PACIFIC GAS AND ELECTRIC COMPANY'S PROCESS EVALUATION OF THE 2004-2005 STATEWIDE BUILDING OPERATORS CERTIFICATION AND TRAINING PROGRAM

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Final Report

Process Evaluation of the 2004-2005 Statewide Building Operators Certification and Training Program

PG&E Study: #1125-04

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The Research Into Action team was under the overall direction of Jane S. Peters, Ph.D. and the day-to-day direction of Marjorie McRae, Ph.D. Assisting Dr. McRae were Robert Scholl and Natalie Yager. The team was aided by Kris Bradley and John Bidwell of Itron, Inc., who developed the survey questions for building operators to explore the frequency with which they undertake energy-efficient O&M behaviors. Itron also conducted the nonparticipant survey, under the direction of Richard Mountain. Laurie Lago, of Business Services Bureau, produced the report.

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ES EXECUTIVE SUMMARY

This report provides a process evaluation of the 2004-2005 Statewide Building Operators Certification and Training (Statewide BOCT) Program, focusing on Level I training activities. The Statewide BOCT is one of many energy efficiency programs managed by the four California investor-owned utilities (IOUs): Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), Southern California Edison (SCE), and Southern California Gas Company (SoCal Gas). These efficiency programs are funded by California ratepayers under the auspices of the California Public Utilities Commission (CPUC). Research into Action, Inc. conducted the evaluation under contract with PG&E on behalf of the four IOUs.

The BOCT curriculum was developed by the Northwest Energy Efficiency Council (NEEC), which implements the program for the IOUs. The BOCT Program is an educational series for commercial and industrial building operators and facility maintenance staff. It teaches personnel how to operate and maintain building systems for optimal performance, energy efficiency, and occupant comfort. A BOC program is offered in 20 states. The current evaluation builds on the findings of two previous studies of the California Statewide BOCT Program and nine studies of BOC programs conducted elsewhere.

The evaluation method for this report included surveys and interviews with: 58 of the 449 Level I BOCT students participating in 2004-2005; 25 supervisors of these students; 58 building operations and maintenance staff who had received program marketing materials, but had not sent staff to the BOCT training (nonparticipants); three utility BOCT program managers; and twelve NEEC staff (BOCT instructors and managers).

SUMMARY OF FINDINGS

The Statewide BOCT is a mature program, with a mature delivery system. The 2004-2005 program period was a stable one in terms of utility program management and program operations. However, during the time the research was being conducted, the BOCT Program was in transition to the utility energy resource centers. While the change may be uneventful, it is certainly the most significant one in the program since its inception.

BOCT students and their supervisors are highly satisfied with the training and report it has been useful to the students' on-the-job activities. Their responses to the training suggest the training objectives described by the instructors are being met. Demand for the program appears high among interviewed participants (for training of additional staff) and nonparticipants. A comparison between students and nonparticipants of 12 BOCT-taught O&M behaviors show students more frequently undertake the behaviors, although the current research did not rule out

the possibility that students were already, prior to training, engaging in these behaviors more frequently than nonparticipants.

The evaluation did not find any problems with training locations, venues, and logistics. Students and their supervisors had little to offer in terms of recommendations for course improvement. However, it appears from the comments of instructors that there are some course series for which students do not receive brochures or other information they can take with them on the utilities' energy efficiency programs. The evaluation similarly did not find any problems with the curricula.

The single greatest barrier to participation is an organization's lean operations and maintenance staff, from which it is difficult to spare staff for training. The report also identifies other possible barriers to participation. For example, the report discusses the possibility that language might be a barrier to course attendance by operators whose first language is English and the possibility that the program acronym—BOCT—is confusing to people who access the program Web site or have other connections with the national program, which goes by the acronym BOC.

SUMMARY OF CONCLUSIONS

The evaluation team reached the following conclusions in answer to key research questions for the BOCT process evaluation. Recommendations follow in the next section.

1. **Are the process findings consistent with the developmental stage of the Statewide BOCT Program?** The Statewide BOCT is a mature program, launched by the IOUs in 2002 and previously launched in other states; consistent with a mature program, the findings point to areas where the program can be fine-tuned or enhanced (as detailed in the recommendations), but do not reveal any substantive issues for the program.

2. **What changes are planned for the Statewide BOCT Program and what issues might the program managers anticipate?** The program was in transition at the time of this research to the utilities' energy resource centers for implementation. This move is anticipated to increase the thoroughness with which the utilities market the program. However, the BOCT Program and its marketing differ in some respects (such as charging a tuition for the course and asking the help of account representatives to identify customer candidates for on-site trainings) from the typical resource center offerings and, while no problems are anticipated due to the transition, it is these points of difference that are most likely to challenge the program managers in the near term.

