicago metro area. When the course runs at less than full capacity, the program as a whole becomes less cost effective. Program staff indicated that they are grateful for DCEO financial support and that it helps to support program awareness and delivery in central and southern Illinois.
- Strong utility partnerships continue to drive participation: The ComEd Retro Commissioning Program requires at least one Operations and Maintenance staff member from the participating building to attend the BOC course. While Ameren does not require the BOC course for participation, it has become more involved with the program during the recent year. Ameren Illinois sponsored an "Employer Appreciation Breakfast" for employers that have sent staff to BOC. MEEA hosted the event, which highlighted employers' dedication to EE and to promote the veterans pilot. Ameren also hosted the BOC Renewal Fair, where it presented an overview of its incentive and rebate programs. The Illinois natural gas utilities promote the BOC in the e-newsletter when courses are approaching. Additionally, all utilities, DCEO, and SEDAC are invited to present during one of the BOC in-class sessions when scheduling allows.
- Introduction of Military Veteran Component: MEEA staff explained that over the past year, the BOC has introduced an initiative to provide opportunities for military veterans to participate in the training courses and seek employment or internships through networking with facility managers and program staff. In this initiative, the BOC is used as a tool to help veterans earn the credential and transfer to a career in facility operations. The BOC was able to leverage some workforce funding by partnering with the DCEO Office of Employment and Training, which assisted in paying for the veteran tuitions. This pilot program was designed to expand the scope of the BOC program and serve as a benefit to the veteran community while preserving the general BOC training program structure. Additionally, the program involves a mentoring component where veterans are paired with facility managers who have previously sent their staff members for BOC training. This assists the veteran participants in completing the training-related coursework.
- Quality Assurance and Participant Satisfaction: Quality assurance processes are integrated into the program to ensure program standards are met and feedback is both elicited and managed. A MEEA staff member attends at least one class session to observe both the students and the instructor. Students also complete post course and final overall evaluations. In the post course surveys participants are asked about their overall satisfaction with the course and value added. This assists in ensuring participant satisfaction and identifying any continued trends in the participant perspective that may require attention in future program years.
- Barriers to Program Participation: The primary barrier to participation, as identified by MEEA program staff, is the time required to attend and participate in the course. When an

employer or interested party inquires about the program and ultimately decides not to participate, MEEA will ask why the interested party ultimately decided not to participate and send their facility staff. Employers typically understand the value in the certification and most often want their staff to participate, but feedback suggests that it is difficult for interested parties to take the necessary time off, paid or unpaid. The BOC course requires participants to dedicate 74 hours, 64 of which are in-class while the other 10 are on-site at their facility.

- Potential for Online Component: MEEA staff stated that they have considered integrating online course delivery in the past. Both NEEC and MEEA administered surveys to BOC participants and stakeholders nationwide to better understand the interest in online participation. The results indicated that participants generally preferred classroom-based learning. While interest exists in blending the two course delivery methodologies, online and in-class, very few think that the course would be as effective if there were no in-class requirements. MEEA staff expects the NEEC will integrate more blended learning in future BOC courses.

Interviewed program staff members were also asked to provide information related to the recommendations received for the program during the prior evaluation year. This was designed to gauge whether any program changes had occurred as a result of the past recommendations. These past recommendations, along with relevant MEEA staff commentary, are summarized below:

- Addition of more "hands-on" activities to the BOC training: MEEA encourages course instructors to regularly conduct and emphasize the group discussions and activities that are outlined in the course work books. Additionally, the BOC instructors were given an opportunity to attend a training course for the 2013 curriculum that focused on these group activities and emphasized participant engagement. This session was attended by approximately 30 of the BOC instructors.
- Addition of a new facility for BOC training so that participants can choose a convenient location: MEEA staff explained that the prior Chicago training site was located at the Chicago Center for Green Technology. This required participants to drive to the classes, which may have been a source for some participant commentary regarding the inconvenience of the classroom location. The new location for training is a conference room that is accessible by public transit. This should be more convenient for a large portion of the participant population. Another benefit of the new MEEA training location is that it allows for relationship building among instructors, coordinators, and participants. In addition to the new Chicago location, one series of courses was held in the western suburbs in PY5, and a northern suburbs location is planned for PY6.
- Real-time tracking of participants' current and planned energy efficiency projects: It was previously suggested that MEEA record participant project data and implementation progress so that the evaluators and DCEO staff would have a starting point when conducting the savings evaluation phase. Although MEEA conducts a preliminary survey and final

evaluation, these are currently administered anonymously and cannot be linked to specific participants. However, MEEA staff explained that future changes are being considered for the 2013-2014 years. These changes include an online preliminary survey and final evaluation that allows students to optionally provide their name and other information. MEEA staff reported that it may be possible to invest in scanning software in order to upload the hardcopy surveys and more efficiently assess the evaluation results.

5. Conclusions and Recommendations

The following section presents a summary of key findings from the process and impact evaluations of the Building Operator Certification® Program during electric program year four and natural gas program year one (EPY4/GPY1). These conclusions and recommendations are based on a combination of research activities including participant surveys, interviews with program staff, and reviews of program tracking data, documentation, and prior evaluation reports.

5.1 Impact Conclusions

- Limited Program Savings Impacts: The savings estimation procedure determined that although participants reported implementing a wide range of projects after their participation in the BOC training, the total net savings impacts resulting from these projects were lower than program expectations. Chapter 2 and Chapter 3 provide further discussion of the savings impacts for EPY4/GPY1 and summarize the potential obstacles to increased program savings levels.
- BOC Influence: Based on the savings impact analysis, it is apparent that the Building Operator Certification training led to the implementation of a significant number of energy efficiency measures and maintenance-related energy efficiency improvements. However, a substantial number of these measures were incentivized by a utility-implemented energy efficiency program, and therefore are not claimable by the BOC Program. Therefore, the net savings attributable to the program do not account for the value of the program as a "gateway" to participation in utility-implemented programs.
- Measure Exclusion: During the savings estimation process, some measures were identified as having very low or no potential savings for participant facilities. These mainly included maintenance measures such as motor maintenance, where participant feedback suggested that the change in maintenance practices was not sufficient to warrant quantification and attribution of savings. While it is likely beneficial to educate program participants about facility improvements even when they may not result in energy savings, these measures and practices will not generally result in measurable program savings impacts.
- Net-to-Gross Methodology: Based on the net-to-gross methodology defined for EPY4/GPY1, a significant portion of the projects cited by participants were excluded from program net savings. Many participants indicated that certain projects would have occurred even without the influence of the BOC Program, or that they would have attended the BOC training even if there had been no tuition rebate from DCEO. While the BOC training appears to be motivating participants to implement a variety of projects in their facilities, the actual level of influence attributable to DCEO and the tuition rebate appears to be low for many of the cited projects.

5.2 Process Conclusions

- Program Satisfaction: Overall, the participant surveys showed that participants were generally pleased with their program experiences. The majority of course feedback was positive, and many of the respondents provided commentary that praised the BOC classes for their relevance, effectiveness, and structure. Most of the respondents who provided feedback for program incentives indicated that the financial support was valuable and influential in their decision to participate. The results suggest that the BOC Program has been very well-received by participants, and that participant satisfaction has either been maintained or improved since prior program years.
- Participant Perspectives on Course Structure: Participants provided several suggestions regarding the overall operation, structure, and delivery of the BOC training courses. For example, several participants indicated that it would be useful to receive training workbooks and other course materials in advance of the class in which they will be used. Additionally, program participants have continued to report that they would prefer to learn about more topics through hands-on methods such as working with relevant measures or generally applying their course knowledge to a relevant facility. MEEA feedback suggests that these and other participant recommendations are being continually considered, and that changes to program structure may be implemented in the upcoming program years in order to address these areas.
- Quality Assurance and Participant Satisfaction: Quality assurance processes are integrated into the program to ensure program standards are met and feedback is both elicited and managed. A MEEA staff member attends at least one class session to observe both the students and the instructor. Students also complete post course and final overall evaluations. This assists in ensuring participant satisfaction and identifying any continued trends in the participant perspective that may require attention in future program years.
- Barriers to Program Participation: The primary barrier to participation, as identified by MEEA program staff, is the time required to attend and participate in the course. When an employer or interested party inquires about the program and ultimately decides not to participate, MEEA will ask why the interested party ultimately decided not to participate and send their facility staff. Employers typically understand the value in the certification and most often want their staff to participate, but feedback suggests that it is difficult for interested parties to take the necessary time off, paid or unpaid. The BOC course requires participants to dedicate 74 hours, 64 of which are in-class while the other 10 are on-site at their facility.

