Evaluation of Illinois Energy Now Building Operator Certification® Program

June 2012 through May 2013

Prepared for:
Illinois Department of Commerce Economic Opportunity

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Executive Summary

This report presents the results of the impact and process evaluations of the Building Operator Certification® Program (BOC), which is administered by the Midwest Energy Efficiency Alliance (MEEA) under a license provided by the Northwest Energy Efficiency Council, and which receives program support and tuition rebate funding from the Department of Commerce and Economic Opportunity (DCEO). This report presents the results the evaluation of program activity occurring during the period June 2012 through May 2013, defined as electric program year five and natural gas program year two (EPY5/GPY2).

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

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

Measure Category	*Energy Savings Sources*
Heating System Maintenance	Illinois Statewide TRM
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

Measure Category	*Total Sampled Net Savings (Adjusted for Partial FR)*		
	kWh	*kW*	*Therms*
Lighting Controls	100,813.62	85.66	0.00
Lighting	52,344.66	2.92	0.00
VSD	94,932.68	14.13	0.00
Water Heating	31,731.08	7.77	0.00
Maintenance	137,648.22	16.37	9,715.85
Total	417,470.25	126.85	9,715.85

The sample savings shown above were then extrapolated to the population of BOC participants who received a tuition rebate from DCEO during EPY5/GPY2. 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 EPY5/GPY2. It should be noted that because some participants were serviced by non-EEPS electric utilities such as municipal utilities, electric savings generated through these participants were not attributed to the BOC Program.

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

Electric Utility	*Realized Net kWh Savings*
Ameren	101,445.45
ComEd	452,602.79
Total	554,048.25

Table ES-4 presents the program's EPY5/GPY2 net kW savings by utility.

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

Utility	*Realized Net kW Savings*
Ameren	14.69
ComEd	65.54
Total	80.23

Table ES-5 presents the program's EPY5/GPY2 net natural gas savings by utility. It should be noted that because some participants were serviced by non-EEPS natural gas utilities such as municipal utilities, natural gas savings generated through these participants were not attributable to the BOC Program.

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

Utility	*Realized Net Therm Savings*
Ameren	9,179.17
Nicor	5,163.28
Peoples	11,187.11
North Shore	286.85
Total	25,816.41

The total net energy savings of the Building Operator Certification® Program during EPY5/GPY2 are summarized in Table ES-6. During this period, net energy savings attributable to the program totaled 554,048 kWh, 80.23 kW, and 25,816 therms. These values do not include savings generated through non-EEPS utilities, which totaled 226,301 kWh, 32.77 kW, and 2,868.49 therms.

Table ES-6 Summary of Net Savings from EPY5/GPY2 Projects

Savings Level	*Total Net Savings**		
	kWh	*kW*	*Therms*
Per Participant	9,939.77	3.02	231.33
Extrapolated to EPY5/GPY2 Participants	554,048.25	80.23	25,816.41

*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 EPY5/GPY2 activity:

- **Continued Limitations for Program Savings Impacts:** As with EPY4/GPY1, the savings estimation procedure determined that although participants reported implementing a wide range of projects after their participation in the BOC training, the total net savings impacts resulting from these projects were lower than program expectations. This limitation may be related to several issues including participants' ability to recall project implementation information 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.
- **Externally Incentivized Savings:** The EPY4/GPY1 evaluation showed that many BOC participants implemented energy efficiency projects following their course attendance but also received additional incentives for these projects. This trend appears to have continued in EPY5/GPY2, with the participant survey results indicating that more than 40% of the implemented measures had received additional incentives. This causes the savings from those projects to be ineligible for attribution to the BOC Program, and limits the program's savings potential. The BOC Program serves as a gateway to additional utility-sponsored energy efficiency incentives, and program planning must consider that some generated savings will be attributed to those utility programs rather than to the BOC Program.
- **Program Satisfaction:** Overall, the participant survey findings from the current year are very consistent with the findings from EPY4/GPY1. Respondents provided few instances of dissatisfaction with the BOC training program and for the most part did not indicate any systematic or major issues with program structure, management, or operation. These results suggest that the BOC Program has been very well-received by participants, and that participant satisfaction has either been maintained or improved since prior program years. From the participant perspective, there are very few issues or weaknesses in program structure or delivery that require attention. As there were no significant increases in dissatisfaction or issues with program participation and some of the survey results suggest an improvement over prior years, the BOC Program appears to be maintaining or increasing its overall effectiveness.
- **Organizational Staffing Transition:** Aside from strategic changes to program structure and delivery, the BOC Program has experienced organizational transitions related to changes in program operational staff. Interviewed MEEA staff stated that several staff members who were responsible for managing the BOC Program during EPY4/GPY1 had since moved on to other positions or were no longer with the organization. This required additional MEEA staff members to step in and maintain the BOC Program while locating new individuals to fill the open program staff positions. MEEA staff reported that the transition had been unexpected, but that there had been few difficulties or disruptions that would affect the performance and operation of the BOC Program during this process.
- **Potential Future Program Changes:** The evaluation revealed several program modifications that may be implemented during future years of the Building Operator Certification Program. These changes include increasing the number of training locations, administering more in-depth surveys that focus on project implementation, and adding new

course components or training content as needed. Additionally, MEEA staff are currently discussing and considering the further development of more online course components, which would provide an opportunity for distance learning in addition to onsite training. The program staff members who are responsible for designing and operating the BOC are frequently considering modifications to the program, and are likely to make adjustments that will continually improve the quality of BOC training, as well as the overall structure of the program as a whole.

The following is a summary of key recommendations from the EPY5/GPY2 evaluation of the BOC Program:

- **Notify Participants of Potential Evaluation Follow-up:** Currently, a limited amount of information is collected from participants about their upcoming or existing project plans, which requires extensive follow-up and data collection efforts during the evaluation process in order to assess savings attributable to the program. Additionally, some participants tend to be unresponsive to these data collection efforts, and they may not be aware that program performance is partially assessed through achieved savings levels. Thus, it would likely be beneficial for MEEA to notify participants that they may be contacted for savings verification in the months following BOC training.
- **Encourage Participant Documentation and Project Tracking:** It may be useful to encourage participants to keep records of their project plans and documentation, as this is both an ideal business practice and would ensure that project details are accessible at the time of savings verification. Facilitating the documentation and tracking of projects could also involve providing graduating individuals with a checklist or form that contains a list of project categories (lighting, cooling efficiency, energy management system, etc.) and encouraging them to track any implementations as they occur. These steps would contribute to accurate project tracking and may increase participants' receptiveness to follow-up savings verification surveys. If needed, ADM is willing to create a draft project tracking form that could be given to BOC graduates, perhaps as they submit their course assessment forms.
- **Consider and Plan for External Project Incentive Activity:** BOC participants have continued to seek and receive additional measure incentives from external efficiency programs. This splits the role of the BOC program into two objectives: serving as a method to increase participation in utility incentive programs that will claim energy savings, and serving as a direct cause of energy savings. As mentioned in the prior program year, it may be possible for DCEO to share the savings associated with projects that receive incentives from utilities or other energy efficiency programs. The feasibility of this savings attribution structure is dependent upon discussions and cooperation between DCEO and relevant utilities or other parties, and may require program design or incentive changes in order to effectively allocate savings and costs so as to maximize the overall net social benefit.
- **Continue with Plans to Further Implement Electronic Program Delivery:** MEEA staff reported that the University of Chicago has been a helpful partner in developing blended learning experiences that combine online and in-person educational methods to prospective and current program participants. Much of this program component is still in development,

but MEEA plans to offer a course format consisting of five in-person classes supplemented by online courses. This is 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.

As the time commitment and distance to courses appear to be a primary barrier to participation for some customers, ADM encourages the use of these and other methods of overcoming participation burdens. With regard to data collection and documentation in the electronic context, it may be beneficial to allow participants to record their class-related work and project progress through an electronic-based system. This would allow for easier record-keeping and may benefit staff members and evaluators in reviewing the evaluation and project data that may be provided by participants.

1. Introduction

This report presents the results of the 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 2012 through May 2013.

1.1 Description of Program

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

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

1.1.1 Curriculum Structure Overview

The Building Operator Certification Program course schedule as of EPY5/GPY2 has been modified in terms of content and course structure. The purpose of these modifications was to emphasize course topics that would be most relevant and crucial for attendees, as well as to combine related topics and allow for flexibility within the training.

A primary objective of this change in course structure was to increase the focus on HVAC systems, as these are a large source of facility energy use and savings and previous participants have noted their interest in HVAC training. For example, BOC 101 (Building Systems Overview) and BOC 103 (HVAC Systems & Controls) were combined into a single core course titled BOC 1001 (Energy Efficient Operation of Building HVAC Systems).

Additionally, some courses were shifted from the core curriculum to a supplementary course list, such as BOC 107 (Facility Electrical Systems). The supplementary course list is comprised of six courses, and BOC participants are required to complete one supplemental course as an elective in addition to the seven core courses. Table 1-1 outlines the changes that were made to the BOC curriculum for EPY5/GPY2.

Table 1-1 Building Operator Certification Curriculum Transition

Course prior to EPY5/GPY2	*Course Modification*	*Course as of EPY5/GPY2*
BOC 101 (Building Systems Overview)	Combined with BOC 103 as Core Class	BOC 1001 (Energy Efficient Operation of Building HVAC Systems)
BOC 102 (Energy Conservation Techniques)	Moved to Core Class Schedule	BOC 1002 (Measuring and Benchmarking Energy Performance)
BOC 103 (HVAC Systems & Controls)	Combined with BOC 101 as Core Class	[See BOC 1001 Above]
BOC 104 (Efficient Lighting Fundamentals)	Moved to Core Class Schedule	BOC 1003 (Efficient Lighting Fundamentals)
BOC 105 (O&M Practices for Sustainable Buildings)	Moved to Supplemental Class Schedule	BOC 1008 (O&M Practices for Sustainable Buildings)
BOC 106 (Indoor Environmental Quality)	Moved to Core Class Schedule	BOC 1005 (Indoor Environmental Quality)
BOC 107 (Facility Electrical Systems)	Moved to Supplemental Class Schedule	BOC 1007 (Facility Electrical Systems)
N/A	Added to Core Class Schedule (New Course)	BOC 1004 (HVAC Controls Fundamentals
N/A	Added to Core Class Schedule (New Course)	BOC 1006 (Common Opportunities for Low-Cost Operational Improvement)

Program staff explained that these modifications should enhance the program's ability to provide highly relevant and thorough information to course participants, while presenting course content in a way that links similar concepts and focuses on practical training. The core curriculum now emphasizes HVAC systems and includes coursework that trains participants to be proactive in facility operation and maintenance. The supplemental elective format allows participants to customize their training based on the topics that address their interests or relate to their facility's needs.

While the purpose of the BOC is to educate participants about the full scope of best practices in facility maintenance and operation, the program benefits from highlighting topics that motivate participants to make immediate modifications to their equipment or facility operations. In addition to the HVAC-related changes, the addition of BOC 1006 (Common Opportunities for Low-Cost Operational Improvement) will provide students with actionable information about increasing facility energy efficiency, monitoring equipment performance, and cost-effectively maintaining ideal operating conditions. Overall the new BOC curriculum continues to provide participants with a broad spectrum of information regarding facility management and operations, while including modifications that may contribute to increased energy savings in the future.

During the June 2012 through May 2013 period, 124 participants completed the Building Operator Certification® Program and received a tuition rebate through DCEO.

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

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

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

1.2 Impact Evaluation Approach

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

The M&V approach includes the following main features:

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

1.2.1 Data Collection Procedures

A sample of participants in the BOC Program for EPY5/GPY2 was contacted by telephone to ascertain what energy efficiency measures they have implemented since attending the training program. Participants were also asked questions to determine the probability that they were free riders (i.e., that they would have implemented the measures without the training) and questions related to the process evaluation.

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

1.2.2 Data Collection and Estimation of Sample Site Gross Savings

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

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

1.3 Process Evaluation Approach

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

1.3.1 Review Program Documentation

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

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

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

1.3.2 Conduct Program Staff Interviews

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

For EPY5/GPY2, topics addressed by these in-depth interviews included:

- Organizational changes to the program since EPY4/GPY1;
- Marketing activity and strategy for the current program year;
- Current participant characteristics and enrollment levels;
- Current strengths and weaknesses of the program;
- Areas where the program has been changed or strengthened; and
- Anticipated changes to the program.

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

1.3.3 Conduct Participant Surveys

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

The sample design was developed using program participation data provided by DCEO. For this survey effort, the evaluators used the 90% confidence level with a ±10 percent accuracy for determining the sample size. In total, 50 BOC participants responded to the savings impact portion of the participant survey, with 41 of those participants providing sufficient information to inform the process evaluation component.

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

- Awareness of the program;
- Motivations for participating in the program;
- Factors that influenced the participant to enroll in the program;
- Participant satisfaction with the program;
- Participant suggestions for program improvement;
- Whether the participant has engaged in energy efficient practices since participating in the program;

- Whether the participant made additional energy efficient purchases since participating in the program; and
- Firmographics and demographics.

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

1.4 Organization of Report

This report on the impact and process evaluation of the Building Operator Certification® Program for the period June 2012 through May 2013 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.
- Appendix C provides a copy of the questionnaire used for the supervisor survey.
- Appendix D presents tabulated results from the supervisor survey.
- Appendix E provides a copy of the interview guide used for the BOC instructor survey.

2. Savings Calculation Methodology

This chapter addresses the estimation of kWh, peak kW, and therm reductions resulting from measures implemented in facilities of participants that obtained tuition rebates from DCEO for participating in the Building Operator Certification® Program in electric program year five and natural gas program year two (EPY5/GPY2) during the period of June 2012 through May 2013. Section 2.1 through Section 0 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 EPY5/GPY2 net savings for the program.

2.1 Review of Participant Survey Responses

The participant survey administered to BOC training participants served as the initial source for data regarding projects implemented during EPY5/GPY2. Participants provided information related to measures installed and equipment changes implemented after participating in the training program, along with any available inputs such as measure type, facility square footage, and other details. The evaluators reviewed these results and identified all projects that would potentially generate savings for EPY5/GPY2 of the program.

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

2.2 Selection of Data Sources for Savings Calculation

Upon completion of the data collection process, the evaluators performed a desk review of the available data and determined the optimal savings calculation methodology (such as referring to the Illinois TRM). The evaluators referred to several sources in order to estimate savings for each measure type. This process included referring to the Illinois TRM for deemed savings values and stipulated savings calculations, as well as reviewing deemed savings databases and work papers as necessary for certain measures. The data sources referenced during the EPY5/GPY2 savings estimation process are listed in Table 2-1 below.

Table 2-1 Sources Referenced for Savings Calculations

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

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

$$\Delta kWh = kW_{Controlled} * Hours * ESF * WHF_e$$

Summer Coincident Peak Demand Savings

$$\Delta kW = kW_{controlled} * WHF_d * (CF_{baseline} - CF_{os})$$

Where,

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

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

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

[1] Goldberg et al, State of Wisconsin Public Service Commission of Wisconsin, Focus on Energy Evaluation, Business Programs, Incremental Cost Study, KEMA, October 28, 2009

[2] Ibid

[3] Efficiency Vermont TRM 2/19/2010

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

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

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

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

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

$CF_{baseline}$ = 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.[5]

Natural Gas Energy Savings

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

Where,

IF_{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 buidling type.

2.3.2 Daylight Controls Savings

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

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

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

Energy Savings

$$\Delta kWh = kW_{controlled} * HOURS * (1 + IFkWh) * ESF$$

Where,

$kW_{controlled}$ = 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.

2.3.3 High Performance T8 Lighting Savings

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

Electric Energy Savings

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

Summer Coincident Demand Savings

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

Where,

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

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

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

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

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

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

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

Natural Gas Energy Savings

$$\Delta Therms^{6} = (((Watts_{base}-Watts_{ee})/1000) * ISR * Hours *- IF_{Therms}$$

Where,

IF_{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. The Reference Table in Section 4.5 of the TRM displays this value for each building type.

2.3.4 CFL Energy Savings

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

$$\Delta kWH = (Watts_{base} – Watts_{ee} * HOURS * (1 + WHF_e) / 1000$$

Where,

$Watts_{base}$ = connected wattage of the baseline fixtures

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

$Watts_{ee}$ = connected wattage of the high efficiency fixtures

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

Hours = total operating hours of the lighting.

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

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

$$\Delta kW = (Watts_{base} – Watts_{ee}) * CF * (1 + WHF_d) / 1000$$

Where,

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

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

$$\Delta MMBtu = \Delta kWh * IFMMBtu$$

Where,

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

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

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

2.3.5 VSD Energy Savings

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

Electric Energy Savings

$\Delta kWh = kW_{connected} * Hours * ESF$

Where,

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

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

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

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

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

ESF = Energy savings factor varies by VFD application.

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

Application	*ESF*[8]
Hot Water Pump	0.482
Chilled Water Pump	0.432
Constant Volume Fan	0.535
Air Foil/inlet Guide Vanes	0.227
Forward Curved Fan, with discharge dampers	0.179
Forward Curved Inlet Guide Vanes	0.092

Summer Coincident Peak Demand Savings

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

Where,

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

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

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

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

$$\Delta Therms = Ngi * SF * EFLH/(Eff_{pre} * 100))$$

Where,

Ngi = Boiler gas input size (kBTU/hr)

= custom

SF = Savings factor

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

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

= 1.6%[10] or custom

EFLH = Equivalent Full Load Hours for heating[11]

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

Eff_{pre} = Boiler Combustion Efficiency Before Tune-Up

= 80%[12] or custom

2.3.7 Heating Equipment Maintenance: Steam Trap Service

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

Energy Savings

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

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

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

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

Where,

S = Maximum theoretical steam loss per trap

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

Hv = Heat of vaporization of steam

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

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

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

Hours = Annual operating hours of steam plant

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

A = Adjustment factor
= 50%[18]

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

L = Leaking & blow-thru

L is 1.0 when applied to the replacment of an individual leaking trap. If the number of steam traps replaced is unknown and the system has not been audited, the leaking and blow-thru is applied to reflect the assumed percentage of steam

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

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

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

2.3.8 Cooling System Maintenance: Condenser Coil Cleaning

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

Electric Energy Savings

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

Summer Coincident Peak Demand Savings

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

2.3.9 Cooling System Maintenance: Cooling Tower Service

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

2.3.10 Cooling System Maintenance: Chiller Bundle Cleaning

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

2.3.11 Other Maintenance: Refrigerator Coil Cleaning

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

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

Electric Energy Savings

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

Summer Coincident Peak Demand Savings

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

2.3.12 Air Conditioning System: Chilled and Condenser Water Reset

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

Energy Savings

$$\Delta kWh = Tons \times \Delta kWh_{ton}$$

Where,

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

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

Summer Coincident Peak Demand Savings

$$\Delta kW = Tons \times \Delta kW_{ton} \times CF$$

Where,

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

CF = the summer coincident peak factor, or 0.74.