3. **Have the program managers and implementers responded to prior evaluation recommendations and is there room for any additional improvement?** The program managers and implementers have taken steps to address recommendations made in prior evaluations; one prior recommendation points to room for additional improvement. Utilities appear to be increasing their presence during BOCT training, yet according to instructors, there are classes—especially those held at locations other than the energy

resource centers—for which students don't receive materials on the utilities' energy efficiency programs.

4. **What are reasonable travel times for BOCT students and are additional training locations needed?** Few students travel further than one hour from place of employment to the training centers and few nonparticipants expressed a willingness to travel one hour. At least one additional training location is needed. In the 2004-2005 program years, the plurality of students traveling more than one hour worked for businesses in the Bakersfield area, suggesting Bakersfield would be a good location for a training center. In addition, some students traveled long distances in Northern California, suggesting additional training centers may be needed there.

5. **What are the current market barriers to training?** The greatest barrier to BOCT is lean operations and maintenance organizations that cannot afford to have staff away from the facility. In addition, only about one-third of interviewed building operations supervisors were aware of BOCT, in spite of the fact that all of the supervisors had received (often repeated) emails and brochures from NEEC advising them of the training. It appears the market for the BOCT might be limited by language barriers, as some of the study findings suggest a Spanish-language version might be useful for the building operators market. Finally, the program name—BOCT—imparts a parochial flavor on what is otherwise a national program (BOC) and is even inconsistent within California, as SMUD also uses the term BOC. This nonstandard nomenclature may be a source of confusion for prospective attendees who visit the program Web site.

6. **Is the curriculum suited to California?** The course curricula appear to be well suited to California, yet ongoing improvements could be made, as detailed in the recommendations.

7. **Are there any indications that building operators apply the concepts they have learned and reap energy savings in their buildings?** The reported O&M behaviors of students and nonparticipants *suggest* the BOCT training leads to energy savings. Further research would be necessary to *conclude* the training results in energy savings.

8. **Do the current study findings suggest areas or approaches for future research?** The current study suggests several areas that warrant further investigation and also have implications for the research methodology. One, an impact evaluation is necessary to conclude whether or not the BOCT Program generates energy savings. Two, whether or not an impact evaluation is conducted, further research could shed light on common O&M behaviors, particularly some of the unexpected behavior patterns reported by students in the current study. Three, it will be interesting to monitor the evolution of program marketing under the auspices of the energy resource centers, particularly examining how the utilities and NEEC balance the continued marketing needs. Four, further research would be needed to directly explore the extent to which language is a market barrier and the potential market size for a Spanish-language course. Five, while

the current research did not support the concern that the curriculum places too much emphasis on boilers, it did not conclusively reject the concern; targeted research could yield more conclusive findings. Six, in common with all research, the current research produced some unexpected findings, such as the finding that students with air conditioning efficiency projects were more likely than those with other types of projects to cite the influence of the BOCT. Additional research would be needed to better understand any unexpected findings the program managers find worthy of pursuit. Finally, the current study has implications for methodology with respect to an exploration of O&M behaviors, such as how to assess the efficiency implications on operators' behaviors when they report a piece of equipment is designed so that it does not require the behavior in question or when they report they continually monitor equipment but only take action "when needed".

RECOMMENDATIONS

1. **The program managers should monitor the BOCT Program during the first few years it is implemented by the energy resource centers for signs of difficulty in making the transition,** noting in particular the division of marketing efforts between NEEC and the utilities, the involvement of account representatives in identifying customer candidates for on-site trainings, and the compatibility of this fee-based training with the free trainings offered by the centers.

2. **The program managers should further increase the utilities' presence at trainings held away from the energy resource centers.** To this end, the utilities and NEEC should establish set procedures for providing students with efficiency program information, such as delineating the materials to be provided, drafting a basic script for conveying information orally, and designating a course during which the information will be presented.

3. **The BOCT should be offered in the Bakersfield area.**

4. **The program managers and implementers should select training locations within one hour's drive of commercial areas anticipated to be able to support cost-effective training.** A geographic analysis of commercial employment patterns—such as general commercial/industrial employment levels or employment within targeted business types or business sizes—would identify the areas still needing to be served by the BOCT. Training should be offered in those areas that can be served for a cost less than or commensurate with the projected value of energy-saving of the training to the utilities. When the indirect impact evaluation research is conducted (see recommendation 9), the results of this research can be used to identify cost-effective training locations for which the anticipated life-cycle savings of the training more than off-set the net Public Goods Charge cost of the training.

