

Evaluation of Illinois Energy Now  
Building Operator Certification® Program  
June 2013 through May 2014

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Prepared for:  
Illinois Department of Commerce Economic Opportunity

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# Table of Contents

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Executive Summary .....	ES-1
1.Introduction.....	1-1
2.Savings Calculation Methodology .....	2-1
3.Estimation of Net Savings .....	3-1
4.Process Evaluation .....	4-1
5.Conclusions and Recommendations .....	5-1
Appendix A: Questionnaire for Participant Survey .....	A-1
Appendix B: Participant Survey Responses .....	B-1

## List of Figures

---

Figure 4-1 Process Evaluation Overview .....	4-2
Figure 4-2 Participant Reported Current Job Titles .....	4-4
Figure 4-3 How Participants Learned about the BOC Tuition Rebate .....	4-6
Figure 4-4 Information Sources Typically Used by Participants.....	4-7
Figure 4-5 Participant Motivations to Enroll in BOC Course .....	4-8
Figure 4-6 Energy Efficiency Implementations Following BOC Training .....	4-10
Figure 4-7 Maintenance Changes Following BOC Training .....	4-11
Figure 4-8 Procedural Energy Efficiency Activities Completed by Participants .....	4-12

## List of Tables

---

Table ES-1 Sources Referenced for Savings Calculations .....	ES-1
Table ES-2 Net Savings by Measure for Participant Sample .....	ES-2
Table ES-3 Summary of Net kWh Savings for BOC Program.....	ES-3
Table ES-4 Summary of Net kW Savings for BOC Program.....	ES-3
Table ES-5 Summary of Net Therms Savings for BOC Program .....	ES-3
Table ES-6 Summary of Net Savings from EPY6/GPY3 Projects.....	ES-4
Table 2-1 Sources Referenced for Savings Calculations .....	2-1
Table 3-1 Free Ridership Scores for Survey Variable Responses .....	3-2
Table 3-2 Reported Projects by Measure Type and Influence Level.....	3-3
Table 3-3 Distribution of Net-to-Gross Respondents for Cited Projects.....	3-5
Table 3-4 Net Savings by Measure for Participant Sample .....	3-5
Table 3-5 Distribution of Natural Gas Utilities Among BOC Participants .....	3-6
Table 3-6 Distribution of Electric Utilities Among BOC Participants .....	3-6
Table 3-7 Summary of Net kWh Savings for BOC Program .....	3-7
Table 3-8 Summary of Net kW Savings for BOC Program .....	3-7
Table 3-9 Summary of Net Therms Savings for BOC Program.....	3-7
Table 3-10 Summary of Net Savings from EPY6/GPY3 Projects .....	3-8
Table 4-1 Respondent Facility Types .....	4-3
Table 4-2 Existing Energy Efficiency Policies and Procedures .....	4-5
Table 4-3 Barriers to Applying BOC Knowledge .....	4-13
Table 4-4 Participant Satisfaction Ratings by Program Element.....	4-14

# Executive Summary

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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 2013 through May 2014, defined as electric program year six and natural gas program year three (EPY6/GPY3).

The main features of the evaluation approach are as follows:

- Data used to perform the savings evaluation were collected through review of program materials, interviews with MEEA staff, 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.
- Free ridership and program net savings were estimated using survey-based analysis methods applied to data collected through a survey of BOC participants.
- For the process evaluation, relevant MEEA staff provided information about program performance and changes to program design.

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*

<i>Measure Category</i>	<i>Energy Savings Sources</i>
Lighting Controls	Illinois Statewide TRM
VSD	Illinois Statewide 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.
Water Heating Improvements	Illinois Statewide TRM

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*

<i>Measure Category</i>	<i>Total Sampled Net Savings (Adjusted for Partial FR)</i>		
	<i>kWh</i>	<i>kW</i>	<i>Therms</i>
Lighting Controls	4,278.37	.72	-
VSD	9,791.52	3.84	-
Water Heating	-	-	42.13
Maintenance	2,427.30	.21	-
Total	16,497.19	4.77	42.13

The total savings shown above were extrapolated to represent the population of BOC participants who completed the MEEA BOC Program training during EPY6/GPY3. Of the nine sampled BOC participants who were associated with potential net savings through the program, evaluators were able to contact and verify savings for four facilities. The remaining five participants either could not be reached during the follow-up effort, or were not able to provide sufficient information to calculate savings for their projects.

This resulted in a total savings value representing the nine BOC participants who had implemented projects attributable to the program. In order to account for the savings associated with the projects from these five participants, the evaluators calculated the average savings among the four participants whose projects could be verified and quantified. This average savings value was then applied to each of the five participants whose project savings could not otherwise be adequately calculated.

This savings value was then divided by the total number of survey respondents (26) in order to determine the average savings per sampled participant. Once this savings value was determined, the savings were extrapolated to the program participant population.

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 EPY6/GPY3. 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 are not attributed to the EEPS funded BOC Program.

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

<i>Electric Utility</i>	<i>Realized Net kWh Savings</i>
Ameren	28,552.84
ComEd	59,960.96
Total	88,513.80

Table ES-4 presents the program's EPY6/GPY3 net kW savings by utility.

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

<i>Utility</i>	<i>Realized Net kW Savings</i>
Ameren	8.25
ComEd	17.32
Total	25.57

Table ES-5 presents the program's EPY6/GPY3 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 EEPS funded BOC Program.

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

<i>Utility</i>	<i>Realized Net Therm Savings</i>
Ameren	87.49
Nicor	58.33
Peoples	69.27
North Shore	7.29
Total	222.38

The total net energy savings of the Building Operator Certification® Program during EPY6/GPY3 are summarized in Table ES-6. During this period, net energy savings attributed to the program totaled 88,513.80 kWh, 25.57 kW, and 222.38 therms. These values do not include savings generated through non-EEPS utilities, which totaled 28,552.84 kWh, 8.25 kW, and 76.56 therms.



*Table ES-6 Summary of Net Savings from EPY6/GPY3 Projects*

<i>Savings Level</i>	<i>Total Net Savings*</i>		
	<i>kWh</i>	<i>kW</i>	<i>Therms</i>
Per Participant	1,079.44	0.31	2.71
Extrapolated to EPY6/GPY3 Participants	88,513.80	25.57	222.38

\*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 EPY6/GPY3 activity:

- **There are Persisting Limitations for Program Savings Impacts:** As with prior program years, 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 much lower than program expectations. These limitations are likely related to multiple issues. One specific example is that several participants have reported that they participated in the BOC Program in order to meet the requirements of the ComEd Retro-commissioning program. Although the existence of the ComEd program has generated interest in Building Operator Certification, participants who sign up to the BOC Program for this purpose may be less likely to implement additional measures beyond those included in their rebated retro-commissioning project. Other more general issues related to savings limitations include participants' ability to recall project implementation during surveying, financial barriers to actual project implementation, organizational barriers to implementation such as supervisor approval challenges, and possible lack of motivation to proceed with project implementation.
- **Program Net Savings Have Decreased Substantially Across Program Years:** Net attributable kWh savings decreased from over one million kWh in EPY4/GPY1, to approximately 550,000 kWh in EPY5/GPY2, to less than 100,000 kWh in EPY6/GPY3. However, there is no evidence to suggest that the lower savings for EPY6/GPY3 are due to a systematic program issue, or that savings will continue to decrease in future years. As the range of possible projects implemented by BOC participants is very wide in terms of scope, cost, and end use, there is likely to be high savings variability across program years.
- **The Majority of Reported Measures Received Rebates from other Incentive Programs:** Both EPY4/GPY1 and EPY5/GPY2 evaluations showed that many BOC participants implemented energy efficiency projects following their course attendance but also received additional incentives for these projects. For EPY6/GPY3, of the 49 non-maintenance

measures reported by survey participants, 25 measures (51%) received a rebate. This is a slightly higher percentage than was found for EPY5/GPY2 (40%). Although it appears that the BOC Program is successfully directing participants toward additional incentive programs, these savings are not included in the BOC Program's net savings totals.

- **Staffing Resources appear to be Sufficient:** MEEA experienced an organizational staffing transition during EPY5/GPY2, which involved training new staff members and reorganizing BOC program responsibilities. Currently in EPY6/GPY3, it appears that the newer program staff members have become familiar with program procedures and structure, and overall the BOC program has sufficient staffing resources to meet its objectives.
- **Program Satisfaction Continues to be High:** Consistent with prior years, respondents provided few reports 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. The majority of respondents cited specific courses or topics that had been particularly useful to them in their current employment roles, and some respondents explained that they had been able to implement specific energy saving initiatives as a result of new information learned through BOC training. From the participant perspective, there are no apparent issues with program structure or delivery that require immediate attention.
- **MEEA is Continually Monitoring and Improving Program Components:** MEEA has made significant changes to BOC course structure, program marketing and outreach, and program resources over the past three years. MEEA has created new partnerships with educational institutions and community organizations, developed electronic informational tools, and refined course content to reflect the most up-to-date building operation trends and practices. As the program moves forward it will be important to have a proactive management structure that can modify program design and strategies as needed, and MEEA appears well-suited to this role.

The following is a summary of key recommendations from the EPY6/GPY3 evaluation of the BOC Program:

- **Consider and Plan for External Project Incentive Activity:** Throughout the program cycle, BOC participants sought and received additional measure incentives from external efficiency programs. As stated in prior evaluation reports, the BOC program leads to energy savings through two channels: by directing participants toward utility incentive programs that will claim energy savings, and by encouraging participants to achieve non-incentivized energy savings. As the incentivized energy savings are not attributed to the BOC program itself, the program savings goals should account for the fact that many BOC graduates will seek additional rebates for their energy efficiency implementations.
- **Continue to Notify Participants of Potential Evaluation Follow-up:** During the evaluation, it was difficult to reach a sufficient number of participants by telephone or email for surveying purposes. As the contact information for participants appeared to be accurate and complete, the lack of responsiveness likely derived from participant disinterest in completing a survey, or participants not expecting to receive survey requests about their

experiences in the program. In either of these cases, ensuring that BOC graduates are aware of potential survey follow-up calls and emails may help to increase participant responsiveness. MEEA has made efforts to inform participants that evaluator surveying may occur, and continuing this practice may help to improve future evaluator data collection results.

- **Continue to Pursue Distance Learning Development and Online Resources:** In EPY5/GPY2, MEEA discussed the possibility of offering a course format consisting of five in-person classes supplemented by online courses. This was intended to increase the appeal of the BOC to those who otherwise would not be able to attend all of the courses in person due to the time and distance commitments. While only a few participants have mentioned the training locations as being inconvenient, it is possible that a lack of distance learning options is a persisting barrier for non-participants who have not applied for the program. If the demand for further online resources and distance learning is not currently known, it may be beneficial for MEEA to conduct a survey or interviews with building operators at existing non-participant facilities in order to determine the value that these resources may have.

# 1. Introduction

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This report presents the results of the impact and 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 2013 through May 2014.

## 1.1 Description of Program

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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 three-year program cycle began in June 2011.

### 1.1.1 Program Administration

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 materials provided by NEEC are related to technical foundations. MEEA works with instructors to create course content specific to the region, e.g. 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, industry associations, and industry groups such as ASHRAE and the State Board of Education.

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## 1.2 Impact Evaluation Approach

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The overall objective of the impact evaluation of the BOC Program was to estimate the electric and natural gas savings that resulted from participation in the program. 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:

- Surveys administered to EPY6/GPY3 BOC Program participants<sup>1</sup>;
- 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

Participants in the BOC Program for EPY6/GPY3 were contacted by telephone or email to ascertain what energy efficiency measures they had 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 implemented the measures without the training) and questions related to process evaluation.

Although ADM attempted to contact all EPY6/GPY3 participants by telephone and email, some participants did not respond to the survey requests. Out of the 82 participants who completed the BOC Program training during the program year, 26 responded to the initial participant survey.

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. ADM evaluation staff members verified that the energy efficiency measures were installed and functioning 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 savings estimation methodology being referenced for the particular measure.

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<sup>1</sup> ADM attempted to contact all EPY6/GPY3 participants for the purposes of telephone or online surveying. A total of 26 participants ultimately responded to the survey requests.

- Third, ADM staff members interviewed the contact personnel at the 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

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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 MEEA staff to identify and obtain relevant documents for review.

As with prior years, 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.
- Extracting information about participant facility types and the types of businesses represented by program participants.
- Quantifying the total number of EPY6/GPY3 BOC Program participants for the purposes of savings extrapolation.

#### 1.3.2 Conduct Program Staff Interviews

The evaluators interviewed MEEA program management staff in order to gain insight into changes to program structure or operation, to identify current program issues and trends, and to determine the status of issues identified during prior evaluations.

For EPY6/GPY3, topics addressed by the in-depth interview included:

- Organizational changes to the program since EPY5/GPY2;
- Marketing activity and strategy for the current program year;
- Current strengths and weaknesses of the program;
- Areas where the program has been changed or strengthened; and
- Anticipated changes to the program.