5.3 Impact Recommendations

- Consider and Plan for External Project Incentive Activity: As mentioned in the prior year's evaluation report, it may be possible for DCEO to share the savings associated with projects that receive incentives from utilities or other energy efficiency programs, although this would require an agreement between the involved parties. This arrangement may involve tracking which BOC participants proceed to participate in other incentive programs as a result of their

BOC participation, and then dividing the resulting project savings between the other program(s) and the BOC Program. The feasibility of this savings attribution structure is dependent upon discussions and cooperation among DCEO and any relevant utilities or other parties, and may require program design or incentive changes in order to effectively distribute savings and costs.

- Continue to Monitor Tuition Rebate Effectiveness: Participants who enroll themselves or their staff members in the Building Operator Certification® Program without taking the DCEO tuition rebate into account are likely to be counted as free riders in the net savings estimation process. While these participants may proceed to implement projects that are a result of information gained through the BOC Program, they likely would have implemented the same projects if DCEO had not provided a tuition rebate. Thus, it is important to continually monitor the participant decision making process in order to gauge the level of interest in the DCEO rebate and ensure that this rebate is an effective allocation of DCEO resources.
- Consider Implementing Real-time Project Tracking: The prior year evaluation suggested gathering continuous updates from participants regarding their current plans for energy efficiency projects as the course progresses. Although project tracking is performed to some degree under the current program, it is for the most part conducted anonymously which does not allow the data to be linked with specific participants. Additionally, the evaluation recommended tracking any changes that participants make to their facilities during the training, as this may assist in informing the savings impact evaluation. This would provide evaluators and DCEO staff with records of potential savings projects rather than fully relying on a retrospective survey approach to identify program savings.

5.4 Process Recommendations

- Continue or Increase Course Evaluation Procedure: This will allow program staff and program evaluators to continue gauging overall program satisfaction and compare results with those obtained through the independent participant survey. Additionally, administering the course evaluation forms shortly after the course is completed increases the likelihood that participants will be able to recall their experiences and accurately reflect upon their perspectives of the program. It may be useful to provide similar course evaluations at a midpoint during the BOC training program in order to compare participant activity and perspectives over time, although a year-to-year comparison is likely sufficient.
- Separate Course Evaluation into Implementation and Assessment Components: As the course evaluations are administered anonymously, it is not possible to gather information regarding participant project activity or other facility characteristics and then use this in the savings calculation stage of the program evaluation. It may be useful to administer a separate project tracking form during the in-class assessments so that evaluators and program staff can follow up with participants regarding their project activity. This may be helpful in informing the savings assessment procedure and would be separate from the evaluation documentation in order to preserve participant privacy and reduce response biases.

- Consider Implementation of Electronic Components: MEEA staff stated that they have considered integrating online course delivery in the past. Although both NEEC and MEEA surveys suggested that participants generally preferred classroom-based learning, it may be useful to at least provide an online option for some participants for any portion of the course that could feasibly be taught outside of the classroom. If this option is not favorable, it may be beneficial to allow participants to record their class-related work and project progress through an electronic-based system. This would allow for easier record-keeping and may benefit staff members and evaluators in reviewing the evaluation and project data that may be provided by participants.

Appendix A: Questionnaire for Participant Survey

1. What are the sources your organization relies on for information about energy efficient practices, equipment, materials and design features? *(Do not read list. Select all that apply.)*
   ( ) DCEO representatives
   ( ) The DCEO website
   ( ) Utility representatives
   ( ) The Midwestern Energy Efficiency Alliance (MEEA)
   ( ) Brochures or advertisements
   ( ) Trade associations or business groups you belong to
   ( ) Trade journals or magazines
   ( ) Friends and colleagues
   ( ) The Smart Energy Design Assistance Center (SEDAC)
   ( ) The Energy Resource Center (ERC)
   ( ) Architects, engineers or energy consultants
   ( ) Equipment vendors or building contractors
   ( ) Other (please describe)
   ( ) Don’t know

2. How did you learn about the DCEO tuition rebate for the BOC training? *(Do not read list. Select all that apply.)*
   ( ) From a BOC program representative
   ( ) A Midwestern Energy Efficiency Alliance (MEEA) 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 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 describe)
   ( ) Don’t know

3. When you learned about the tuition rebate available for the BOC courses, did you already know about the BOC training?
   ( ) Yes
   ( ) No
   ( ) Don't know

4. Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements at this facility? *(Select all that apply)*
   ( ) An energy management plan (If checked, go to 4A)
   ( ) A staff member responsible for energy and energy efficiency
   ( ) Policies that incorporate energy efficiency in operations and procurement
   ( ) Active training of staff
   ( ) Other (please specify)
   ( ) Don't know

4A. Does your energy management plan include goals for energy savings?
   ( ) Yes (If checked, go to 4B)
   ( ) No
   ( ) Don't know

4B. Could you describe the goals specified in your energy management plan?

5. What motivated you to participate in the BOC course? *(Do not read list. Select all that apply.)* (*Use as prompts if necessary*)
   ( ) Career opportunity
   ( ) Learn new skills
   ( ) Personal interest
   ( ) Learn about energy efficiency
   ( ) Don't know
   ( ) Other: (please specify)

6. How important was the tuition rebate in your decision to participate? *(Read list)*
   ( ) Very important
   ( ) Somewhat important
   ( ) Only slightly important
   ( ) Not important at all
   ( ) Don't know

7. Would you have been financially able to attend the BOC training if the tuition rebate had not been available?
   ( ) Yes
   ( ) No
   ( ) Don't know

8. If the tuition rebate had not been available, how likely would you have been to participate in the BOC course anyway? *(Read list)*
   ( ) Definitely would have participated
   ( ) Probably would have participated
   ( ) Probably would not have participated
   ( ) Definitely would not have participated
   ( ) Don't know

9. Were any of the courses you took through the BOC program particularly useful?
   ( ) Yes (If marked, go to 9A)
   ( ) No
   ( ) Don't know

9A. Which ones and what made them useful?

10. Were there any courses that you found to not be very useful?
   ( ) Yes (If marked, go to 10A)
   ( ) No
   ( ) Don't know

10A. Which ones and what made them not very useful?

11. Why did you attend the BOC training? *(Do not read list. Select all that apply.)* (*Use as prompts if necessary*)
   ( ) Required by company/organization
   ( ) To learn new job skills
   ( ) To advance in my current job
   ( ) To improve my chances of getting a new job
   ( ) To earn continuing education credits
   ( ) To learn about energy efficiency
   ( ) Because of the tuition rebate
   ( ) Other (please describe)
   ( ) Don't know

12. Have you encountered any barriers to applying what you learned about energy efficiency improvements during the BOC training?
   ( ) Yes (If checked, go to 12A)
   ( ) No
   ( ) Don't know

12a. What barriers have you encountered? *(Do not read list, but use as possible prompts)*
   ( ) Lack of supervisor support
   ( ) Insufficient budget
   ( ) Organization/company not committed to energy efficiency improvements
   ( ) Not enough staff resources to plan efficiency projects
   ( ) Other (please describe)
   ( ) Don't know

13. What is the approximate square footage of your building or buildings?

14. What percentage of that space are you responsible for?

15. What is the primary fuel source for heating? *(Do not read list)*
    ( ) Electric
    ( ) Gas
    ( ) Oil
    ( ) Purchased steam
    ( ) Other
    ( ) Don't know

16. What is the primary heating system type? *(Do not read list)*
    ( ) Hot air furnace
    ( ) Wall or floorboard radiator (steam, Hot Water or electric resistance)
    ( ) Steam, hot water or electric resistance coils in ventilation system.
    ( ) Space heaters
    ( ) Heat pump, air source
    ( ) Heat pump, ground source
    ( ) Heat pump, water loop
    ( ) Other, (please describe)
    ( ) Don't know

17. Do you have a secondary heating system?
    ( ) Yes (If checked, go to 17A then 17B)
    ( ) No
    ( ) Don't know

17A. What is the fuel source for the secondary heating? *(Do not read list)*
    ( ) Electric
    ( ) Gas
    ( ) Oil
    ( ) Purchased steam
    ( ) Other
    ( ) Don't know

17B. What is the secondary heating system type? *(Do not read list)*
    ( ) Hot air furnace
    ( ) Wall or floorboard radiator (steam, Hot Water or electric resistance)
    ( ) Steam, hot water or electric resistance coils in ventilation system.
    ( ) Space heaters
    ( ) Heat pump, air source
    ( ) Heat pump, ground source
    ( ) Heat pump, water loop
    ( ) Other, (please describe)

18. What type of cooling system does the facility have? *(Do not read list)*
    ( ) Chiller – air-cooled
    ( ) Chiller – water or evaporatively cooled
    ( ) Evaporative cooler

( ) Fans
( ) Direct Expansion – air-cooled packaged or split system cooling or like a heat pump
( ) Geothermal heat pump
( ) Window units
( ) Other, (please describe)
( ) Don't know

19. What is the primary fuel used for water heating at the facility?
( ) Electric
( ) Gas
( ) Oil
( ) Solar
( ) Steam
( ) Other, (please describe)
( ) Don't know