5. **The most commonly reported market barrier is formidable and largely beyond the influence of the program implementers—lean organizations that cannot afford to have staff away from the facility; nonetheless, NEEC should continue its efforts to serve these organizations.** NEEC should continue considering ways to reach the "lean organization" market, such as NEEC's current exploration of Web-based training. Although this evaluation and the proceeding one both found that participants and nonparticipants prefer the current seven-day, once-a-month structure to fourteen half-day sessions, the implementers might consider how the market would respond to an offer of a "swing shift" training from 3 pm to 9 pm. Students would need to be served a light dinner during a short break.

6. **NEEC and the utilities should continue efforts to expand marketing, including efforts to attract the participation of large employers to offer the training on-site**. NEEC should explore ways to vary the visual or other presentation format of marketing materials sent to building supervisors on its marketing list, to attract the attention of supervisors who have received prior communications from NEEC without taking sufficient time to understand the training opportunity. Marketing materials might highlight the finding that just over half of nonparticipating supervisors indicated their managements were concerned that facility operations might be wasting energy. Consider pursuing marketing recommendations offered by course instructors: to promote the training through vendors and to customers interested in LEED (Leadership in Energy and Environmental Design, a program of the U.S. Green Building Council); and continue to promote the program to past participants, as they indicate they will seek advanced BOCT training and their organizations will likely send other staff to the training.

7. **The program name should be changed from BOCT to BOC, the term used elsewhere in California and the rest of the nation, and on the program Web site.**

8. **NEEC should consider the recommendations offered by students and their supervisors,** which include providing students with materials to study before each class, providing more information about BOCT electives, and sending supervisors class reminders and follow-up information on certification.

9. **The CPUC should consider conducting the research necessary to estimate energy savings resulting from the BOCT training.** The current research suggests the training yields energy savings. Were this finding to be validated by an impact evaluation, the utilities would have information useful for determining how many students to train each year and whether a proposed training location might warrant the additional costs incurred to offer training there.

10. **Future program evaluations should address outstanding issues from the current research.** The issues potentially having the greatest programmatic implications include program processes (especially marketing) as the program is implemented by the resource centers, an estimation of the size of the building operators market comprised of Spanish-

speakers, and issues pertinent to the BOCT curriculum as highlighted in Conclusion 8, above.

1 INTRODUCTION

This report provides a process evaluation of the 2004-2005 Statewide Building Operators Certification and Training (BOCT) Program. It builds on the findings of two prior process evaluations of the BOCT Program, including a study of 2002 Level I participants and a study of 2003 Level II participants and nonparticipants. BOCT is a mature program and its implementation processes in 2004-2005 largely resemble those documented in the studies of the 2002 and 2003 program years. The current study therefore investigates any new developments in implementation processes or issues, as well as investigating instructors' goals for students' learning, the post-training O&M behaviors of students, the O&M behaviors of nonparticipants, and barriers to participation among nonparticipants.

Research into Action, Inc. conducted the evaluation under contract with Pacific Gas and Electric Company (PG&E) on behalf of the four California investor-owned utilities (IOUs): PG&E, San Diego Gas & Electric Company (SDG&E), Southern California Edison (SCE), and Southern California Gas Company (SoCal Gas). The Statewide BOCT is one of many energy efficiency programs managed by the four IOUs and funded by California ratepayers under the auspices of the California Public Utilities Commission (CPUC).

1.1 PROGRAM BACKGROUND AND STRUCTURE

1.1.1 Program Background

The Building Operators Certification and Training program is an educational course for commercial and industrial building operators and facility managers. It teaches personnel how to operate and maintain building systems for optimal performance, energy-efficiency, and occupant comfort.

Facility operations and maintenance (O&M) activities have long been identified as critical components for the efficient operation of commercial and industrial buildings. Yet, building O&M personnel are often among the least educated about energy issues and among the least valued of staff in a company. These conditions led professionals interested in increasing energy efficiency to wonder how operations and maintenance staff could receive training and education that would increase their capabilities, improve their estimation of the importance of their work, and raise their valuation by the market.

The Northwest Energy Efficiency Council (NEEC), extending efforts initiated by the Washington State Energy Office and the Idaho Building Operators Association, developed the Building Operators Certification program for the Northwest Energy Efficiency Alliance (NEEA) in 1997.

The NEEC BOC course is now offered in about twenty states. Detailed participant satisfaction studies and impact evaluations have been conducted in two regions where the course has been offered for multiple years: the Pacific Northwest (for the Northwest Energy Efficiency Alliance) and the Northeast (for the Northeast Energy Efficiency Partnerships—NEEP).

The California utilities licensed the course from NEEC and have contracted with NEEC for its delivery. San Diego Gas & Electric Company ran the BOCT Program as a pilot in 2001. It was first offered in California as a statewide program in 2002, when eight Level I series (the basic courses) were offered. The program first offered the Level II series (advanced courses) in 2003. In 2004, nine Level I series were conducted; an additional six series of courses concluded in 2005. Three Level II series were offered in 2004-2005.