Fossil Fuel Impact Descriptions and Calculation

$$\Delta MMBtu = Tons \times \Delta MMBtu_{ton}$$

Where,

$\Delta MMBtu_{ton}$ = the natural gas savings per ton, this depends on whether the chiller is air-cooled or water-cooled.

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

2.3.13 Economizer on Air Handler

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

3. Estimation of Net Savings

This chapter reports the results from estimating the net impacts of the Building Operator Certification (BOC) Program during EPY5/GPY2, where net savings represents the portion of gross savings achieved by program participants that can be attributed to the effects of the program. The net savings estimation procedure for EPY5/GPY2 is identical to the procedure used in for the EPY4/GPY1 evaluation.

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

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

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

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

The evaluators determined that while the DCEO tuition rebate is likely an important factor in participant decision-making, its importance to participants would not be considered for the purposes of the net savings analysis. This determination was implemented for the EPY4/GPY1 net savings estimation, and is also applied to the EPY5/GPY2 evaluation.

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

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

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

The data used to assign free ridership and net savings scores were collected through a participant survey of 50 program participants for projects completed during or after participant attendance of various BOC training courses in EPY5/GPY2.

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 measure or maintenance improvements at their facilities since attending the Building Operator Certification training;
2. The participant did not receive incentives from DCEO or any utilities for implementing the indicated measure or maintenance projects; and
3. The participant received a free ridership rating of less than 100%.

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

3.2 Results of Net Savings Estimation

The procedures described in the preceding section were used to estimate free ridership rates and net-to-gross ratios for the Building Operator Certification (BOC) Program during EPY5/GPY2.

Thirty-seven out of the 50 surveyed participants indicated that they implemented a project because of their completion of the BOC training courses. Of these 37, 29 stated that they did not receive a separate utility incentive for at least one project. Thus, 29 of the surveyed participants reported projects whose savings are at least partially attributable to the program.[22]

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

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

Measure/Maintenance Type	Number of Projects	
	BOC Training Influenced	Net Projects (BOC Training Influenced + Did not receive project incentive)
Lighting Controls	13	9
Lighting	17	6
Motors	4	2

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

Measure/Maintenance Type	Number of Projects	
	BOC Training Influenced	Net Projects (BOC Training Influenced + Did not receive project incentive)
VSD	10	4
Compressed Air	1	-
EMS	11	5
Heating System	10	6
Air Conditioning	10	6
Water Heating	3	2
Other Equipment	3	2
Cooling Maintenance	8	8
Heating Maintenance	9	9
Compressed Air Maintenance	4	4
Ventilation Maintenance	9	9
Other Maintenance	1	1
N	37	29

It should be noted that the above values are based solely on responses gathered through the participant survey effort, and do not necessarily reflect the number of projects that achieved savings through the verification and measurement effort. Some of the above projects, including EMS, compressed air, and some maintenance types, 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. The evaluators conducted follow-up verification and data collection with each participant in order to ensure that the measures cited during the survey effort were accurately recorded and were associated with BOC Program influences.

Table 3-3 displays the distribution of responses to the discussed net-to-gross indicator. The table presents the percentage of total projects that were associated with each response. Participants indicated the likelihood of implementation without BOC training for each type of project, which allows for a measure-level breakdown of net-to-gross ratios for each participant. This analysis for the current program year suggests that very few of the BOC participants were certain that they would not have implemented the energy efficiency measure without the BOC training. All but one percent of sampled measures were associated with some level of free-ridership. The values shown below represent all reported measures in the survey, regardless of whether a separate utility incentive was received for the project. As more than 40% of reported measures were associated with an additional external incentive, it is likely that many participants attribute

some or all of their project implementation decision to these external incentives rather than to the BOC Program.

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

Associated Free Ridership Score	*Associated Free Ridership Score*	*Percentage of Claimed Projects (N = 147)*
Definitely would have implemented without program	100%	29%
Probably would have implemented without program	50%	47%
Probably would not have implemented without program	33%	23%
Definitely would not have implemented without program	0%	1%

3.2.1 Discussion of Net-to-Gross Findings

This section summarizes a few key discussion points related to the findings outlined above. Both of the topics listed below were relevant to the EPY4/GPY1 evaluation, and the trends have continued through EPY5/GPY2. Although immediate action is not required, these topics may be useful to consider for future years of designing and operating the DCEO component of the Building Operator Certification® Program.

- BOC Project Influence: Based on the above tables, it is apparent that the Building Operator Certification training is leading to a significant number of measure and maintenance-related energy efficiency improvements. The training itself appears to be associated with a fairly high number of total projects, which suggests that the content and structure of the BOC courses is effectively engaging and informing program participants. However, these results indicate that more than 40% of the claimed projects were associated with either an external utility or DCEO incentive.
- External Project Incentive Activity: As mentioned in the prior year's evaluation report, it may be possible for DCEO to share the savings associated with projects that receive incentives from utilities or other energy efficiency programs, although this would require an agreement between the involved parties. This arrangement may involve tracking which BOC participants proceed to participate in other incentive programs as a result of their BOC participation, and then dividing the resulting project savings between the other program(s) and the BOC Program. The feasibility of this savings attribution structure is dependent upon discussions and cooperation among DCEO and any relevant utilities or other parties, and may require program design or incentive changes in order to effectively distribute savings and costs.

3.3 Net Savings Summary

Table 3-4 presents the sampled net savings, by measure, for each measure and maintenance category that achieved net savings within the sampled participant group. Lighting controls were associated with the largest portion of 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

Measure Category	*Total Sampled Net Savings (Adjusted for Partial FR)*		
	kWh	*kW*	*Therms*
Lighting Controls	100,813.62	85.66	0.00
Lighting	52,344.66	2.92	0.00
VSD	94,932.68	14.13	0.00
Water Heating	31,731.08	7.77	0.00
Maintenance	137,648.22	16.37	9,715.85
Total	417,470.25	126.85	9,715.85

The total savings shown above were then extrapolated to represent the population of BOC participants who received a tuition rebate from DCEO during EPY5/GPY2. Of the 29 sampled BOC participants who were associated with potential net savings through the program, the evaluators were able to contact and verify savings with 21 facilities. As the remaining eight participants could not be reached for verification, the evaluators did not assign a savings value to these facilities and instead did not count them as part of the sample size. Thus, the total sample size was reduced from 50 participants to 42 participants and then extrapolated to represent the full rebated participant population.

According to program documentation, there were 124 rebated graduates of the BOC program during this period. Savings were extrapolated based on the distribution of utility service providers among the participant population. Table 3-5 and Table 3-6 present the percentage of BOC participants serviced by each electric and gas utility during EPY5/GPY2. These proportions were applied to the net savings value in order to develop savings by utility.

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

Utility	*Percentage of Total Participants*
Ameren	32%
Nicor	18%
Peoples	39%
North Shore	1%
Other/None	10%
Total	100%

Table 3-6 Distribution of Electric Utilities Among BOC Participants

Utility	*Percentage of Total Participants*
Ameren	13%
ComEd	58%
Other	29%
Total	100%

Table 3-7 presents the net kWh savings by utility for the Building Operator Certification® Program during EPY5/GPY2. It should be noted that because some participants were serviced by non-EEPS electric utilities such as municipal utilities, electric savings generated through these participants were not attributable to the BOC Program investor utilities.

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

Electric Utility	*Realized Net kWh Savings*
Ameren	101,445.45
ComEd	452,602.79
Total	554,048.25

Table 3-8 presents the net kW savings by utility for the Building Operator Certification® Program during EPY5/GPY2.

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

Utility	*Realized Net kW Savings*
Ameren	14.69
ComEd	65.54
Total	80.23

Table 3-9 presents the net natural gas savings by utility for the Building Operator Certification® Program during EPY5/GPY2. It should be noted that because some participants were serviced by non-EEPS natural gas utilities such as municipal utilities, natural gas savings generated through these participants were not attributable to the BOC Program investor utilities.

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

Utility	*Realized Net Therm Savings*
Ameren	9,179.17
Nicor	5,163.28
Peoples	11,187.11
North Shore	286.85
Total	25,816.41

The total net energy savings of the Building Operator Certification® Program during EPY5/GPY2 are summarized in Table 3-10. During this period, net energy savings attributable to the program totaled 554,048 kWh, 80.23 kW, and 25,816 therms. These values do not include savings generated through non-EEPS utilities, which totaled 226,301 kWh, 32.77 kW, and 2,868therms.

Table 3-10 Summary of Net Savings from EPY5/GPY2 Projects

Savings Level	*Total Net Savings**		
	kWh	*kW*	*Therms*
Per Participant	9,939.77	3.02	231.33
Extrapolated to EPY5/GPY2 Participants	554,048.25	80.23	25,816.41

*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 lower than those estimated for EPY4/GPY1, although the difference in savings does not appear to be related to a systematic shift in implemented measure type or overall measure activity. The finalized savings estimate is lower than what may be expected when initially reviewing the high number of measures reported in the participant survey, and this is due to many measures being deemed ineligible for savings upon follow-up conversations with participants.

Many of the measures initially cited by participants in the survey were eliminated from savings consideration because participants later clarified that the measure had not been installed due to the BOC Program, or that the measure did not result in energy savings for the facility. It appears that some participants may be misunderstanding the survey questions, or may be having difficulties when attempting to recall the specific implementations that have occurred since attending the training. Encouraging participants to continually track their energy efficiency improvements, and prepare for potential evaluation follow-up conversations, may increase the initial accuracy of the results obtained through the participant survey.

4. Process Evaluation

This chapter discusses results of the Building Operator Certification® Program process evaluation for electric program year five and natural gas program year two. The purpose of the process evaluation is to assess the program and tuition rebate structure offered by DCEO from a structural, operational, and managerial perspective in order to identify program strengths, weaknesses, and opportunities. This evaluation is based upon surveys with BOC participants and their supervisors, interviews with MEEA staff members, interviews with BOC course instructors, and analysis of program data and documentation. As a similar process evaluation was conducted for the BOC Program during the prior program year, 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 EPY5/GPY2 BOC participant survey and BOC participant supervisor survey. The chapter continues by presenting the results of interviews that were conducted with instructors who were responsible for teaching one or more BOC courses during the program year. This is followed by a discussion of the outcomes of in-depth interviews conducted with MEEA staff members who are responsible for managing the BOC Program. The chapter concludes by highlighting key findings and program recommendations resulting from the process evaluation.

4.1 Evaluation Objectives

The purpose of the process evaluation is to examine program operations and results throughout the program operating year, and to identify potential program improvements that may prospectively increase program efficiency or effectiveness in terms of participation and satisfaction levels. This process evaluation was designed to document the operations and delivery of the Building Operator Certification® Program during electric program year five and natural gas program year two (EPY5/GPY2). Figure 4-1 provides an overview of the evaluation process, including the research activities performed.

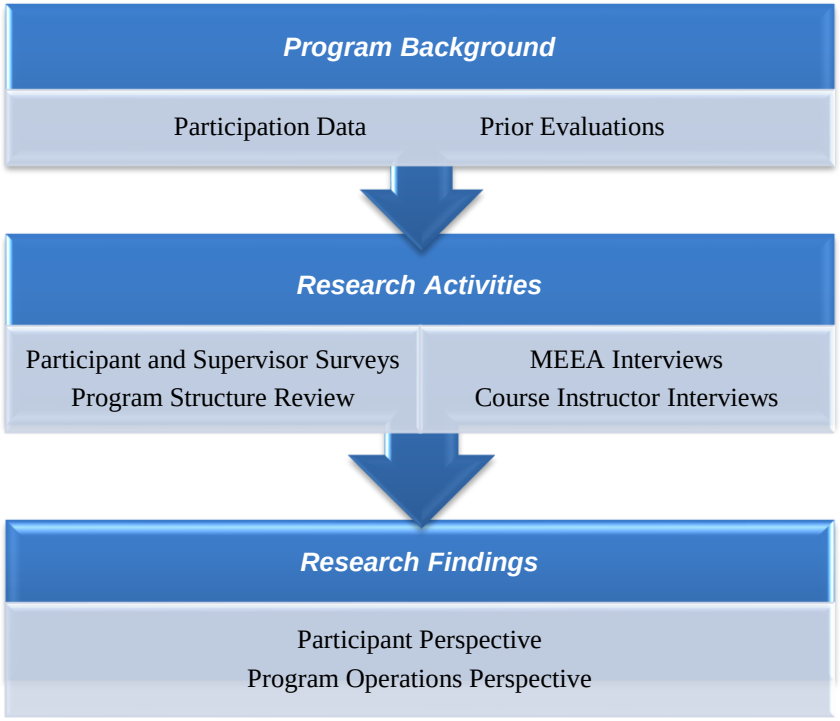

Figure 4-1 Process Evaluation Overview

Key research questions to be addressed by this evaluation of EPY5/GPY2 activity include:

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

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

4.2 Summary of Primary Data Collection

- Participant surveys: Participant surveys serve as the foundation for understanding the participant perspective. The participant surveys provide participant feedback and insight regarding participant experiences with the Building Operator Certification® Program. Respondents report on their satisfaction with the program, detail their motivations and the factors affecting their decision making process, and provide recommendations related to improving the program. For EPY5/GPY2 of the Building Operator Certification® Program evaluation, 50 program participants responded to impact evaluation components of the participant telephone survey, with 41 of these participants providing sufficient information to inform the process evaluation component.
- Supervisor surveys: Surveys with the supervisors of individuals who have participated in the BOC training serve to provide additional insight into organizational decision making and satisfaction with the program. Specifically, supervisors are asked about the background behind their decision to send employees to the training, and are also asked a series of questions related to the organizational and energy efficiency outcomes resulting from employee participation in the program.
- Instructor interviews: Interviews with instructors who have taught one or more courses within the BOC training curriculum provide information regarding course structure and program effectiveness. Instructors are asked about their professional background, their opinions regarding course structure and effectiveness, their perspectives on BOC participant reception to the program, and whether they have recommendations for program improvements.
- Interviews with MEEA staff members: Interviews with MEEA staff members provide insight into various aspects of the program and its organization. MEEA staff members also provide information regarding recent organizational and procedural improvements that have been implemented in order to enhance program efficiency and effectiveness. For EPY5/GPY2 of the Building Operator Certification® Program evaluation, the evaluators conducted in-depth interviews with two staff members from MEEA who were directly involved with managing and operating the BOC Program.

4.3 Participant Outcomes

A telephone survey was conducted to collect data about participant decision-making, preferences, and opinions of the Building Operator Certification (BOC) Program. In electric program year five and natural gas program year two (EPY5/GPY2), 124 course participants received a DCEO rebate, successfully completed the training, and received the associated certification. In total, 41 participants fully responded to the process evaluation components of the telephone survey.

It is important to the note that, while the survey results discussed below are used as inputs for the calculation of estimated free ridership, participant responses to individual survey items do not, in

isolation from additional factors, infer specific levels of net savings. The net savings chapter of this report details the methodology used to estimate total net savings based on survey response data, while this chapter provides a qualitative discussion of participant responses.

4.3.1 Participant Characteristics

Survey respondents represented a wide range of facility types. As shown in Table 4-1, 24% of respondents reported belonging to colleges or universities and 22% of respondents reported belonging to offices, most commonly high-rise offices (15% of total respondents). Twenty-nine percent of respondents belonged to other facility types. The remaining respondents reported a range of other facility types including hospitals, manufacturing facilities, retail/department stores, and warehouses.

Table 4-1 Respondent Facility Types

	Response	*Percentage of Respondents (N =41)*
What is your facility type?	Other	29%
	College/University	24%
	Office – High Rise	15%
	Hospital	10%
	Manufacturing Facility	10%
	Office – Low Rise	5%
	Office – Mid Rise	2%
	Retail – Department Store	2%
	Warehouse	2%
	Elementary	-
	Grocery	-
	Healthcare Clinic	-

Survey respondents were asked a series of questions related to their current employment positions such as job titles and length of employment in their current role. As shown in the figure below, 29% of respondents stated that they were engineers. Twenty-two percent of respondents reported that they were other managers, team leaders, or supervisors. This contrasts with the findings from EPY4/GPY1, where respondents most commonly reported having managerial positions rather than direct engineering positions. However, the wide variety in employment roles among participants has been a consistent characteristic across program years.

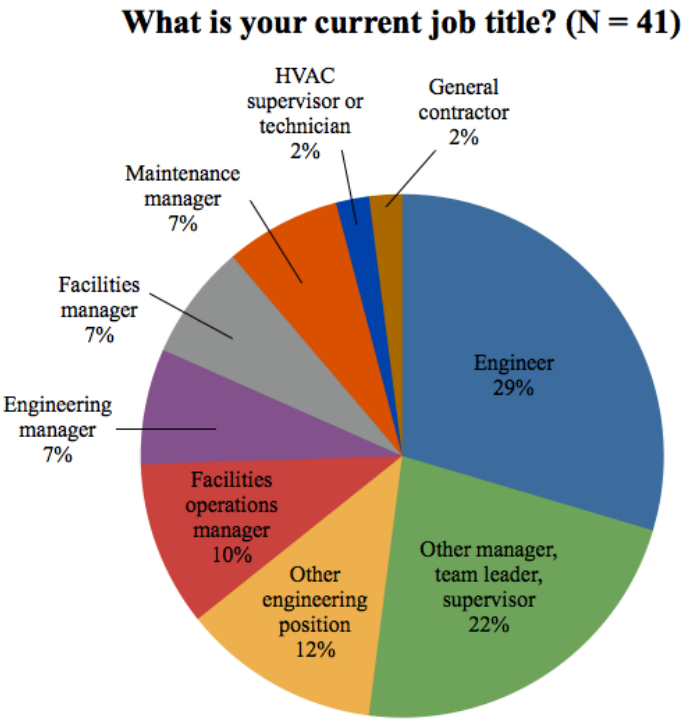

Figure 4-2 Participant Reported Current Job Titles

When asked how long they had worked in this role, respondents provided a wide range of responses, ranging from two months to 30 years. The average was approximately 12.2 years. One respondent explained that they had changed companies or specific positions fairly recently, but that they had worked in their specific industry for many years. This suggests that BOC participants are fairly experienced in their roles and industries, and that they are likely very familiar with the equipment and processes of their facilities.

Respondents were also asked about the number of building operator staff in their facilities. On average, respondents reported that their facilities had approximately thirteen 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 a third of their building operator staff had done this.

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 various energy efficiency policies or procedures that may be in place at their facilities. As shown in Table 4-2, the majority of respondents reported that they have a staff member who is responsible for energy efficiency improvements (63%) or that they have active training of staff (63%). Forty-four percent indicated that they have an energy management plan. Approximately 41% of respondents reported having policies that incorporate energy efficiency in operations and procurement.

These results differ slightly from EPY4/GPY1, although in both cases many respondents reported having multiple policies or procedures in place regarding energy efficiency improvements.