20. How many hours per week is your site open for business?

21. What is your site's estimated total electricity cost ($/year)?

22. What is your site's estimated total natural gas cost ($/year)?

23. What type of facility is it? *(Do not read list)*
( ) College/University
( ) Elementary
( ) Grocery
( ) Healthcare Clinic
( ) Heavy Industry
( ) High School/Middle School
( ) Hospital
( ) Hotel/Motel
( ) Light Industry
( ) Lodging Hotel/Motel
( ) Manufacturing Facility
( ) Medical
( ) Office - High Rise
( ) Office - Low Rise
( ) Office - Mid Rise
( ) Religious Facility
( ) Restaurant
( ) Retail - Department Store
( ) Retail - Strip Mall
( ) Retail/Service
( ) School (K-12)
( ) Warehouse
( ) Other(please describe)

24. Since participating in the BOC program have you implemented any of the following types of energy efficiency projects? *(Ask follow up energy impact assessment questions for any project types indicated)*
    ( ) Lighting Controls
    ( ) Energy efficient lighting
    ( ) NEMA premium energy efficient motors
    ( ) VSDs
    ( ) Compressed air projects
    ( ) Energy management systems
    ( ) Heating system improvements
    ( ) Air conditioning improvements
    ( ) Economizer on an air handler
    ( ) Water heating efficiency improvements
    ( ) Other improvements
    ( ) None
    ( ) Don't know

25. At how many facilities did you implement any of the previously listed products?
    ( ) 1
    ( ) 2
    ( ) 3
    ( ) 4
    ( ) 5
    ( ) 6
    ( ) 7
    ( ) 8
    ( ) 9
    ( ) 10 or more
    ( ) Don't know

LC1. Now I would like to ask you some questions about the lighting controls you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*
    ( ) Definitely would have made the improvements
    ( ) Probably would have made the improvements
    ( ) Probably would not have made the improvements
    ( ) Definitely would not have made the improvements
    ( ) Don't know

LC2. Had you implemented a similar project prior to attending the BOC training?
    ( ) Yes
    ( ) No
    ( ) Don't know

LC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?

( ) Yes
( ) No
( ) Don't know

LC4. What type of new lighting controls did you implement?

( ) Occupancy sensors (if checked, go to LC4A, LC4B, LC4C)
( ) Daylighting controls (if checked, go to LC4D, LC4E, LC4F)
( ) Don't know

LC4A. How many fixtures are controlled by the occupancy sensors and what type are they?

LC4B. How many hours per day did the lights controlled by the occupancy sensors operate before the controls were installed?

LC4C. Did the hours of operation for the lights change on weekends or holidays? If so, what were the operational hours during weekends or holidays?

LC4D. How many fixtures are controlled by the daylighting controls and what type are they?

LC4E. How many hours per day did the lights controlled by the daylighting controls operate before the controls were installed?

LC4F. Did the hours of operation for the lights change on weekends or holidays? If so, what were the operational hours during weekends or holidays?

Energy efficient lighting

EEL1. Now I would like to ask you some questions about the energy efficient lighting you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

EEL2. Had you implemented a similar project prior to attending the BOC training?

( ) Yes
( ) No
( ) Don't know

EEL3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?

( ) Yes

( ) No
( ) Don't know

EEL4. What is the square footage of the area that new efficient lighting was installed in?

EEL5. What type and number of fixtures were installed and what type and number of fixtures did they replace? An example of the type of answer we are looking for is "replaced 121 4-Lamp T-8 fixtures with 121 4-Lamp T-5 fixtures."

	Old Fixture Type	Old Fixture Count	New Fixture Type	New Fixture Count
(for each project completed)				

EEL6. How many hours a day are the lights operational?

Energy efficient motors

EEM1. Now I would like to ask you some questions about the energy efficient motors you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

EEM2. Had you implemented a similar project prior to attending the BOC training?
( ) Yes
( ) No
( ) Don't know

EEM3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?
( ) Yes
( ) No
( ) Don't know

EEM4. Were these motors installed for HVAC end-uses or for industrial end-uses? (*select all that apply*)
( ) HVAC end-use (if selected, go to EEM4A, EEM4B, and EEM4C)
( ) Industrial end-use (if selected, go to EEM4D)

EEM4A. Were any of the HVAC motors used for HVAC pumps? If so, please provide the efficiency of the motors, the number of motors installed, the number installed that were early

replacements as opposed to replacements on burnout, total horsepower of the motors, and whether or not VSDs were installed. [*Please complete the table based on the level of motor efficiency. For example, for 91.0% efficiency motors, provide the number installed, the number that were early replacements, the total horsepower of the motors, and whether or not they have VSDs installed*]

	Efficiency of motors	Number Installed	Number that were Early Replacements	Total Horsepower of Motors	VSDs ("y" for yes/"n" for no)
(for each project completed)					

EEM4B. Were any of the HVAC motors used for ventilation fans? If so, provide the efficiency of the motors, the number of motors installed, the number installed that were early replacements as opposed to replacements on burnout, total horsepower of the motors, and whether or not VSDs were installed. [*Please complete the table based on the level of motor efficiency. For example, for 91.0% efficiency motors, provide the number installed, the number that were early replacements, the total horsepower of the motors, and whether or not they have VSDs installed*]

	Efficiency of motors	Number Installed	Number that were Early Replacements	Total Horsepower of Motors	VSDs ("y" for yes/"n" for no)
(for each project completed)					

EEM4C. Were any of the HVAC motors used for other purposes? If so, provide the efficiency of the motors, the number of motors installed, the number installed that were early replacements as opposed to replacements on burnout, total horsepower of the motors, and whether or not VSDs were installed. [*Please complete the table based on the level of motor efficiency. For example, for 91.0% efficiency motors, provide the number installed, the number that were early replacements, the total horsepower of the motors, and whether or not they have VSDs installed*]

	Efficiency of motors	Number Installed	Number that were Early Replacements	Total Horsepower of Motors	VSDs ("y" for yes/"n" for no)
(for each project completed)					

EEM4D. For motors used for industrial purposes, please provide the efficiency of the motors, the number of motors installed, the number installed that were early replacements as opposed to replacements on burnout, total horsepower of the motors, operating hours, and whether or not VSDs were installed. [*Please complete the table based on the level of motor efficiency. For example, for 91.0% efficiency motors, provide the number installed, the number that were early replacements, the total horsepower of the motors, operating hours, and whether or not they have VSDs installed*]

	Efficiency of motors	Number Installed	Number that were Early Replacements	Total Horsepower of Motors	Hours per day of operation	VSDs ("y" for yes/"n" for no)
for each project completed						

VSDs

VSD1. Now I would like to ask you some questions about the VSDs you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

VSD2. Had you implemented a similar project prior to attending the BOC training?

( ) Yes
( ) No
( ) Don't know

VSD3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?

( ) Yes
( ) No
( ) Don't know

VSD4. Were the VSDs installed on existing motors part of an HVAC system?
( ) Yes (if selected, go to VSD4A)
( ) No (if selected, go to VSD4B)
( ) Some were part of an HVAC system, some were not (if selected, go to VSD4A and VSD4B)
( ) Don't know

VSD4A. For each of the VSDs used in a HVAC system, please provide the number of VSDs installed and the horsepower of the motors controlled.

- Motor Application
- Hot Water Pump
- Chilled Water Pump
- Supply Fan: Constant Volume
- Supply Fan: Air Foil/inlet Guide Vanes
- Supply Fan: Forward Curved Fan, with discharge dampers
- Supply Fan: Forward Curved Inlet Guide Vanes
- Cooling Tower Fan
- Custom Process

VSD4B. For the existing motors not used in a HVAC system, what is the total number of motors and total motor horsepower controlled by the VSDs?

VSD5. Who can we contact about the technical specifics of the VSD installation if needed? Please provide a name, phone number, and email address.

Compressed air projects

CA1. Now I would like to ask you some questions about the compressed air projects you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements

CA2. Had you implemented a similar project prior to attending the BOC training?
( ) Yes
( ) No
( ) Don't know

CA3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?

( ) Yes
( ) No
( ) Don't know

CA4. What is the total horsepower of the motor(s) in the air compressor system?

CA5. What kind of compressed air project did you implement? *(Do not read list. Select all that apply.)*
( ) New high efficiency single-speed compressor
( ) New high efficiency variable-speed compressor
( ) New efficient refrigerated air dryer
( ) New efficient desiccant air dryer
( ) Improved staging controls
( ) Other (Please specify type of compressed air equipment and quantity of units____)
( ) Don't know

CA6. Who can we contact about the technical specifics of the compressed air project(s)? Please provide name, phone number, and email address.

Energy management systems

EMS1. Now I would like to ask you some questions about the energy management system(s) you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

EMS2. Had you implemented a similar project prior to attending the BOC training?
( ) Yes
( ) No
( ) Don't know

EMS3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?
( ) Yes
( ) No
( ) Don't know

EMS4. What is the square footage of the area that the Energy Management System controls?