1.1.2 Structure of the Training

As offered in California, per the directive of the CPUC (Decision D.01-11-066), the BOCT Program educates operators of commercial buildings on "short- and long-term peak demand and energy savings strategies."

The first of the training and certification series is Level I training, which comprises eight days over a seven-month period. Its seven courses (one spans two days) are:

- *Building Systems Overview* (BOC 101)
- *Energy Conservation Techniques* (BOC 102)
- *HVAC Systems and Controls* (BOC 103, two days)
- *Efficient Lighting Fundamentals* (BOC 104)
- *Environmental Health and Safety Regulations* (formerly *Maintenance and Related Codes*, BOC 105)
- *Indoor Air Quality* (BOC 106)
- *Facility Electrical Systems* (BOC 107)

The Level II series course and certification are available for students wishing to further their training. Students completing the Level I training are eligible to enroll in the Level II courses, as are building operators who can demonstrate they are prepared to take the advanced series.

The Level II course consists of four core classes:

- *Preventive Maintenance and Troubleshooting Principles* (BOC 201)
- *Advanced Electrical Diagnostics* (BOC 202)
- *HVAC Troubleshooting and Maintenance* (BOC 203)

- *HVAC Controls and Optimization* (BOC 204)

Seven elective courses have been developed as well. NEEC, in coordination with the utilities, selects two of these seven classes to be offered as part of each Level II series, along with the four core classes. The seven electives are:

- *Advanced Indoor Air Quality* (BOC 210)
- *Motors in Facilities* (BOC 211)
- *Water Efficiency for Building Operators* (BOC 212)
- *Mastering Electric Control Circuits* (BOC 213)
- *Introduction to Building Commissioning* (BOC 214)
- *Electric Motor Management* (BOC 215)
- *Enhanced Automation and Demand Reduction* (BOC 216)

Both the Level I and Level II course series cost $1,095 for the first participant from a given facility and $795 for subsequent participants sent to the same training series.

1.2 PRIOR EVALUATIONS OF THE STATEWIDE BOCT PROGRAM

This process evaluation addresses the third and fourth years of operation of the Level I BOCT courses in California. It builds on the findings of two prior process evaluations of the Statewide BOCT Program: an evaluation of Level I experiences for the 2002 program year and an evaluation of Level II experiences for the 2003 program year.[1] The latter evaluation included a market research component, investigated through a nonparticipant survey.

The prior process evaluations addressed a number of specific research questions, as shown in Table 1.1 for the 2002 program year and Table 1.2 for the 2003 program year.

[1] PG&E and the three other sponsoring utilities received the *Evaluation of the 2002 Statewide Building Operators Certification and Training Program* at the end of 2003, and received the *Evaluation of the 2003 Statewide Building Operators Certification and Training Program* in early 2005, both prepared by Research Into Action, Inc. These reports are available through the California Measurement Advisory Counsel (CALMAC) Web site (www.calmac.org; PGE0083.01 and PGE0207.01, respectively).

Table 1.1: 2002 Level I BOCT Process Evaluation Conclusions

QUESTION	CONCLUSION
Are participants satisfied with the Level I training?	Yes. High satisfaction was evident in the students' and supervisors' responses to a variety of questions, including those examining: program satisfaction, likelihood of pursuing Level II training or other staff attending Level I training, and application of methods taught in the course.
Is the BOCT curriculum appropriate for California?	Yes, according to 93% of students; 7% said they would have liked the curriculum to be better tailored to California conditions. The results do *not* support one specific concern raised by utility program managers—that the curriculum placed too great an emphasis on boilers. Among students, 73% reported working on boilers, compared with 72% reporting working on chillers, and 82% reporting working on furnaces.[2]
Is there a market? Who is it?	Yes, there appears to be a large market for BOCT in California, according to interviewed contacts. Satisfied 2002 BOCT students came from all types and sizes of commercial and industrial facilities, and had a variety of experience levels and supervisory responsibilities. Satisfaction with the BOCT Program did not differ by facility type or by location within the state, although only one-half of the most experienced building operators (10+ years), with the highest levels of responsibility (supervisors of O&M staff for million-square-foot facilities), were satisfied.
Will the market bear the cost?	Apparently yes. Two-thirds of supervisors who provided an estimate of what their organization would be willing to pay for the BOCT training indicated an amount equal to, or greater than $1,175.
How many O&M staff might attend per facility?	Facilities choosing to participate in the BOCT Program are likely to train, on average, between three and four students over a period of several years. On average, each participating facility sent 1.6 students and participants estimate just under 2 additional students from their facilities are likely to attend future series.
Should the classes be offered independently of certification?	No. Students value the certification that is earned through the BOCT Program, as evidenced by their stated preferences for both a training providing certification and a training that will be offered in California for the rest of their careers. Supervisors also reported valuing the certification, but with less frequency than did students.
Does utility involvement contribute to the success of the BOCT Program in California?	Yes. Students and supervisors appreciate the utilities' involvement in BOCT and relate it to their satisfaction with the program. About 50% of students and supervisors said that increased utility involvement would increase their satisfaction with the program and more than 25% would be less satisfied were the utilities less involved. Utility involvement tangibly contributes to the program's success through the use of their fully-equipped training centers throughout the state. Finally, the utilities' marketing activities contributed to program demand and to courses being easily filled.
Does BOCT appear to have synergies with other utility programs?	Yes. Students reported that their participation in BOCT has increased the likelihood that their organizations will participate in energy efficiency programs and will make energy efficiency investments; it has also increased their awareness of demand responsiveness. Supervisors confirmed these reports. Utility program staff believe BOCT addresses a niche unmet by other programs, yet is complementary to them.