#### 1.3.3 Conduct Participant Surveys

The evaluators collected data from BOC Program participants to support the process evaluation. As with the EPY5/GPY2 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. In total, 26 of the 82 BOC participants responded to the participant survey.

The content of the survey focused on the following issues:

- Motivations for participating in the program;
- Factors that influenced the participant to enroll in the program;
- Satisfaction with the program;
- 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 used 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 provided 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

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This report on the impact and process evaluation of the Building Operator Certification® Program for the period June 2013 through May 2014 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

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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 six and natural gas program year three (EPY6/GPY3) during the period of June 2013 through May 2014. 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 EPY6/GPY3 net savings for the program.

### 2.1 Review of Participant Survey Responses

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The participant survey administered to BOC training participants served as the initial source for data regarding projects implemented during EPY6/GPY3. Participants provided information related to measures installed and equipment changes implemented after participating in the training program. Participants provided 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 EPY6/GPY3 of the program.

### 2.2 Selection of Data Sources for Savings Calculation

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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 EPY6/GPY3 savings estimation process are listed in Table 2-1 below.

*Table 2-1 Sources Referenced for Savings Calculations*

<i>Measure Category</i>	<i>Energy Savings Sources</i>
Lighting Controls	Illinois Statewide TRM
VSD	Illinois Statewide 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.
Water Heating Improvements	Illinois Statewide TRM



## 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.

### 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*

$$\Delta kWh = kW_{\text{Controlled}} * \text{Hours} * \text{ESF} * \text{WHF}_e$$

#### *Summer Coincident Peak Demand Savings*

$$\Delta kW = kW_{\text{controlled}} * \text{WHF}_d * (\text{CF}_{\text{baseline}} - \text{CF}_{\text{os}})$$

Where,

$kW_{\text{Controlled}}$  = 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;

<i>Lighting Control Type</i>	<i>Default kw controlled</i>
Wall mounted occupancy sensor	0.350 <sup>2</sup>
Remote mounted occupancy sensor	0.587 <sup>3</sup>
Fixture mounted sensor	0.073 <sup>4</sup>

Hours = total operating hours of the controlled lighting circuit before the lighting controls are installed. This number should be collected from the participant. Average hours of use per year are provided in the TRM for each building type if participant-specific information is not collected. If unknown building 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).

<i>Lighting Control Type</i>	<i>Energy Savings Factor<sup>5</sup></i>
Wall or Ceiling-Mounted Occupancy Sensors	41% or custom
Fixture Mounted Occupancy Sensors	30% or custom

<sup>2</sup> Goldberg et al, State of Wisconsin Public Service Commission of Wisconsin, Focus on Energy Evaluation, Business Programs, Incremental Cost Study, KEMA, October 28, 2009

<sup>3</sup> Ibid

<sup>4</sup> Efficiency Vermont TRM 2/19/2010

<sup>5</sup> Kuiken, Tammy et 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.

$WHF_e$  = 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  $WHF_d$  is 1.

$CF_{baseline}$  = 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.

$CF_{os}$  = Retrofit Summer Peak Coincidence Factor. This factor is 0.15 for the lighting system with Occupancy Sensors installed, of building type.<sup>6</sup>

### *Natural Gas Energy Savings*

$$\Delta\text{Therms} = \Delta\text{kWh}^* - IF_{\text{Therms}}$$

Where,

$IF_{\text{Therms}}$  = 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 building 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:

#### *Energy Savings*

$$\Delta\text{kWh} = \text{kW}_{\text{controlled}} * \text{HOURS} * (1 + IF_{\text{kWh}}) * \text{ESF}$$

Where,

$\text{kW}_{\text{controlled}}$  = 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.

<sup>6</sup> 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.

### 2.3.3 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*

$$\Delta \text{kWh} = \text{kW}_{\text{connected}} * \text{Hours} * \text{ESF}$$

Where,

$\text{kW}_{\text{Connected}}$  = kW of equipment is calculated using motor efficiency.

$(\text{HP} * .746 \text{ kw/hp} * \text{load factor}) / \text{motor efficiency}$

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.<sup>7</sup> When available, actual hours should be used.

<i>Building Type</i>	<i>Pumps and fans</i>
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.

<i>Application</i>	<i>ESF<sup>8</sup></i>
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227

<sup>7</sup>Com Ed Trm June 1, 2010 page 139.

<sup>8</sup>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>.

<i>Application</i>	<i>ESF<sup>8</sup></i>
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

### *Summer Coincident Peak Demand Savings*

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

Where,

DSF = Demand Savings Factor varies by VFD application.<sup>9</sup> Values listed below are based on typical peak load for the listed application. When possible the actual Demand Savings Factor should be calculated.

<i>Application</i>	<i>DSF</i>
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

### 2.3.4 Water Heater Savings

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

#### *Energy Savings*

$$\Delta \text{Therms} = [(W_{\text{gal}} \times 8.33 \times 1 \times (T_{\text{out}} - T_{\text{in}}) \times [(1/\text{Eff base}) - (1/\text{Eff ee})]/100,000] + [(SL \times 8,766)/\text{Eff base}] / 100,000 \text{ Btu/Therms}]$$

Where,

$W_{\text{gal}}$  = Custom, otherwise assume 21,915 gallons

$T_{\text{out}}$  = Custom, otherwise assume 130 degree F

$T_{\text{in}}$  = Custom, otherwise assume 54.1 degree F

### 2.3.5 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 an 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

<sup>9</sup>Ibid

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.

### 3. Estimation of Net Savings

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This chapter reports the results from estimating the net impacts of the Building Operator Certification (BOC) Program during EPY6/GPY3, where net savings represents the savings achieved by program participants that can be attributed to the effects of the program (i.e. savings that are not associated with free-ridership).

The free-ridership methodology for EPY6/GPY3 is identical to the methodology used for EPY5/GPY2.

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 estimating net and gross savings.

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

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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 has stated that some BOC training courses would not have taken place, or that they 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. This determination has been implemented for all evaluation years including EPY6/GPY3.

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 “100%” in Table 3-1.

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

*Table 3-1 Free Ridership Scores for Survey Variable Responses*

<i>Likelihood of Implementation without Program</i>	<i>Free Ridership Score</i>
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%

To prevent double counting savings across programs, participants were asked if they received an incentive for the energy saving project that was 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 26 program participants for projects completed during or after participant attendance of BOC training courses in EPY6/GPY3.

In order to conduct an efficient and accurate savings estimation process, free ridership rates were initially calculated at 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 measures 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 EPY6/GPY3.

Ten out of the 26 surveyed participants indicated that they implemented at least one project because of their completion of the BOC training courses. Of these 10, nine stated that they did not receive a separate utility incentive for at least one project. Thus, nine of the surveyed participants reported projects whose savings are at least partially attributable to the program.<sup>10</sup> Savings were calculated only for projects with savings at least partially attributable to the DCEO BOC Program. The following table presents the number of reported projects by measure type or 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 he or she did not receive a separate incentive from another energy efficiency program. Determining net savings for the DCEO BOC Program includes accounting for the influence BOC training had. Follow-up telephone interviews were conducted to determine the savings for 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	6	1
Lighting	7	2
Motors	2	1

<sup>10</sup> 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)
VSD	3	0
EMS	2	1
Heating System	2	1
Air Conditioning	5	4
Water Heating	2	2
Cooling Maintenance	4	4
Heating Maintenance	5	5
Ventilation Maintenance	4	4
Other Maintenance	2	2
Total	44	27

The evaluators conducted follow-up verification and data collection with each participant to ensure that measures cited during the survey effort were accurately recorded and were associated with BOC Program influences.

The above values are based 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, including EMS measures and some types of maintenance, were determined to have been implemented prior to the participant enrolling in the BOC training, or had not yet been implemented at the time of the follow-up verification telephone call. Additionally, during the follow-up call one respondent indicated that they actually had received an incentive for their project.

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.

The free-ridership responses were fairly evenly distributed. The most significant difference between the EPY6/GPY3 free-ridership responses and the EPY5/GPY2 free-ridership responses is that during EPY5/GPY2, 99% of reported projects had full or partial free-ridership. For the current year, 24% of projects definitely would not have occurred without the BOC Program and therefore have a 0% free-ridership score. This suggests that participants for EPY6/GPY3 were more influenced to implement projects than participants in prior years.

The values shown below represent all reported measures in the survey, regardless of whether a separate utility or DCEO incentive was received for the project.

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

<i>Associated Free Ridership Score</i>	<i>Associated Free Ridership Score</i>	<i>Percentage of Claimed Projects (N = 80)</i>
Definitely would have implemented without program	100%	21%
Probably would have implemented without program	50%	34%
Probably would not have implemented without program	33%	21%
Definitely would not have implemented without program	0%	24%

### 3.2.1 Discussion of Net-to-Gross Findings

Although a smaller percentage of EPY6/GPY3 projects were associated with full or partial free-ridership than prior years, the percentage of projects receiving utility or DCEO incentives remained high. Of the 49 non-maintenance measures reported by BOC participants in EPY6/GPY3, more than half (51%) were associated with other incentive programs. While the BOC training was likely influential for many of these projects, the incentivized savings are claimable by DCEO and the utilities and cannot also be attributed to the BOC Program. This issue has been relevant for each evaluation year, and it is possible that a higher proportion of projects will be incentivized in coming years as incentive program awareness increases over time.

### 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 kWh and kW savings among equipment retrofit implementations, followed by variable speed drives (VSD) and lighting replacements. Maintenance improvements accounted for the highest overall portion of kWh, kW, and Therms savings.

*Table 3-4 Net Savings by Measure for Participant Sample*

<i>Measure Category</i>	<i>Total Sampled Net Savings (Adjusted for Partial FR)</i>		
	<i>kWh</i>	<i>kW</i>	<i>Therms</i>
Lighting Controls	4,278.37	.72	-
VSD	9,791.52	3.84	-
Water Heating	-	-	42.13
Maintenance	2,427.30	.21	-
Total	16,497.19	4.77	42.13

The total savings shown above were then extrapolated to represent the population of BOC participants who completed the MEEA BOC Program training during EPY6/GPY3. Of the nine

sampled BOC participants who were associated with potential net savings through the program, the evaluators were able to contact and verify savings with four facilities. The remaining five participants either could not be reached during the follow-up effort, or were not able to provide sufficient information to calculate savings for their projects.

In order to account for the savings associated with the projects from these five participants, the evaluators calculated the average savings among the four participants whose projects could be verified and quantified. This average savings value was then applied to each of the five participants whose project savings could not otherwise be adequately calculated. This resulted in a total savings value representing the nine BOC participants who had implemented attributable projects.

This savings value was then divided by the total number of survey respondents (26) in order to determine the average savings per sampled participant. Once this savings value was determined, the savings were extrapolated to the program participant population.

According to program documentation, there were 82 graduates of the BOC program during EPY6/GPY3. Savings were extrapolated based on the distribution of utility service providers among the participant population. Table 3-5 and Table 3-6 present the percentage of BOC participants serviced by each electric and gas utility during EPY6/GPY3. 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*

<i>Utility</i>	<i>Percentage of Total Participants</i>
Ameren	29%
Nicor	20%
Peoples	23%
North Shore	2%
Other/None	26%
Total	100%

*Table 3-6 Distribution of Electric Utilities Among BOC Participants*

<i>Utility</i>	<i>Percentage of Total Participants</i>
Ameren	24%
ComEd	51%
Other	24%
Total	100%

Table 3-7 presents the net kWh savings by utility for the Building Operator Certification® Program during EPY6/GPY3. 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 claimable by the BOC Program investor utilities.

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

<i>Electric Utility</i>	<i>Realized Net kWh Savings</i>
Ameren	28,552.84
ComEd	59,960.96
Total	88,513.80

Table 3-8 presents the net kW savings by utility for the Building Operator Certification® Program during EPY6/GPY3.

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

<i>Utility</i>	<i>Realized Net kW Savings</i>
Ameren	8.25
ComEd	17.32
Total	25.57

Table 3-9 presents the net natural gas savings by utility for the Building Operator Certification® Program during EPY6/GPY3. 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*

<i>Utility</i>	<i>Realized Net Therm Savings</i>
Ameren	87.49
Nicor	58.33
Peoples	69.27
North Shore	7.29
Total	222.38

The total net energy savings of the Building Operator Certification® Program during EPY6/GPY3 are summarized in the following table. During this period, net energy savings attributable to the program totaled 88,513.80 kWh, 25.57 kW, and 222.38 therms. These values do not include savings generated through non-EEPS utilities, which totaled 28,552.84 kWh, 8.25 kW, and 76.56 therms.

*Table 3-10 Summary of Net Savings from EPY6/GPY3 Projects*

<i>Savings Level</i>	<i>Total Net Savings*</i>		
	<i>kWh</i>	<i>kW</i>	<i>Therms</i>
Per Participant	1,079.44	0.31	2.71
Extrapolated to EPY6/GPY3 Participants	88,513.80	25.57	222.38

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

These savings values are much lower than either EPY5/GPY2 or EPY4/GPY1 savings, although EPY6/GPY3 participants reported a higher rate of measure implementation than participants in prior years. Two main factors account for the lower savings values for this program year:

1. Some measures were deemed ineligible for savings during follow-up conversations with participants. This includes measures that received incentives, measures that were implemented prior to the BOC training, and measures that did not result in energy savings.
2. In prior years, a small number of large projects with high energy savings skewed the sampled savings upward, substantially influencing the extrapolated savings. In EPY6/GPY3, all savings-eligible projects were fairly small (less than 20,000 kWh and 100 therms) by comparison. Without any large lighting, lighting controls, or HVAC projects, the potential for savings decreased significantly.