Table 4-2 Existing Energy Efficiency Policies and Procedures

	Response	*Percent of Respondents (n=35)*
Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements?	A staff member responsible for energy and energy efficiency	63%
	Active training of staff	63%
	An energy management plan	44%
	Policies that incorporate energy efficiency in operations and procurement	41%
	Don't know	7%
	Other	2%

Twelve respondents provided information about their facilities' energy management goals. These explanations were primarily qualitative in nature, with only one respondent reporting specific annual energy reduction targets (5% reduction in the next year). Overall, respondents explained that their energy management goals were centered on incremental and continued energy reduction over time, obtaining LEED Certification, decreasing their energy costs, and reducing their emissions. Specific commentary related to energy management plans includes:

[The plan is to] reduce our water and electrical usage within our building.

[We want to] achieve LEED certification for existing buildings.

[We are] basically trying to reduce costs in all facets of our organization.

[We are] working diligently to reduce emissions and reach LEED certification for all [our] buildings.

4.3.3 Program Awareness and Information Channels

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

Figure 4-3 displays participant responses regarding how they learned about the BOC incentive. The percentages shown are the percentages of respondents. The most common way BOC participants learned about the available tuition incentive was through a friend of colleague. Several of these respondents reported that they had not learned of the incentive until their BOC instructor provided them with information about the DCEO rebate program. Fifteen percent of respondents reported learning about the program from other sources, and several of these respondents explained that a utility representative had informed them of the training program and rebate. Respondents also learned of the DCEO rebate program from a Midwest Energy Efficiency Alliance (MEEA) representative, a Smart Energy Design Assistance Center (SEDAC) representative, architects, engineers or energy consultants, and equipment vendors or building contractors.

These findings are fairly consistent with those from EPY4/GPY1, where the most commonly cited sources of program awareness were BOC representatives and friends or colleagues.

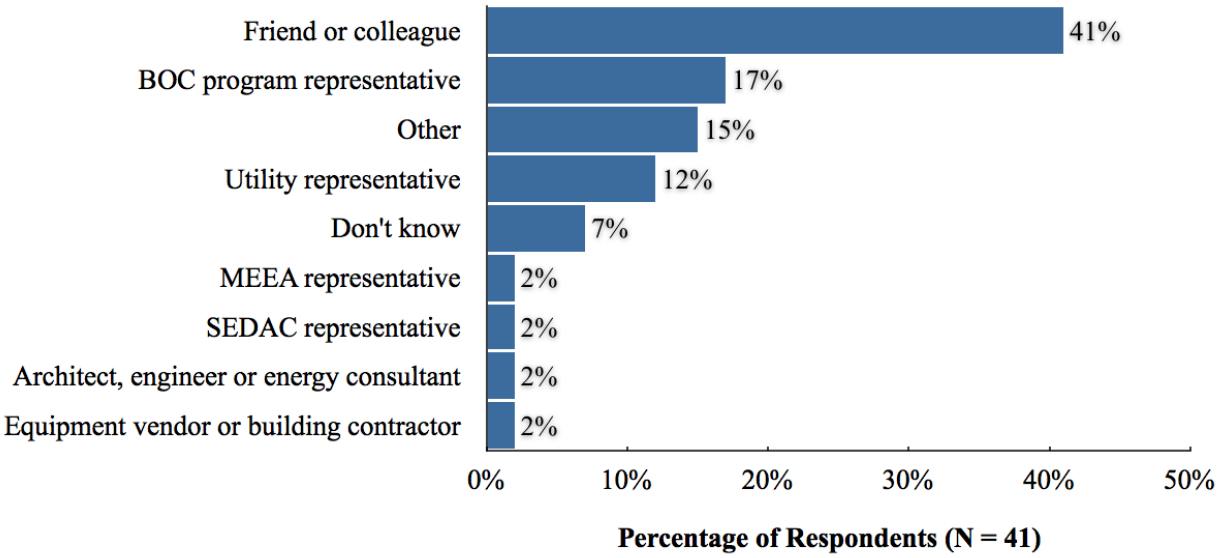

Figure 4-3 How Participants Learned about the BOC Tuition Rebate

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;
- Conference workshop or seminar;

- Past experience with the program and;
- An energy service company.

Participants were also asked about the information sources that their organizations typically rely on for information regarding energy efficiency (including energy efficient practices, equipment, materials, and design features). The following figure displays the distribution of results, where respondents were able to provide multiple responses. Respondents commonly reported relying on friends and colleagues and equipment vendors or building contractors for this type of information. A large portion of respondents (41%) reported relying on sources that were not listed as response options. These other sources were primarily specific websites such as the U.S. Energy Renewal Office website, the U.S. Green Building Council website, or various utility websites.

Relatively fewer respondents indicated that they rely on utility representatives, trade associations or business groups, and architects, engineers, or energy consultants, and trade journals or magazines. When compared with the results regarding how participants learned about the BOC incentive, it is apparent that many participants are learning about the incentive through channels they typically use, friends and colleagues as well as other sources. However, a significant amount learned specifically about the BOC incentive through BOC program representatives. This demonstrates the continued importance of the BOC Program's marketing channel in facilitating participation.

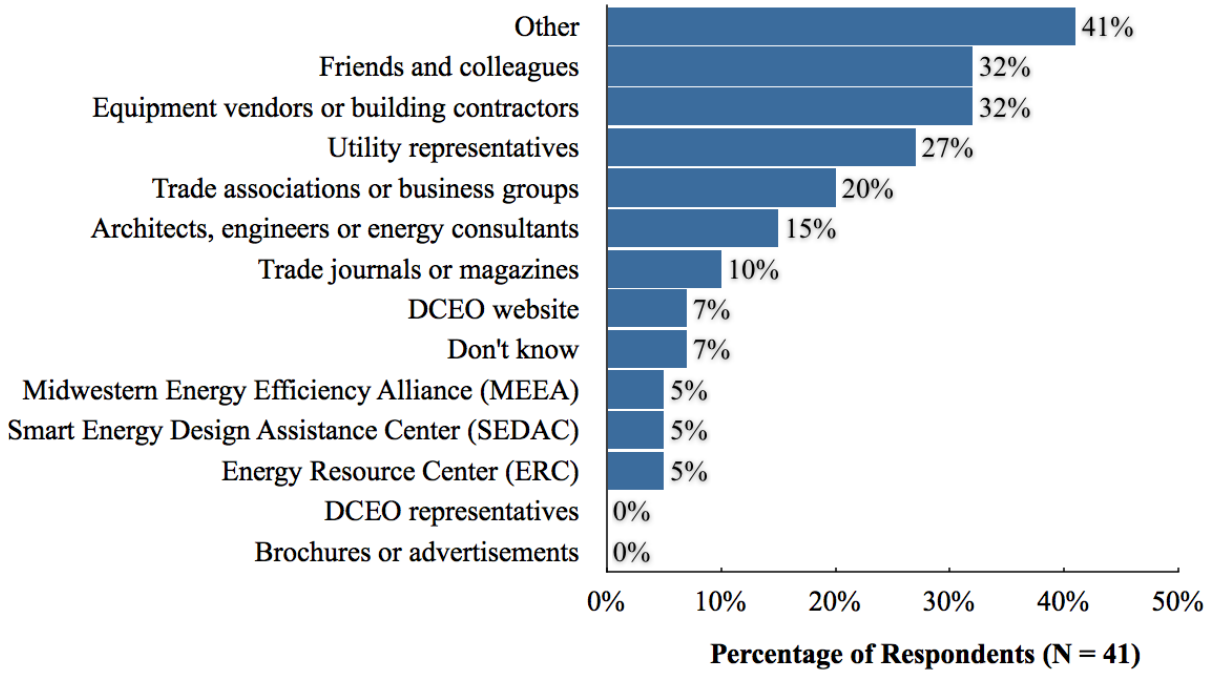

Figure 4-4 Information Sources Typically Used by Participants

4.3.4 Prior Awareness of BOC Training

Respondents were then asked whether they had already been aware of the BOC training course when they became aware of the BOC tuition rebate offered by DCEO. Forty-nine percent of respondents reported that they were aware of the BOC course before learning of the tuition rebate opportunity. This includes the respondents who previously indicated that they learned about the tuition rebate during a BOC course or as a result of applying to participate. The remaining 49% of respondents indicated that they learned about the BOC course and DCEO tuition incentive at the same time. Consistent with the results from the EPY4/GPY1 evaluation, these results suggest that a substantial percentage of participants may not have become aware of the BOC course if there had not been an associated incentive, as the availability of the rebate likely increased the amount of promotion and overall awareness of the course.

4.3.5 Factors Affecting Participation

When asked about what motivated them to participate in the course, participants cited several main motivating factors; the results are shown in Figure 4-5. The most common reason for participating was to learn about energy efficiency; this factor was cited by approximately three-quarters of the respondents. The next most common response was that the respondent wanted to learn new skills related to energy efficiency. Nearly 50% of respondents stated that they had taken the course to pursue personal interests, and 34% of respondents indicated that the BOC training was associated with a career opportunity.

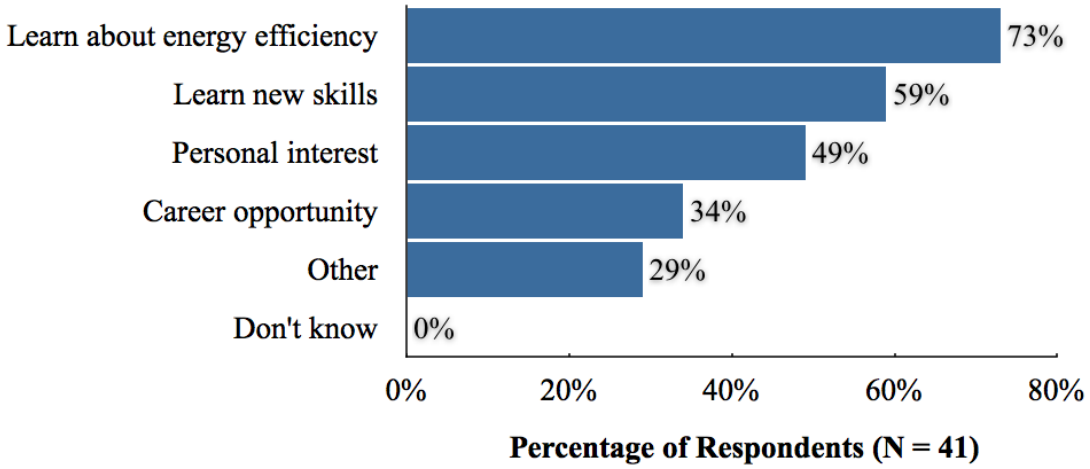

Figure 4-5 Participant Motivations to Enroll in BOC Course

Twenty-nine percent of respondents indicated other motivations for participating in the program, and the majority of these motivations were related to the fact that the ComEd Retro-commissioning Program requires a facility staff member to obtain building operator certification. This finding and the overall distribution of responses to this survey question are fairly consistent with those from the previous program year.

As reported during the prior year, 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.

4.3.6 Tuition Rebate Importance

When asked about the importance of the DCEO tuition rebate in the decision to participate in the BOC training, the majority of participants (65%) reported that the rebate was at least somewhat important. These results are consistent with those found during EPY4/GPY1, and suggest that the DCEO tuition rebate is directly influencing participant decision-making.

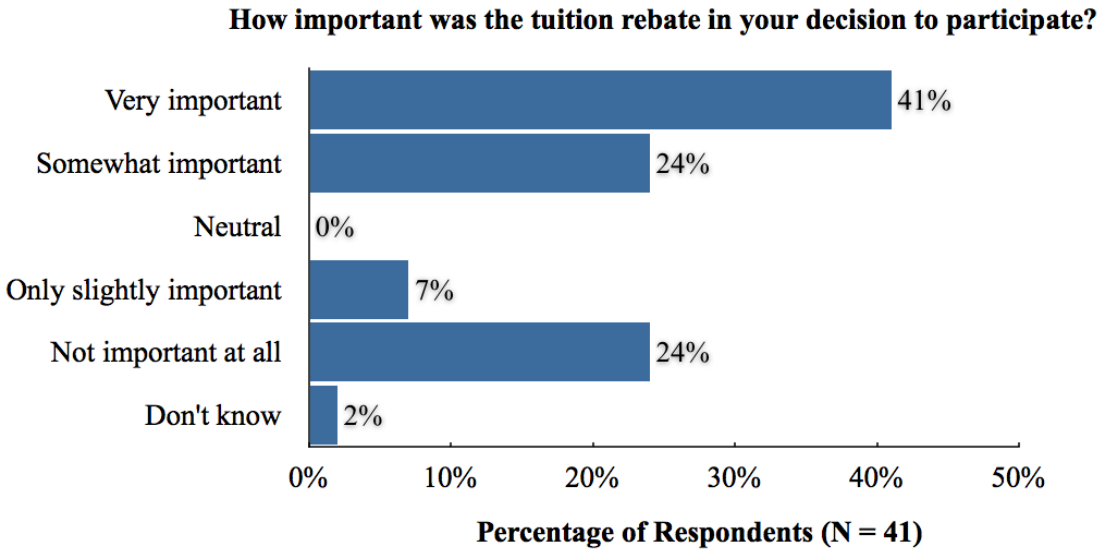

Figure 4-6 Importance of DCEO Incentive in Decision to Participate

4.3.7 Participant Actions Following BOC Training

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

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

- Lighting;
- Lighting controls;

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

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

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

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

4.3.8 Energy Efficient Equipment Implementation

Approximately 85% of respondents (35 of 41) indicated that they had purchased and installed new equipment since participating in the BOC courses. This is very similar to the findings from EPY4/GPY1, where 86% of respondents reported purchasing and installing such equipment. Figure 4-7 displays the types of projects that were cited by these respondents. The most commonly reported projects involved energy efficiency lighting and lighting controls measures, which were cited by 51% and 34% of these respondents, respectively. This was followed by heating system improvements (32%) and air conditioning improvements (29%). Approximately 17% of respondents reported implementing a VSD following BOC training, and few respondents reported installing water heating efficiency improvements, and economizers, and other improvements. Lighting and lighting controls were also the most common new equipment types cited by EPY4/GPY1 participants. As lighting is a commonly implemented measure and typically involves a more straightforward implementation process than some of the other possible measure types, commercial and industrial facilities may be more likely to complete these types of projects in general.

It should be noted that the information presented below presents all measures reported by BOC participant survey respondents, regardless of whether they were influenced by the BOC training or the associated tuition rebate. The savings impact chapter of this report presents net savings for

the BOC Program, taking into account BOC training influence, tuition rebate influence on attendance, and whether the participant received a separate incentive for implementing their energy efficiency project(s).

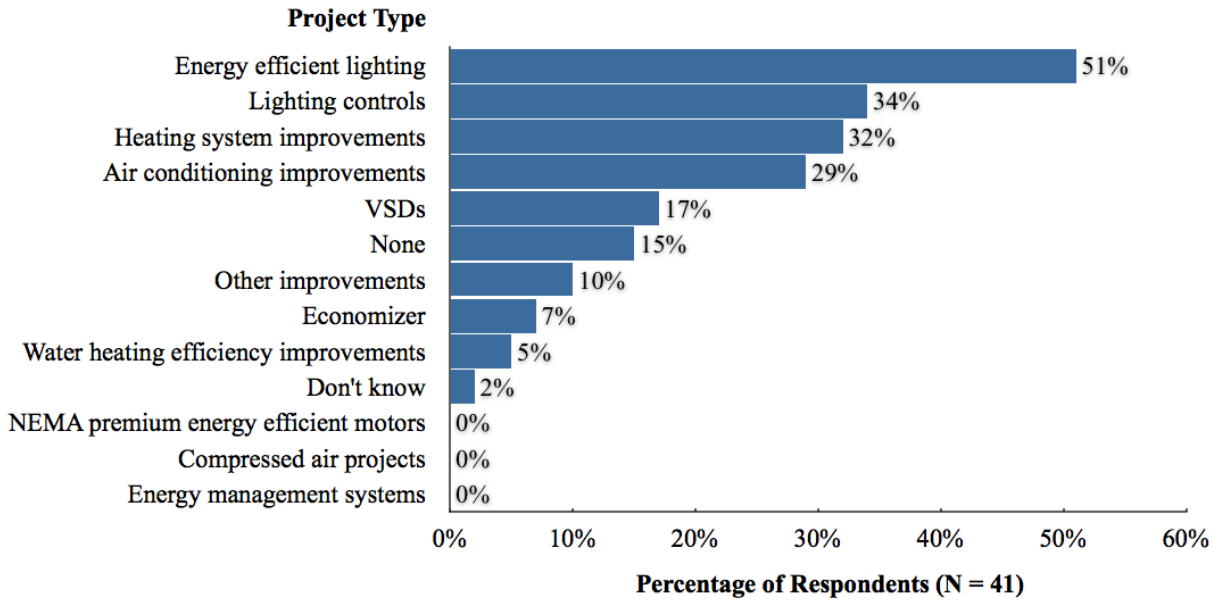

Figure 4-7 Energy Efficiency Implementations Following BOC Training

4.3.9 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 4-8 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 cooling system maintenance frequency, which was cited by 20% of these respondents. This was followed by increased heating system, motor, and compressed air system maintenance, each cited by 17% of respondents. Overall, the maintenance activities cited by respondents were mainly related to increased maintenance frequency rather than methodological changes.

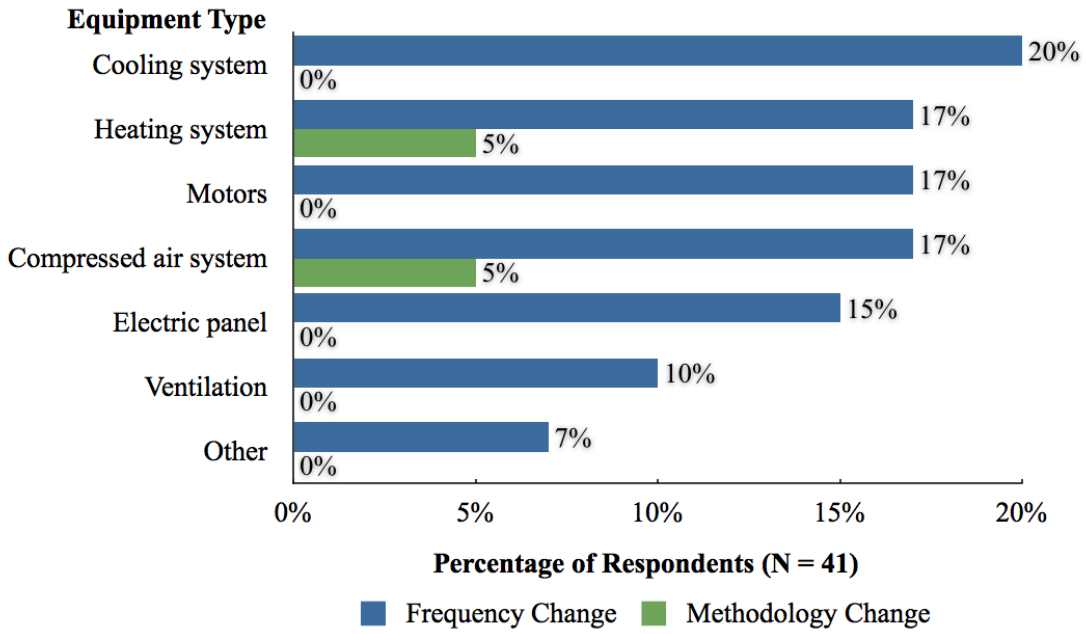

Figure 4-8 Maintenance Changes Following BOC Training

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

4.3.10 Other Energy Efficiency Activities

Respondents were also asked about other activities related to energy efficiency that may have occurred at their facilities. These activities included implementing an energy budget, recording energy use, and setting and achieving energy savings goals. Participants provided information about which of these had occurred prior to participating in the BOC course, and which had occurred only after participating in the BOC course. Figure 4-9 displays the results. Thirty-seven percent of respondents reported that they had set energy savings goals prior to participating in the BOC training, and 22% of respondents indicated that they had achieved these goals before participating in the program. Seventeen 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 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. However, the presence of these behaviors among respondents increased by

an average of 50% after attending the BOC courses, suggesting that the program may have successfully motivated participants to implement specific energy saving or energy monitoring initiatives.