EMS5. Please describe the function of the Energy Management System? *(Do not read list. Select all that apply.)*
( ) On and off schedule

( ) Does everything
( ) Cooling plant optimization
( ) Cooling distribution optimization
( ) Outdoor air ventilization (economizer)
( ) Outdoor air ventilization (demand controlled ventilation with CO sensor)
( ) Air distribution optimization
( ) Heating plant and distribution optimization
( ) Other, (please describe)
( ) Don't know

EMS7. Did the energy management system produce electricity, or natural gas savings or both?
( ) Electricity savings
( ) Natural gas savings
( ) Both
( ) Don't know

EMS8. Who can we contact about the technical specifics of the energy management system project(s)? Please provide name, phone number, and email address.

Heating system improvements

HS1. Now I would like to ask you some questions about the heating system improvements you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

HS2. Had you implemented a similar project prior to attending the BOC training?
( ) Yes
( ) No
( ) Don't know

HS3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?
( ) Yes
( ) No
( ) Don't know

HS4. What type of heating system improvements that produced energy savings did you implement? *(Do not read list. Select all that apply)*
( ) Installed a heat recovery system
( ) Installed a high efficiency boiler
( ) Installed a high efficiency low turn-down burner

( ) Installed oxygen trim control
( ) Other (Please describe the type and quantity of equipment installed)
( ) Don't know

HS5. Can you describe those heating system improvements?

HS6. Did the heating system improvements produce electricity, or natural gas savings or both?
( ) Electricity
( ) Natural gas
( ) Both
( ) Don't know

HS7. Who can we contact about the technical specifics of the heating system project(s)? Please provide name, phone number, and email address.

Air conditioning improvements

AC1. Now I would like to ask you some questions about the air conditioning improvements you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

AC3. Had you implemented a similar project prior to attending the BOC training?
( ) Yes
( ) No
( ) Don't know

AC4 Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?
( ) Yes
( ) No
( ) Don't know

AC5. What type of air conditioning improvements that produced energy savings did you implement? *(Do not read list. Select all that apply)*
( ) Installed new high-efficiency chiller(s)
( ) Installed new cooling towers
( ) Installed new terminal units
( ) Installed an oxygen trim control
( ) Other (Please describe the type and quantity of equipment installed)
( ) Don't know

AC2. Can you describe those air conditioning improvements?

AC6. Who can we contact about the technical specifics of the air-conditioning system project(s)? Please provide name, phone number, and email address

Economizers on Air Handlers

E1. Now I would like to ask you some questions about the economizers on air handlers you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements

E2. Had you implemented a similar project prior to attending the BOC training?

( ) Yes
( ) No
( ) Don't know

E3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?

( ) Yes
( ) No
( ) Don't know

E4. What is the size of the area affected by the economizer on the air handler?

E6. Did the economizers produce electricity, or natural gas savings or both?

( ) Electricity
( ) Natural gas
( ) Both
( ) Don't know

E7. Who can we contact about the technical specifics of the economizer project(s)? Please provide name, phone number, and email address

Water heating efficiency improvements

WH1. Now I would like to ask you some questions about the water heating improvements you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements

( ) Definitely would not have made the improvements
( ) Don't know

WH2. Had you implemented a similar project prior to attending the BOC training?
( ) Yes
( ) No
( ) Don't know

WH3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?
( ) Yes
( ) No
( ) Don't know

WH5. What type of water heating improvements that produced energy savings did you implement? *(Do not read list. Select all that apply)*
( ) Insulated pipes(s) (How thick was the insulation? How many feet?)
( ) Installed heat recovery system (How many?)
( ) Installed time clock to turn off circulation pump after hours
( ) Other (Please describe the type and quantity of equipment installed)
() Installed a more efficient hot water heater (What was old unit efficiency? New?)
( ) Don't know

WH4. Can you describe those water heating improvements?

WH7. Did the water heating project produce electricity, or natural gas savings or both?
( ) Electricity
( ) Natural gas
( ) Both
( ) Don't know

Other improvements

O1. You mentioned that you implemented some other energy efficiency projects. Can you describe what these projects were?

O2. Now I would like to ask you some questions about the other projects you implemented. How likely is it that you would have made these improvements had you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

O3. Had you implemented a similar project(s) prior to attending the BOC training?

( ) Yes
( ) No
( ) Don't know

O4. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?

( ) Yes
( ) No
( ) Don't know

O5. Did the water heating project produce electricity, or natural gas savings or both?

( ) Electricity
( ) Natural gas
( ) Both
( ) Don't know

O6. Who can we contact about the technical specifics of these other project(s)? Please provide name, phone number, and email address

Maintenance Energy Impacts Assessment

26. Now I'd like to ask you about changes in maintenance activities you may have implemented at your facility since completing the BOC training. For each of the following activities, please indicate if you have performed them differently or more frequently or both since participating in the BOC training.

- Maintenance on the cooling system equipment
- Maintenance on the heating equipment
- Motor maintenance, including belt alignment and tension
- Maintenance on compressed air system
- Electrical panel maintenance
- Ventilation maintenance
- Other energy savings maintenance

[*If maintenance is performed differently, more frequently, or both, for any category go to M1 and ask selected Maintenance Improvement Questions*]

27. At how many facilities did you implement any of the previously listed products?

( ) 1
( ) 2
( ) 3
( ) 4
( ) 5
( ) 6
( ) 7
( ) 8

( ) 9
( ) 10 or more
( ) Don't know

Cooling system

CS1. You mentioned that you have changed how you perform maintenance on cooling system equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

CS2. Please tell me which of the following changes you've made to your cooling system maintenance practices?
( ) Changes to water treatment
( ) Changes to cooling tower service
( ) Changes to chiller bundle cleaning
( ) Changes to condenser cleaning
( ) Changes to refrigerant charge adjustment
( ) Changes to sensor calibration
( ) Changes to system diagnostics
( ) Other changes
( ) Don't know

[For each practice selected ask CS2A-CS2C]

CS3. Please describe the cooling system maintenance changes that you have made since attending the BOC training? [*If needed, prompt with please describe the change in practice and how frequently it is performed*]

CS4. Who can we contact about the technical specifics of the cooling system maintenance practices if needed? Please provide a name, phone number, and email address.

Heating equipment

HE1. You mentioned that you have changed how you perform maintenance on heating equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

HE2. Please tell me which of the following changes you've made to your heating equipment maintenance practices. (select all that apply)

( ) Water treatment
( ) Steam trap service
( ) Heat exchanger cleaning
( ) Blowdown frequency
( ) Sensor Calibration
( ) System diagnostics
( ) Other
( ) Don't know

HE3. Please describe the heating system maintenance changes that you have made since attending the BOC training? [*If needed, prompt with please describe the change in practice and how frequently it is performed*]

HE4. Who can we contact about the technical specifics of the heating system maintenance practices if needed? Please provide a name, phone number, and email address.

Motor Maintenance

MM1. You mentioned that you have changed how you perform maintenance on motor equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don’t know

MM2. Please tell me all the changes you have made to your motor maintenance.

( ) Lubrication
( ) Belt alignment/tensioning/replacement
( ) Coupling alignment
( ) Notched/Cogged/X-belts
( ) Other
( ) Don't know

MM3. Please describe the motor maintenance changes that you have made since attending the BOC training? [*If needed, prompt with please describe the change in practice and how frequently it is performed*]

MM4. How many motors did you perform maintenance on?

MM5. What is the average horsepower of the motors you performed maintenance on?

MM6. Who can we contact about the technical specifics of the motor maintenance practice changes if needed? Please provide a name, phone number, and email address.

Air Compressor Maintenance

AC1. You mentioned that you have changed how you perform maintenance on air compressor equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

AC2. Please tell me all the changes you have made to your air compressor equipment maintenance.

( ) Audible leak detection
( ) Ultra-sonic leak detection
( ) Pressure optimization
( ) End-use isolation
( ) Filter changes
( ) System diagnostics
( ) Other
( ) Don't know

AC3. Please describe the air compressor maintenance changes that you have made since attending the BOC training? [*If needed, prompt with please describe the change in practice and how frequently it is performed*]

AC4. What is the total horsepower of the air compressor(s)?

AC5. What is the average CFM (Cubic Feet Per Minute) of the air compressor(s)?

AC6. Who can we contact about the technical specifics of the air compressor maintenance changes if needed? Please provide a name, phone number, and email address.

Electrical Panel Maintenance

EP1. You mentioned that you have changed how you perform maintenance on electrical panels since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements

EP2. Please tell me all the changes you have made to your electrical panel maintenance.