There is no evidence to suggest that the lower savings for EPY6/GPY3 were due to a systematic program issue, or that savings will continue to decrease in future years. The range of possible projects implemented by BOC participants is very wide in terms of scope, cost, and end use likely resulting in high savings variability across program years.

## 4. Process Evaluation

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This chapter discusses results of the Building Operator Certification® Program process evaluation for electric program year six and natural gas program year three (EPY6/GPY3).

The purpose of the process evaluation is to assess the program from a structural, operational, and managerial perspective in order to identify program strengths, weaknesses, and opportunities. This evaluation is based on surveys with BOC participants, MEEA staff feedback, and analysis of program data and documentation.

As the BOC Program has now been evaluated for multiple consecutive years, this evaluation includes comparisons of findings across program years in order to document any significant similarities or differences in program operation or performance over time.

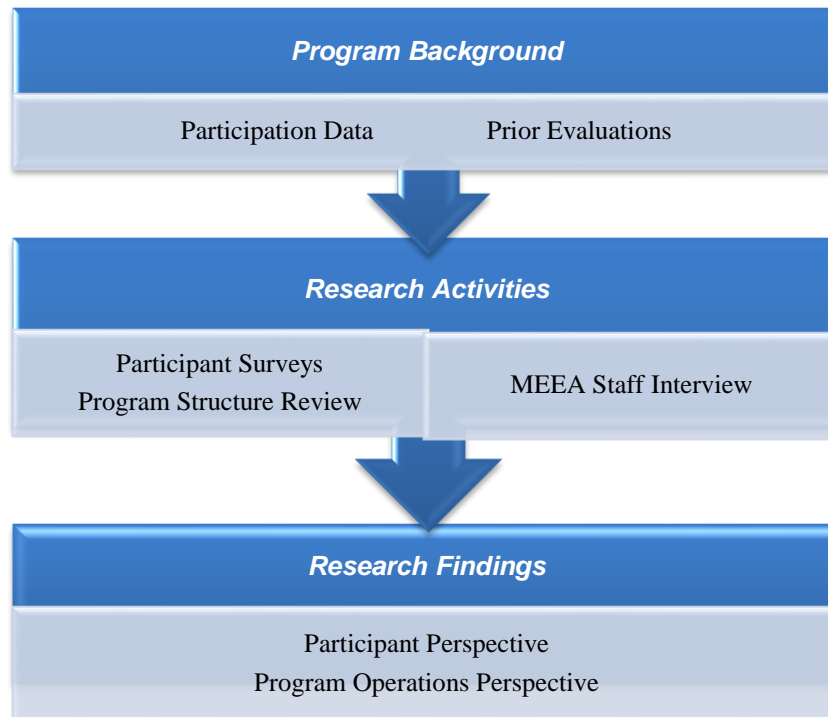
This chapter begins with a summary and discussion of the results from the EPY6/GPY3 BOC participant survey. This is followed by a discussion of the outcomes of the MEEA staff interview. The chapter concludes by highlighting key findings and program recommendations resulting from the process evaluation.

### 4.1 Evaluation Objectives

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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 six and natural gas program year three (EPY6/GPY3). 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 EPY6/GPY3 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 reduce barriers to increased energy efficiency project implementation?
- Did the Building Operator Certification® Program respond to previous recommendations obtained through prior evaluation efforts?

During the evaluation, data and information from several sources were analyzed to achieve the stated research objectives. Participant perspectives on the BOC training program were collected using a survey tool conducted over the phone and online. Staff perspectives on the internal organization and operational efficiency of program delivery were examined through an interview with MEEA Program Management staff, and review of program documentation (e.g. promotional literature, 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 EPY6/GPY3 of the Building Operator Certification® Program evaluation, 26 program participants responded to the participant survey.

- Interview with MEEA staff: An interview with MEEA staff provided insight into various aspects of the program and its organization. MEEA staff also provided information about recent organizational and procedural improvements that have been implemented in order to enhance program efficiency and effectiveness.

### 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 six and natural gas program year three (EPY6/GPY3), 82 course participants successfully completed the training and received the associated certification. In total, 26 participants fully responded to the process evaluation components of the telephone or online survey.

The EPY6/GPY3 survey instrument was nearly identical to the instrument used for EPY5/GPY2 in terms of program areas discussed and types of information gathered. This section presents comparisons between EPY6/GPY3 and EPY5/GPY2 participant responses when relevant.

#### 4.3.1 Participant Characteristics

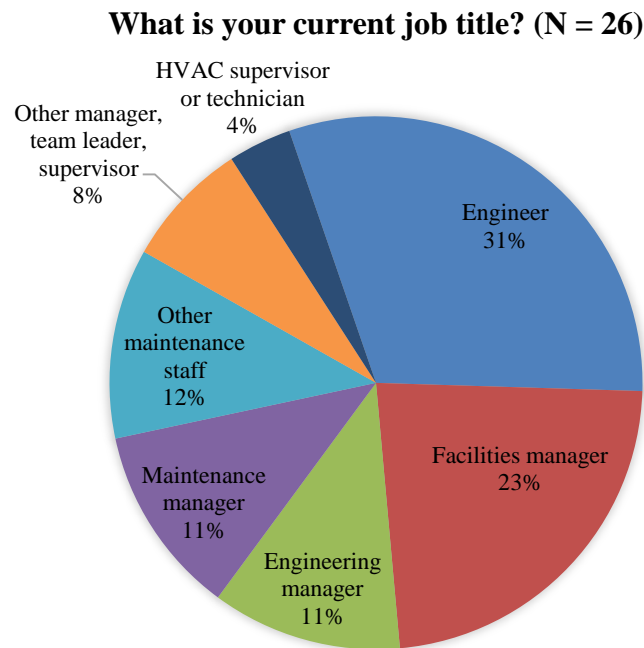
Survey respondents represented a range of facility types. As shown in Table 4-1, 23% of respondents reported belonging to hospitals and 38% of respondents reported belonging to offices, most commonly mid-rise offices (19% of total respondents). Nineteen percent of respondents reported belonging to other facility types that were not listed, including a courthouse and a retirement center.

*Table 4-1 Respondent Facility Types*

	<i>Response</i>	<i>Percentage of Respondents (N =26)</i>
What is your facility type?	Hospital	23%
	Office - Mid Rise	19%
	Other	19%
	Office - High Rise	15%
	Manufacturing Facility	12%
	College/University	4%
	Office - Low Rise	4%
	Retail/Service	4%



Survey respondents were asked a series of questions related to employment including job titles, and length of employment in their current role. As shown in the figure below, 31% of respondents stated that they were engineers. Twenty-three percent of respondents reported being facilities managers. Overall, more than one-half of the survey respondents reported holding managerial or supervisory roles. These results are fairly consistent with those from EPY5/GPY2, and suggest that individuals with a wide range of backgrounds are participating in BOC training.



*Figure 4-2 Participant Reported Current Job Titles*

When asked how long they had worked in their current role, respondents provided a wide range of responses, ranging from one to 36 years. The average was approximately nine years. As with prior evaluations, this suggests that participants are highly experienced in their fields, and are likely very familiar with their facilities' equipment and processes.

Respondents were also asked about the number of building operator staff in their facilities. On average, respondents reported that their facilities had 7.6 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 only 1.9 staff members had accomplished this. Based on these responses, there are likely remaining BOC Program candidates in many of the currently participating facilities.

#### 4.3.2 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 energy efficiency policies or procedures that

may be in place at their facilities. As shown in Table 4-2, more than two-thirds of respondents (69%) indicated that they have an energy management plan, while 62% reported that they have policies that incorporate energy efficiency into operations and procurement procedures.

More than one-half of the survey respondents stated that they actively train their staff about energy efficiency, which suggests that these BOC graduates may have structured opportunities to share their knowledge with colleagues. The results for this topic have been very similar across program years, and generally indicate that BOC participants belong to organizations that engage in energy efficiency planning and implementation.

*Table 4-2 Existing Energy Efficiency Policies and Procedures*

	<i>Response</i>	<i>Percent of Respondents (n=26)</i>
Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements?	An energy management plan	69%
	Policies that incorporate energy efficiency in operations and procurement	62%
	A staff member responsible for energy and energy efficiency	58%
	Active training of staff	54%
	Don't know	8%
	Other	8%

Eight respondents provided information about their facilities' energy management plan goals. Goals varied widely among respondents, with some goals relating to specific end-uses and others affecting the energy usage of the entire facility. Three respondents were not able to provide specific details and explained the goals are set by their supervisors or other staff members. Specific commentary related to energy management plans includes:

*[The goal is] to cut utility usage by three percent.*

*The goal we shoot for is 5-8 percent reduction per year.*

*The peak load is not to exceed 1,200 kW, [and the] base load has to be under 200 kW.*

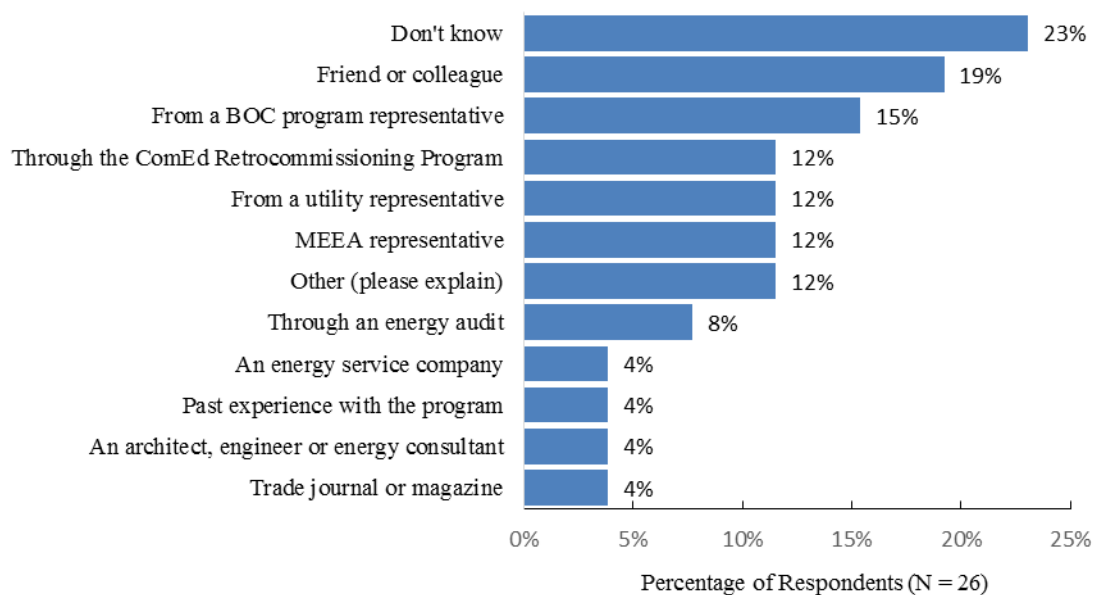
#### 4.3.3 Program Awareness and Information Channels

As with prior years, BOC participants were asked a series of questions designed to offer 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 tuition rebate. The percentages shown are the percentages of respondents. A fairly high percentage of respondents (23%) were not able to state how they learned about the tuition rebate; these respondents may not have known that their organization received the rebate on their behalf. Aside from this, the most common way BOC participants learned about the available tuition incentive was through a friend or colleague.

Although this option was not included in the initial response list, three respondents reported that they learned of the BOC Program or tuition rebate through the ComEd Retro-commissioning Program. As stated in prior evaluation reports, this Retro-commissioning Program includes a Building Operator Certification® requirement for participating facilities, which has consistently generated a small amount of BOC participation in each program year.

Respondents also learned of the BOC rebate from a utility representative, a Midwest Energy Efficiency Alliance (MEEA) representative, and through energy audits. Only one respondent reported that they knew about the tuition rebate due to past experience with the BOC Program.