Continued

[2] The current study found 61% of students reporting their responsibilities include the operation of a boiler system, and 69% of nonparticipants. A chi-squared test of the difference between the two groups indicates the difference is not statistically significant.

QUESTION	CONCLUSION
Are BOCT Program administration and marketing effective?	Yes, program administration and marketing are working smoothly, according to utility program managers, instructors, and NEEC staff. The program launched quickly and operates simply, without generating problems for the utility managers.
Does BOCT appear to influence building operator actions?	Yes, the BOCT Program appears to influence the actions of building operators. Students reported applying information learned in BOCT, saving energy, and undertaking, recommending, or influencing energy efficiency projects based on what they had learned. Supervisors confirmed these reports.
Does experience to date warrant moving ahead with the BOCT Program?	Yes. The 2002 program experience warrants moving ahead with Statewide BOCT. The 2002 program generated high satisfaction among participating students. Supervisors reported a willingness to pay the full cost of the training and a likelihood of sending an additional one or two staff members, on average, to future BOCT series. Participants find value in the certification generated by the training and in the utilities' sponsorship and involvement. Students report the BOCT Program training has influenced their O&M activities, has enabled them to save energy and money, and has increased the likelihood their facilities will participate in utility efficiency programs. Finally, the program is operating smoothly.

Table 1.2: 2003 Level II BOCT Process Evaluation Conclusions

QUESTION	CONCLUSION
Are participants satisfied with the Level II training?	Yes. Students and their supervisors expressed high levels of satisfaction. About 75% of students liked the training so much they said they would be willing to pay for it themselves.
Does Level II build appropriately and adequately upon Level I?	Yes. Large majorities of the students indicated both the difficulty level and pace of the course material were appropriate and that the Level II course materials were more advanced than the corresponding subject matter in Level I.
Are students interested in additional training?	Yes. Students indicated a desire for more training. Students specifically requested additional training in troubleshooting, HVAC engineering design, indoor air quality, and management of managed systems. Some students went so far as to say, "So when can I take Level III?"
Are nonparticipants interested in training for building operators?	A majority of nonparticipants consider certification in building operations and maintenance for their staff to be important. At least some O&M staff from most nonparticipants' facilities had attended an outside training or education program during the last three years, and virtually every organization had money budgeted for outside training in 2005. Certifications already received by the nonparticipant respondents and their co-workers included training in building or facilities management, electrical, HVAC, OSHA, refrigeration, fire safety, asbestos, indoor air quality, energy efficiency, operating engineering, the ADA, playground safety, aquatic facilities operation, water treatment, underground storage tanks, domestic water systems, hoists, elevators, and specialized welding.
Is certification a valued aspect of building operator training?	Yes. Students, their supervisors, and nonparticipants value certification for building operator training. All of the students believe it is important for the BOCT Program to be ongoing in California; without an ongoing presence, certification loses its value.