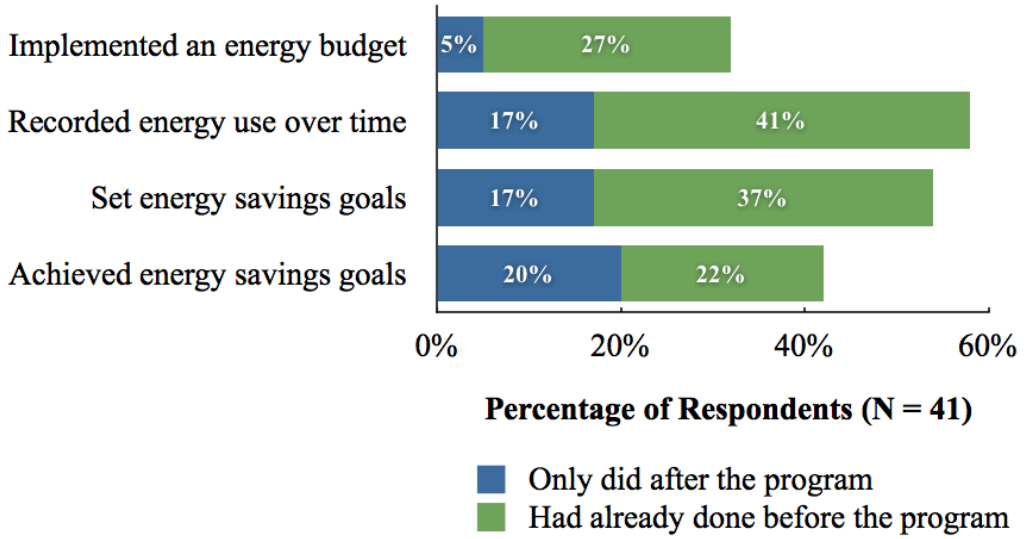

Figure 4-9 Procedural Energy Efficiency Activities Completed by Participants

4.3.11 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 4-3 shows participant satisfaction by each selected program element. Overall, participants reported high satisfaction levels for all program elements, most notably with the course instructors and the tuition rebate application process. Course instructors were also highly rated during EPY4/GPY1, which suggests that the BOC Program has continued to use well-qualified and effective training staff. Respondents provided fewer instances of "very satisfied" responses for the time elapsed to receive the tuition rebate, although some of the respondents may not have directly received the rebate as it may have been issued to the supervisor or facility accounting department. All of the survey respondents were either satisfied or very satisfied with their overall BOC Program experience. There was only one reported instance of dissatisfaction with a single component of the program, a course instructor. One respondent felt that one particular course instructor seemed to be rushed and not fully engaged in the training.

Table 4-3 Participant Satisfaction Ratings by Program Element

Element of Program Experience	*Satisfaction Rating (N = 41)*					
	Very Satisfied	*Satisfied*	*Neither Satisfied nor Dissatisfied*	*Dissatisfied*	*Very Dissatisfied*	*Don't know*
Course instructors	49%	49%	-	2%	-	-
Course schedule	39%	59%	2%	-	-	-
Tuition rebate application process	41%	32%	7%	-	-	20%
Tuition rebate amount	32%	39%	7%	-	-	22%
Time elapsed to receive tuition rebate	17%	49%	10%	-	-	22%
Overall BOC Program experience	61%	39%	-	-	-	-

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

4.3.12 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. As was the case with the prior program year, nearly all of the respondents (95%) reported that they had found at least one of the courses very useful and provided further details regarding their opinions of these courses. Specific courses or subject matter cited as particularly useful by survey respondents include:

- Lighting
- HVAC
- Electrical systems
- Energy management

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 segment [made] us aware of the different opportunities to cut back on energy, like LED lights. The HVAC course opened ours eyes to our dampers which aren't very energy efficient.*

> *All the tools they gave you to make calculations and all the information they handed out with all the different disciplines—energy management, reading your bill, how to calculate electric usage [were all very useful].*

During the [building certification] class, different segments, they have you different websites to go to, different avenues to look up additional information or people to go to for a particular problem or difficulty.

The lighting course showed how to calculate the different wattages. Calculations of gas therms showed how energy efficient our boilers are.

[What was useful] was the detailed information in each course. It expanded the things I didn't know the details about, like how to calculate energy savings and what the new building standards are.

The responses and open-ended commentary received from respondents indicates that participants have gained valuable information and insight into the operations and management of their facilities. Additionally, as the survey was administered several months after the courses were completed and the majority of respondents were able to recall the specific course content that had been useful to them, it appears that the BOC is effectively training participants with lasting knowledge and skills. This has been the case with the past two evaluation years, which reflects positively on program structure and delivery.

Respondents were then asked whether they thought that any particular BOC course was not useful. Five of the respondents (12%) reported that they had found at least one course to not be very useful, and provided details regarding these opinions. Three of these participants explained that some of the content in several of the courses was not relevant to their particular employment role. Additionally, two of these participants reported that they already knew the information provided in the courses. Several respondents also noted that some of the course material was too difficult to understand, or that they did not have enough basic knowledge about some subjects in order to benefit from some topics.

Overall, fewer EPY5/GPY2 respondents than EPY4/GPY1 respondents indicated that a particular course was not useful, but overall it appears that the perceived issues with courses are fairly anecdotal in nature. It is likely that participants will continue to focus on the courses and content that is most relevant to their facilities and roles, and while some topics may not benefit a small number of individuals, the course format and structure are likely generally effective for the majority of participants.

4.3.13 Participant Recommendations and Overall Impressions

Overall, the participant survey findings from the current year are very consistent with the findings from EPY4/GPY1. In both cases 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. Most of the respondents who provided feedback for program incentives indicated that the financial support was valuable and influential in their decision to participate. Additionally, the majority of respondents cited specific courses or topics that had been particularly useful to them in their current employment roles, or explained that they

had been able to implement specific energy saving initiatives as a result of new information learned through BOC training.

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

From the participant perspective, there are very few issues or weaknesses in program structure or delivery that require attention. As there were no significant increases in dissatisfaction or issues with program participation and some of the survey results suggest an improvement over prior years, the BOC Program appears to be maintaining or increasing its overall effectiveness.

4.4 Supervisor Outcomes

ADM administered an internet survey to supervisors of employees who attended the BOC training. The purpose of the survey was to assess the value of the training the organization, any impacts on employees' job behaviors and performance that the supervisor may have observed, barriers to completing efficiency improvements, and barriers to participation in the program. ADM received the contact information for 43 supervisors, of whom 14 responded to the survey.

Supervisors of Building Operator Certification Program graduates were asked whether the courses had been useful in increasing their employees' skill level and knowledge in various aspects of their jobs. Specifically, the survey asked how useful the courses had been in helping the employee identify energy efficiency improvements, monitor facility energy use, improve maintenance practices, and identify ways to improve occupant comfort. As shown in Table 4-4, supervisors generally reported that the courses had been somewhat or highly useful in all of these areas. None of the supervisors indicated that the courses had not been useful in improving employee skill and knowledge in any of the listed categories. Although the level of awareness of employee knowledge likely varies among supervisors, these results suggest that supervisors have seen improvement in several aspects of employee performance since the BOC courses were completed.

Table 4-4 Supervisor Rating of Course Usefulness

Skill Category	*Rating of BOC Usefulness*				
	Very Useful	*Somewhat Useful*	*Not Useful*	*Don't know/Not applicable*	*n*
Identifying Energy Efficiency Improvements	50%	43%	-	7%	14
Monitoring Facility Energy Use	36%	57%	-	7%	14
Improving Maintenance Practices	36%	57%	-	7%	14
Identifying Ways to Improve Occupant Comfort	31%	62%	-	8%	13

Nearly all of the interviewed supervisors indicated that the BOC Program had also been useful in helping their employees perform more effectively in other areas of their jobs. When asked to elaborate on these other areas of improvement, supervisors provided a wide range of responses indicating that employees had become more confident and comfortable with the facility's systems, had become more mindful of energy usage, and had acquired various pieces of knowledge that generally assist them in their everyday working roles. Additionally, one supervisor noted that their employee had started to develop annual operating budgets.

When asked whether their employees had used or applied any of the concepts or methods taught in the BOC courses, more than 90% of the supervisors confirmed that employees had done this. The remaining respondent did not know whether their employee had applied these concepts or methods.

4.4.1 Equipment Changes Implemented or Recommended Since Graduation

Supervisors were then asked to specify the equipment changes that their employees had either implemented or recommended since they completed the BOC training courses. These changes were separated into several categories, including:

- Lighting controls;
- Energy efficient lighting;
- Variable speed drives or variable frequency drives;
- Energy saving improvements to compressed air systems;
- Energy management systems;
- Energy saving improvements to heating systems;
- Energy saving improvements to cooling systems;
- Economizers; and

- Water heating efficiency improvements.

For each of the above categories, supervisors were asked to indicate whether their employees had either implemented a change or recommended the implementation of a change within that specific system or equipment type. Table 4-5 presents the results of these questions, identifying the percentage of supervisor respondents who provided each response. The most common measures implemented since BOC graduation were lighting controls and energy efficient lighting, each reported by 36% of supervisor respondents. Energy efficient lighting had the highest level of overall activity, with nearly 80% of supervisor respondents indicating that this measure type had been either recommended or implemented since the employee completed BOC training. Variable speed drives or variable frequency drives also represented a large portion of the measure activity, with 21% of supervisors indicating that this measure had been installed and 29% of supervisors indicating that it had been recommended by the employee.

Heating system improvements and cooling system improvements were among the measures most recommended by BOC graduates, but also represented the lowest levels of implementation activity with only one supervisor reporting that one of these improvements had actually been made. From these results, it appears that facilities are more likely to proceed with the implementation of potentially low-cost, straightforward measures that require a lower level of project planning. Recommendations alone are not likely to result in measure implementation unless the measure meets the facility's financial requirements and purchasing guidelines.

Table 4-5 Supervisor Reported Measure Activity of BOC Graduates

Measure Category	*Measure Status (n = 14)*		
	Implemented	*Recommended*	*Don't know*
Lighting controls	36%	21%	14%
Energy efficient lighting	36%	43%	7%
Variable speed/frequency drives	21%	29%	29%
Compressed air improvements	7%	29%	36%
Energy management systems	7%	29%	29%
Heating system improvements	0%	43%	29%
Cooling system improvements	7%	36%	29%
Economizers	14%	14%	36%
Water heating improvements	7%	29%	29%

Supervisors were also asked whether their employees had recommended or implemented any measures that were not included in the provided list. Fifty-seven percent of respondents reported that their employees had recommended one or more other measures since completing the program, and 14% of supervisors reported that their employees had implemented one or more other measures. Although most of the respondents did not provide further information about these other recommendations or implementations, one of the supervisors who indicated that their

employee had implemented once such measure explained that the employee had assisted in the implementation of an energy efficient ice melting system.

Overall, nearly all of the supervisor respondents indicated that their employees had recommended one or more measure improvements since completing BOC training, and 9 out of 14 supervisors (64%) reported that one or more measures had actually been implemented. This suggests that BOC graduates are actively applying the knowledge and skills obtained from the BOC Program, resulting in direct improvements to facility equipment and reductions in energy usage.

4.4.2 Maintenance Changes Implemented or Recommended Since Graduation

Supervisors were then asked to specify the maintenance changes that their employees had either implemented or recommended since they completed the BOC training courses. Approximately one-third (35%) of supervisor respondents reported that their employees had either recommended or implemented a maintenance improvement since completing the BOC Program. When asked to elaborate on these maintenance changes, supervisors cited a range of improvements including:

- Regular monitoring and repair of steam traps;
- Modified lubrication and filter maintenance schedules;
- Power management schedule for HVAC equipment; and
- Overall attention to energy efficient maintenance practices.

As a follow-up, supervisors were asked whether their employees had performed any maintenance activities more often since completing the BOC Program. Twenty-one percent of respondents indicated that the employee had increased the frequency of maintenance activities, including increasing the frequency of air filter change-outs and modifying the maintenance schedules for economizers and cooling towers.

When asked whether their employees had performed any maintenance activities more effectively since completing BOC training, 29% of respondents reported that their employees were more effective in one or more areas. One of these supervisors explained that their employee is now more confident during interactions with other maintenance staff, which contributes to the quality of work performed. Another supervisor stated that their employee has become more proficient in working with company owners to plan and implement facility cost improvements.

These results provide further evidence that the BOC Program is effectively providing students with information and skills that can be applied to facility maintenance activities. It appears that BOC graduates have actively increased or improved their maintenance efforts, and in some cases have gained valuable skills with regard to confidence and communication with their colleagues.

4.4.3 Barriers to Energy Efficiency Implementation

In order to gauge the overall ability of organizations to reduce their energy usage, supervisors were asked whether they face any barriers to the implementation of energy efficiency improvements. As shown in Table 4-6, supervisors most commonly reported that they do not have sufficient financial resources for energy efficiency projects. This is consistent with findings from the participant survey and MEEA staff interviews, which emphasized the importance of financial considerations when planning and approving energy saving improvements. Additionally, 21% of supervisors reported that they do not have enough staff resources for energy efficiency planning. This may be addressed by providing additional guidance to participating organizations after a participant has completed the BOC training; working with supervisors to identify specific steps towards project implementation may further motivate them to seek approval for and plan the projects recommended by BOC graduates. MEEA staff reported that in upcoming program years, there will be increased efforts to work with supervisors, educating them and answering questions that they may have about energy savings or project implementation procedures. This may alleviate some of the staffing limitations cited by supervisors.

Table 4-6 Supervisor Barriers to Energy Efficiency Project Implementation

Implementation Barrier	*Percentage of Respondents (N =14)**
Organization/company not committed to energy efficiency improvements	14%
Lack of knowledge about ways to save energy	0%
Not enough financial resources for energy efficiency projects	43%
Not enough staff resources to plan efficiency projects	21%
Other	21%
Don't know	14%

*Respondents were able to provide multiple responses. The percentages shown are percentages of respondents, and therefore the sum of percentages exceeds 100%.

Although none of the respondents reported that they lack knowledge about ways to save energy, the supervisors who reported having other barriers to project implementation mainly stated that their organization either lacks the knowledge or motivation to actually implement projects. This further emphasizes the benefit of educating not only building operators, but their supervisors and other staff as well. It is likely that if multiple staff members in an organization are trained and knowledgeable about energy efficiency and planning procedures, the overall organization will be more inclined to take actual steps towards energy reduction.

Supervisors were also given the opportunity to provide open-ended comments about the barriers to energy efficiency that their organizations face. Examples of these comments include:

> *[We] do not have enough people to execute some of the goals.*
>
> *Supporting capital projects compromises our staff time to take on new planned projects.*
>
> *Not enough knowledge on how to maintain energy upgrades, for instance multi-zone energy projects.*

4.4.4 Internal Knowledge and Skill Sharing

In order to gauge to what extent BOC graduates share their training knowledge and educate colleagues about what they have learned, supervisors were asked about their employees' activities since returning from the BOC courses. When asked whether their employees had shared what they had learned with other employees, more than half of the supervisor respondents reported that this had occurred. The remaining respondents did not know whether their employees had shared BOC training knowledge with colleagues.

The supervisors who reported that their employees had shared knowledge or skills were then asked to elaborate on what actions the employee had taken in this regard. As shown in Table 4-7, the majority of these supervisors reported that their employees had given verbal explanations of concepts or methods, while one-quarter of these supervisors reported that their employees had conducted on the job demonstrations of concepts or methods. Three of these supervisors (38%) stated that their employees had shared BOC course materials. Additionally, one supervisor noted that their employee had conducted educational workshops with colleagues.

Table 4-7 BOC Graduate Knowledge Sharing Activities

Activity Type	*Percentage of Respondents (N =8)**
On the job demonstration of concepts or methods	25%
Verbal explanation of concepts or methods	63%
Written explanation of concepts or methods	0%
Shared course materials	38%
Other	13%
Don't know	0%

*Respondents were able to provide multiple responses. The percentages shown are percentages of respondents, and therefore the sum of percentages exceeds 100%.

These results suggest that BOC graduates are engaging in some knowledge and skill sharing, although it is unclear to what extent each of these activities is occurring and whether their colleagues are receptive to the new information.

4.4.5 Organizational Importance of Building Operator Certification

The Building Operator Certification Program is now established as a widely recognized training and education program that encourages best practices and contributes to efficient and mindful facility operation. The effects of the training program are not only limited to the specific projects and maintenance improvements conducted by BOC graduates, and include qualitative benefits to employees and their organizations. The supervisor survey included several questions to address this idea, focusing on the overall value and importance of the certification.

BOC graduates may have increased skill levels that allow them to improve their working environments and play a more valuable role in their organization's success. In order to address this, BOC participant supervisors were asked whether their employees had added value to their organization since completing the training, with responses separated into several categories. Nearly all of the surveyed supervisors reported that their employees had conducted value-adding activities, and the majority of respondents indicated that their employees had engaged in more than one such activity. As shown in Table 4-8, supervisors most commonly reported that their employees had become more proficient in saving energy at the facility (86%). A high percentage of respondents (71%) also reported that their employees had added value by saving money, having more productive interactions with contractors, and undertaking or influencing energy efficiency projects. It is expected that most BOC graduates would engage in these activities, and these results indicate that supervisors view these behaviors as valuable to their organizations.

Table 4-8 Value Adding Improvements from BOC Graduates

Value Adding Improvement	*Percentage of Respondents (N = 14)**
Saving energy at your facility	86%
Saving money	71%
Helping to improve occupant comfort	57%
Advising in decisions about equipment operation or replacement	64%
Having more productive interactions with contractors	71%
Undertaking, recommending, or influencing any energy-efficiency projects	71%

*Respondents were able to provide multiple responses. The percentages shown are percentages of respondents, and therefore the sum of percentages exceeds 100%.