*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:

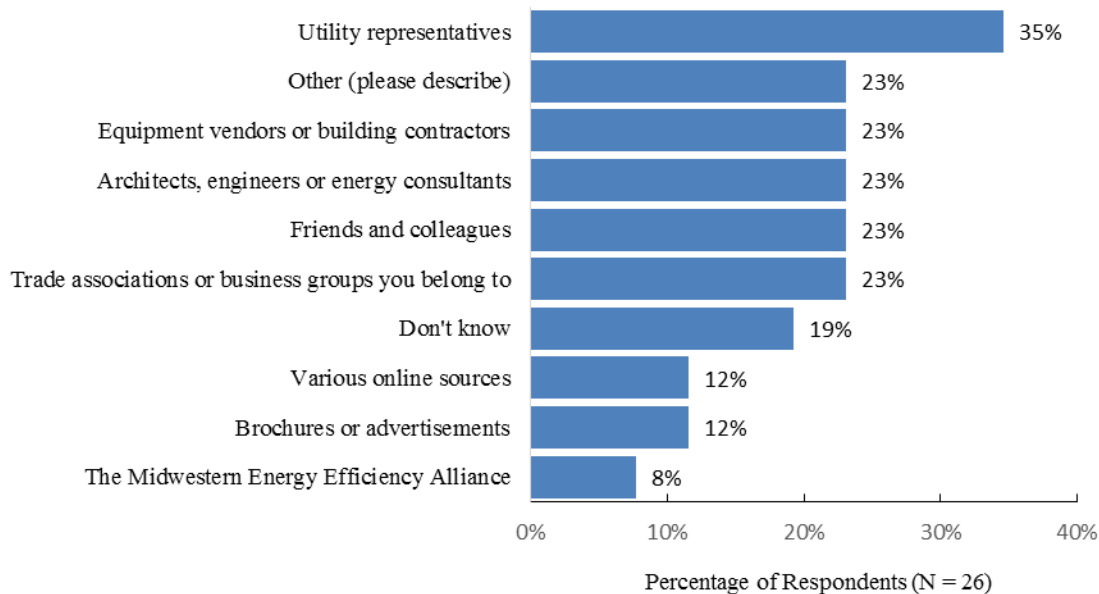
- A DCEO representative;
- The DCEO website;
- Brochures or advertisements;

- Trade associations or business groups;
- An Energy Resource Center (ERC) representative;
- Equipment vendor or building contractor; and
- Conference workshop or seminar.

Participants were asked to name sources 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 source of information was utility representatives, mentioned by more than one-third of respondents. This was followed by several other sources, including equipment vendors and contractors, friends and colleagues, and trade associations and business groups. These responses contrast with those found for EPY5/GPY2, where very few respondents reported relying on utility representatives as sources for energy efficiency. Additionally, none of the survey respondents reported that they rely on DCEO representatives or the DCEO website for information regarding energy efficiency practices and opportunities.

MEEA conducts outreach through many channels, including working with community organizations, publishing newsletters, and developing online resources. The broad range of information sources used by participants highlights the importance of this comprehensive marketing approach.

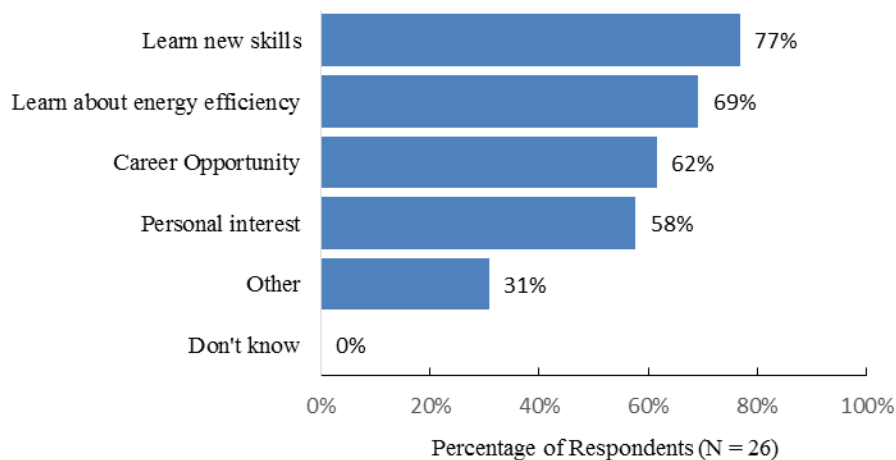


*Figure 4-4 Information Sources Typically Used by Participants*

#### 4.3.4 Factors Affecting Participation

Participants cited several main factors when asked what motivated them to participate in the courses, as shown in Figure 4-5. Respondents were able to select more than one reason for participating in the program, and the majority of respondents provided at least two responses.

The most common reasons participants cited for participating in the training course were to learn new skills, or to learn about energy efficiency. Sixty-two percent of respondents indicated that they participated due to a career opportunity, and more than half (58%) stated that they participated out of personal interest.



*Figure 4-5 Participant Motivations to Enroll in BOC Course*

Additionally, four respondents explained that they were required to complete the BOC training in order to receive a rebate from another program. This likely relates to the ComEd Retro-commissioning Program requirement discussed above, which has been cited by participants in each year of this program cycle.

As reported during prior years, 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, although it is possible that these individuals have been cross-influenced by multiple factors.

#### 4.3.5 Participant Actions Following BOC Training

In order to inform the savings impact component of the program evaluation, 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.

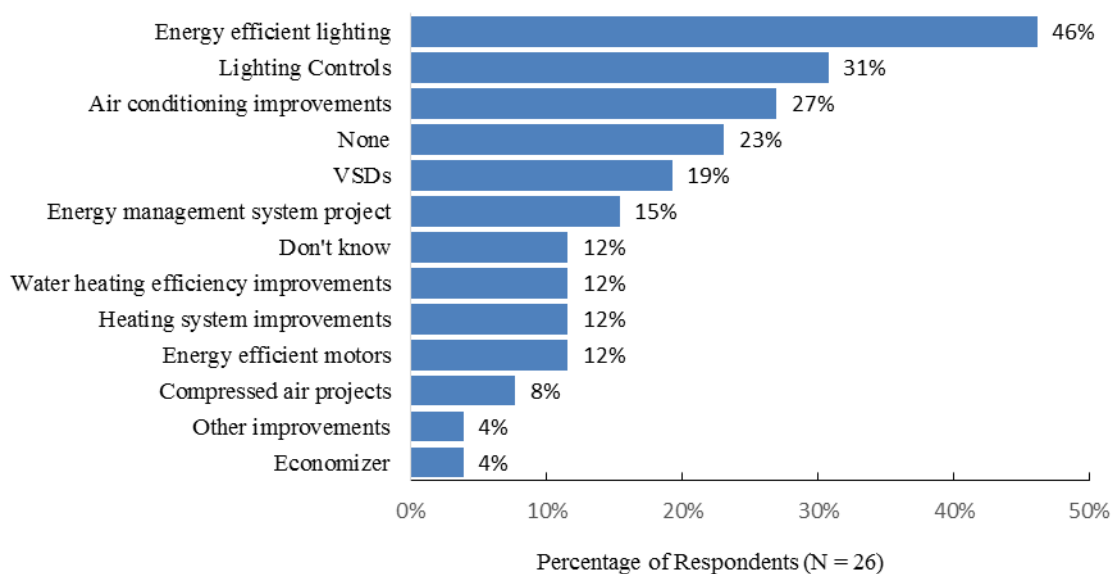
#### 4.3.6 Energy Efficient Equipment Implementation

Approximately 65% of respondents (17 of 26) indicated that they had purchased and installed new equipment since participating in the BOC courses. This is somewhat lower than prior program years, where approximately 85% of respondents reported implementing energy efficiency equipment following their participation.

Figure 4-6 displays the types of projects that were cited by these respondents. The distribution of equipment types is very similar to that of EPY5/GPY2 and EPY4/GPY1, with lighting and lighting controls being the most commonly reported measures. The next most common energy

efficiency measure was air conditioning improvements, followed by VSDs. Few respondents reported implementing heating, water heating, or motors improvements, and only one respondent reported that they had installed an economizer.

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).



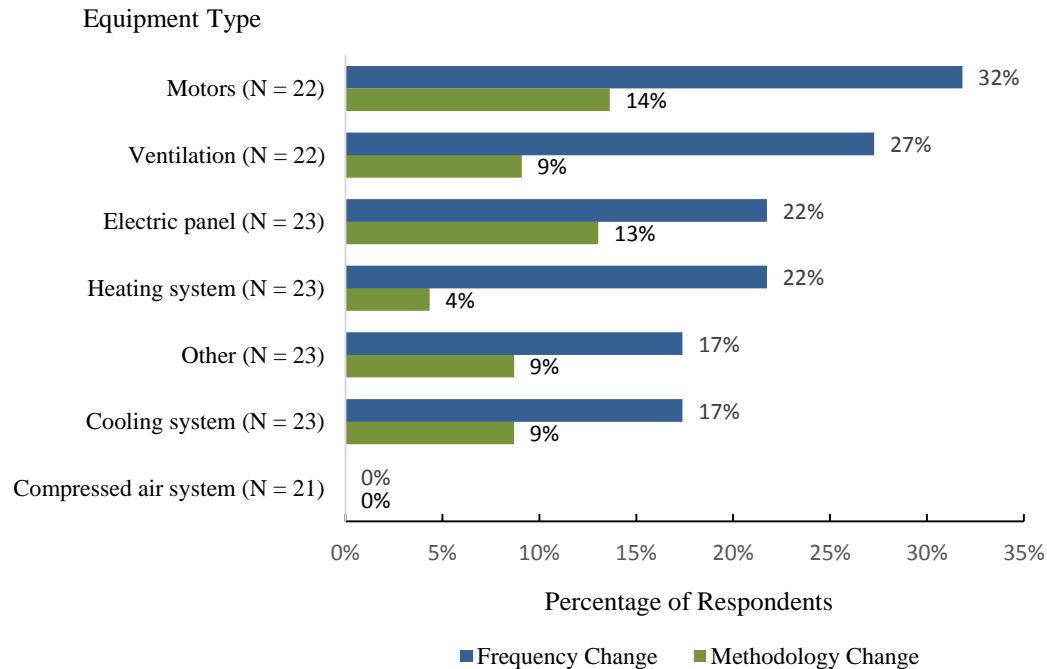
*Figure 4-6 Energy Efficiency Implementations Following BOC Training*

#### 4.3.7 Maintenance Improvements and Changes

Respondents were asked if they had implemented one or more maintenance improvements 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) or more frequently (such as maintaining equipment every six months rather than every year) since participating in the BOC training program.

Figure 4-7 displays the distribution of maintenance activities cited by 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 motors maintenance frequency, which was cited by 32% of these respondents. This was followed by increases in ventilation,

electric panel, and heating system maintenance frequency. As with prior years, the maintenance changes cited by respondents were more commonly related to frequency changes rather than methodological changes.



*Figure 4-7 Maintenance Changes Following BOC Training*

As with prior years, 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.

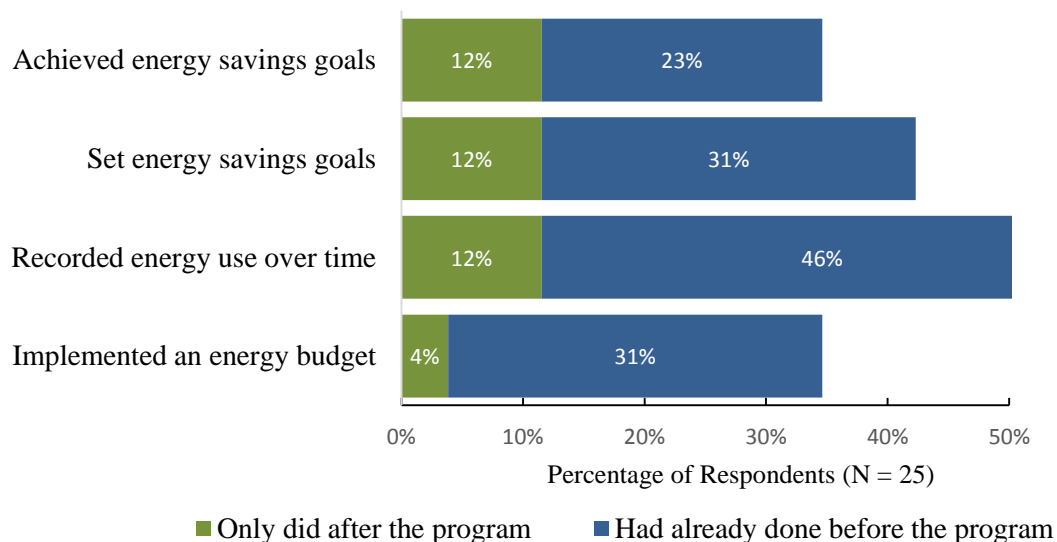
#### 4.3.8 Other Energy Efficiency Activities

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 4-8 displays the results.

Thirty-one percent of respondents reported that they had set energy savings goals prior to participating in the BOC training, and 23% of these respondents reported that they had achieved these goals before participating in the program. Twelve percent of respondents stated that they had only started recording their facilities' energy use after attending BOC training, while more than 40% of respondents reported that they had done this prior to the training. These findings are fairly similar to those from EPY5/GPY2 and EPY4/GPY1, and generally suggest that a significant portion of BOC participants had already implemented one or more energy saving behaviors before participating in the BOC Program. Overall, few respondents reported that they had only implemented a procedural energy efficiency activity after participating in the program.



*Figure 4-8 Procedural Energy Efficiency Activities Completed by Participants*

#### 4.3.9 Barriers to Implementation

In addition to asking participants whether they had implemented equipment or maintenance improvements since attending the BOC training, survey respondents were asked whether they had encountered any barriers to applying their BOC training in their workplace. Twenty-eight percent of respondents reported that they have encountered such barriers, and these respondents were asked to identify the barriers they have encountered.