Continued

QUESTION	CONCLUSION
How does the training location influence participation?	Most students, supervisors, and nonparticipants would neither pay more for a class located closer to their facility nor send more students.
How do the potential barriers of the tuition cost and time required for the training compare?	The greatest barrier to outside training for the nonparticipants is time away from the job. This barrier was the one most often mentioned by both private-sector and institutional operations and maintenance staff. (Even so, most interviewed O&M staff prefer the current one-day monthly classes to shorter, more frequent sessions.) Time away from the job was particularly mentioned frequently by government employees and staff from K-12 schools. Lack of funding was far less frequently mentioned than time away from their job by private-sector employees, and not mentioned at all by staff of institutional customers. Among institutional nonparticipants in particular, a lack of awareness of the BOCT Program was also a barrier to participation in the training.
How does utility involvement contribute to the success of the Statewide BOCT Program?	Utility involvement reflects well upon the utility and enhances the credibility of the program. For nonparticipants, utility sponsorship enhances the credibility of the series. Among participants, satisfaction with their utility increased for some students and supervisors because of the utility's sponsorship of the BOCT Program. Utility sponsorship of the course did not diminish the standing of the utility in anyone's eyes.
How do the utility program managers view BOCT?	The utility program managers are supportive of the Level II training. They believe the program is working well and will continue to do so. The Level II training is seen as being good for the students' careers, and for attracting and retaining business in California.
Does the training appear to affect operators' energy efficiency behaviors?	Yes. Most students and their supervisors credit the Level II training with positive changes in the students' job activities and with a positive influence on their facilities' energy efficiency decisions. Most participant contacts report that, as a result of the training, students are: advising in decisions about equipment operation or replacement; undertaking, recommending, or influencing energy efficiency projects at their facilities; saving energy and improving occupant comfort at their facilities; saving money for their facilities; and training other staff in the concepts learned during the course.

The two prior Statewide BOCT evaluations also provided a number of recommendations for program improvement or enhancement. These recommendations are given in Table 1.3.

Table 1.3: Recommendations from the 2002 and 2003 Evaluations

RECOMMENDATION
2002 PROGRAM YEAR—LEVEL I PROGRAM
Market the Level I series as courses for line staff, as designed, discouraging highly-experienced operators.
Plainly identify course content relating to demand responsiveness. The utilities should identify for NEEC California-specific information relating to when and how demand-response events are called and strategies they want students to implement.
Develop a long-term vision for BOCT in California to give on-going value to the certification and training.
Evaluate the Level II BOCT.
Continued

RECOMMENDATION
2003 PROGRAM YEAR—LEVEL II PROGRAM
Offer additional advanced training.
Increase utility presence at BOCT Program trainings, including staff appearance at trainings and provision of program materials at training sites other than utilities' energy resource centers.
Increase utility marketing of BOCT (to complement NEEC's efforts), comprehensively, including the BOCT Program in the marketing of other training efforts.
Target institutional customers in marketing efforts to counter low levels of awareness found among this group.
Continue to seek opportunities to hold trainings at the site of large employers.
Address site-related issues described in the report.

Chapter 6, Program Operations, provides the status of these recommendations as determined by the current research (see section 6.7).

In addition to these evaluations of Statewide BOCT, numerous other evaluations of the BOC program have been conducted for program sponsors in the Pacific Northwest and New England. Appendix A lists these references. Table 1.4 provides a summary of students' assessments, as found by five BOC evaluations, of whether they use the BOC information on their job, in what ways, and the results they perceive from their BOC activities.

Table 1.4: Student Assessment of BOCT Influence on the Job

BOCT IMPACT	NORTHWEST STUDY (N=92)	NORTHEAST STUDY 1 (N=49)	NORTHEAST STUDY 2 (N=93)	2002 STATEWIDE BOCT EVALUATION (N=67)	2003 STATEWIDE BOCT EVALUATION (N=20)*
Uses BOCT Information	—	90%	—	93%	95%
Performs New Activities	—	57%	—	72%	70%
Does Some Activities More Frequently	—	57%	—	61%	55%
Does Some Activities Better/ Faster	—	—	—	—	70%
Improved Job Performance	87%	94%	—	75%	—
Saved Energy	75%	78%	85%	79%	80%
Saved Money**	78%	69%	87%	78%	75%
Improved Occupant Comfort	75%	76%	84%	67%	80%

* Level II participants.

** The second Northeast study qualified the item "saved money" to read "saved money on labor and materials." The 87% given in the table is the percent of supervisors agreeing. Among students in this second study, the response was 46% agreeing.

1.3 EVALUATION OBJECTIVES

The evaluation seeks to answer the following questions:

1. Are the process findings consistent with the developmental stage of the Statewide BOCT Program?
2. What changes are planned for the Statewide BOCT Program and what issues might the program managers anticipate?
3. Have the program managers and implementers responded to prior evaluation recommendations and is there room for any additional improvement?
4. What are reasonable travel times for BOCT students and are additional training locations needed?
5. What are the current market barriers to training?
6. Is the curriculum suited to California?
7. Are there any indications that building operators apply the concepts they have learned and reap energy savings in their buildings?
8. Do the current study findings suggest areas or approaches for future research?