( ) Thermal analysis and connection tightening
( ) Other
( ) Don't know

[For each practice selected ask EP2A-EP2C]

EP3. Please describe the electrical panel maintenance changes that you have made since attending the BOC training? [*If needed, prompt with please describe the change in practice and how frequently it is performed*]

EP4. Who can we contact about the technical specifics of the electrical panel maintenance practices if needed? Please provide a name, phone number, and email address.

Ventilation Maintenance

VM1. You mentioned that you have changed how you perform ventilation maintenance since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? *(Read list)*
( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don’t know

VM2. Please tell me all the changes you have made to your ventilation maintenance. (For each change mentioned, ask how frequently they do this).
( ) Economizer optimization/repair
( ) Sensor Calibration
( ) Setpoint optimization
( ) Balancing
( ) Filter changes
( ) System diagnostics
( ) Sealed leaks / replaced door gaskets
( ) Other
( ) Don't know

VM3. Please describe the ventilation maintenance changes that you have made since attending the BOC training? [*If needed, prompt with please describe the change in practice and how frequently it is performed*]

VM4. Who can we contact about the technical specifics of the ventilation maintenance practices if needed? Please provide a name, phone number, and email address.

VM5. What is the total horsepower of the serviced fans?

Other Maintenance

OM1. You mentioned that you have made some other energy saving changes to your maintenance practices. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? *(Read list)*

( ) Definitely would have made the improvements
( ) Probably would have made the improvements
( ) Probably would not have made the improvements
( ) Definitely would not have made the improvements
( ) Don't know

OM2. Please describe the other maintenance changes that you have made since attending the BOC training? [*If needed, prompt with please describe the change in practice and how frequently it is performed*]

OM3. Who can we contact about the technical specifics of the other maintenance practices if needed? Please provide a name, phone number, and email address.

Now I would like to ask a few general questions about your experience with the program.

28. Do you think that there are certain barriers that may make it difficult for potential program participants to attend or complete the BOC training? What are they? *(Don't read list. Select all that apply.)*

( ) Time
( ) Cost
( ) Not aware of it
( ) Supervisor approval
( ) No barriers
( ) Don't know

29. Please indicate your level of satisfaction with the following elements of the BOC training. (Participants given an option of: very dissatisfied, dissatisfied, neither satisfied nor dissatisfied, satisfied, very satisfied, and don't know.)

- Course schedule
- Course instructors
- Tuition rebate application process
- Tuition rebate amount
- Time elapsed to receive tuition rebate
- Overall experience with the BOC Program

30. Please describe the ways in which you were not satisfied with the BOC training or the tuition rebate?

31. For each of the following activities, please indicate if you had already completed them prior to completing BOC training, before and after the training, only completed them after attending BOC training, or have not yet completed them:

- Implemented an energy budget

- Recorded energy use over time
- Set energy savings goals
- Achieved energy savings goals

32. Have you participated in any other DCEO energy efficiency programs?
( ) Yes (if checked, go to 30A)
( ) No
( ) Don't know

32A. What other DCEO energy efficiency programs did you participate in?

32B.How important was the BOC course in your decision to participate in these other DCEO programs? *(Read list)*
( ) Very important
( ) Somewhat important
( ) Neutral
( ) Somewhat unimportant
( ) Not important at all
( ) Don't know/Not applicable

33. What is your current job title? *(Do not read list)*
( ) Operations/Facilities operations manager
( ) Maintenance manager
( ) HVAC supervisor or technician
( ) Engineering manager
( ) Facilities manager
( ) Engineer
( ) Maintenance manager
( ) General contractor
( ) Building management specialist
( ) Other engineering position
( ) Other manager, team leader, supervisor

34. How many years have you worked in this role?

35. How many building operator staff is there at your current location?

36. How many of these staff have completed the BOC training (either Level 1 or Level 1&2)?

Thank you for taking this survey of participants in the Building Operator Certification® Program.
Your response is very important to us.

Appendix B: Participant Survey Responses

As part of the evaluation effort, a telephone survey was administered to Building Operator Certification training participants who received a tuition rebate through DCEO. This survey provided the information used in Chapter 3 to estimate free ridership and potential savings for projects in the BOC 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 A. 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 BOC Program, and (3) the influence that the BOC Program had on his or her decision to install energy efficiency measures (e.g., lighting measures, HVAC measures, maintenance and operation improvements).

The following tabulations summarize participant survey responses. Three columns of data are presented. The first column presents the number of survey respondents (n) associated with each response. The second column presents the percentage of survey respondents associated with each response.

	Response	*(n=36)*	*Percent of Respondents**
1. What are the sources your organization relies on for information about energy efficient practices, equipment, materials and design features? (Do not read list. Select all that apply.)	DCEO representatives	1	3%
	The DCEO website	0	0%
	Utility representatives	0	0%
	The Midwestern Energy Efficiency Alliance (MEEA)	1	3%
	Brochures or advertisements	3	9%
	Trade associations or business groups you belong to	4	11%
	Trade journals or magazines	11	31%
	Friends and colleagues	4	11%
	The Smart Energy Design Assistance Center (SEDAC)	0	0%
	The Energy Resource Center (ERC)	0	0%
	Architects, engineers or energy consultants	7	20%
	Equipment vendors or building contractors	12	34%
	Other (please describe)|Other (please describe)	0	0%
	Don't know	6	17%

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

	Response	*(n=35)*	*Percent of Respondents**
2. How did you learn about the DCEO tuition rebate for the BOC training?	From a BOC program representative	7	20%
	A Midwestern Energy Efficiency Alliance (MEEA) representative	2	6%
	A DCEO representative mentioned it	2	6%
	The DCEO website	0	0%
	From a utility representative	0	0%
	Brochures or advertisements	0	0%
	Trade association or business group you belong to	0	0%
	Trade journal or magazine	0	0%
	Friend or colleague	7	20%
	From a representative of Smart Energy Design Assistance Center (SEDAC)	0	0%
	From a representative of the Energy Resource Center (ERC)	0	0%
	An architect, engineer or energy consultant	3	9%
	Equipment vendor or building contractor	0	0%
	Attended a conference workshop or seminar	1	3%
	Past experience with the program	0	0%
	An energy service company	0	0%
	Other (please explain)	13	37%
	Don't know	4	11%

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

3. When you learned about the tuition rebate available for the BOC courses, did you already know about the BOC training?	*Response*	*(n=35)*	*Percent of Respondents*
	Yes	14	40%
	No	21	60%
	Don't know	0	0%

4. Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements?	*Response*	*(n=35)*	*Percent of Respondents**
	An energy management plan	0	0%
	A staff member responsible for energy and energy efficiency	19	54%
	Policies that incorporate energy efficiency in operations and procurement	14	40%
	Active training of staff	14	40%
	Other (please specify)	5	14%
	Don't know	2	6%

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

4A. Does your energy management plan include goals for energy savings?	*Response*	*(n=13)*	*Percent of Respondents*
	Yes	10	77%
	No	3	23%
	Don't know	0	0%

5. What motivated you to participate in the BOC course? (Do not read list. Select all that apply.) (Use as prompts if necessary)	*Response*	*(n=35)*	*Percent of Respondents**
	Career Opportunity	7	20%
	Learn new skills	16	46%
	Personal interest	8	23%
	Learn about energy efficiency	18	51%
	Other (please specify)	14	40%
	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%.*

6. How important was the tuition rebate in your decision to participate? (Read list) "	*Response*	*(n=36)*	*Percent of Respondents*
	Very important	16	44%
	Somewhat important	10	28%
	Neutral	0	0%
	Only slightly important	3	8%
	Not important at all	5	14%
	Don't know	2	6%

7. Would you have been financially able to attend the BOC training if the tuition rebate had not been available?	*Response*	*(n=35)*	*Percent of Respondents*
	Yes	15	43%
	No	17	49%
	Don't know	3	9%

	Response	*(n=35)*	*Percent of Respondents*
8. If the tuition rebate had not been available, how likely would you have been to participate in the BOC course anyway? (Read list)"	Definitely would have participated	9	26%
	Probably would have participated	9	26%
	Probably would not have participated	12	34%
	Definitely would not have participated	4	11%
	Don't know	1	3%

	Response	*(n=36)*	*Percent of Respondents*
9. Were any of the courses you took through the BOC program particularly useful?"	Yes	33	92%
	No	2	6%
	Don't know	1	3%

	Response	*(n=35)*	*Percent of Respondents*
10. Were there any courses that you found to not be very useful? "	Yes	10	29%
	No	24	69%
	Don't know	1	3%

	Response	*(n=35)*	*Percent of Respondents**
11. Why did you attend the BOC training? (Do not read list. Select all that apply.) (Use as prompts if necessary)	Required by company/organization	8	23%
	To learn new job skills	21	60%
	To advance in my current job	9	26%
	To improve my chances of getting a new job	1	3%
	To earn continuing education credits	0	0%
	To learn about energy efficiency	17	49%
	Because of the tuition rebate	2	6%
	Other (please specify)	4	11%
	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=35)*	*Percent of Respondents*
12. Have you encountered any barriers to applying what you learned about energy efficiency improvements during the BOC training?"	Yes	11	31%
	No	23	66%
	Don't know	1	3%