These respondents provided a range of responses, but the majority (71%) cited insufficient budget as a barrier to BOC knowledge application. Respondents also cited lack of supervisor support and lack of organizational commitment to energy efficiency as barriers. Two respondents

mentioned barriers related to implementation of specific measures, including LEDs and air handler maintenance.

*Table 4-3 Barriers to Applying BOC Knowledge*

	<i>Response</i>	<i>Percent of Respondents (N = 7)</i>
What barriers have you encountered?	Lack of supervisor support	29%
	Insufficient budget	71%
	Organization/company not committed to energy efficiency improvements	29%
	Not enough staff resources to plan efficiency projects	14%
	Other (please specify)	43%
	Don't know	0%

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

These results suggest that with additional financial support, BOC participants may be better able to apply their BOC knowledge and implement energy efficiency improvements in their facilities, although the specific magnitude of existing financial barriers is unclear.

#### 4.3.10 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 *very dissatisfied* to *very satisfied*. Table 4-4 shows participant satisfaction by each selected program element.

Generally, participants reported high satisfaction levels for all program elements, most notably with the course instructors and the overall BOC Program experience. Course instructors were also highly rated during the prior two program years, which strongly indicates that the BOC Program has consistently used well-qualified and effective training staff. However, two respondents reported being dissatisfied with the course instructors, and one explained that their instructor was not thorough enough in reviewing the course content.

Respondents provided fewer instances of “very satisfied” responses for the course schedule, although only one respondent reported that they were dissatisfied with the schedule. This participant did not provide additional feedback regarding the course schedule, but participants in prior years have made scheduling recommendations such as reducing the number of required classes and spreading the course schedule out over a longer time period.

Several respondents were not able to provide satisfaction ratings for the tuition rebate program elements, likely because someone else in their organization processed and received the rebate.

Similarly, the respondent who reported being very dissatisfied with the rebate application process and the time elapsed to receive the rebate explained that they were not aware of the rebate.

Two respondents reported being dissatisfied with their overall program experience. One of these respondents explained that they did not learn anything useful from the program, while the other implied that the program was not relevant to their facility or position.

It should be noted that there were only a few instances of dissatisfaction overall, and that the majority of respondents provided positive feedback about the program both in their satisfaction ratings and in open-ended commentary during the survey.

*Table 4-4 Participant Satisfaction Ratings by Program Element*

<i>Element of Program Experience</i>	<i>Satisfaction Rating (N = 26)</i>					
	<i>Very Satisfied</i>	<i>Satisfied</i>	<i>Neither Satisfied nor Dissatisfied</i>	<i>Dissatisfied</i>	<i>Very Dissatisfied</i>	<i>Don't know</i>
Course instructors	42%	42%	8%	8%	-	-
Overall experience with BOC Program	38%	46%	8%	8%	-	-
Tuition rebate amount	35%	27%	19%	-	-	19%
Tuition rebate application process	31%	35%	15%	-	4%	15%
Time elapsed to receive tuition rebate	23%	35%	19%	-	4%	19%
Course schedule	19%	62%	15%	4%	-	-

Respondents have provided high satisfaction ratings for all listed program elements throughout the program cycle, which reflects very positively on program design, operation, and delivery. These consistent 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.

#### 4.3.11 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. Eighty-five percent of survey respondents reported that they had found at least one of the courses to be very useful. These respondents were asked to provide more information about which course(s) they found particularly useful and why they were useful.

Specific courses or subject matter cited as particularly useful by survey respondents include:

- Lighting (7 respondents)
- HVAC (2 respondents)
- Energy management (2 respondents)

- Indoor air quality (1 respondent)
- Electrical systems (1 respondent)
- VSDs (1 respondent)

Several participating survey respondents provided further details regarding why they benefited or what they learned from particular BOC courses. Specific commentary regarding course usefulness includes:

*The lighting courses helped me understand lighting retrofits and different strategies for energy savings through lighting.*

*We do a lot in lighting, the retro-commissioning was very interesting and the instructors were very good.*

*Benchmarking Energy Performance gives you the building blocks to start to track and see improvements that you have made when you implement something.*

*I found all of the courses useful. Some more than others. My back ground is HVAC but as a building manager I am exposed to everything.*

Throughout the program cycle, respondents have indicated that the BOC courses have been very valuable, and that the courses provide very useful and actionable information. Many of these participants had completed the BOC courses several months before responding to the survey, but were able to identify specific topics and courses that were particularly relevant and useful. As with prior years, it appears that the BOC is effectively training participants with lasting knowledge and skills.

Respondents were then asked whether they thought that any particular BOC course was not useful. Seven of the respondents (27%) reported that they had found at least one course to not be very useful, and five of these respondents elaborated on these opinions. One respondent explained that the electrical courses were too complex for most students, and that the course material was too advanced to be understood by non-electricians. Another respondent stated the opposite, explaining that as an electrician they did not gain anything from the electrical course.

Two respondents cited issues with particular instructors, with one respondent stating that their instructor was absent from one of the courses. The other of these respondents explained that their instructors were not fully engaged in the course material for one or more courses.

Overall, negative feedback about BOC courses appeared fairly anecdotal in nature, and the majority of respondents only provided positive course feedback. As participants have a wide array of backgrounds and facility types, it is likely that some course topics will not be relevant to certain individuals. However, the overall course feedback indicates that BOC participants are gaining valuable information and skills that are related to multiple end-uses.

#### 4.3.12 Participant Recommendations and Overall Impressions

The participant survey findings have been fairly consistent throughout the program cycle. Across program years, the majority of course feedback has been positive, and many of the respondents have provided commentary that praises the BOC classes for their relevance, effectiveness, and structure.

The majority of respondents cited specific courses or topics that had been particularly useful to them in their current employment roles, and some respondents explained that they had been able to implement specific energy saving initiatives as a result of new information learned through BOC training.

BOC participants rely on a fairly wide range of information sources to learn about energy efficiency, which emphasizes the importance of MEEA's active marketing and outreach strategy. Additionally, it appears that the currently participating facilities may have additional staff members who would be eligible for BOC training, so continued outreach with past participants may be beneficial.

In terms of barriers to energy efficiency implementation, participants most commonly reported insufficient funding as a barrier. However, the majority of participants stated that they had not encountered any significant barriers in applying the knowledge they had gained through BOC training.

As with prior years, 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.

#### 4.4 Program Operations Perspective

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This section summarizes core Midwest Energy Efficiency Alliance (MEEA) staff interview findings. In order to gather information regarding the operational efficiency and program delivery process for the Building Operator Certification® Program, MEEA program management staff was interviewed. Interview questions were designed to provide insight into any changes to the design, structure, and operation of the BOC Program since EPY5/GPY2, and to identify current program issues and trends.

##### 4.4.1 Summary of Interview Findings

- **Overcoming Program Barriers:** When asked about current and future program performance, interviewed staff discussed possible upcoming barriers to program success in coming years. Specifically, staff noted that the program is likely beginning to saturate the market of currently participating facility types, and that it will be necessary to reach new audiences and business types in the future. In order to address this, program staff has hired a marketing consultation firm that will be responsible for developing new promotional

methods and marketing messages. MEEA is also promoting the program through the “MEEA Minute” newsletter and through social networking sites in order to reach wider audiences.

- **Positioning of Program Outreach:** Program staff noted that MEEA has made efforts to build working relationships with various organizations in order to increase program awareness and provide energy education. For example, MEEA has worked with local colleges, the Energy Office, and the Green Technology Center, and these organizations currently promote the program throughout their respective networks of students, community organizations, and partners. Program staff explained that it is important for the marketing message to originate from a trusted local source, and that these working relationships are helpful in building program credibility. Additionally, MEEA is emphasizing customer testimonials and case studies of successful projects in its promotional strategy in order to highlight program benefits and demonstrate the value that Building Operator Certification has had for local organizations.
- **City of Chicago Benchmarking Ordinance Effects:** Program staff noted that the new benchmarking ordinance in the City of Chicago increased interest in the BOC program. The ordinance, effective June 1 of 2014, requires commercial and municipal facilities of 250,000 square feet or more to report their energy use. Program staff explained that this ordinance increases building operators’ awareness of their energy consumption and likely increases the priority of potential energy saving opportunities. Additionally, graduates of the BOC program are authorized by the City of Chicago to conduct energy benchmarking and collect energy data for submission to the city. This increases the overall appeal and value of the certification program.

The Chicago ordinance will continue to have this effect in future years as well due to its tiered implementation phases. In 2015, commercial and municipal facilities between 50,000 and 250,000 square feet will be added to the ordinance requirements, as will residential buildings with 250,000 or more square feet. In 2016 as the final phase of the ordinance, residential buildings between 50,000 and 250,000 square feet will also be added. Thus, the ordinance will likely increase program interest among a wide range of organizations in the City of Chicago, and may help in increasing program awareness outside the city as well.

- **Technical and Community College Connections:** Program staff explained that MEEA works with local technical and community colleges as part of its outreach effort. Staff noted that these schools usually have students who are willing to attend the BOC courses, some of whom are professionals who already have substantial work experience and are looking for further technical education. MEEA staff noted that although the BOC program is intended for individuals who have two or more years of work experience, some students who do not meet this requirement have been given a certificate of completion until they are able to obtain the experience. This working relationship with technical and community colleges helps to position the BOC program as a continuing education tool for both working professionals and full-time students.
- **Monitoring of Course Content and Relevance:** MEEA significantly modified the BOC course structure for EPY5/GPY2 in order to emphasize HVAC system education and to focus

on up-to-date coursework that trains participants to be proactive in facility operations and maintenance. The course structure remained fairly consistent between EPY5/GPY2 and EPY6/GPY3, although program staff noted that MEEA continually seeks to ensure that course topics and materials are up-to-date and relevant. This includes working with course coordinators to determine potential courses that may be beneficial to participants, and reviewing industry best practices. MEEA staff noted that additional curriculum changes will likely occur in the coming year.

- **Continued Military Veteran Outreach and Support:** MEEA continued to offer the military veteran component of the BOC for EPY6/GPY3, and a total of three veterans attended BOC courses during the year. Although veteran enrollment fell short of the target of 20 veterans, this program component serves as a valuable networking and employment resource to both veterans and building managers. During EPY6/GPY3, MEEA began working with employment partners in order to help BOC graduate veterans obtain employment after they complete the program. These employment partners have agreed to offer assistance with veterans' resume reviews, and to inform MEEA of job opportunities when they become available. For the coming program year, MEEA is expanding the veteran component to offer tuition discounts to military veterans who are employed, which may help to increase veteran enrollment.

MEEA staff also provided information related to the recommendations that were received for the program during EPY5/GPY2. This was designed to gauge whether any program changes had occurred as a result of the past recommendations. Relevant MEEA staff commentary is summarized as follows:

- **Development of Electronic Resources:** During the EPY5/GPY2 evaluation, MEEA staff discussed the online resources that had been developed for the BOC program, including technical education videos and informational literature hosted on the MEEA website. MEEA also mentioned the possible development of distance learning courses, which would be appealing to BOC participants who are not able to travel to the physical training locations.

For EPY6/GPY3, staff reported that MEEA has worked more closely with the Northwest Energy Efficiency Council (NEEC) to develop online resources, but that the distance learning program has not yet been implemented. As many BOC candidates prefer in-person meetings to computer-based interactions, and in-person training provides a more comprehensive educational experience, the primary program goal has been to provide high-quality in-person training. However, MEEA staff noted that the distance learning course may be implemented in the future.

- **Course Assessment Format and Frequency:** In order to collect more thorough and representative feedback on the program, MEEA has made efforts to improve the post-course surveying process for program participants. For example, a \$25 gift card is now offered to participants for completing the survey. Additionally, MEEA has revised and standardized all of the post-course surveys so that the answers can be compiled for regional comparison.

MEEA staff reported that the information gathered from these surveys will be useful in improving the program and meeting the needs and interests of its participants.

In addition to the post-course surveys, MEEA plans to conduct a post-graduate survey in the coming program year for participants who completed the BOC training in prior years. This is intended to gain insight into what BOC graduates have done in their workplaces since attending the training, as well as whether they are still applying the knowledge gained from the courses.