The current process evaluation was designed to build on the findings of the previous studies of the Statewide BOCT Program, as well as the findings from numerous studies conducted of the program in the Pacific Northwest and the Northeast. The BOCT curriculum is the same in all locations where BOC is offered. The implementation of the BOCT Program in California from 2002 to 2005 has been very similar to its implementation in Washington, as NEEC is the program implementer in both states. There is a rough similarity in implementation practices in every state where BOC is practiced, as NEEC provides the implementing organizations with logistical and marketing advice in conjunction with the curriculum license. Thus, BOCT is a mature program, both in its curricula and its implementation processes. The current evaluation recognizes that it is a mature program and designed the data collection strategy and instruments accordingly.

This third evaluation of the Statewide BOCT Program addresses issues of satisfaction and indicators of behavioral change for Level I participants. The evaluation also explores potential barriers to participation among nonparticipants to whom the program had been marketed through direct mail and follow-up phone calls.

The theory supporting the BOCT Program is as follows: Building performance can be made more energy efficient through energy-efficient operations and maintenance practices. Building operators are trained in energy-efficient O&M practices and, as a result of this training, learn how to change their behavior to adopt the energy-efficient O&M practices. In addition, building

operators are trained on how a building's electrical and mechanical systems work together to complement each other and, as a result of the training, make decisions that increase the building's energy efficiency.

This process evaluation explores, among other things, whether students attribute the Statewide BOCT Program with improving their understanding of building operations, increasing their knowledge of efficient O&M practices, and thereby increasing their ability to save energy and increase occupant comfort.

The objectives of this third evaluation are to:

- Document satisfaction with the Statewide BOCT Program from the perspectives of 2004-2005 Level I participants and their employers;
- Understand instructor objectives for students' learning;
- Examine the frequency with which students post-training and nonparticipants conduct selected BOC-taught energy efficiency behaviors (according to respondent self-reports);
- Obtain suggestions for Level I process and content improvements offered by participants and course implementers;
- Assess factors relating to the program's appeal to nonparticipants and barriers to training, including any differences between nonparticipants aware of the training and those not aware; and
- Recommend any modifications to the program suggested by the evaluation findings.

In addition to these objectives, reviewers of the evaluation research plan requested some specific survey questions be asked and analyses be conducted. These are:

1. Asking building operators whether they have responsibility for monitoring and controlling energy use at their facilities and for paying or approving payments of energy bills.
2. Asking building operators what, if any, energy efficiency projects they conducted in the prior year (or since taking the training).
3. Asking students whether they shared course information in discussions with others they know in similar positions outside their organization, and if this sharing has led to any energy efficiency projects.

Also, to support an analysis of how far students travel to attend training, using MapQuest®, the evaluation team gathered data on the distance between the students' workplaces and the location where they took the training.

1.4 ORGANIZATION OF THE REPORT

This report is organized into seven chapters:

- *Chapter 1: Introduction*
- *Chapter 2: Methodology*
- *Chapter 3: Training Objectives and Participant Response*
- *Chapter 4: Nonparticipant Response to Building Operator Training*
- *Chapter 5: O&M Behaviors of Students and Nonparticipants*
- *Chapter 6: Assessment of Program Operations*
- *Chapter 7: Findings, Conclusions, and Recommendations*

In addition, there are five appendices:

- *Appendix A: Other BOC Program Evaluations*
- *Appendix B: Travel Times and Distances for 2004-2005 BOCT Students*
- *Appendix C: Respondent characteristics*
- *Appendix D: Methodological Discussion and Subsequent Research*
- *Appendix E: Survey Instruments*

2 METHODOLOGY

This chapter describes the procedures that governed data collection and analysis for this evaluation to ensure the research produced a representative sample, adequate response rates, reliable data, and sound analyses.

2.1 OVERVIEW OF METHODOLOGY

This evaluation sought to assess current program implementation activities by discussing BOCT with the people directly involved in its implementation: the utility program managers, the NEEC program staff, and the BOCT instructors—contractors to NEEC. In addition, the evaluation obtained feedback from program participants—the BOCT students. In addition, because the sponsoring utilities wanted assurance that the organizations that sent their building operators to be trained were satisfied with the training their staffs received, the evaluation surveyed the supervisors of the BOCT students.

Finally, the evaluation surveyed nonparticipants in order to address two of the evaluation's objectives—an assessment of the potential appeal of the BOCT among nonparticipants, including barriers to participation, and a comparison of the O&M behaviors of trained and non-trained building operators as an indicator of the effectiveness of BOCT.

The comparison of trained and non-trained building operators provides an indicator of training effects, yet cannot conclude whether or not the BOCT Program caused any observed differences in behavior because the method does not rule out the possibility that the two groups of operators differed in their behaviors even prior to the survey. Such an assessment was beyond the resources allocated to this evaluation.