Supervisor respondents were then asked how important to the hiring decision it would be for a potential employee of their organization to have the Building Operator Certification. All but one

of the supervisors reported that it would be either important or very important to the hiring decision. Supervisors were then asked how important having the certification is for current employees to receive promotions or advancements, and 79% of supervisors reported that the certification is an important factor. Overall, these results further confirm that the Building Operator Certification is a valuable achievement, not only to graduates, but also from the perspective of their supervisors and the organization as a whole.

4.4.6 Considerations for Enrolling Employees in BOC

In order to gauge how supervisors determine who to send to BOC training, respondents were asked what factors they consider when deciding whether to enroll employees in the program. As shown in Table 4-9, these considerations were divided into a list of categories including time and staff availability, training location and costs, and organizational benefits of Building Operator Certification. Supervisors most commonly reported (71%) that employee professional development was a primary consideration for whether to send individuals to the BOC Program. A large portion of supervisors also cited considerations related to the training itself, such as location (64%), costs (43%), and training length (36%). More than half (57%) of surveyed supervisors stated that they considered the benefits that Building Operator Certification would have for their organizations.

Table 4-9 Considerations for Enrolling Employees in BOC

Consideration for Enrollment	*Percentage of Respondents (n = 14)**
Time/staff availability	64%
Training costs	43%
Location of the training	64%
Instructor/sponsor for the training	7%
Length of training	36%
Your organization's approval process for sending employees to training	21%
Employee professional development	71%
Legal requirements	0%
Gain/benefits for company of certification	57%
The employee's personal interest	43%

*Respondents were able to provide multiple responses. The percentages shown are percentages of respondents, and therefore the sum of percentages exceeds 100%.

Nearly half of the supervisors reported that training cost was a primary consideration when deciding whether to send employees to BOC training. When asked how important the tuition

rebate was in their decision to enroll their employees, all of the supervisors either reported that the rebate was important (57%) or very important (43%) to their enrollment decision.

As a follow-up question, supervisors were then asked whether their employees would have been sent to the Building Operator Certification Program if the tuition rebate had not been available. Table 4-10 shows that although none of the supervisors reported that their employee definitely would have attended the training without the existence of the tuition rebate, 29% stated that their employees probably would have attended. This suggests that some supervisors may not be fully aware of how the rebate factored into the enrollment decision, or that although rebates were important, they were one of several consideration factors. However, the majority of supervisors reported that their employees probably would not have (43%) or definitely would not have (21%) attended the training in the absence of the tuition rebate.

Table 4-10 Likelihood of Attendance absent Tuition Rebate

Response	*Percentage of Respondents (N = 14)*
Definitely would have	-
Probably would have	29%
Probably would not have	43%
Definitely would not have	21%
Don't know	7%

4.4.7 Future Energy Efficiency Activity

In order to gauge whether the BOC has had a significant effect on organizations' overall decision making and planning, supervisors were asked to speculate about their future involvement in energy efficiency. First, supervisors were asked whether the BOC training has increased the likelihood that their organization will participate in energy efficiency programs such as incentive programs. Half of the supervisors stated that the program has increased this likelihood, and were asked to elaborate on their responses. Specific commentary resulting from this question includes:

> *[We are] more aware of the program and what we can do.*
>
> *Employees taking the BOC training class are more informed about incentive programs that exist.*
>
> *With the knowledge acquired at the BOC class it only inspires one to achieve greater heights.*

Supervisors reporting that the BOC Program has not increased the likelihood of participating in energy efficiency programs were also asked to elaborate on their responses. These respondents

mainly stated that they already participate in incentive programs, so the BOC Program is not going to significantly affect their participation decisions.

As a general follow-up question, supervisors were asked whether the employee training for Building Operator Certification has increased the likelihood that the organization will make investments in energy efficiency. More than half (57%) of respondents stated that the training has increased this likelihood, and were asked to elaborate on their responses. Specific commentary resulting from this question includes:

> *As we spend more on investments their worth is becoming more clear.*
>
> *Getting enough building engineers engaged leads to feedback about their buildings. It becomes easier to build a business case about a program that addresses campus-wide efficiency issues.*
>
> *If you acquire a certain understanding on a subject, it becomes easier to convince the fiscal office of the savings that could be achieved.*

Similarly, supervisors who reported that the training has not increased the likelihood of energy efficiency investments were also asked to elaborate on their responses. All of these respondents reported that they already make energy efficiency investments, so the BOC training will not have a significant effect on their decision making.

According to these results, some supervisors believe that their organizations are already participating in energy efficiency programs and making energy efficiency investments at a sufficient level. This perspective may result in some resistance to energy efficiency recommendations made by BOC graduates unless these projects can be incorporated into the organizations' existing investment plans. It may be useful to provide guidance and further support to supervisors and approval committees within participating organizations, as they will likely be the final decision makers with regard to future project recommendations.

4.4.8 Future Enrollment and Program Referrals

Finally, supervisors were asked about future plans to recommend the BOC Program or to enroll additional employees in the program. All of the supervisors reported that they would recommend the BOC Program to their colleagues, either within or outside of their organizations. When asked whether they expected to enroll any other staff members in the BOC Program, half of the supervisors responded in the affirmative while a third of supervisors did not know. The two supervisors who stated that they were unlikely to enroll additional employees in the program explained that their organization only has one maintenance employee. The other respondent stated that their organization is too busy, and that they have a small staff and a small budget.

Overall, these results speak favorably of the program and suggest that a high percentage of organizations will at least consider sending additional employees for certification. There were

very few complaints or negative issues raised by supervisor respondents, which further supports the perceived value of, and satisfaction with, the Building Operator Certification Program.

4.5 Course Instructor Outcomes

The evaluators completed five telephone interviews with instructors in the BOC Program. The interviews were completed during August and early September, and respondents were recruited from a list of Program instructors provided by DCEO. Interviews used a discussion guide addressing the following topics:

- Length of time instructors had been teaching in the Program and the courses that were taught
- Work experience as it relates to the BOC Program
- Evaluation of the current BOC Program curriculum
- Evaluation of current BOC Program course content
- Evaluation of facilities where BOC Program courses are taught
- Evaluation of BOC Program student motivation to learn
- Evaluation of BOC Program administration
- Suggestions for changes and improvements

It should be noted that the results discussed in this section are based on a small number of interviews. While the information does provide insight into the instructor perspective, the number of interviews is not sufficient to allow the information to be generalized to all BOC Program instructors..

In the following subsections, extensive verbatim quotations are used to illustrate key points. While the words are those of the respondents, the quotations have been edited for brevity and appropriateness and to make the quotations easier to read.

4.5.1 Length of Time Teaching in the BOC Program and Number of Courses Taught

Responding BOC instructors have taught in the program for as few as three years to more than ten years. During their time teaching, each instructor has taught a number of courses. All have taught multiple times, and some have taught over fifty courses. As a group, the individuals who were interviewed are experienced instructors.

> *I think the first class I taught was in 2002 or 2003. Some classes are two days, probably be somewhere around 100 to 150. I'm not sure exactly.*
>
> *Close to 6 years. I would say over 50 courses.*
>
> *About 3 years. At least 7. I hedge on that because I teach in Ohio and I've also taught with NEEA filling in as an instructor, so I've taught at least 14 courses.*

I would say close to 7 years.

I think it's been at least 10 years. I want to say maybe 5 courses a year.

4.5.2 Specific BOC Program Courses Taught

The interviewed instructors teach a range of courses, from HVAC troubleshooting and controls to indoor air quality and sustainability. Instructors reported that they often teach the same courses each year.

BOC 103 which is the HVAC controls class, and then BOC 203 and 204, it's level 2 HVAC troubleshooting and building controls.

I have taught, they just instituted a new curriculum, but in the past, I taught the original orientation course and sustainable facilities, indoor air quality, preventative maintenance, and I have done the lighting unit.

I teach BOC 102 and 107. 102 is the energy efficiency program and 107 is basic facilities electrical.

The indoor air quality, which is now indoor environmental quality. I used to teach a regulations course, and now they've changed that to operations and maintenance for sustainable operations and maintenance.

4.5.3 Related Work Experience

As a group, the interviewed instructors bring a great deal of related experience to the classes that they teach. This experience allows the instructors to present an appropriate "real world" perspective in the classes and to provide practical examples of theoretical topics.

About 10-15 years in operations and HVAC systems and about 12 years in energy efficiency.

I managed facilities for almost 30 years. When I left that world, I worked for an environmental health and safety consulting firm, and I've done other things.

I've had about 50 years of experience in the electric power industry, ranging from electrical utilities, which was the majority of my experience, having my own engineering consulting company for several years on energy efficiency.

I'm the Educational Training Fund Training Director and Fund Administrator at the International Union of Operating Engineers Local 399 in Chicago. Licensed electrician, licensed stationary engineer and certified energy manager.

I have extensive work experience in indoor environmental quality.

4.5.4 Current Teaching Outside the BOC Program

Three out of the five instructors interviewed do not currently teach outside the BOC Program. The two that do teach outside BOC teach a variety of courses, some of which are also related to building operations.

> *I also teach as adjunct faculty at Wright College for the Industrial Environmental Technology program and at Oakton for their high pressure steam program, and I teach maintenance and management at IIT.*
>
> *Probably 25-50% of my work time is related to teaching. My specialty is industrial hygiene, which means that I do environmental sampling of all different types, and then I try to interpret the results.*

Additionally, all of the interviewed instructors reported that they continue to work in addition to teaching in the BOC Program.

4.5.5 Thoughts on BOC Program Curriculum

In general, instructors feel that the BOC Program courses cover the necessary material and are valuable to program participants. There are some concerns about the amount of material and the speed at which it is presented, and some concern about keeping the material current and up to date.

> *I think the concepts in general and the material are good. Test questions tend to be really poor. Material just doesn't seem to get updated, maybe not updated, but there's no clear method to allow you to correct the material. From my standpoint, I basically bring supplemental material.*
>
> *I think we cover the right topics. There's always room for growth and improvement. I think it's all centered around energy conservation, which that's a common core thing for all the classes.*
>
> *I find it to be very useful from the basis of understanding what the end-user customer needs to know about electrical, energy consumption. All of the programs in BOC deliver all that information very well for the practitioners that are working with buildings and building systems.*
>
> *For the indoor environmental quality, it covers the right topics. It could refer more extensively to ASHRAE, the professional trade group.*

4.5.6 Appropriateness of Topics Covered by the Curriculum

For the most part, interviewed instructors reported that the topics being taught are the right topics, although several explained that there is room for improvement. Instructors noted that at some points they will quickly go over some topics so that they are able to spend more time on higher value topics. One instructor stated that too much is taught and that students are not always sufficiently well prepared.

> *Yeah, I think there's room for improvement, and one thing that has changed, is there's a tendency to put an awful lot of material in the class. The strategy is that you can go through the stuff that's more applicable to a given area.*

> *I've been trying to keep up with the new changes and staying current. There's room for growth, but I don't have any real good suggestions at this point.*

> *I think there are probably not any topics that should be covered more or less, or less of what they are covering. I think they are covering too much. To take somebody who has no electrical background and bring them through electrical distribution to three phase and transformers and power quality, I think they are covering way too much in way too little time. I think they could take some of those away and get a lot better knowledge base the person could absorb for what they are trying to do.*

Although there were some concerns about the scope of topics offered, the interviewed instructors explained that the current set of topics is fairly appropriate, and that there are not any topics that should be removed from the training. In terms of additions to the curriculum, instructors suggested including topics such as float level safety and arc flash safety. Instructors also reported that if they perceive the need for a specific topic to be covered even when it is not in the actual curriculum, they will often use their own materials or experiences to cover the topic as a supplemental activity.

4.5.7 Assessment of Course Materials

The experience and knowledge of the instructors enhance the course content, and instructors reported that they routinely use examples from their own professional experiences to relay a specific point. This provides a richer learning experience for the students and tends to provide a more practical application of the information. Instructors noted that the materials that are provided, books and slides, cover the appropriate content.

Some instructors explained that they often supplement the provided course materials with their own items. This typically occurs when the course materials are thin or when the instructor has specific knowledge and experience to offer, and the supplementary materials include handouts, additional slides, or video clips. Instructors stated that these materials are sourced from industry publications, equipment manufacturers and the Federal government.

The book, what you see is what you get. I think they are well done. Each instructor, as far as in their presentation, they bring their own experiences, handouts, photos, references and that enhances the product. Kind of brings it into the real world a little bit. Every instructor has a different way of doing things. That's part of the wealth of the program because the instructors are all, I use the term loosely, experts in their field, and that enhances the learning.

I think that the materials are getting better because now the slides are color. The new books that are coming out, they really did a great job on trying to proactively make these courses transition to the new platform. Those books are supplied, the PowerPoint is supplied, nice write up. I just think that a lot of times the students need to read them possibly before the first class, not at the first class.

In my case, in the arc flash, I've introduced into the PowerPoint several slides that tell what arc flash is so the students get a better understanding of it. I'll have a few show and tell in the electrical portion on meter reading. I've seen other instructors pass around meters and things of that nature. I find instructors bring additional things to the table in addition to their skill sets.

4.5.8 Evaluation of Course Facilities

Instructors generally have no criticisms of the locations and facilities where the courses are taught. Often the courses are taught at a community college, which the instructors agree, is an ideal setting – sufficient room and lighting, and an environment conducive to learning. Courses are sometimes taught in hotel meeting rooms, which are also acceptable. Instructors explained that the best facilities are those that permit walking around and observing a physical plant. This allows for a more hands-on approach to learning, and also provides a setting that may be more interesting and engaging than a standard classroom.

The most common place is a community or technical college. Sometimes they are at hotels – rooms rented. I taught a course at a restaurant. I sat at the bar all day and taught. Some of the utilities host classes. Yes, usually they are top notch.

They are all over the place. Typically they are taught in a community college, which are generally very good. They could be in the NEEA facility, that's a good place. There's been a mixed bag. Generally community colleges which are very nice places to teach.

4.5.9 Student Readiness and Motivation

According to instructors, the readiness of students to take the various courses varies, as some have little experience while others have extensive experience in the specific field. Instructors explained that some students know one area well, such as HVAC, but may not know another area, such as lighting. Instructors noted that more knowledgeable and experienced students are

better able to take advantage of the classes. However, this has an upper limit as there have been a few students who are over-prepared and already know all of the information being presented.

> *You have guys who know lighting, but they may not know anything about HVAC. There's also people from a facility management standpoint that understand concepts related to energy efficiency but have no idea of the physical implementation of it. What's interesting is you end up getting people who have some experience related to a building, and the class allows them to start tying some of that experience to the newer concepts.*
>
> *Some are in supervisory positions and it helps them to understand what their worker people need to go through. But the majority of these people are doing the work, and they appreciate this kind of exposure.*
>
> *I think when you have experienced engineers, they do very well because they've seen a lot of this already and they can take on new topics rather quickly. It's the novices I think have the trouble.*

In terms of overall motivation, instructors reported that Students are interested in obtaining the certification as a building operator, and that this need or desire generally provides sufficient motivation to complete the work. The extent that the courses provide actual tools to help students in their jobs also serves as a motivating factor.

4.5.10 Program Administration

Instructors reported that program administration staff members are well organized, listen to their concerns, and are available for assistance as needed. Specifically, instructors explained that program administration staff provides the type and level of support needed, which helps to build a positive working relationship.

> *As far as the program, it looks very organized. They make a great effort to reach out to instructors to gain input to make changes to fix things. From a management point of view, they do a very good job. They try to communicate with all the instructors and make it convenient for everybody. I think that part is good.*
>
> *I just send them an email, and I usually get a response within a day or two. It's not a problem, and NEEA has been really great about, I send multiple versions of test questions to them, and in many cases if NEEA does not respond, they just include the test questions and issue them with the test.*
>
> *They are very good. Anytime I needed anything, they were quick to respond, efficient, very pleasant, very professional. That has all been very good.*

4.5.11 Satisfaction with the Program

Instructors reported few areas of dissatisfaction with regard to their experiences in the program. One instructor noted that the program could benefit from increased marketing, while another instructor expressed a desire to teach more courses. One instructor mentioned that the test questions could be improved, but did not provide additional details regarding specific possible improvements. Additionally, instructors expressed some concerns about test questions and about the speed with which material is presented, but generally there are no major criticisms or areas of dissatisfaction.

> *If there was one thing, it's the test questions. I find the test questions dissatisfying and frustrating.*
>
> *No. I cannot offer any negatives in that regard. I am very pleased with it, and I would like to be teaching more if the opportunities were there.*
>
> *I would say the biggest thing is there is too much material that is paced too quickly to give them enough time to really gain something that they want. It's not that they don't have the desire, I don't think it's physically possible to go over so much in a short period of time.*
>
> *We don't teach often enough. I think there's a variety of instructors. I feel like there are seasons where they have a bunch in a row, and then they won't have any for a long time.*

4.5.12 Suggestions for Improvement

Instructors suggested several areas for improvement or change. These suggestions were primarily related to developing a way for instructors to provide feedback about their experiences in the program, or to recommend additional materials that may be beneficial to the training process.

> *I think there needs to be a simple process for instructors to provide feedback on additional material or enhancements to the program so that you can get material in.*
>
> *I think they could ask for more comments from the instructors. Maybe more suggestions. That's labor intensive, but they should probably do that once every two years.*

4.5.13 Conclusions and Recommendations

According to instructors, the BOC Program seems to be working well and to provide students with the knowledge they need to serve as building operators. Instructors have no major dissatisfactions with the program and thus no major suggestions for improvements or changes. Administrators provide the needed support, materials are appropriate both in content and level of difficulty, and the instructors are an experienced, engaged group.

The following suggestions for improvement and changes may be considered:

- Establish a more formal process for soliciting instructor suggestions.
- Use the student evaluations to discuss with instructors their performance and needed changes.
- Attempt to hold the courses in Community College facilities, which provide an environment that is conducive to learning – sufficient seating, well lighted, availability of support materials such as projectors, laptops, and boards.
- Periodically review the current curriculum, using a panel of building operators, to ensure that all necessary topics are included, that any unnecessary topics are removed, and that the curriculum remains fresh and relevant.

4.6 Program Operations Perspective

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

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

4.6.1 Summary of Interview Findings

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

- **Course Curriculum Restructuring:** The Building Operator Certification Program course schedule as of EPY5/GPY2 has been modified in terms of content and course structure. The purpose of these modifications was to emphasize course topics that would be most relevant and crucial for attendees, as well as to combine related topics and allow for flexibility within the training. Program staff explained that these modifications should enhance the program's ability to provide highly relevant and thorough information to course participants, while presenting course content in a way that links similar concepts and focuses on practical training. The core curriculum now emphasizes HVAC systems and includes coursework that trains participants to be proactive in facility operation and maintenance. The supplemental elective format allows participants to customize their training based on the topics that address their interests or relate to their facility's needs.