## 5. Conclusions and Recommendations

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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 six and natural gas program year three (EPY6/GPY3). 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

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- **There are persisting limitations for program savings impacts.** As with prior program years, 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 much lower than program expectations. These limitations are likely related to multiple issues. One specific example is that several participants have reported that they participated in the BOC Program in order to meet the requirements of the ComEd Retro-commissioning program. Although the existence of the ComEd program has generated interest in Building Operator Certification, participants who sign up to the BOC Program for this purpose may be less likely to implement additional measures beyond those included in their rebated retro-commissioning project. Other more general issues related to savings limitations include participants' ability to recall project implementation during surveying, financial barriers to actual project implementation, organizational barriers to implementation such as supervisor approval challenges, and possible lack of motivation to proceed with project implementation.
- **Program net savings have decreased substantially across program years.** Net attributable kWh savings decreased from over one million kWh in EPY4/GPY1, to approximately 550,000 kWh in EPY5/GPY2, to less than 100,000 kWh in EPY6/GPY3. However, there is no evidence to suggest that the lower savings for EPY6/GPY3 are due to a systematic program issue, or that savings will continue to decrease in future years. As the range of possible projects implemented by BOC participants is very wide in terms of scope, cost, and end use, there is likely to be high savings variability across program years.
- **The majority of reported measures received rebates from other incentive programs.** Both EPY4/GPY1 and EPY5/GPY2 evaluations showed that many BOC participants implemented energy efficiency projects following their course attendance but also received additional incentives for these projects. For EPY6/GPY3, of the 49 non-maintenance measures reported by survey participants, 25 measures (51%) received a rebate. This is a slightly higher percentage than was found for EPY5/GPY2 (40%). Although it appears that the BOC Program is successfully directing participants towards additional incentive programs, these savings are not included in the BOC Program's net savings totals.

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## 5.2 Process Conclusions

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- **Staffing resources appear to be sufficient.** MEEA experienced an organizational staffing transition during EPY5/GPY2, which involved training new staff members and reorganizing BOC program responsibilities. Currently in EPY6/GPY3, it appears that the newer program staff members have become very familiar with program procedures and structure, and that the BOC program has sufficient staffing resources to meet its objectives.
- **Program satisfaction continues to be high.** As with prior years, 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. The majority of respondents cited specific courses or topics that had been particularly useful to them in their current employment roles, and some respondents explained that they had been able to implement specific energy saving initiatives as a result of new information learned through BOC training. From the participant perspective, there are no apparent issues with program structure or delivery that require immediate attention.
- **MEEA is continually monitoring and improving program components.** MEEA has made significant changes to BOC course structure, program marketing and outreach, and program resources over the past three years. This includes creating new partnerships with educational institutions and community organizations, developing electronic informational tools, and refining course content in order to reflect the most up-to-date building operation trends and practices. As the program moves forward, it will be important to have a proactive management structure that is able to modify program design and strategies as needed, and MEEA appears to be well-suited to this role.

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## 5.3 Impact Recommendations

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- **Consider and Plan for External Project Incentive Activity:** Throughout the program cycle, BOC participants have sought and received additional measure incentives from external efficiency programs. As stated in prior evaluation reports, the BOC leads to energy savings through two channels: by directing participants towards utility incentive programs that will claim energy savings, and by causing participants to achieve non-incentivized energy savings. As the incentivized energy savings are not attributed to the BOC program itself, the program savings goals should account for the fact that many BOC graduates will seek additional rebates for their energy efficiency implementations.

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## 5.4 Process Recommendations

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- **Continue to Notify Participants of Potential Evaluation Follow-up:** During the evaluation, it was difficult to reach a sufficient number of participants by telephone or email for surveying purposes. As the contact information for participants appeared accurate and complete, the lack of responsiveness likely related to participants not wanting to take the time to complete a survey, or participants not expecting to receive survey requests about their experiences in the program. In either of these cases, ensuring that BOC graduates are aware of potential survey follow-up calls and emails may help to increase participant

responsiveness. MEEA has made efforts to inform participants that evaluator surveying may occur, and continuing this practice may help to improve future evaluator data collection results.

- **Continue to Pursue Distance Learning Development and Online Resources:** In EPY5/GPY2, MEEA discussed possible to offer a course format consisting of five in-person classes supplemented by online courses. This was intended to increase the appeal of the BOC to those who otherwise would not be able to attend all of the courses in person due to the time and distance commitments. While only a few participants have mentioned the training locations as being inconvenient, it is possible that a lack of distance learning options is a persisting barrier for non-participants who have not applied for the program. If the demand for further online resources and distance learning is not currently known, it may be beneficial for MEEA to conduct a survey or interviews with building operators at existing non-participant facilities in order to determine the value that these resources may have.

## Appendix A: Questionnaire for Participant Survey

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Hello may I speak with [participant name]? My name is \_\_\_\_\_ and I am calling on behalf of the Midwestern Energy Efficiency Alliance and the Illinois Department of Commerce and Economic Opportunity (DCEO).

According to our records you completed building operator certificate training and received a tuition rebate.

Is that correct?

- Yes
- No (*Thank and terminate*)
- Don't know (*Thank and terminate*)

I would like to speak with you about your experience with that course. The survey should take about 20 minutes. Is this a good time to talk?

*[If no, reschedule]*

*[If refused, skip to end of survey and hit submit]*

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
  - Other
  - Don't know
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
  - 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
- 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. How many hours per week is your site open for business?
16. 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
  - Don't know
17. 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
18. Is there somebody we can contact about the measures that may have been installed after attending the BOC course? Please provide a name, phone number, and email address.
19. At how many facilities did you implement any of the previously listed projects?
- 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7
  - 8
  - 9
  - 10 or more
  - Don't know
20. Is there somebody we can contact about the measures that may have been installed after attending the BOC course? Please provide a name, phone number, and email address.

### Energy Impact Follow Up Questions

#### Lighting Controls

- 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*)  
 Day lighting controls (*if checked, go to LC4D, LC4E, LC4F*)  
 Don't know

LC4A. How many fixtures are controlled by the occupancy sensors, what type of fixture are they, and what is the wattage of those fixtures?

	Type of fixture	Number of fixtures	Wattage of fixtures
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

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 sensors, what type of fixture are they, and what is the wattage of those fixtures?

	Type of fixture	Number of fixtures	Wattage of fixtures
1			
2			
3			
4			
5			
6			
7			

8			
9			
10			

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?

LC5 . What was the total estimated project cost for the lighting controls you installed? Please be as specific as possible.

### 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. How many lighting projects did you complete?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 or more
- Don't know

EEL3. Had you implemented a similar project prior to attending the BOC training?

- Yes
- No
- Don't know

EEL4. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?

- Yes
- No
- Don't know

EEL5. For the fixtures that were replaced in the (number of project) project, please indicate the type of fixture, number of fixtures, and wattage of those fixtures. (Repeat question for each facility which lighting projects were completed.)

	Fixture Type	Fixture Count	Fixture Wattage
Old fixture			
New fixture			

EEL6. How many hours per 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,*)
- Industrial end-use (*if selected, go to EEM4B*)
- Don't know

EEM4A. Thinking about one of the motors you installed, please provide the motor application (hot water pump, chilled water pump, supply fan, return fan, or cooling tower fan), efficiency of the motor, horsepower of the motor, and whether or not VSD's control the motor. Additionally, please state how many motors you installed that have these same specifications. (*After respondent provides this information, ask whether they installed any additional motors with different specifications. Then, place the additional data in a separate motor group and repeat the data collection procedure until all motors or sets of motors have been described.*)

*(If the respondent is unable to provide the information on the project specifics, ask if the interview could be rescheduled at a time when the respondent could provide the information, or if there is someone else to speak to who was knowledgeable about the projects.)*

	Efficiency of Motors	Motor application	Horsepower of motors	VSD's ("y" for yes / "n" for no)	Number installed
(Motor Group 1)					
(Motor Group 2)					
(Motor Group 3)					
(Motor Group 4)					
(Motor Group 5)					

EEM4B. Thinking about one of the motors you installed for industrial purposes, please provide the motor application (hot water pump, chilled water pump, supply fan, return fan, or cooling tower fan), efficiency of the motor, horsepower of the motor, and whether or not VSD's control the motor. Additionally, please state how many motors you installed that have these same specifications. *(After respondent provides this information, ask whether they installed any additional motors with different specifications. Then, place the additional data in a separate motor group and repeat the data collection procedure until all motors or sets of motors have been described.)*

*(If the respondent is unable to provide the information on the project specifics, ask if the interview could be rescheduled at a time when the respondent could provide the information, or if there is someone else to speak to who was knowledgeable about the projects.)*

	Efficiency of Motors	Number installed	Motor application	Horsepower of motors	Hours per day of operation	VSD's ("y" for yes / "n" for no)
(Motor Group 1)						
(Motor Group 2)						
(Motor Group 3)						
(Motor Group 4)						
(Motor Group 5)						

EEM5. What was the total estimated project cost for the efficient motors you installed? Please be as specific as possible.

EEM6. Who can we contact about the technical specifics of the energy efficient motors you installed? Please be as specific as possible.

**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	Number of VSDs Installed	Horsepower of Motors Controlled by VSDs
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?

Number of motors:	
-------------------	--

Individual motor horsepower:	
Operation hours:	
Motor efficiency:	

VSD5. What was the total estimated project cost for the VSD's you installed? Please be as specific as possible.

VSD6. 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 horsepower of each air compressor in the system?

	Horsepower	VSD? (yes or no)
Compressor 1		
Compressor 2		
Compressor 3		
Compressor 4		
Compressor 5		

CA5. What kind of compressed air project did you implement? (*Do not read list.*) (*Select all that apply.*) (*For each response selected, follow up with CA6.*)

- 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. For the new high efficiency (type of air compressor) compressor, what is the total number of compressors and horsepower of each new compressor? (Repeated for each compressed air project selected in CA5.)

Number of new compressors:	
Horsepower for each new compressor:	

CA7. What type of other air compressor project did you implement? Please describe the equipment and quantity of units.

CA8. 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. Did you install a new energy management system after the BOC training?

- Yes
- No
- Don't know

EMS6. Did you make changes to an existing energy management system after the BOC training?

- Yes
- No

Don't know

EMS7. 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 ventilation (economizer)
- Outdoor air ventilation (demand controlled ventilation with CO sensor)
- Air distribution optimization
- Heating plant and distribution optimization
- Other (*Please specify all other*)
- Don't know

EMS8. What was the total estimated project cost for the energy management system you installed? Please be as specific as possible.

EMS9. 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 is the primary heating system type for the system you made improvements to? (*Do not read list*) (*Select all that apply*)

- 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)
- Electric boiler
- Gas boiler
- Other (*Please specify*)
- Don't know

HS5. What type of heating system improvements that produce energy savings did you implement? (*Do not read list*) (*Select all that apply*) (*For each response selected, follow up with HS8.*)

- Installed a heat recovery system
- Installed a furnace
- 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

HS6. What is the primary fuel source for heating? (*Do not read list*)

- Electric
- Gas
- Oil
- Purchased steam
- Other (*Please specify*)
- Don't know

HS7. What kind of heating system efficiency improvements did you make? Please include as many details about capacity, efficiency, and quantity as possible.

HS8. What is the capacity and efficiency of the (improvement type) installed? (*Repeated for each project selected in HS5.*)

Capacity (BTU):	
Efficiency level (AFUE):	

HS9. What was the total estimated project cost for the energy efficient heating system you installed? Please be as specific as possible.

HS10. 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
- AC2. Had you implemented a similar project prior to attending the BOC training?
- Yes
  - No
  - Don't know
- AC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?
- Yes
  - No
  - Don't know
- AC4. What is the primary cooling system type for the system you made improvements to? (Do not read list) (Select all that apply)
- Chiller – air-cooled
  - Chiller – water or evaporatively cooled
  - Evaporative cooler
  - Fans
  - Direct expansion – air-cooled packaged or split system cooling or heat pump
  - Geothermal heat pump
  - Window or thermal units (PTAC/PTHP)
  - Other (*Please specify*)
  - 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) (*Go to AC7*)
  - Installed new terminal unit(s) (*Go to AC8*)
  - Installed heat pump(s) (*Go to AC9*)
  - Installed package unit(s) (*Go to AC10*)
  - Installed split system(s) (*Go to AC11*)
  - Other (*Please describe the type and quantity of equipment installed*)
  - Don't know
- AC6. What kind of air conditioning improvements did you make that were not listed above?
- AC7. What is the capacity and efficiency level of the chiller(s) you installed?

	Capacity	Efficiency level
Improvement type 1		

Improvement type 2		
Improvement type 3		

AC8. What is the capacity and efficiency level of the terminal unit(s) you installed?

	Number of units	Capacity (tons)	Efficiency level (EER)	Efficiency level (SEER)
Unit(s)				

AC9. What type of heat pump did you install? (*Do not read list*) (*Use as possible prompts*)

- Air cooled heat pump
- Water source heat pump
- Ground source heat pump
- Water cooled heat pump
- Don't know

AC9A. What is the capacity and efficiency level of the chiller(s) you installed?

	Number of heat pumps	Efficiency level (EER or SEER or HSPF or COP)
Capacity of: Less than 1 1/2 tons		
Capacity of: 1 1/2 tons to 2 1/2 tons		
Capacity of: More than 2 1/2 tons to 5 tons		
Capacity of: More than 5 tons to 11 tons		
Capacity of: More than 11 tons to less than 20 tons		
Capacity of: More than 20 tons		

AC10. What is the capacity and efficiency level of the package unit(s) you installed?

	Number of units	Efficiency level (EER or SEER)
Capacity of: Less than 1 1/2 tons		
Capacity of: 1 1/2 tons to 2 1/2 tons		
Capacity of: More than 2 1/2 tons to 5 tons		
Capacity of: More than 5 tons to 11 tons		
Capacity of: More than 11 tons to less than 20 tons		
Capacity of: More than 20 tons		

AC11. What is the capacity and efficiency level of the split system you installed?