	Response	*(n=11)*	*Percent of Respondents*
12a. What barriers have you encountered? (Do not read list, but use as possible prompts)	Lack of supervisor support	0	0%
	Insufficient budget	7	64%
	Organization/company not committed to energy efficiency improvements	1	9%
	Not enough staff resources to plan efficiency projects	0	0%
	Other (please specify)	3	27%
	Don't know	0	0%

	Response	*(n=35)*	*Percent of Respondents*
15. What is the primary fuel source for heating? (Do not read list)	Electric	6	17%
	Gas	25	71%
	Oil	0	0%
	Purchased steam	0	0%
	Other (please specify)	4	11%
	Don't know	0	0%

	Response	*(n=36)*	*Percent of Respondents*
16. What is the primary heating system type? (Do not read list)	Hot air furnace	2	6%
	Wall or floorboard radiator (steam, Hot Water or electric resistance)	4	11%
	Steam, hot water or electric resistance coils in ventilation system.	13	36%
	Space heaters	1	3%
	Heat pump, air source	0	0%
	Heat pump, ground source	2	6%
	Heat pump, water loop	2	6%
	Other (please specify)	12	33%
	Don't know	0	0%

	Response	*(n=35)*	*Percent of Respondents*
17. Do you have a secondary heating system?	Yes	7	20%
	No	28	80%
	Don't know	0	0%

	Response	*(n=7)*	*Percent of Respondents*
17A. What is the fuel source for the secondary heating? (Do not read list)	Electric	2	29%
	Gas	3	43%
	Oil	0	0%
	Purchased steam	0	0%
	Other	2	29%
	Don't know	0	0%

	Response	*(n=7)*	*Percent of Respondents*
17B. What is the secondary heating system type? (Do not read list)	Hot air furnace	2	29%
	Wall or floorboard radiator (steam, Hot Water or electric resistance)	0	0%
	Steam, hot water or electric resistance coils in ventilation system.	2	29%
	Space heaters	0	0%
	Heat pump, air source	0	0%
	Heat pump, ground source	0	0%
	Heat pump, water loop	0	0%
	Other (please specify)	3	43%
	Don't know	0	0%

	Response	(n=35)	Percent of Respondents
18. What type of cooling system does the facility have? (Do not read list)	Chiller - water or evaporatively cooled	0	0%
	Chiller water or evaporatively cooled	0	0%
	Evaporative cooler	0	0%
	Fans	0	0%
	Direct Expansion - air-cooled packaged or split system cooling or like a heat pump	0	0%
	Geothermal heat pump	1	3%
	Window units	1	3%
	Other (please specify)	6	17%
	Don't know	0	0%

	Response	(n=35)	Percent of Respondents
19. What is the primary fuel used for water heating at the facility? (Do not read list)	Electric	12	34%
	Gas	20	57%
	Oil	0	0%
	Solar	0	0%
	Steam	1	3%
	Other (please specify)	2	6%
	Don't know	0	0%

	Response	(n=35)	Hours per week
20. How many hours per week is your site open for business?	Average Dollars per year		103.2

	Response	(n=27)	Cost per year
21. What is your site's estimated total electrical cost ($/year)?	Average Dollars per year		171707.9

	Response	(n=26)	Cost per year
22. What is your site's estimated total natural gas cost ($/year)?	Average Dollars per year		6423.1

	Response	*(n=35)*	*Percent of Respondents*
23. What type of facility is it? (Do not read list)	College/University	2	6%
	Elementary	2	6%
	Grocery	0	0%
	Healthcare Clinic	0	0%
	Heavy Industry	1	3%
	High School/Middle School	0	0%
	Hospital	3	9%
	Hotel/Motel	0	0%
	Light Industry	0	0%
	Lodging Hotel/Motel	0	0%
	Manufacturing Facility	0	0%
	Medical	0	0%
	Office - High Rise	3	9%
	Office - Low Rise	5	14%
	Office - Mid Rise|	7	20%
	Religious Facility	0	0%
	Restaurant	0	0%
	Retail - Department Store	1	3%
	Retail - Strip Mall	0	0%
	Retail/Service	0	0%
	School (K-12)	1	3%
	Warehouse	0	0%
	Other (please specify)	10	29%
	Don't know	0	0%

	Response	*(n=35)*	*Percent of Respondents**
24. Since participating in the BOC program have you implemented any of the following types of energy efficiency projects? (Read list)	Lighting Controls	21	60%
	Energy efficient lighting	24	69%
	NEMA premium energy efficient motors	2	6%
	VSDs	11	31%
	Compressed air projects	2	6%
	Energy management systems	11	31%
	Heating system improvements	8	23%
	Air conditioning improvements	8	23%
	Economizer on an air handler	6	17%
	Water heating efficiency improvements	4	11%
	Other improvements	2	6%
	None	5	14%
	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=30)*	*Percent of Respondents*
25. At how many facilities did you implement any of the previously listed projects?	1	21	70%
	2	1	3%
	3	4	13%
	4	1	3%
	5	1	3%
	6	0	0%
	7	0	0%
	8	0	0%
	9	0	0%
	10 or more	2	7%
	Don't know	0	0%

	Response	*(n=21)*	*Percent of Respondents*
LC1. Now I would like to ask you some questions about the lighting controls you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	4	19%
	Probably would have made the improvements	11	52%
	Probably would not have made the improvements	5	24%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	1	5%

	Response	*(n=21)*	*Percent of Respondents*
LC2. Had you implemented a similar project prior to attending the BOC training?	Yes	11	52%
	No	10	48%
	Don't know	0	0%

	Response	*(n=21)*	*Percent of Respondents*
LC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	11	52%
	No	7	33%
	Don't know	3	14%

	Response	*(n=21)*	*Percent of Respondents**
LC4. What type of new lighting controls did you implement? (Do not read list)	Occupancy sensors	21	100%
	Daylighting	5	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=5)*	*Number of fixtures*
LC4A. How many fixtures are controlled by the daylighting controls and what type are they?	Average hours per day		30.4

LC4B. How many hours per day did the lights controlled by the daylighting controls operate before the controls were installed?	*(n=5)*	
	Average hours per day	14.4

	Response	*(n=24)*	*Percent of Respondents*
EEL1. Now I would like to ask you some questions about the energy efficient lighting you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	10	42%
	Probably would have made the improvements	11	46%
	Probably would not have made the improvements	3	13%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=24)*	*Percent of Respondents*
EEL2. Had you implemented a similar project prior to attending the BOC training?	Yes	13	54%
	No	10	42%
	Don't know	1	4%

	Response	*(n=24)*	*Percent of Respondents*
EEL3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	15	63%
	No	6	25%
	Don't know	3	13%

EEL6. How many hours a day are the lights operational?	*(n=24)*	
	Average hours per day	13.6

	Response	*(n=2)*	*Percent of Respondents*
EEM1. Now I would like to ask you some questions about the energy efficient motors you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	1	50%
	Probably would have made the improvements	1	50%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

	Response	*(n=2)*	*Percent of Respondents*
EEM2. Had you implemented a similar project prior to attending the BOC training?	Yes	0	0%
	No	2	100%
	Don't know	0	0%

EEM3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=2)*	*Percent of Respondents*
	Yes	0	0%
	No	2	100%
	Don't know	0	0%

EEM4. Were these motors installed for HVAC end-uses or for industrial end-uses? (select all that apply)	*Response*	*(n=2)*	*Percent of Respondents**
	HVAC end-use	1	50%
	Industrial end-use	1	50%
	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%.*

VSD1. Now I would like to ask you some questions about the VSDs you implemented. How likely is it that you would have made these improvements had you not attended the course? (Read list)	*Response*	*(n=11)*	*Percent of Respondents*
	Definitely would have made the improvements	4	36%
	Probably would have made the improvements	6	55%
	Probably would not have made the improvements	1	9%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

VSD2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=11)*	*Percent of Respondents*
	Yes	5	45%
	No	6	55%
	Don't know	0	0%

VSD3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=11)*	*Percent of Respondents*
	Yes	5	45%
	No	6	55%
	Don't know	0	0%

VSD4. Were the VSDs installed on existing motors part of an HVAC system?)	*Response*	*(n=11)*	*Percent of Respondents*
	Yes	8	73%
	No	0	0%
	Some were part of an HVAC system, some were not	3	27%
	Don't know	0	0%

	Response	*(n=2)*	*Percent of Respondents*
CA1. Now I would like to ask you some questions about the compressed air projects you implemented. How likely is it that you would have made these improvements had you not attended the course? (Read list)	Definitely would have made the improvements	1	50%
	Probably would have made the improvements	1	50%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