While the purpose of the BOC is to educate participants about the full scope of best practices in facility maintenance and operation, program is likely to achieve higher savings if it highlights topics that motivate participants to make immediate modifications to their equipment or operational behavior. In addition to the HVAC-related changes, the addition of BOC 1006 (Common Opportunities for Low-Cost Operational Improvement) will provide students with actionable information about increasing facility energy efficiency, monitoring equipment performance, and cost-effectively maintaining ideal operating conditions. Overall the new BOC curriculum continues to provide participants with a broad spectrum of information regarding facility management and operations, while including modifications that may contribute to increased energy savings in the future.

- **Organizational Staffing Transition:** Aside from strategic changes to program structure and delivery, the BOC has experienced organizational transitions related to program operations staff. Interviewed MEEA staff stated that several staff members who were responsible for managing the BOC during EPY4/GPY1 had since moved on to other positions or were no longer with the organization. This change required additional MEEA staff members to step in and maintain the BOC while locating new individuals to fill the open program staff positions. MEEA staff reported that the transition had been unexpected, but that there had been few difficulties or disruptions that would affect the performance and operation of the BOC Program during this process.

  MEEA has hired several staff members who will fill the program management and administrative roles for the BOC moving forward, and MEEA staff noted that the training process for these staff has gone smoothly. Interviewed staff explained that MEEA had developed a roadmap of notes and information regarding staff responsibilities, procedures, and organizational needs, and that these records had been useful for training the new staff members and managing the transition overall. Additionally, there was some overlap between the EPY4/GPY1 program staff and the new program staff, which had further aided the hiring and training process. MEEA staff reported that communication with DCEO and other key contacts had not been interrupted during this time, and that in general all parties involved have been cooperative and helpful during the transitional period.

- **Operational Process Changes:** MEEA staff noted that the new BOC staff members will have somewhat modified responsibilities as compared with those in EPY4/GPY1. Primarily, the new structure separates administrative tasks and program management tasks so that staff members who are responsible for operating the BOC in one or more states are able to fully focus on program management activities. Rather than having each program manager perform both program operations tasks (such as coordinating with key contacts, strategic planning, etc.) as well as administrative or clerical tasks, administrative tasks for all states will generally be handled by a single staff member. This is designed to more effectively allocate responsibilities among staff members so that administrative tasks can be completed efficiently and program management tasks can be a primary focus.

- **Continuation of Veteran Component:** Interviewed MEEA staff reported that the veteran component of the Building Operator Certification Program has continued into EPY5/GPY2,

with two new veteran participants. The veteran component was first offered as a pilot program with a goal of 20 veteran participants during EPY4/GPY1, but only six veterans ultimately enrolled and participated. MEEA plans to continue offering the veteran component, and is seeking to increase enrollment levels in this area. With regard to project tracking for this component, MEEA staff noted that there will likely be expanded follow-up efforts with employed veteran participants in the future in order to gather information about any projects they have implemented since completing the certification training.

The veteran component of the BOC Program serves as a valuable resource to both veterans and current building managers, as the program provides opportunities for networking and eventual hiring of veteran BOC graduates by other BOC participants or their supervisors. Additionally, the Illinois veteran component will serve as a model for other states in the future, as MEEA plans to apply the refinements and overall structure of this component to new veteran pilot programs elsewhere.

- **Potential Incentive Structure Modifications:** Interviewed MEEA staff explained that there may be opportunities to modify the incentive structure for the BOC so that it either incorporates elements of other incentive programs, or offers a tiered incentive to participants. This may involve offering an incentive to participants who complete the program and then develop an energy efficiency project plan, with an additional incentive for actually completing the project. Alternatively, the BOC could feed directly into other DCEO programs by guiding participants to implement projects and receive available measure rebates. These options would likely encourage BOC participant organizations to move forward with the projects that are recommended by BOC graduates, and may increase the appeal of the BOC Program to prospective participants.

  Additionally, incorporating an incentive for project planning or implementation would allow for more accurate and up-to-date project tracking, which would contribute to timely and comprehensive savings estimation. Currently, it is somewhat difficult to identify completed projects that occur as a result of BOC training, but an associated incentive would require participants to file their projects with MEEA or DCEO, thereby creating a project record that could be referenced during program evaluation.

- **Overcoming Barriers to Project Approval:** When asked about persisting barriers to project implementation following BOC training, MEEA staff explained that although many BOC graduates recommend several energy efficiency projects to their supervisors, their organizations may not ultimately approve the projects. This finding is corroborated by the findings from the BOC supervisor survey, where nearly all supervisors reported that multiple projects had been recommended, but far fewer projects were ultimately implemented. This may be due to financial considerations, lack of knowledge regarding energy efficiency, or general lack of motivation to move forward with project implementation. Thus, MEEA plans to conduct further outreach efforts with participating BOC organizations, particularly supervisor staff, so that the recommendations made by BOC graduates may be better received and understood.

This will likely not only contribute to successful project implementation, but may encourage supervisor staff to send additional employees to BOC training over time. Training multiple staff members from a single organization may not lead to proportionally more measure implementations, but may facilitate the implementation of projects that have not yet gained full support from supervisors and the organization as a whole.

- **Certification Renewal Support:** The Building Operator Certification must be maintained annually after it is granted to a graduate of the training. For participants who complete Level I certification, this involves completing five hours of training per year, while Level II certification requires ten hours of training per year. Ongoing employment counts for two of the certification maintenance hours, and the remaining hours can be completed through online courses, in-person workshops, and other training opportunities.

  Additionally, there is an annual fee required to maintain the certification, and DCEO has provided funds on behalf of participants in order to offset this cost. Overall, a combination of DCEO financial and advisory support, as well as MEEA outreach and continued training toward BOC graduates, has helped to create a straightforward and useful certification renewal process. These resources also contribute to a well-informed population of BOC graduates who are better able to remain current in their knowledge and technical skills.

Interviewed program staff members were also asked to provide information related to the recommendations received for the program during prior evaluation years, including EPY4/GPY1. 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:** MEEA staff reported that the University of Chicago has been a helpful partner in developing blended learning experiences that combine online and in-person educational methods to prospective and current program participants. Much of this program component is still in development, but MEEA plans to offer a course format consisting of five in-person classes supplemented by online courses. This is 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.

  Additionally, MEEA has released several Tech Talks, online videos that focus on specific technical subjects relevant to BOC training. These Tech Talks are intended not only for BOC participants, but for prospective participants and for general education purposes. Past BOC participants will also be able to use the Tech Talks to help maintain their certifications over time. MEEA plans to not only attract new participants to the BOC program, but to continue developing resources for past BOC graduates so that they can maintain their certification and remain current with technical knowledge relevant to building operation.

- **Course Assessment Format and Frequency:** Program staff reported that the BOC Program has continued to perform successfully during EPY5/GPY2, and that several changes have been made to improve program delivery. One of these changes was to administer electronic surveys to course participants rather than only using hardcopy surveys. This allows for more accurate and maintained record-keeping, and may provide participants with more flexibility

in terms of completing the survey at a convenient time. Although the content of the surveys has not been modified, program staff explained that the assessment surveys are now administered after each course rather than after the series of classes has been completed. This likely increases the accuracy and completeness of survey results, as participants are better able to recall specific details of each class and can continually provide information specific to their most recent program experiences.

- **Educational and Promotional Efforts:** When asked about the promotional and educational efforts conducted by MEEA for the BOC Program, MEEA staff explained that a main focus moving forward will be to further educate and inform commercial and industrial customers of building operation practices and efficiency. The addition of educational webinars, as well as the continuation and expansion of informational events such as educational fairs and trade shows, are likely to increase awareness of the benefits associated with building operator certification and overall facility maintenance. Overall, MEEA appears to be proactively considering new methods of informing the customer base and appealing to prospective participants, which is likely to contribute to maintained or increased program awareness and participation over time.
- **Potential Future Program Changes:** Program staff also mentioned several changes that may be implemented during future years of the Building Operator Certification Program. These changes include increasing the number of training locations, administering more in-depth surveys that focus on project implementation, and adding new course components or training content as needed. Additionally, MEEA staff are currently discussing and considering the further development of more online course components, which would provide an opportunity for distance learning in addition to onsite training. The program staff members who are responsible for designing and operating the BOC are frequently considering modifications to the program, and are likely to make adjustments that will continually improve the quality of BOC training, as well as the overall structure of the program as a whole.

5. Conclusions and Recommendations

The following section presents a summary of key findings from the process and impact evaluations of the Building Operator Certification® Program during electric program year five and natural gas program year two (EPY5/GPY2). 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

- **Continued Limitations for Program Savings Impacts:** As with EPY4/GPY1, the savings estimation procedure determined that although participants reported implementing a wide range of projects after their participation in the BOC training, the total net savings impacts resulting from these projects were lower than program expectations. This limitation may be related to several issues including 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.
- **Externally Incentivized Savings:** The EPY4/GPY1 evaluation showed that many BOC participants implemented energy efficiency projects following their course attendance but also received additional incentives for these projects. This trend appears to have continued in EPY5/GPY2, with the participant survey results indicating that more than 40% of the implemented measures had received additional incentives. This causes the savings from those projects to be ineligible for attribution to the BOC Program, and limits the program's savings potential. The BOC Program serves as a gateway to additional utility-sponsored energy efficiency incentives, and program planning must consider that some generated savings will become attributable to those utility programs rather than to the BOC Program.

5.2 Process Conclusions

- **Program Satisfaction:** Overall, the participant survey findings from the current year are very consistent with the findings from EPY4/GPY1Respondents provided few instances of dissatisfaction with the BOC training program and for the most part did not indicate any systematic or major issues with program structure, management, or operation. These results suggest that the BOC Program has been very well-received by participants, and that participant satisfaction has either been maintained or improved since prior program years. From the participant perspective, there are very few issues or weaknesses in program structure or delivery that require attention. As there were no significant increases in dissatisfaction or issues with program participation and some of the survey results suggest an improvement over prior years, the BOC Program appears to be maintaining or increasing its overall effectiveness.

- **Organizational Staffing Transition:** Aside from strategic changes to program structure and delivery, the BOC has experienced organizational transitions related to program operational staff. Interviewed MEEA staff stated that several staff members who were responsible for managing the BOC during EPY4/GPY1 had since moved on to other positions or were no longer with the organization. This required additional MEEA staff members to step in and maintain the BOC while locating new individuals to fill the open program staff positions. MEEA staff reported that the transition had been unexpected, but that there had been few difficulties or disruptions that would affect the performance and operation of the BOC Program during this process.
- **Potential Future Program Changes:** The evaluation revealed several program modifications that may be implemented during future years of the Building Operator Certification Program. These changes include increasing the number of training locations, administering more in-depth surveys that focus on project implementation, and adding new course components or training content as needed. Additionally, MEEA staff are currently discussing and considering the further development of more online course components, which would provide an opportunity for distance learning in addition to onsite training. The program staff members who are responsible for designing and operating the BOC are frequently considering modifications to the program, and are likely to make adjustments that will continually improve the quality of BOC training, as well as the overall structure of the program as a whole.

5.3 Impact Recommendations

- **Encourage Participant Documentation and Project Tracking:** It may be useful to encourage participants to keep records of their project plans and documentation, as this is both an ideal business practice and would ensure that project details are accessible at the time of savings verification. This could also involve providing graduating individuals with a checklist or form that contains a list of project categories (lighting, cooling efficiency, energy management system, etc.) and encouraging them to track any implementations as they occur. These steps would contribute to accurate project tracking and may increase participants' receptiveness to follow-up savings verification surveys. If needed, ADM is willing to create a draft project tracking form that could be given to BOC graduates, perhaps as they submit their course assessment forms.
- **Consider and Plan for External Project Incentive Activity:** BOC participants have continued to seek and receive additional measure incentives from external efficiency programs. This splits the role of the BOC program into two objectives: serving as a method to increase participation in utility incentive programs that will claim energy savings, and serving as a direct cause of energy savings. As mentioned in the prior program year, it may be possible for DCEO to share the savings associated with projects that receive incentives from utilities or other energy efficiency programs. The feasibility of this savings attribution structure is dependent upon discussions and cooperation between DCEO and relevant utilities

or other parties, and may require program design or incentive changes in order to effectively allocate savings and costs so as to maximize the overall net social benefit.

5.4 Process Recommendations

- **Notify Participants of Potential Evaluation Follow-up:** Currently, a limited amount of information is collected from participants about their upcoming or existing project plans, which requires extensive follow-up and data collection efforts during the evaluation process. Additionally, some participants tend to be unresponsive to these data collection efforts, and they may not be aware that program performance is partially assessed through achieved savings levels. Thus, it would likely be beneficial for MEEA to notify customers that they may be contacted for savings verification in the months following BOC training.
- **Continue with Plans to Further Implement Electronic Program Delivery:** MEEA staff reported that the University of Chicago has been a helpful partner in developing blended learning experiences that combine online and in-person educational methods to prospective and current program participants. Much of this program component is still in development, but MEEA plans to offer a course format consisting of five in-person classes supplemented by online courses. This is 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.

  As the time commitment and distance to courses appear to be a primary barrier to participation for some customers, ADM encourages the use of these and other methods of overcoming participation burdens. With regard to data collection and documentation in the electronic context, it may be beneficial to allow participants to record their class-related work and project progress through an electronic-based system. This would allow for easier record-keeping and may benefit staff members and evaluators in reviewing the evaluation and project data that may be provided by participants.

Appendix A: Questionnaire for Participant Survey

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 a building operator certificate [Level and date] 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 selected, 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 selected, 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 selected, 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 id 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 selected, go to LC4A, LC4B, LC4C)
( ) Day lighting controls (if selected, 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 ventilization (economizer)
( ) Outdoor air ventilization (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?)
( ) 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.

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

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?	( )	( )	( )	( )	( )
Maintenance on the heating equipment?	( )	( )	( )	( )	( )
motor maintenance, including belt alignment and tension?	( )	( )	( )	( )	( )
Maintenance on compressed air system?	( )	( )	( )	( )	( )
Electrical panel maintenance?	( )	( )	( )	( )	( )
Ventilation maintenance?	( )	( )	( )	( )	( )
Other energy savings maintenance?	( )	( )	( )	( )	( )

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

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.

21. 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

22. 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	( )	( )	( )	( )	( )	( )
Course instructors	( )	( )	( )	( )	( )	( )
Tuition rebate application process	( )	( )	( )	( )	( )	( )
Tuition rebate amount	( )	( )	( )	( )	( )	( )
Time elapsed to receive tuition rebate	( )	( )	( )	( )	( )	( )
Overall experience with the BOC Program	( )	( )	( )	( )	( )	( )

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

23. 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	( )	( )	( )	( )	( )
Recorded energy use over time	( )	( )	( )	( )	( )
Set energy savings goals	( )	( )	( )	( )	( )
Achieved energy savings goals	( )	( )	( )	( )	( )

24. Have you participated in any other DCEO energy efficiency programs?
( ) Yes (if selected, 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

25. 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

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

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

28. 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

As part of the evaluation effort, a telephone survey was administered to Building Operator Certification training participants who received a tuition rebate through DCEO. This survey provided the information used in Chapter 3 to estimate free ridership and potential savings for projects in the BOC Program. However, the survey also provided more general information pertaining to the making of decisions to improve energy efficiency by program participants.

Each participant was interviewed using the survey instrument provided in Appendix A. During the interview, a participant was asked questions about (1) his or her general decision making regarding purchasing and installing energy efficient equipment, (2) his or her knowledge of and satisfaction with the BOC Program, and (3) the influence that the BOC Program had on his or her decision to install energy efficiency measures (e.g., lighting measures, HVAC measures, maintenance and operation improvements).

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

	Response	*(n=41)*	*Percent of Respondents**
1. What are the sources your organization relies on for information about energy efficient practices, equipment, materials and design features? (Do not read list. Select all that apply.)	DCEO representatives	0	0%
	The DCEO website	3	7%
	Utility representatives	11	27%
	The Midwestern Energy Efficiency Alliance (MEEA)	2	5%
	Brochures or advertisements	0	0%
	Trade associations or business groups you belong to	8	20%
	Trade journals or magazines	4	10%
	Friends and colleagues	13	32%
	The Smart Energy Design Assistance Center (SEDAC)	2	5%
	The Energy Resource Center (ERC)	2	5%
	Architects, engineers or energy consultants	6	15%
	Equipment vendors or building contractors	13	32%
	Other (please describe)	17	41%
	Don't know	3	7%

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

	Response	*(n=41)*	*Percent of Respondents**
2. How did you learn about the DCEO tuition rebate for the BOC training?	From a BOC program representative	7	17%
	A Midwestern Energy Efficiency Alliance (MEEA) representative	1	2%
	A DCEO representative mentioned it	0	0%
	The DCEO website	0	0%
	From a utility representative	5	12%
	Brochures or advertisements	0	0%
	Trade association or business group you belong to	0	0%
	Trade journal or magazine	0	0%
	Friend or colleague	17	41%
	From a representative of Smart Energy Design Assistance Center (SEDAC)	1	2%
	From a representative of the Energy Resource Center (ERC)	0	0%
	An architect, engineer or energy consultant	1	2%
	Equipment vendor or building contractor	1	2%
	Attended a conference workshop or seminar	0	0%
	Past experience with the program	0	0%
	An energy service company	0	0%
	Other (please explain)	6	15%
	Don't know	3	7%

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

3. When you learned about the tuition rebate available for the BOC courses, did you already know about the BOC training?	*Response*	*(n=41)*	*Percent of Respondents*
	Yes	20	49%
	No	20	49%
	Don't know	1	2%

4. Which of the following policies or procedures does your organization have in place regarding energy efficiency improvements?	*Response*	*(n=41)*	*Percent of Respondents**
	An energy management plan	18	44%
	A staff member responsible for energy and energy efficiency	26	63%
	Policies that incorporate energy efficiency in operations and procurement	17	41%
	Active training of staff	26	63%
	Other (please specify)	1	2%
	Don't know	3	7%

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

4A. Does your energy management plan include goals for energy savings?	*Response*	*(n=18)*	*Percent of Respondents*
	Yes	12	67%
	No	4	22%
	Don't know	2	11%

5. What motivated you to participate in the BOC course? (Do not read list. Select all that apply.) (Use as prompts if necessary)	*Response*	*(n=41)*	*Percent of Respondents**
	Career Opportunity	14	34%
	Learn new skills	24	59%
	Personal interest	20	49%
	Learn about energy efficiency	30	73%
	Other (please specify)	12	29%
	Don't know	0	0%

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

6. How important was the tuition rebate in your decision to participate? (Read list) "	*Response*	*(n=41)*	*Percent of Respondents*
	Very important	17	41%
	Somewhat important	10	24%
	Neutral	0	0%
	Only slightly important	3	7%
	Not important at all	10	24%
	Don't know	1	2%

7. Would you have been financially able to attend the BOC training if the tuition rebate had not been available?	*Response*	*(n=40)*	*Percent of Respondents*
	Yes	21	53%
	No	18	45%
	Don't know	1	3%