	Number of units	Efficiency level (EER or SEER)
Capacity of: Less than 1 1/2 tons		
Capacity of: 1 1/2 tons to 2 1/2 tons		
Capacity of: More than 2 1/2 tons to 5 tons		

Capacity of: More than 5 tons to 11 tons		
Capacity of: More than 11 tons to less than 20 tons		
Capacity of: More than 20 tons		

AC12. What was the total estimated project cost for the air conditioning improvements you installed? Please be as specific as possible.

AC13. 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
- Don't know

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. For the installed economizer, what is the capacity of the cooling system (in tons)?

E5. What is the total estimated project cost for the economizer you installed?

E6. 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

WH4. What type of water heating improvements that produced energy savings did you implement? (*Do not read list. Select all that apply*)

- Installed timeclock to turn off circulation pump after hours (*Go to WH5 and WH6*)
- Installed heat recovery system (*Go to WH8*)
- Installed a more efficient hot water heater (*Go to WH7*)
- Insulated pipes(s) (*How thick was the insulation and how many linear feet were installed?*)
- Installed low-flow faucets, pre-rinse spray valves, or low-flow showerheads (*Go to WH10*)
- Other (*Go to WH8*)
- Don't know

WH5. What kind of water heating system is controlled by the timeclock?

- Boiler
- Hot water heater
- Don't know

WH6. What is the capacity and efficiency level of the boiler that the timeclock is installed on?

	Capacity (BTU)	Efficiency level (AFUE %)
Boiler		

WH7. What is the capacity, number, and efficiency level of the more efficient hot water heater or boiler?

	Capacity	Type	New efficiency	Old efficiency	Quantity
Heater/Boiler					
Heater/Boiler					
Heater/Boiler					
Heater/Boiler					
Heater/Boiler					

WH8. Please describe the water heating improvements that produced energy savings including the type of equipment and quantity.

WH9. What was the total estimated project cost for the water heating improvements you installed? Please be as specific as possible.

WH10. Please indicate the quantity of low-flow faucets, pre-rinse spray valves, and low-flow showerheads you installed:

Measure Type	Quantity Installed
Low-flow faucets	
Low-flow showerheads	
Pre-rinse spray valves	

### 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 these projects produce electricity, or natural gas savings or both?

- Electricity  
 Natural gas  
 Both  
 Don't know

O6. What was the total estimated project cost for the other energy efficiency improvements you installed? Please be as specific as possible.

O7. 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

21. 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.

	Differently	More Frequently	Both	No Chance	Don't Know
Maintenance on the cooling system equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maintenance on the heating equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Motor maintenance, including belt alignment and tension?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maintenance on compressed air system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electrical panel maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other energy savings maintenance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

22. At how many facilities did you make these changes to your maintenance practices?

- 1  
 2

- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 or more
- Don't know

### Follow Questions for Maintenance Improvements

#### 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 cooling tower service (*please include total tons*)
- Changes to chiller bundle cleaning (*please include chiller tons*)
- Changes to condenser cleaning (*please include cooling tons*)
- Changes to refrigerant charge adjustment (*please include system tons*)
- Other changes
- Don't know

**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)**

- Heat exchanger cleaning (*Please provide capacity in BTU's*)
- Blowdown frequency (*Please provide boiler capacity in BTU's and number of traps*)
- Steam trap (*Please provide number of traps and whether they were cleaned, repaired, or replaced*)
- Other
- Don't know

**HE3. Please ask for additional information for each change indicated above, such as how frequently the maintenance was performed before and after the course.**

**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.**

**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 ask for additional information for each change indicated above, such as how frequently the maintenance was performed before and after the course.**

**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.**

### **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 ask for additional information for each change indicated above, such as how frequently the maintenance was performed before and after the course.**

**VM4. What is the total horsepower of the serviced fans?**

**VM5. Who can we contact about the technical specifics of the ventilation maintenance practices if needed? Please provide a name, phone number, and email address.**

### **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.**

23. 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

24. Please indicate your level of satisfaction with the following elements of the BOC training.

Element of Experience	Very Dissatisfied	Dissatisfied	Neither Satisfied nor Dissatisfied	Satisfied	Very Satisfied	Don't know
Course schedule	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Course instructors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tuition rebate application process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tuition rebate amount	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time elapsed to receive tuition rebate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall experience with the BOC Program	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

24A. Please describe the ways in which you were not satisfied with the BOC training or the tuition rebate?

25. 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:

Activity	Completed Prior to Training	Completed Before and After Training	Only Completed After Training	Not Yet Completed Them	Don't know

Implemented an energy budget	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recorded energy use over time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Set energy savings goals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Achieved energy savings goals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

26. Have you participated in any other DCEO energy efficiency programs?  
 Yes (*if checked, go to 30A*)  
 No  
 Don't know
- 26A. What other DCEO energy efficiency programs did you participate in?
- 26B. 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
27. **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
28. How many years have you worked in this role?
29. How many building operator staff is there at your current location?
30. How many of these staff has 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

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As part of the evaluation effort, a telephone survey was administered to Building Operator Certification training participants who completed the MEEA program. 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.

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents*</i>
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	0	0%
	The DCEO website	0	0%
	Utility representatives	9	35%
	The Midwestern Energy Efficiency Alliance (MEEA)	2	8%
	Brochures or advertisements	3	12%
	Trade associations or business groups you belong to	6	23%
	Trade journals or magazines	9	35%
	Friends and colleagues	6	23%
	The Smart Energy Design Assistance Center (SEDAC)	0	0%
	The Energy Resource Center (ERC)	0	0%
	Architects, engineers or energy consultants	6	23%
	Equipment vendors or building contractors	6	23%
	Other (please describe)	9	35%
	Don't know	5	19%

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

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents*</i>
2. How did you learn about the DCEO tuition rebate for the BOC training?	From a BOC program representative	4	15%
	A Midwestern Energy Efficiency Alliance (MEEA) representative	3	12%
	A DCEO representative mentioned it	0	0%
	The DCEO website	0	0%
	From a utility representative	3	12%
	Brochures or advertisements	0	0%
	Trade association or business group you belong to	0	0%
	Trade journal or magazine	1	4%
	Friend or colleague	1	4%
	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	1	4%
	Equipment vendor or building contractor	0	0%
	Attended a conference workshop or seminar	0	0%
	Past experience with the program	1	4%
	An energy service company	1	4%
	Other (please explain)	12	46%
Don't know	6	23%	

*\*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?	<i>Response</i>	<i>(n=21)</i>	<i>Percent of Respondents</i>
	Yes	11	52%
	No	8	38%
	Don't know	2	10%

4. Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements?	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents*</i>
	An energy management plan	18	69%
	A staff member responsible for energy and energy efficiency	15	58%
	Policies that incorporate energy efficiency in operations and procurement	16	62%
	Active training of staff	14	54%
	Other (please specify)	2	8%
Don't know	2	8%	

\*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?	<i>Response</i>	<i>(n=18)</i>	<i>Percent of Respondents</i>
	Yes	11	61%
	No	4	22%
	Don't know	3	17%

5. What motivated you to participate in the BOC course? (Do not read list. Select all that apply.) (Use as prompts if necessary )	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents*</i>
	Career Opportunity	16	62%
	Learn new skills	20	77%
	Personal interest	15	58%
	Learn about energy efficiency	18	69%
	Other (please specify)	8	31%
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) "	<i>Response</i>	<i>(n=24)</i>	<i>Percent of Respondents</i>
	Very important	5	21%
	Somewhat important	7	29%
	Neutral	0	0%
	Only slightly important	2	8%
	Not important at all	6	25%
Don't know	4	17%	



7. Would you have been financially able to attend the BOC training if the tuition rebate had not been available?	<i>Response</i>	<i>(n=23)</i>	<i>Percent of Respondents</i>
	Yes	11	48%
	No	5	22%
	Don't know	7	30%

8. If the tuition rebate had not been available, how likely would you have been to participate in the BOC course anyway? (Read list)	<i>Response</i>	<i>(n=24)</i>	<i>Percent of Respondents</i>
	Definitely would have participated	6	25%
	Probably would have participated	3	13%
	Probably would not have participated	8	33%
	Definitely would not have participated	1	4%
Don't know	6	25%	

9. Were any of the courses you took through the BOC program particularly useful?	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
	Yes	22	85%
	No	2	8%
	Don't know	2	8%

10. Were there any courses that you found to not be very useful?	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
	Yes	7	27%
	No	17	65%
	Don't know	2	8%

11. Why did you attend the BOC training? (Do not read list. Select all that apply.) (Use as prompts if necessary )	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents*</i>
	Required by company/organization	10	38%
	To learn new job skills	19	73%
	To advance in my current job	13	50%
	To improve my chances of getting a new job	8	31%
	To earn continuing education credits	7	27%
	To learn about energy efficiency	23	88%
	Because of the tuition rebate	3	12%
	Other (please specify)	5	19%
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%.

12. Have you encountered any barriers to applying what you learned about energy efficiency improvements during the BOC training?	<i>Response</i>	<i>(n=25)</i>	<i>Percent of Respondents</i>
	Yes	7	28%
	No	18	72%
	Don't know	0	0%

12a. What barriers have you encountered? (Do not read list, but use as possible prompts)	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents</i>
	Lack of supervisor support	2	29%
	Insufficient budget	5	71%
	Organization/company not committed to energy efficiency improvements	2	29%
	Not enough staff resources to plan efficiency projects	1	14%
	Other (please specify)	3	43%
	Don't know	0	0%

13. What is the approximate square footage of your building or buildings?	<i>Response</i>	<i>(n=21)</i>	<i>Average square footage</i>
	Average square footage		

14. What percentage of that space are you responsible for?	<i>Response</i>	<i>(n=22)</i>	<i>Percent responsible</i>
	Percent responsible		

15. How many hours per week is your site open for business?	<i>Response</i>	<i>(n=23)</i>	<i>Hours per week</i>
	Hours per week		

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
	16. What type of facility is it? ( Do not read list)	College/University	1
Elementary		0	0%
Grocery		0	0%
Healthcare Clinic		0	0%
Heavy Industry		0	0%
High School/Middle School		0	0%
Hospital		6	23%
Hotel/Motel		0	0%
Light Industry		0	0%
Lodging Hotel/Motel		0	0%
Manufacturing Facility		3	12%
Medical		0	0%
Office - High Rise		4	15%
Office - Low Rise		1	4%
Office - Mid Rise		5	19%
Religious Facility		0	0%
Restaurant		0	0%
Retail - Department Store		0	0%
Retail - Strip Mall		0	0%
Retail/Service		1	4%
School (K-12)	0	0%	
Warehouse	0	0%	
Other (please specify)	5	19%	
Don't know	0	0%	

	<i>Response</i>	<i>(n=28)</i>	<i>Percent of Respondents*</i>
	17. Since participating in the BOC program have you implemented any of the following types of energy efficiency projects? (Read list)	Lighting Controls	8
Energy efficient lighting		12	46%
Energy efficient motors		3	12%
VSDs		5	19%
Compressed air projects		2	8%
Energy management system project		4	15%
Heating system improvements		3	12%
Air conditioning improvements		7	27%
Economizer		1	4%
Water heating efficiency improvements		3	12%
Other improvements		1	4%
None		6	23%
Don't know		3	12%

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

19. At how many facilities did you implement any of the previously listed projects?	<i>Response</i>	<i>(n=17)</i>	<i>Percent of Respondents</i>
	1	9	53%
	2	2	12%
	3	3	18%
	4	1	6%
	5	0	0%
	6	0	0%
	7	0	0%
	8	0	0%
	9	0	0%
	10 or more	1	6%
	Don't know	1	6%

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)	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	1	14%
	Probably would have made the improvements	2	29%
	Probably would not have made the improvements	4	57%
	Definitely would not have made the improvements	0	0%
Don't know (Don't read)	0	0%	

LC2. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents</i>
	Yes	4	57%
	No	3	43%
Don't know	0	0%	

LC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents</i>
	Yes	6	86%
	No	1	14%
Don't know	0	0%	

LC4. What type of new lighting controls did you implement? (Do not read list)	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents*</i>
	Occupancy sensors	7	100%
	Daylighting	3	43%
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%.

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)	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	5	42%
	Probably would have made the improvements	4	33%
	Probably would not have made the improvements	3	25%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

EEL2. How many lighting projects did you complete?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	1	5	42%
	2	3	25%
	3	1	8%
	4	1	8%
	5	0	0%
	6	0	0%
	7	0	0%
	8	0	0%
	9	0	0%
	10 or more	1	8%
Don't know	1	8%	

EEL3. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	6	50%
	No	5	42%
	Don't know	1	8%

EEL4. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	<i>Response</i>	<i>(n=12)</i>	<i>Percent of Respondents</i>
	Yes	7	58%
	No	3	25%
	Don't know	2	17%

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)	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	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 (Don't read)	0	0%

EEM2. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Yes	2	67%
	No	1	33%
	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?	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Yes	1	33%
	No	1	33%
	Don't know	1	33%

EEM4. Were these motors installed for HVAC end-uses or for industrial end-uses? (select all that apply)	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents*</i>
	HVAC end-use	3	100%
	Industrial end-use	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%.