	Response	*(n=2)*	*Percent of Respondents*
CA2. Had you implemented a similar project prior to attending the BOC training?	Yes	0	0%
	No	2	100%
	Don't know	0	0%

	Response	*(n=2)*	*Percent of Respondents*
CA3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	1	50%
	No	1	50%
	Don't know	0	0%

	Response	*(n=2)*	*Percent of Respondents**
CA5. What kind of compressed air project did you implement? (Do not read list. Select all that apply.)	New high efficiency single-speed compressor	0	0%
	New high efficiency variable-speed compressor	1	50%
	New efficient refrigerated air dryer	2	100%
	New efficient desiccant air dryer	0	0%
	Improved staging controls	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=11)*	*Percent of Respondents*
EMS1. Now I would like to ask you some questions about the energy management system(s) you implemented. How likely is it that you would have made these improvements had you not attended the course? (Read list)	Definitely would have made the improvements	7	64%
	Probably would have made the improvements	3	27%
	Probably would not have made the improvements	1	9%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

EMS2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=11)*	*Percent of Respondents*
	Yes	4	36%
	No	7	64%
	Don't know	0	0%

EMS3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=11)*	*Percent of Respondents*
	Yes	4	36%
	No	7	64%
	Don't know	0	0%

EMS5. Please describe the function of the energy management system? (Do not read list. Select all that apply.)	*Response*	*(n=11)*	*Percent of Respondents**
	On and off schedule	6	55%
	Does everything	1	9%
	Cooling plant optimization	5	45%
	Cooling distribution optimization	2	18%
	Outdoor air ventilization (economizer)	5	45%
	Outdoor air ventilization (demand controlled ventilation with CO sensor)	2	18%
	Air distribution optimization	3	27%
	Heating plant and distribution optimization	4	36%
	Other (please specify)	7	64%
	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%.*

EMS6. Did the energy management system produce electricity or natural gas savings or both?	*Response*	*(n=11)*	*Percent of Respondents*
	Electricity savings	4	36%
	Natural gas savings	0	0%
	Both	7	64%
	Don't know	0	0%

HS1. Now I would like to ask you some questions about the heating system improvements you implemented. How likely is it that you would have made these improvements had you not attended the course? (Read list)	*Response*	*(n=8)*	*Percent of Respondents*
	Definitely would have made the improvements	5	63%
	Probably would have made the improvements	3	38%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

HS2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	3	38%
	No	5	63%
	Don't know	0	0%

HS3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	2	25%
	No	5	63%
	Don't know	1	13%

HS4. What type of heating system improvements that produced energy savings did you implement? (Do not read list. Select all that apply)	*Response*	*(n=8)*	*Percent of Respondents**
	Installed a heat recovery system	2	25%
	Installed a high efficiency boiler	2	25%
	Installed a high efficiency low turn-down burner	0	0%
	Installed oxygen trim control	0	0%
	Other (please describe the type and quantity of equipment installed)	5	63%
	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%.*

HS6. Did the heating system improvements produce electricity or natural gas savings or both?	*Response*	*(n=8)*	*Percent of Respondents*
	Electricity savings	3	38%
	Natural gas savings	3	38%
	Both	2	25%
	Don't know	0	0%

AC1. Now I would like to ask you some questions about the air conditioning improvements you implemented. How likely is it that you would have made these improvements had you not attended the course? (Read list)	*Response*	*(n=8)*	*Percent of Respondents*
	Definitely would have made the improvements	5	63%
	Probably would have made the improvements	2	25%
	Probably would not have made the improvements	1	13%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

AC2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	0	0%
	No	8	100%
	Don't know	0	0%

AC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	3	38%
	No	4	50%
	Don't know	1	13%

	Response	*(n=8)*	*Percent of Respondents**
AC4. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Installed new high-efficiency chiller(s)	2	25%
	Installed new cooling towers	1	13%
	Installed new terminal units	1	13%
	Installed an oxygen trim control	1	13%
	Don't know	0	0%
	Other (please explain)	4	50%

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

	Response	*(n=6)*	*Percent of Respondents*
E1. Now I would like to ask you some questions about the economizers on air handlers you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	1	17%
	Probably would have made the improvements	3	50%
	Probably would not have made the improvements	1	17%
	Definitely would not have made the improvements	0	0%
	Don't know	1	17%

	Response	*(n=6)*	*Percent of Respondents*
E2. Had you implemented a similar project prior to attending the BOC training?	Yes	2	33%
	No	4	67%
	Don't know	0	0%

	Response	*(n=6)*	*Percent of Respondents*
E3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	1	17%
	No	5	83%
	Don't know	0	0%

	Response	*(n=6)*	*Percent of Respondents*
E5. Did the economizers produce electricity, or natural gas savings or both?	Electricity savings	4	67%
	Natural gas savings	0	0%
	Both	2	33%
	Don't know	0	0%

	Response	*(n=4)*	*Percent of Respondents*
WH1. Now I would like to ask you some questions about the water heating improvements you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	2	50%
	Probably would have made the improvements	1	25%
	Probably would not have made the improvements	1	25%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

WH2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	0	0%
	No	4	100%
	Don't know	0	0%

WH3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=4)*	*Percent of Respondents*
	Yes	2	50%
	No	1	25%
	Don't know	1	25%

WH4. What type of water heating improvements that produced energy savings did you implement? (Do not read list. Select all that apply)	*Response*	*(n=2)*	*Percent of Respondents**
	Installed timeclock to turn off circulation pump after hours	0	0%
	Installed heat recovery system (How many?)	0	0%
	Insulated pipes(s) (How thick was the insulation? (How many feet?)	0	0%
	Installed a more efficient hot water heater? (What was the efficiency of the old unit? And the new unit?	0	0%
	Other (Please describe the type and quantity of equipment installed)	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%.*

WH6. Did the water heating project produce electricity, or natural gas savings or both?	*Response*	*(n=4)*	*Percent of Respondents*
	Electricity savings	1	25%
	Natural gas savings	2	50%
	Both	1	25%
	Don't know	0	0%

O1. Now I would like to ask you some questions about the other projects you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	*Response*	*(n=2)*	*Percent of Respondents*
	Definitely would have made the improvements	1	50%
	Probably would have made the improvements	1	50%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

O2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=2)*	*Percent of Respondents*
	Yes	2	100%
	No	0	0%
	Don't know	0	0%

O3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=2)*	*Percent of Respondents*
	Yes	1	50%
	No	1	50%
	Don't know	0	0%

O4. Did the water heating project produce electricity, or natural gas savings or both?	*Response*	*(n=2)*	*Percent of Respondents*
	Electricity savings	2	100%
	Natural gas savings	0	0%
	Both	0	0%
	Don't know	0	0%

26A. Please indicate if you have performed maintenance on the cooling system equipment differently or more frequently or both since participating in the BOC training. Maintenance on the cooling system.	*Response*	*(n=35)*	*Percent of Respondents*
	Differently	2	6%
	More Frequently	6	17%
	Both	2	6%
	No Change	20	57%
	Don't know	5	14%

26B. Please indicate if you have performed maintenance on the heating equipment differently or more frequently or both since participating in the BOC training. Maintenance on the heating equipment.	*Response*	*(n=35)*	*Percent of Respondents*
	Differently	1	3%
	More Frequently	5	14%
	Both	2	6%
	No Change	22	63%
	Don't know	5	14%

26C. Please indicate if you have performed maintenance on motors (including belt alignment and tension) differently or more frequently or both since participating in the BOC training. Motor maintenance, including belt alignment and tension.	*Response*	*(n=35)*	*Percent of Respondents*
	Differently	0	0%
	More Frequently	9	26%
	Both	1	3%
	No Change	20	57%
	Don't know	5	14%

26D. Please indicate if you have performed maintenance on compressed air systems differently or more frequently or both since participating in the BOC training. Maintenance on compressed air system.	*Response*	*(n=35)*	*Percent of Respondents*
	Differently	1	3%
	More Frequently	1	3%
	Both	1	3%
	No Change	21	60%
	Don't know	11	31%

26E. Please indicate if you have performed electrical panel maintenance differently or more frequently or both since participating in the BOC training. Electrical panel maintenance.	*Response*	*(n=35)*	*Percent of Respondents*
	Differently	1	3%
	More Frequently	4	11%
	Both	0	0%
	No Change	26	74%
	Don't know	4	11%

26F. Please indicate if you have performed ventilation maintenance differently or more frequently or both since participating in the BOC training. Ventilation maintenance.	*Response*	*(n=35)*	*Percent of Respondents*
	Differently	1	3%
	More Frequently	5	14%
	Both	1	3%
	No Change	23	66%
	Don't know	5	14%

26G. Please indicate if you have performed other energy savings maintenance differently or more frequently or both since participating in the BOC training. Other maintenance.	*Response*	*(n=35)*	*Percent of Respondents*
	Differently	1	3%
	More Frequently	3	9%
	Both	0	0%
	No Change	23	66%
	Don't know	8	23%