8. If the tuition rebate had not been available, how likely would you have been to participate in the BOC course anyway? (Read list)"	*Response*	*(n=41)*	*Percent of Respondents*
	Definitely would have participated	11	27%
	Probably would have participated	10	24%
	Probably would not have participated	13	32%
	Definitely would not have participated	7	17%
	Don't know	0	0%

9. Were any of the courses you took through the BOC program particularly useful?"	*Response*	*(n=41)*	*Percent of Respondents*
	Yes	39	95%
	No	0	0%
	Don't know	2	5%

10. Were there any courses that you found to not be very useful? "	*Response*	*(n=41)*	*Percent of Respondents*
	Yes	5	12%
	No	35	85%
	Don't know	1	2%

11. Why did you attend the BOC training? (Do not read list. Select all that apply.) (Use as prompts if necessary)	*Response*	*(n=41)*	*Percent of Respondents**
	Required by company/organization	16	39%
	To learn new job skills	21	51%
	To advance in my current job	10	24%
	To improve my chances of getting a new job	6	15%
	To earn continuing education credits	4	10%
	To learn about energy efficiency	24	59%
	Because of the tuition rebate	4	10%
	Other (please specify)	6	15%
	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?"	*Response*	*(n=41)*	*Percent of Respondents*
	Yes	8	20%
	No	33	80%
	Don't know	0	0%

	Response	*(n=8)*	*Percent of Respondents*
12a. What barriers have you encountered? (Do not read list, but use as possible prompts)	Lack of supervisor support	0	0%
	Insufficient budget	5	63%
	Organization/company not committed to energy efficiency improvements	0	0%
	Not enough staff resources to plan efficiency projects	0	0%
	Other (please specify)	3	38%
	Don't know	0	0%

13. What is the approximate square footage of your building or buildings?	*Response*	*(n=41)*	*Average square footage*
	Average square footage		1242406.4

14. What percentage of that space are you responsible for?	*Response*	*(n=35)*	*Percent responsible*
	Percent responsible		92.1

15. How many hours per week is your site open for business?	*Response*	*(n=40)*	*Hours per week*
	Hours per week		120.2

	Response	*(n=41)*	*Percent of Respondents*
16. What type of facility is it? (Do not read list)	College/University	10	24%
	Elementary	0	0%
	Grocery	0	0%
	Healthcare Clinic	0	0%
	Heavy Industry	0	0%
	High School/Middle School	0	0%
	Hospital	4	10%
	Hotel/Motel	0	0%
	Light Industry	0	0%
	Lodging Hotel/Motel	0	0%
	Manufacturing Facility	4	10%
	Medical	0	0%
	Office - High Rise	6	15%
	Office - Low Rise	2	5%
	Office - Mid Rise|	1	2%
	Religious Facility	0	0%
	Restaurant	0	0%
	Retail - Department Store	1	2%
	Retail - Strip Mall	0	0%
	Retail/Service	0	0%
	School (K-12)	0	0%
	Warehouse	1	2%
	Other (please specify)	12	29%
	Don't know	0	0%

	Response	*(n=41)*	*Percent of Respondents**
17. Since participating in the BOC program have you implemented any of the following types of energy efficiency projects? (Read list)	Lighting Controls	14	34%
	Energy efficient lighting	21	51%
	NEMA premium energy efficient motors	0	0%
	VSDs	7	17%
	Compressed air projects	0	0%
	Energy management systems	0	0%
	Heating system improvements	13	32%
	Air conditioning improvements	12	29%
	Economizer	3	7%
	Water heating efficiency improvements	2	5%
	Other improvements	4	10%
	None	6	15%
	Don't know	1	2%

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

	Response	*(n=34)*	*Percent of Respondents*
19. At how many facilities did you implement any of the previously listed projects?	1	18	53%
	2	5	15%
	3	0	0%
	4	3	9%
	5	1	3%
	6	0	0%
	7	1	3%
	8	0	0%
	9	2	6%
	10 or more	4	12%
	Don't know	0	0%

	Response	*(n=14)*	*Percent of Respondents*
LC1. Now I would like to ask you some questions about the lighting controls you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	5	36%
	Probably would have made the improvements	7	50%
	Probably would not have made the improvements	2	14%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

	Response	*(n=14)*	*Percent of Respondents*
LC2. Had you implemented a similar project prior to attending the BOC training?	Yes	9	64%
	No	5	36%
	Don't know	0	0%

	Response	*(n=14)*	*Percent of Respondents*
LC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	6	43%
	No	6	43%
	Don't know	2	14%

	Response	*(n=14)*	*Percent of Respondents**
LC4. What type of new lighting controls did you implement? (Do not read list)	Occupancy sensors	12	86%
	Daylighting	4	29%
	Don't know	0	0%

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

	Response	*(n=21)*	*Percent of Respondents*
EEL1. Now I would like to ask you some questions about the energy efficient lighting you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	7	33%
	Probably would have made the improvements	10	48%
	Probably would not have made the improvements	4	19%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=21)*	*Percent of Respondents*
EEL2. How many lighting projects did you complete?	1	8	38%
	2	4	19%
	3	3	14%
	4	2	10%
	5	2	10%
	6	0	0%
	7	0	0%
	8	0	0%
	9	1	5%
	10 or more	1	5%
	Don't know	0	0%

	Response	*(n=21)*	*Percent of Respondents*
EEL3. Had you implemented a similar project prior to attending the BOC training?	Yes	14	67%
	No	7	33%
	Don't know	0	0%

	Response	*(n=21)*	*Percent of Respondents*
EEL4. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	14	67%
	No	5	24%
	Don't know	2	10%

	Response	*(n=2)*	*Percent of Respondents*
EEM1. Now I would like to ask you some questions about the energy efficient motors you implemented. How likely is it that you would have made these improvements had you had not attended the course? (Read list)	Definitely would have made the improvements	1	50%
	Probably would have made the improvements	0	0%
	Probably would not have made the improvements	1	50%
	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?	*Response*	*(n=2)*	*Percent of Respondents*
	Yes	0	0%
	No	2	100%
	Don't know	0	0%

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

EEM4. Were these motors installed for HVAC end-uses or for industrial end-uses? (select all that apply)	*Response*	*(n=2)*	*Percent of Respondents**
	HVAC end-use	2	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)	*Response*	*(n=7)*	*Percent of Respondents*
	Definitely would have made the improvements	1	14%
	Probably would have made the improvements	4	57%
	Probably would not have made the improvements	1	14%
	Definitely would not have made the improvements	0	0%
	Don't know	1	14%

VSD2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	5	71%
	No	2	29%
	Don't know	0	0%

VSD3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	3	43%
	No	3	43%
	Don't know	1	14%

VSD4. Were the VSDs installed on existing motors part of an HVAC system?	*Response*	*(n=7)*	*Percent of Respondents*
	Yes	5	71%
	No	1	14%
	Don't know	1	14%

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)	*Response*	*(n=0)*	*Percent of Respondents*
	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 (Don't read)	0	0%

CA2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=0)*	*Percent of Respondents*
	Yes	0	0%
	No	0	0%
	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?	*Response*	*(n=0)*	*Percent of Respondents*
	Yes	0	0%
	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)	*Response*	*(n=8)*	*Percent of Respondents*
	Definitely would have made the improvements	2	25%
	Probably would have made the improvements	5	63%
	Probably would not have made the improvements	1	13%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

EMS2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	3	38%
	No	5	63%
	Don't know	0	0%

EMS3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	2	25%
	No	4	50%
	Don't know	2	25%

EMS5. Did you install a new energy management system after the BOC training?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	4	50%
	No	4	50%
	Don't know	0	0%

EMS6. Did you make changes to an existing energy management system after the BOC training?	*Response*	*(n=8)*	*Percent of Respondents*
	Yes	4	50%
	No	2	25%
	Don't know	2	25%

HS1. Now I would like to ask you some questions about the heating system improvements you implemented. How likely is it that you would have made these improvements had you not attended the course? (Read list)	*Response*	*(n=13)*	*Percent of Respondents*
	Definitely would have made the improvements	5	38%
	Probably would have made the improvements	5	38%
	Probably would not have made the improvements	3	23%
	Definitely would not have made the improvements	0	0%
	Don't know (Don't read)	0	0%

HS2. Had you implemented a similar project prior to attending the BOC training?	*Response*	*(n=13)*	*Percent of Respondents*
	Yes	9	69%
	No	4	31%
	Don't know	0	0%

HS3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	*Response*	*(n=13)*	*Percent of Respondents*
	Yes	7	54%
	No	5	38%
	Don't know	1	8%

	Response	*(n=13)*	*Percent of Respondents**
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	2	15%
	Wall or floorboard radiator (steam, Hot Water or electric resistance)	3	23%
	Steam, hot water or electric resistance coils in ventilation system.	4	31%
	Space heaters	0	0%
	Heat pump, air source	0	0%
	Heat pump, ground source	0	0%
	Heat pump, water loop	0	0%
	Electric boiler	0	0%
	Gas boiler	1	8%
	Other (please specify)	3	23%
	Don't know	0	0%

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

	Response	*(n=12)*	*Percent of Respondents*
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?	Definitely would have made the improvements	2	17%
	Probably would have made the improvements	8	67%
	Probably would not have made the improvements	1	8%
	Definitely would not have made the improvements	1	8%
	Don't know (Don't read)	0	0%

	Response	*(n=12)*	*Percent of Respondents*
AC2. Had you implemented a similar project prior to attending the BOC training?	Yes	7	58%
	No	5	42%
	Don't know	0	0%

	Response	*(n=12)*	*Percent of Respondents*
AC3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	7	58%
	No	4	33%
	Don't know	1	8%

	Response	*(n=12)*	*Percent of Respondents**
AC4. What is the primary cooling system type for the system you made improvements to?	Chiller - air-cooled	1	8%
	Chiller - water or evaporatively cooled	8	67%
	Evaporative cooler	0	0%
	Fans	0	0%
	Direct Expansion - air-cooled packaged or split system cooling or heat pump	2	17%
	Geothermal heat pump	0	0%
	Window or thermal units (PTAC/PTHP)	0	0%
	Other (please specify)	1	8%
	Don't know	0	0%

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

	Response	*(n=3)*	*Percent of Respondents*
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?	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	0	0%

	Response	*(n=3)*	*Percent of Respondents*
E2. Had you implemented a similar project prior to attending the BOC training?	Yes	3	100%
	No	0	0%
	Don't know	0	0%

	Response	*(n=3)*	*Percent of Respondents*
E3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	3	100%
	No	0	0%
	Don't know	0	0%

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

	Response	*(n=2)*	*Percent of Respondents*
WH2. Had you implemented a similar project prior to attending the BOC training?	Yes	1	50%
	No	1	50%
	Don't know	0	0%

	Response	*(n=2)*	*Percent of Respondents*
WH3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	0	0%
	No	2	100%
	Don't know	0	0%

	Response	*(n=2)*	*Percent of Respondents**
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	0	0%
	Installed a more efficient hot water heater or boiler?	1	50%
	Insulated pipes(s) (How thick was the insulation and how many linear feet were installed?)	0	0%
	Other	1	50%
	Don't know	0	0%

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

	Response	*(n=4)*	*Percent of Respondents*
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	1	25%
	Probably would have made the improvements	1	25%
	Probably would not have made the improvements	2	50%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=4)*	*Percent of Respondents*
O2. Had you implemented a similar project prior to attending the BOC training?	Yes	2	50%
	No	2	50%
	Don't know	0	0%

	Response	*(n=4)*	*Percent of Respondents*
O3. Have you received or applied for a financial incentive from a utility or the Illinois DCEO for this project?	Yes	1	25%
	No	2	50%
	Don't know	1	25%

	Response	*(n=41)*	*Percent of Respondents*
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	2	5%
	More Frequently	7	17%
	Both	1	2%
	No Change	27	66%
	Don't know	4	10%

	Response	*(n=41)*	*Percent of Respondents*
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.	Differently	0	0%
	More Frequently	7	17%
	Both	2	5%
	No Change	28	68%
	Don't know	4	10%

	Response	*(n=41)*	*Percent of Respondents*
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.	Differently	0	0%
	More Frequently	8	20%
	Both	2	5%
	No Change	27	66%
	Don't know	4	10%

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.	*Response*	*(n=41)*	*Percent of Respondents*
	Differently	0	0%
	More Frequently	4	10%
	Both	1	2%
	No Change	25	61%
	Don't know	11	27%

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.	*Response*	*(n=41)*	*Percent of Respondents*
	Differently	0	0%
	More Frequently	6	15%
	Both	1	2%
	No Change	28	68%
	Don't know	6	15%

21F. Please indicate if you have performed ventilation maintenance differently or more frequently or both since participating in the BOC training. Ventilation maintenance.	*Response*	*(n=41)*	*Percent of Respondents*
	Differently	2	5%
	More Frequently	7	17%
	Both	1	2%
	No Change	27	66%
	Don't know	4	10%

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.	*Response*	*(n=41)*	*Percent of Respondents*
	Differently	0	0%
	More Frequently	3	7%
	Both	0	0%
	No Change	34	83%
	Don't know	4	10%

22. At how many facilities did you make these changes to your maintenance practices?	*Response*	*(n=19)*	*Percent of Respondents*
	1	11	58%
	2	1	5%
	3	1	5%
	4	2	11%
	5	0	0%
	6	0	0%
	7	2	11%
	8	0	0%
	9	0	0%
	10 or more	1	5%
	Don't know	1	5%

	Response	*(n=10)*	*Percent of Respondents*
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	1	10%
	Probably would have made the improvements	4	40%
	Probably would not have made the improvements	4	40%
	Definitely would not have made the improvements	1	10%
	Don't know	0	0%

	Response	*(n=10)*	*Percent of Respondents**
CS2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Changes to cooling tower service	1	10%
	Changes to chiller bundle cleaning	3	30%
	Changes to condenser cleaning	3	30%
	Changes to refrigerant charge adjustment	1	10%
	Other changes	6	60%
	Don't know	1	10%

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

	Response	*(n=9)*	*Percent of Respondents*
HE1. You mentioned that you have changed how you perform maintenance on heating equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	1	11%
	Probably would have made the improvements	4	44%
	Probably would not have made the improvements	4	44%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=9)*	*Percent of Respondents**
HE2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Heat exchanger cleaning (Please provide capacity in BTU's)	3	33%
	Blowdown frequency (Please provide boiler capacity in BTU's and number of traps)	3	33%
	Steam trap	3	33%
	Other	4	44%
	Don't know	0	0%

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

	Response	*(n=5)*	*Percent of Respondents*
AC1. You mentioned that you have changed how you perform maintenance on air compressor equipment since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	1	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%

	Response	*(n=5)*	*Percent of Respondents**
AC2. Please tell me all the changes you have made to your air compressor equipment maintenance. (Do not read list. Select all that apply)	Audible leak detection	0	0%
	Ultra-sonic leak detection	0	0%
	Pressure optimization	0	0%
	End-use isolation	0	0%
	Filter changes	3	60%
	System diagnostics	1	20%
	Other (please specify)	2	40%
	Don't know	0	0%

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

	Response	*(n=10)*	*Percent of Respondents*
VM1. You mentioned that you have changed how you perform ventilation maintenance since taking the BOC training. How likely would you have been to make these improvements to your maintenance practices if you had not attended the course? (Read list)	Definitely would have made the improvements	1	10%
	Probably would have made the improvements	3	30%
	Probably would not have made the improvements	6	60%
	Definitely would not have made the improvements	0	0%
	Don't know	0	0%

	Response	*(n=10)*	*Percent of Respondents**
VM2. What type of air conditioning improvements that produced energy savings did you implement?(Do not read list. Select all that apply)	Economizer optimization/repair	2	20%
	Sensor Calibration	1	10%
	Setpoint optimization	2	20%
	Balancing	1	10%
	Filter changes	4	40%
	System diagnostics	1	10%
	Sealed leaks / replaced door gaskets	1	10%
	Other (please specify)	4	40%
	Don't know	0	0%

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

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

	Response	*(n=41)*	*Percent of Respondents**
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	16	39%
	Cost	12	29%
	Not aware of it	6	15%
	Supervisor approval	5	12%
	No barriers	12	29%
	Don't know	3	7%

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

	Response	*(n=41)*	*Percent of Respondents*
24A. Please indicate your level of satisfaction with the following elements of the BOC training. Course schedule.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	1	2%
	Satisfied	24	59%
	Very Satisfied	16	39%
	Don't know	0	0%

	Response	*(n=41)*	*Percent of Respondents*
24B. Please indicate your level of satisfaction with the following elements of the BOC training. Course instructors.	Very Dissatisfied	0	0%
	Dissatisfied	1	2%
	Neither Satisfied nor Dissatisfied	0	0%
	Satisfied	20	49%
	Very Satisfied	20	49%
	Don't know	0	0%

	Response	*(n=41)*	*Percent of Respondents*
24C. Please indicate your level of satisfaction with the following elements of the BOC training. Tuition rebate application process.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	3	7%
	Satisfied	13	32%
	Very Satisfied	17	41%
	Don't know	8	20%

	Response	*(n=41)*	*Percent of Respondents*
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	3	7%
	Satisfied	16	39%
	Very Satisfied	13	32%
	Don't know	9	22%

	Response	*(n=40)*	*Percent of Respondents*
24E. Please indicate your level of satisfaction with the following elements of the BOC training. Time elapsed to receive tuition rebate.	Very Dissatisfied	0	0%
	Dissatisfied	0	0%
	Neither Satisfied nor Dissatisfied	4	10%
	Satisfied	20	49%
	Very Satisfied	7	17%
	Don't know	9	22%

	Response	*(n=41)*	*Percent of Respondents*
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	0	0%
	Neither Satisfied nor Dissatisfied	0	0%
	Satisfied	16	39%
	Very Satisfied	25	61%
	Don't know	0	0%

	Response	*(n=41)*	*Percent of Respondents*
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.	Completed Prior to Training	11	27%
	Completed Before and After Training	7	17%
	Only Completed After Training	2	5%
	Not Yet Completed Them	11	27%
	Don't know	10	24%

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.	*Response*	*(n=41)*	*Percent of Respondents*
	Completed Prior to Training	17	41%
	Completed Before and After Training	6	15%
	Only Completed After Training	7	17%
	Not Yet Completed Them	6	15%
	Don't know	5	12%

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.	*Response*	*(n=41)*	*Percent of Respondents*
	Completed Prior to Training	15	37%
	Completed Before and After Training	5	12%
	Only Completed After Training	7	17%
	Not Yet Completed Them	10	24%
	Don't know	4	10%

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.	*Response*	*(n=41)*	*Percent of Respondents*
	Completed Prior to Training	9	22%
	Completed Before and After Training	6	15%
	Only Completed After Training	8	20%
	Not Yet Completed Them	14	34%
	Don't know	4	10%

26. Have you participated in any other DCEO energy efficiency programs?	*Response*	*(n=41)*	*Percent of Respondents*
	Yes	2	5%
	No	38	93%
	Don't know	1	2%

26B. How important was the BOC course in your decision to participate in these other DCEO programs? (Read list)	*Response*	*(n=2)*	*Percent of Respondents*
	Very important	0	0%
	Somewhat important	0	0%
	Neutral	1	50%
	Somewhat unimportant	0	0%
	Not important at all	1	50%
	Don’t know/Not applicable	0	0%

	Response	*(n=41)*	*Percent of Respondents*
27. What is your current job title? (Do not read list)	Operations/Facilities operations manager	4	10%
	Maintenance manager	0	0%
	HVAC supervisor or technician	1	2%
	Engineering manager	3	7%
	Facilities manager	3	7%
	Engineer	12	29%
	Maintenance manager	3	7%
	General contractor	1	2%
	Building management specialist	0	0%
	Other engineering position	5	12%
	Other manager, team leader, supervisor	9	22%

	(n=40)	
28. How many years have you worked in this role?	Average Years	12.2

	(n=41)	
29. How many building operator staff is there at your current location?	Average Staff	13.7

	(n=41)	
30. How many of these staff have completed the BOC training (either Level 1 or Level 1&2)?	Average BOC Completion	4.3

Appendix C: Questionnaire for Supervisor Survey

1. According to our records [number] of your employees completed the Building Operator Certification Course. Specifically, our records indicate that [employee name] attended the course. Is this correct?
( ) Yes
( ) No (If selected, go to follow up)
( ) Don't know (If selected, go to follow up)

1A. Did you have one or more employees attend the building operator certification course between June 1 2012 and May 31 2013?
( ) Yes (If selected, go to 1A.1)
( ) No (If selected, go to 1A.2)
( ) Don't know (If selected, go to 1A.2)

1A.1. What are their name(s)?