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)	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	2	40%
	Probably would have made the improvements	3	60%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

VSD2. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
	Yes	4	80%
	No	1	20%
	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?	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
	Yes	4	80%
	No	1	20%
	Don't know	0	0%

VSD4. Were the VSDs installed on existing motors part of an HVAC system?	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
	Yes	4	80%
	No	1	20%
	Don't know	0	0%

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)	<i>Response</i>	<i>(n=2)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	2	100%
	Probably would have made the improvements	0	0%
	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%	

CA2. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=2)</i>	<i>Percent of Respondents</i>
	Yes	1	50%
	No	1	50%
	Don't know	0	0%

CA3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	<i>Response</i>	<i>(n=2)</i>	<i>Percent of Respondents</i>
	Yes	2	100%
	No	0	0%
	Don't know	0	0%

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)	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	1	33%
	Probably would have made the improvements	2	67%
	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%	

EMS2. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Yes	1	33%
	No	2	67%
	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?	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Yes	1	33%
	No	1	33%
	Don't know	1	33%

EMS5. Did you install a new energy management system after the BOC training?	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Yes	0	0%
	No	3	100%
	Don't know	0	0%

	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
EMS6. Did you make changes to an existing energy management system after the BOC training?	Yes	3	100%
	No	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
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)	Definitely would have made the improvements	1	33%
	Probably would have made the improvements	2	67%
	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%

	<i>Response</i>	<i>(n=2)</i>	<i>Percent of Respondents</i>
HS2. Had you implemented a similar project prior to attending the BOC training?	Yes	0	0%
	No	2	100%
	Don't know	0	0%

	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
HS3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	1	33%
	No	2	67%
	Don't know	0	0%

	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents*</i>
HS4. What is the primary heating system type for the system you made improvements to? (Do not read list) (Select all that apply)	Hot air furnace	0	0%
	Wall or floorboard radiator (steam, Hot Water or electric resistance)	1	33%
	Steam, hot water or electric resistance coils in ventilation system.	2	67%
	Space heaters	0	0%
	Heat pump, air source	0	0%
	Heat pump, ground source	0	0%
	Heat pump, water loop	1	33%
	Electric boiler	0	0%
	Gas boiler	1	33%
	Other (please specify)	1	33%
	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%.

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?	<i>Response</i>	<i>(n=6)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	1	17%
	Probably would have made the improvements	4	67%
	Probably would not have made the improvements	1	17%
	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?	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents</i>
	Yes	1	14%
	No	5	71%
	Don't know	1	14%

AC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents</i>
	Yes	3	43%
	No	2	29%
	Don't know	2	29%

AC4. What is the primary cooling system type for the system you made improvements to?	<i>Response</i>	<i>(n=7)</i>	<i>Percent of Respondents*</i>
	Chiller - air-cooled	2	29%
	Chiller - water or evaporatively cooled	6	86%
	Evaporative cooler	1	14%
	Fans	1	14%
	Direct Expansion - air-cooled packaged or split system cooling or heat pump	2	29%
	Geothermal heat pump	0	0%
	Window or thermal units (PTAC/PTHP)	0	0%
	Other (please specify)	1	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%.

E1. Now I would like to ask you some questions about the economizers you implemented. How likely is it that you would have made these improvements had you had not attended the course?	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	0	0%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
Don't know	0	0%	

E2. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents</i>
	Yes	0	0%
	No	0	0%
	Don't know	0	0%

E3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents</i>
	Yes	0	0%
	No	0	0%
	Don't know	0	0%

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)	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	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 (Don't read)	0	0%

WH2. Had you implemented a similar project prior to attending the BOC training?	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Yes	1	33%
	No	2	67%
	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?	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents</i>
	Yes	0	0%
	No	3	100%
	Don't know	0	0%

	<i>Response</i>	<i>(n=3)</i>	<i>Percent of Respondents*</i>
WH4. What type of water heating improvements that produced energy savings did you implement? (Do not read list. Select all that apply)	Installed timeclock to turn off circulation pump after hours	0	0%
	Installed heat recovery system	1	33%
	Installed a more efficient hot water heater or boiler?	0	0%
	Insulated pipes(s) (How thick was the insulation and how many linear feet were installed?)	0	0%
	Other	3	100%
	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%.

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
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)	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	0	0%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
	Don't know	1	100%

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
O2. Had you implemented a similar project prior to attending the BOC training?	Yes	0	0%
	No	0	0%
	Don't know	1	100%

	<i>Response</i>	<i>(n=1)</i>	<i>Percent of Respondents</i>
O3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	0	0%
	No	0	0%
	Don't know	1	100%

	<i>Response</i>	<i>(n=23)</i>	<i>Percent of Respondents</i>
21A. 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.	Differently	0	0%
	More Frequently	2	9%
	Both	2	9%
	No Change	19	83%
	Don't know	0	0%

21B. 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.	<i>Response</i>	<i>(n=23)</i>	<i>Percent of Respondents</i>
	Differently	0	0%
	More Frequently	4	17%
	Both	1	4%
	No Change	18	78%
	Don't know	0	0%

21C. 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.	<i>Response</i>	<i>(n=22)</i>	<i>Percent of Respondents</i>
	Differently	0	0%
	More Frequently	4	18%
	Both	3	14%
	No Change	15	68%
	Don't know	0	0%

21D. 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.	<i>Response</i>	<i>(n=21)</i>	<i>Percent of Respondents</i>
	Differently	0	0%
	More Frequently	0	0%
	Both	0	0%
	No Change	21	100%
	Don't know	0	0%

21E. Please indicate if you have performed electrical panel maintenance differently or more frequently or both since participating in the BOC training. Electrical panel maintenance.	<i>Response</i>	<i>(n=23)</i>	<i>Percent of Respondents</i>
	Differently	0	0%
	More Frequently	2	9%
	Both	3	13%
	No Change	16	70%
	Don't know	2	9%

21F. Please indicate if you have performed ventilation maintenance differently or more frequently or both since participating in the BOC training. Ventilation maintenance.	<i>Response</i>	<i>(n=22)</i>	<i>Percent of Respondents</i>
	Differently	0	0%
	More Frequently	4	18%
	Both	2	9%
	No Change	16	73%
	Don't know	0	0%

21G. Please indicate if you have performed other energy savings maintenance differently or more frequently or both since participating in the BOC training. Other maintenance.	<i>Response</i>	<i>(n=23)</i>	<i>Percent of Respondents</i>
	Differently	0	0%
	More Frequently	2	9%
	Both	2	9%
	No Change	18	78%
	Don't know	1	4%

	<i>Response</i>	<i>(n=9)</i>	<i>Percent of Respondents</i>
22. At how many facilities did you make these changes to your maintenance practices?	1	3	33%
	2	1	11%
	3	2	22%
	4	0	0%
	5	0	0%
	6	1	11%
	7	0	0%
	8	0	0%
	9	0	0%
	10 or more	1	11%
	Don't know	1	11%

	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents</i>
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?	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	3	75%
	Probably would not have made the improvements	1	25%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=4)</i>	<i>Percent of Respondents*</i>
CS2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Changes to cooling tower service	2	50%
	Changes to chiller bundle cleaning	1	25%
	Changes to condenser cleaning	1	25%
	Changes to refrigerant charge adjustment	0	0%
	Other changes	0	0%
	Don't know	2	50%

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

	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
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	2	40%
	Probably would not have made the improvements	3	60%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents*</i>
HE2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Heat exchanger cleaning (Please provide capacity in BTU's)	1	20%
	Blowdown frequency (Please provide boiler capacity in BTU's and number of traps)	3	60%
	Steam trap	3	60%
	Other	1	20%
	Don't know	1	20%

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

	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents</i>
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	0	0%
	Probably would have made the improvements	0	0%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents*</i>
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	0	0%
	Ultra-sonic leak detection	0	0%
	Pressure optimization	0	0%
	End-use isolation	0	0%
	Filter changes	0	0%
	System diagnostics	0	0%
	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%.*

	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents</i>
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	20%
	Probably would have made the improvements	2	40%
	Probably would not have made the improvements	2	40%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

VM2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	<i>Response</i>	<i>(n=5)</i>	<i>Percent of Respondents*</i>
	Economizer optimization/repair	1	20%
	Sensor Calibration	5	100%
	Setpoint optimization	3	60%
	Balancing	3	60%
	Filter changes	3	60%
	System diagnostics	1	20%
	Sealed leaks / replaced door gaskets	2	40%
	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%.*

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)	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents</i>
	Definitely would have made the improvements	0	0%
	Probably would have made the improvements	0	0%
	Probably would not have made the improvements	0	0%
	Definitely would not have made the improvements	0	0%
Don't know	0	0%	

23. 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.)	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents*</i>
	Time	9	35%
	Cost	6	23%
	Not aware of it	10	38%
	Supervisor approval	4	15%
	No barriers	4	15%
Don't know	4	15%	

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

24A. Please indicate your level of satisfaction with the following elements of the BOC training. Course schedule.	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
	Very Dissatisfied	0	0%
	Dissatisfied	1	4%
	Neither Satisfied nor Dissatisfied	4	15%
	Satisfied	16	62%
	Very Satisfied	5	19%
Don't know	0	0%	

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
24B. Please indicate your level of satisfaction with the following elements of the BOC training. Course instructors.	Very Dissatisfied	0	0%
	Dissatisfied	2	8%
	Neither Satisfied nor Dissatisfied	2	8%
	Satisfied	11	42%
	Very Satisfied	11	42%
	Don't know	0	0%

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
24C. Please indicate your level of satisfaction with the following elements of the BOC training. Tuition rebate application process.	Very Dissatisfied	1	4%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	4	15%
	Satisfied	9	35%
	Very Satisfied	8	31%
	Don't know	4	15%

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
24D. 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	5	19%
	Satisfied	7	27%
	Very Satisfied	9	35%
	Don't know	5	19%

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
24E. Please indicate your level of satisfaction with the following elements of the BOC training. Time elapsed to receive tuition rebate.	Very Dissatisfied	1	4%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	5	19%
	Satisfied	9	35%
	Very Satisfied	6	23%
	Don't know	5	19%

	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
24F. 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	2	8%
	Neither Satisfied nor Dissatisfied	2	8%
	Satisfied	12	46%
	Very Satisfied	10	38%
	Don't know	0	0%



25A. 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.	<i>Response</i>	<i>(n=24)</i>	<i>Percent of Respondents</i>
	Completed Prior to Training	4	15%
	Completed Before and After Training	4	15%
	Only Completed After Training	1	4%
	Not Yet Completed Them	0	0%
	Don't know	4	15%

25B. 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.	<i>Response</i>	<i>(n=25)</i>	<i>Percent of Respondents</i>
	Completed Prior to Training	6	23%
	Completed Before and After Training	6	23%
	Only Completed After Training	3	12%
	Not Yet Completed Them	0	0%
	Don't know	4	15%

25C. 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.	<i>Response</i>	<i>(n=25)</i>	<i>Percent of Respondents</i>
	Completed Prior to Training	4	15%
	Completed Before and After Training	4	15%
	Only Completed After Training	3	12%
	Not Yet Completed Them	0	0%
	Don't know	7	27%

25D. 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.	<i>Response</i>	<i>(n=25)</i>	<i>Percent of Respondents</i>
	Completed Prior to Training	3	12%
	Completed Before and After Training	3	12%
	Only Completed After Training	3	12%
	Not Yet Completed Them	0	0%
	Don't know	6	23%

26. Have you participated in any other DCEO energy efficiency programs?	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
	Yes	0	0%
	No	25	96%
	Don't know	1	4%

26B. How important was the BOC course in your decision to participate in these other DCEO programs? (Read list)	<i>Response</i>	<i>(n=0)</i>	<i>Percent of Respondents</i>
	Very important	0	0%
	Somewhat important	0	0%
	Neutral	0	0%
	Somewhat unimportant	0	0%
	Not important at all	0	0%
Don't know/Not applicable	0	0%	

27. What is your current job title? (Do not read list)	<i>Response</i>	<i>(n=26)</i>	<i>Percent of Respondents</i>
	Operations/Facilities operations manager	0	0%
	Maintenance manager	0	0%
	HVAC supervisor or technician	1	4%
	Engineering manager	3	12%
	Facilities manager	6	23%
	Engineer	8	31%
	Maintenance manager	3	12%
	General contractor	0	0%
	Building management specialist	0	0%
	Other engineering position	0	0%
	Other manager, team leader, supervisor	2	8%
Other (please explain)	3	12%	

28. How many years have you worked in this role?	<i>(n=26)</i>	
	Average Years	9.1

29. How many building operator staff is there at your current location?	<i>(n=25)</i>	
	Average Staff	7.6

30. How many of these staff have completed the BOC training (either Level 1 or Level 1&2)?	<i>(n=20)</i>	
	Average BOC Completion	1.9