27. At how many facilities did you make these changes to your maintenance practices?	*Response*	*(n=16)*	*Percent of Respondents*
	1	11	69%
	2	1	6%
	3	0	0%
	4	0	0%
	5	0	0%
	6	0	0%
	7	0	0%
	8	0	0%
	9	0	0%
	10 or more	3	19%
	Don't know	1	6%

CS1. You mentioned that you have changed how you perform maintenance on cooling system equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	*Response*	*(n=10)*	*Percent of Respondents*
	Definitely would have made the improvements	2	20%
	Probably would have made the improvements	2	20%
	Probably would not have made the improvements	6	60%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=10)*	*Percent of Respondents**
CS2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Changes to water treatment	5	50%
	Changes to cooling tower service	4	40%
	Changes to chiller bundle cleaning	5	50%
	Changes to condenser cleaning	7	70%
	Changes to refrigerant charge adjustment	3	30%
	Changes to sensor calibration	6	60%
	Changes to system diagnostics	4	40%
	Other changes	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=8)*	*Percent of Respondents*
HE1. You mentioned that you have changed how you perform maintenance on heating equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	4	50%
	Probably would not have made the improvements	3	38%
	Definitely would not have made the improvements	1	13%
	Don't know	0	0%

	Response	*(n=8)*	*Percent of Respondents**
HE2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Water treatment	3	38%
	Steam trap service	4	50%
	Heat exchanger cleaning	3	38%
	Blowdown frequency	3	38%
	Sensor Calibration	5	63%
	System diagnostics	1	13%
	Other (please specify)	2	25%
	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=10)*	*Percent of Respondents*
MM1. You mentioned that you have changed how you perform maintenance on motor equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	5	50%
	Probably would not have made the improvements	5	50%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=10)*	*Percent of Respondents**
MM2. Please tell me which of the following changes you have made to your motor maintenance. (Do not read list. Select all that apply)	Lubrication	8	80%
	Belt alignment/tensioning/replacement	8	80%
	Coupling alignment	1	10%
	Notched/Cogged/X-belts	1	10%
	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%.*

	(n=10)	
MM4. How many motors did you perform maintenance on?	Average (horsepower)	14.2

	(n=10)		
MM5. What is the average horsepower of the motors you performed maintenance on?	Average (horsepower)		12.1

	Response	*(n=3)*	*Percent of Respondents*
AC1. You mentioned that you have changed how you perform maintenance on air compressor equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	1	33%
	Probably would have made the improvements	1	33%
	Probably would not have made the improvements	1	33%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=3)*	*Percent of Respondents**
AC2. Please tell me all the changes you have made to your air compressor equipment maintenance. (Do not read list. Select all that apply)	Audible leak detection	2	67%
	Ultra-sonic leak detection	1	33%
	Pressure optimization	1	33%
	End-use isolation	2	67%
	Filter changes	2	67%
	System diagnostics	3	100%
	Other (please specify)	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=5)*	*Percent of Respondents*
EP1. You mentioned that you have changed how you perform maintenance on electrical panels since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	3	60%
	Probably would not have made the improvements	1	20%
	Definitely would not have made the improvements	1	20%
	Don't know	0	0%

	Response	*(n=5)*	*Percent of Respondents**
EP2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Thermal analysis and connection tightening	5	100%
	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*
VM1. You mentioned that you have changed how you perform ventilation maintenance since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	1	14%
	Probably would have made the improvements	2	29%
	Probably would not have made the improvements	2	29%
	Definitely would not have made the improvements	0	0%
	Don't know	2	29%

	Response	*(n=7)*	*Percent of Respondents**
VM2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Economizer optimization/repair	4	57%
	Sensor Calibration	2	29%
	Setpoint optimization	3	43%
	Balancing	0	0%
	Filter changes	5	71%
	System diagnostics	0	0%
	Sealed leaks / replaced door gaskets	1	14%
	Other (please specify)	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%.*

	(n=7)	
VM5. What is the total horsepower of the serviced fans?	Average (horsepower)	40.7

	Response	*(n=4)*	*Percent of Respondents*
OM1. You mentioned that you have changed how you perform other types of maintenance since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	1	25%
	Probably would not have made the improvements	3	75%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=7)*	*Percent of Respondents**
28. Do you think that there are certain barriers that may make it difficult for potential program participants to attend or complete the BOC training? What are they? (Don't read list. Select all that apply.)	Time	7	100%
	Cost	10	143%
	Not aware of it	1	14%
	Supervisor approval	3	43%
	No barriers	15	214%
	Don't know	2	29%

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

	Response	*(n=35)*	*Percent of Respondents*
29A. Please indicate your level of satisfaction with the following elements of the BOC training. Course schedule.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	1	3%
	Satisfied	12	34%
	Very Satisfied	22	63%
	Don't know	0	0%

	Response	*(n=35)*	*Percent of Respondents*
29B. Please indicate your level of satisfaction with the following elements of the BOC training. Course instructors.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	1	3%
	Satisfied	10	29%
	Very Satisfied	24	69%
	Don't know	0	0%

	Response	*(n=35)*	*Percent of Respondents*
29C. Please indicate your level of satisfaction with the following elements of the BOC training. Tuition rebate application process.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	1	3%
	Satisfied	11	31%
	Very Satisfied	20	57%
	Don't know	3	9%

	Response	*(n=35)*	*Percent of Respondents*
29D. Please indicate your level of satisfaction with the following elements of the BOC training. Tuition rebate amount.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	1	3%
	Satisfied	11	31%
	Very Satisfied	20	57%
	Don't know	3	9%

	Response	*(n=35)*	*Percent of Respondents*
29E. Please indicate your level of satisfaction with the following elements of the BOC training. Time elapsed to receive tuition rebate.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	1	3%
	Satisfied	10	29%
	Very Satisfied	14	40%
	Don't know	10	29%

	Response	*(n=35)*	*Percent of Respondents*
29F. Please indicate your level of satisfaction with the following elements of the BOC training. Overall experience with the BOC Program.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	0	0%
	Satisfied	13	37%
	Very Satisfied	22	63%
	Don't know	0	0%

	Response	*(n=35)*	*Percent of Respondents*
31A. Please indicate if you had already completed energy budget implementation prior to completing BOC training, before and after the training, only completed them after attending BOC training, or have not yet completed.	Completed Prior to Training	4	11%
	Completed Before and After Training	3	9%
	Only Completed After Training	4	11%
	Not Yet Completed Them	17	49%
	Don't know	7	20%

	Response	*(n=35)*	*Percent of Respondents*
31B. Please indicate if you had already recorded energy use over time prior to completing BOC training, before and after the training, only completed them after attending BOC training, or have not yet completed.	Completed Prior to Training	8	23%
	Completed Before and After Training	5	14%
	Only Completed After Training	7	20%
	Not Yet Completed Them	7	20%
	Don't know	8	23%

	Response	*(n=35)*	*Percent of Respondents*
31C. Please indicate if you had already set energy savings goals prior to completing BOC training, before and after the training, only completed them after attending BOC training, or have not yet completed.	Completed Prior to Training	7	20%
	Completed Before and After Training	7	20%
	Only Completed After Training	5	14%
	Not Yet Completed Them	8	23%
	Don't know	8	23%

	Response	*(n=35)*	*Percent of Respondents*
31D. Please indicate if you had already achieved energy savings goals prior to completing BOC training, before and after the training, only completed them after attending BOC training, or have not yet completed.	Completed Prior to Training	3	9%
	Completed Before and After Training	8	23%
	Only Completed After Training	6	17%
	Not Yet Completed Them	7	20%
	Don't know	11	31%

	Response	*(n=35)*	*Percent of Respondents*
32. Have you participated in any other DCEO energy efficiency programs?	Yes	1	3%
	No	34	97%
	Don't know	0	0%

	Response	*(n=1)*	*Percent of Respondents*
32B. How important was the BOC course in your decision to participate in these other DCEO programs? (Read list)	Very important	1	100%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important at all	0	0%
	Don’t know/Not applicable	0	0%

	Response	*(n=35)*	*Percent of Respondents*
33. What is your current job title? (Do not read list)	Operations/Facilities operations manager	12	34%
	Maintenance manager	0	0%
	HVAC supervisor or technician	1	3%
	Engineering manager	3	9%
	Facilities manager	0	0%
	Engineer	1	3%
	Maintenance manager	2	6%
	General contractor	0	0%
	Building management specialist	5	14%
	Other engineering position	7	20%
	Other manager, team leader, supervisor	4	11%

	(n=35)	
34. How many years have you worked in this role?	Average Years	11.1

	(n=35)	
35. How many building operator staff is there at your current location?	Average Staff	5.5

	(n=32)	
36. How many of these staff have completed the BOC training (either Level 1 or Level 1&2)?	Average BOC Completion	2.6