1A.2. We do not have any further questions for you.

Please scroll to the end of the survey and click submit.

1. How useful would you say the Building Operator Certification course was for helping your employees perform better in the following areas?

	Very Useful	**Somewhat Useful**	**Not Useful**	**Don't know / Not Applicable**
Identifying energy efficiency improvements				
Monitoring facility energy use				
Improving maintenance practices				
Identifying ways to improve occupant comfort				

1A. Was the course useful for helping your [employee/employees] perform better at other aspects of their job?

1B. (if any marked not at all useful) Could you explain more about why you think the course was not useful in improving certain areas of your employee's(s') job performance?

2. From what you have observed, [has your employee / have your employees] used or applied any of the concepts and/or methods taught in the Building Operator Certification courses?
( ) Yes
( ) No

( ) Don't know

3. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended any of the following energy efficiency projects?

	Undertaken	Recommended	Don't Know
Installation of lighting controls			
Installation of energy efficient lighting			
Installation of variable speed drives or variable frequency drives			
Energy saving improvements to compressed air systems			
Energy management system projects			
Energy saving improvements to heating system			
Energy saving improvements to cooling system			
Energy saving economizer project			
Water heating efficiency improvements			

4. Since completing the Building Operator Certification, [has your employee/have your employees] undertaken or recommended any other energy saving improvements not mentioned above?
( ) Yes
( ) No
( ) Don't know

4A. What other energy projects [has your employee / have your employees] undertaken or recommended since attending the Building Operator Certification courses? Please specify whether these projects were undertaken or recommended?

5. [Has your employee / Have your employees] performed any new operation and maintenance actions since completing the Building Operator Certification?
( ) Yes
( ) No
( ) Don't know

5B. What new operations and maintenance activities [has your employee / have your employees] performed since completing the Certification?

6. Would you say that your [employee performs / employees perform] performs some past operation and maintenance more often since completing the Building Operator Certification?
( ) Yes
( ) No
( ) Don't know

6B. What activities [has your employee / have your employees] performed more often since completing the Certification?

7. Would you say that your [employee performs / employees perform] some past operation and maintenance activities better since attending the course?
( ) Yes
( ) No
( ) Don't know

7A. What activities [has your employee / have your employees] performed better since completing the Certification?

8. Does your organization face any of the following barriers to making energy efficiency improvements? (Select all that apply)
( ) Organization/company not committed to energy efficiency improvements
( ) Lack of knowledge about ways to save energy
( ) Not enough staff resources to plan efficiency projects
( ) Other (Please specify)
( ) Don't know

9. Since attending the Building Operator Certification courses [Has your employee / Have your employees] shared what was learned with other employees?
( ) Yes (If selected, go to 9A)
( ) No
( ) Don't know

9A. How [has your employee / have your employees] shared the information learned in the course with other employees? (Select all that apply)
( ) On the job demonstration of concepts or methods
( ) Verbal explanation of concepts or methods
( ) Written explanation of concepts or methods
( ) Shared course materials
( ) Don't know
( ) Other _____

10. Based on your observations, has the Building Operator Certification training course led to your [employee / employees] having increased value to your organization in terms of the following?

	Yes	**No**	**Don't Know**
Saving energy at your facility?	( )	( )	( )
Saving money?	( )	( )	( )
Helping to improve occupant comfort?	( )	( )	( )
Advising in decisions about equipment operation or replacement?	( )	( )	( )

Having more productive interactions with contractors?	( )	( )	( )
Undertaking, recommending, or influencing any energy-efficiency projects?			

11. If you were hiring a new employee, how important would the candidates having a building operator certificate be to your hiring decision?
( ) Very important
( ) Important
( ) Not important
( ) Not at all important
( ) Don't know

12. For current employees, how important is having a building operator certificate for promotion and/or advancement?
( ) Very important
( ) Important
( ) Not important
( ) Not at all important
( ) Don't know

13. What do you consider in deciding whether or not to send your employees to the Building Operator Certification Program training course? (Select all that apply)
( ) Time/staff availability
( ) Training costs
( ) Location of the training
( ) Instructor/sponsor for the training
( ) Length of training
( ) Your organization's approval process for sending employees to training
( ) Employee professional development
( ) Legal requirements
( ) Gain/benefits for company of certification
( ) The employee's personal interest
( ) Other
( ) Don't know

14. How important was the rebate to the decision to send your [employee / employees] to the Building Operator Certification courses?
( ) Very important
( ) Important
( ) Not important
( ) Not at all important
( ) Don't know

15. Would your [employee / employees] have been sent to the Building Operator Certification course if the rebate was not available?
( ) Definitely would have

( ) Probably would have
( ) Probably would not have
( ) Definitely would not have
( ) Don't know

16. Do you think your [employee's/employees'] training in the Building Operator Certification Program training course has increased the likelihood that your organization will participate in energy efficiency programs, such as equipment incentive programs?
( ) Yes (If selected, go to 16A)
( ) No (If selected, go to 16B)
( ) Don't know

16 A. Why has it increased the likelihood of participating in the energy efficiency programs?

16B. Why has it not increased the likelihood of participating in energy efficiency programs?

17. Do you think your (employee's / employees') training in the Building Operator Certification Program training course has increased the likelihood that your organization will make investments in energy efficiency?
( ) Yes (If selected, go to 17A)
( ) No (If selected, go to 17B)
( ) Don't know

17A. Why has it increased the likelihood that your organization will make investments in energy efficiency?

17B. Why has it not increased the likelihood that your organization will make investments in energy efficiency?

18. Would you recommend the Building Operator Certificate Program to any of your colleagues in your organization or in other organizations?
( ) Yes
( ) No (If selected, go to 18A)
( ) Don't know

18A. Why would you not recommend the Building Operator Certification Program to your colleagues?

19. Do you expect your organization to enroll any other staff at your facility in the Building Operator Certificate Program?
( ) Yes
( ) No (If selected, go to 19A)
( ) Don't know

19A. Why do you not expect your organization to enroll any more staff in the Building Operator Certification Program to your colleagues?

Appendix D: Supervisor Survey Responses

As part of the evaluation effort, a telephone survey was administered to supervisors of employees who had enrolled in and completed the BOC training courses. This survey provided information that was used to supplement the process evaluation, such as gauging supervisor knowledge, interest, and perceived value of the BOC training courses, and determining to what extent their employees had applied the knowledge gained through the program.

Each supervisor was interviewed using the survey instrument provided in Appendix C. During the interview, a respondent was asked questions about (1) the overall usefulness of the BOC courses, (2) his or her employees' actions and skill levels following BOC completion, (3) barriers to implementing energy efficiency improvements in his or her facility, and (4) whether he or she would consider sending additional employees to the program, and why or why not.

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.

1a. How useful would you say the Building Operator Certification course was for helping your employees perform better in identifying energy efficiency improvements?	*Response*	*(n=14)*	*Percent of Respondents*
	Very useful	7	50%
	Somewhat useful	6	43%
	Not useful	0	0%
	Don't know/Not applicable	0	0%

1b. How useful would you say the Building Operator Certification course was for helping your employees perform better in monitoring facility energy use?	*Response*	*(n=14)*	*Percent of Respondents*
	Very useful	5	36%
	Somewhat useful	8	57%
	Not useful	0	0%
	Don't know/Not applicable	0	0%

1c. How useful would you say the Building Operator Certification course was for helping your employees perform better in improving maintenance practices?	*Response*	*(n=14)*	*Percent of Respondents*
	Very useful	5	36%
	Somewhat useful	8	57%
	Not useful	0	0%
	Don't know/Not applicable	0	0%

1d. How useful would you say the Building Operator Certification course was for helping your employees perform better in identifying ways to improve occupant comfort?	*Response*	*(n=13)*	*Percent of Respondents*
	Very useful	4	31%
	Somewhat useful	8	62%
	Not useful	0	0%
	Don't know/Not applicable	0	0%

2. From what you have observed, [has your employee / have your employees] used or applied any of the concepts and/or methods taught in the Building Operator Certification courses?	*Response*	*(n=13)*	*Percent of Respondents*
	Yes	12	92%
	No	0	0%
	Don't know	1	8%

3a. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended installation of lighting controls?	*Response*	*(n=10)*	*Percent of Respondents*
	Undertaken	5	50%
	Recommended	3	30%
	Don't know	2	20%

3b. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended installation of energy efficient lighting?	*Response*	*(n=12)*	*Percent of Respondents*
	Undertaken	5	42%
	Recommended	6	50%
	Don't know	1	8%

3c. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended installation of variable speed drives or variable frequency drives?	*Response*	*(n=11)*	*Percent of Respondents*
	Undertaken	3	27%
	Recommended	4	36%
	Don't know	4	36%

3d. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended energy saving improvements to compressed air systems?	*Response*	*(n=10)*	*Percent of Respondents*
	Undertaken	1	10%
	Recommended	4	40%
	Don't know	5	50%

3e. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended energy management system projects?	*Response*	*(n=9)*	*Percent of Respondents*
	Undertaken	1	11%
	Recommended	4	44%
	Don't know	4	44%

3f. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended energy saving improvements to heating system?	*Response*	*(n=10)*	*Percent of Respondents*
	Undertaken	0	0%
	Recommended	6	60%
	Don't know	4	40%

3g. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended energy saving improvements to cooling system?	*Response*	*(n=10)*	*Percent of Respondents*
	Undertaken	1	10%
	Recommended	5	50%
	Don't know	4	40%

3h. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended energy saving economizer project?	*Response*	*(n=9)*	*Percent of Respondents*
	Undertaken	2	22%
	Recommended	2	22%
	Don't know	5	56%

3i. Since completing the Building Operator Certification, [has your employee / have your employees] undertaken or recommended water heating efficiency improvements?	*Response*	*(n=9)*	*Percent of Respondents*
	Undertaken	1	11%
	Recommended	4	44%
	Don't know	4	44%

4. Since completing the Building Operator Certification, [has your employee/have your employees] undertaken or recommended any other energy saving improvements not mentioned above?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	2	14%
	No	8	57%
	Don't know	4	29%

5. [Has your employee / Have your employees] performed any new operation and maintenance actions since completing the Building Operator Certification?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	5	36%
	No	4	29%
	Don't know	5	36%

6. Would you say that your [employee performs / employees perform] some past operation and maintenance more often since completing the Building Operator Certification?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	3	21%
	No	3	21%
	Don't know	8	57%

7. Would you say that your [employee performs / employees perform] some past operation and maintenance activities better since attending the course?	*Response*	*(n=13)*	*Percent of Respondents*
	Yes	4	31%
	No	2	15%
	Don't know	7	54%

	Response	*(n=13)*	*Percent of Respondents*
8. Does your organization face any of the following barriers to making energy efficiency improvements?	Organization/company not committed to energy efficiency improvements	2	15%
	Lack of knowledge about ways to save energy	0	0%
	Not enough financial resources for energy efficiency projects	6	46%
	Not enough staff resources to plan efficiency projects	3	23%
	Other (Please specify)	3	23%
	Don't know	1	8%

9. Since attending the Building Operator Certification courses, [question("value"), id="19"] shared what was learned with other employees?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	8	57%
	No	0	0%
	Don't know	6	43%

8. What barriers does your facility face to completing energy efficiency improvements at your facility?	*Response*	*(n=8)*	*Percent of Respondents*
	On the job demonstration of concepts or methods	2	15%
	Verbal explanation of concepts or methods	5	38%
	Written explanation of concepts or methods	0	0%
	Shared course materials	3	23%
	Other	1	8%
	Don't know	0	0%

10a. Based on your observations, has the Building Operator Certification training course led to your [employee / employees] having increased value to your organization in terms of saving energy at your facility?	*Response*	*(n=13)*	*Percent of Respondents*
	Yes	12	92%
	No	1	8%
	Don't know	0	0%

10b. Based on your observations, has the Building Operator Certification training course led to your [employee / employees] having increased value to your organization in terms of saving money?	*Response*	*(n=12)*	*Percent of Respondents*
	Yes	10	83%
	No	2	17%
	Don't know	0	0%

10c. Based on your observations, has the Building Operator Certification training course led to your [employee / employees] having increased value to your organization in terms of helping to improve occupant comfort?	*Response*	*(n=12)*	*Percent of Respondents*
	Yes	8	67%
	No	1	8%
	Don't know	3	25%

10d. Based on your observations, has the Building Operator Certification training course led to your [employee / employees] having increased value to your organization in terms of advising in decisions about equipment operation or replacement?	*Response*	*(n=12)*	*Percent of Respondents*
	Yes	9	75%
	No	2	17%
	Don't know	1	8%

10e. Based on your observations, has the Building Operator Certification training course led to your [employee / employees] having increased value to your organization in terms of having more productive interactions with contractors?	*Response*	*(n=12)*	*Percent of Respondents*
	Yes	10	83%
	No	0	0%
	Don't know	2	17%

10f. Based on your observations, has the Building Operator Certification training course led to your [employee / employees] having increased value to your organization in terms of undertaking, recommending, or influencing any energy-efficiency projects?	*Response*	*(n=11)*	*Percent of Respondents*
	Yes	10	91%
	No	0	0%
	Don't know	1	9%

11. If you were hiring a new employee, how important would the candidates having a building operator certificate be to your hiring decision?	*Response*	*(n=14)*	*Percent of Respondents*
	Very important	1	7%
	Important	12	86%
	Not important	1	7%
	Not at all important	0	0%
	Don't know	0	0%

12. For current employees, how important is having a building operator certificate for promotion and/or advancement?	*Response*	*(n=14)*	*Percent of Respondents*
	Very important	0	0%
	Important	11	79%
	Not important	3	21%
	Not at all important	0	0%
	Don't know	0	0%

13. What do you consider in deciding whether or not to send your employees to the Building Operator Certification Program training course?	*Response*	*(n=14)*	*Percent of Respondents*
	Time/staff availability	9	64%
	Training costs	6	43%
	Location of the training	9	64%
	Instructor/sponsor for the training	1	7%
	Length of training	5	36%
	Your organization's approval process for sending employees to training	3	21%
	Employee professional development	10	71%
	Legal requirements	0	0%
	Gain/benefits for company of certification	8	57%
	The employee's personal interest	6	43%
	Other	0	0%
	Don't know	0	0%

14. How important was the rebate to the decision to send your [employee / employees] to the Building Operator Certification courses?	*Response*	*(n=14)*	*Percent of Respondents*
	Very important	6	43%
	Important	8	57%
	Not important	0	0%
	Not at all important	0	0%
	Don't know	0	0%

15. Would your [employee / employees] have been sent to the Building Operator Certification course if the rebate was not available?	*Response*	*(n=14)*	*Percent of Respondents*
	Definitely would have	0	0%
	Probably would have	4	29%
	Probably would not have	6	43%
	Definitely would not have	3	21%
	Don't know	1	7%

16. Do you think your [employee's/employees'] training in the Building Operator Certification Program training course has increased the likelihood that your organization will participate in energy efficiency programs, such as equipment incentive programs?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	7	50%
	No	2	14%
	Don't know	5	36%

17. Do you think your (employee's / employees') training in the Building Operator Certification Program training course has increased the likelihood that your organization will make investments in energy efficiency?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	8	57%
	No	3	21%
	Don't know	3	21%

18. Would you recommend the Building Operator Certificate Program to any of your colleagues in your organization or in other organizations?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	14	100%
	No	0	0%
	Don't know	0	0%

19. Do you expect your organization to enroll any other staff at your facility in the Building Operator Certificate Program?	*Response*	*(n=14)*	*Percent of Respondents*
	Yes	7	50%
	No	2	14%
	Don't know	5	36%

Appendix E: Interview Guide for Instructor Survey

Instructor Background

1. For how long have you been teaching in the BOC program and how many BOC courses have you taught?

   1A. Which BOC courses do you teach?

   1B. What is your work experience as it relates to the courses you teach?

2. Are you currently teaching any courses outside of the BOC program? Are these courses also related to building operations?

3. Do you do other work aside from teaching in the BOC program?

Curriculum and Instructional Material

4. What do you think of the BOC curriculum?

   4A. Does it cover the right topics or are there some that aren't taught that should be?

   4B. Do you think any of the course topics are unnecessary?

5. Are you provided with instructional materials (e.g., slides, workbooks)?

   5A. What is your assessment of the materials? Do they do a good job of conveying the concepts presented in the course?

   5B. Do you supplement this material, if so, with what?

   5C. Are there any topics related to energy efficiency that are not addressed that you think should be?

Instructional Environment

6. How would you assess the facility where the courses are taught?

   6A. Is it a good environment for teaching?

   6B. Are the rooms large enough and do they have adequate seating?

   6C. Are the appropriate teaching materials available in the classrooms (e.g., white boards, PowerPoint)?

7. Do you think that the students you teach have enough prior understanding and experience to benefit from the course?

7A. Have you taught students who are not sufficiently challenged by the course?

7B. Are the students generally motivated to learn? If no, are there changes that could be made to the course content or structure that would more effectively motivate students?

Program Administration

8. How well is the program administered?

8A. Do you receive sufficient support from the administrators?

8B. Is there any aspect of the Building Operator Certification program or with your experience as an instructor that you are not satisfied with?

Conclusions

9. Do you have any suggestions how the course could be improved in terms of content or delivery?