Clearly, three factors need to be present for supervisors to decide to send staff or themselves to the training: 1) They need to be aware of the training; 2) they need to believe they will benefit from the training; and 3) they need to have the opportunity to take part in the training, which comprises a number of factors, including having funds available for training, having the ability to afford a building operator being gone from the facility during the training period, and having accessibility to a training location.

Of these three factors, only belief in the value of the training is likely to be correlated with pre-training O&M behaviors. However, the pattern of correlation is not self-evident. If students primarily come from organizations that send their staffs to training because they want to extend their already considerable efforts to operate their facilities efficiently and effectively, then a comparison of student and nonparticipant behaviors will overstate the effect of the training. If most students' organizations have sent their staffs to training because they recognize the subject is an area they are weak in, then the comparison will understate the effect of the training. To the

extent that organizations simply value a well-trained work force and seek the training because of its comprehensiveness, and not because they are either particularly strong or weak in efficient building operations, then prior to the training, the students would resemble the nonparticipants and a comparison would yield an estimate of the effect of the training.

While not ensuring students are comparable to nonparticipants in their pre-training O&M behaviors, the sampling method does take steps to ensure the nonparticipant population is comparable to the student population to the extent that available information allows, specifically by ensuring the students and nonparticipants have similar job responsibilities (as reflected in job title) and come from similar building types, as explained below in *Sampling Plan: Nonparticipants*.

Finally, the evaluation team structured the methodology to be conservative relative to finding that BOCT students take energy-efficiency O&M actions more frequently than nonparticipants. Students were asked the frequency with which *they* take specified energy-efficiency O&M actions and nonparticipants were asked the frequency with which *they or the staff they supervise* take the specified actions. All of the surveyed nonparticipants were supervisors and thus the questions asked of nonparticipants capture the behaviors of entire O&M teams, not just single individuals. Of course, the evaluation design's inclusion of a bias against finding students take the specified actions more frequently than nonparticipants does not resolve the fundamental methodological uncertainty concerning whether students, prior to taking the course, typically engaged in energy-efficiency O&M actions *more*, *less*, or *the same amount* as nonparticipants.

2.2 SAMPLING PLAN

Table 2.1 provides the evaluation's sampling plan. Confidence/Precision is based on a one-tailed test to explore the hypothesis that the BOCT training benefits its students.

Table 2.1: Research Sample Planned and Completed

TARGET GROUP	POPULATION	TARGET SAMPLE SIZE	COMPLETED SAMPLE SIZE	CONFIDENCE / PRECISION
Utility Program Staff	3	3	3	NA
BOCT Staff	3	2	2	NA
BOCT Instructors	16	4-5	10	85/10
Level I Students	449	58	58	Exceeds 90/10
Students' Supervisors*	~225	23-26	25	90/10
Nonparticipants**	8,314	58	58	Exceeds 90/10

* Past research suggests that roughly one out of two students provide, when asked, the name of a supervisor familiar with their work. Confidence/ precision intervals are based on estimated *available* population (see Table 2.3).

** Marketing list provided by NEEC.

2.2.1 Program and Instructor Population and Sample

All three program managers from the sponsoring utilities were interviewed. BOCT staff members who were interviewed included the NEEC BOCT program director and NEEC's program administrator. The NEEC program marketer was unavailable during the interview period.

NEEC provided the evaluation team with a list of 16 Level I BOCT instructors teaching in California, along with the courses they taught in the 2004-2005 program years. The team conducted telephone interviews with ten of the most active instructors in each topic area.

2.2.2 Student Population and Sample

Research Into Action obtained from the NEEC BOCT director lists of Level I BOCT students who had taken the course series during the 2004-2005 period. The evaluation team removed from the list the names of the students who took the series in 2005 at the San Diego and San Francisco locations because these series of courses were not yet completed at the time of the interviews. The team also removed from the list the names of students whose course registrations were withdrawn and the names of students who took only a single course, rather than the complete series. The resulting list comprised 449 names.

To obtain a proportional sampling of the student populations within the service territories of each of the three electric investor-owned utilities, the list was further modified to categorize each student by the one of those three utilities serving the territory surrounding the student's employment location. In this way, populations were obtained for PG&E, SCE, and SDG&E students; these student populations were 157, 251, and 41 respectively (Table 2.2).

Table 2.2: Student Population and Sample Disposition

POPULATION & CHARACTERISTICS	PG&E	SCE	SDG&E	TOTAL
Student Population	157	251	41	449
Not Reachable	28	78	15	121
Available Population	129	173	26	328
Completed Interviews	24	28	6	58
Completed Interviews as Percent of Available Population	19%	16%	23%	18%
Precision/Confidence	—	—	—	90/10

To provide 90/10 confidence/precision intervals, the evaluation team interviewed a sample of 58 of the 449 Level I students. The sample maintained the proportional representation of the student populations from each of the three electric IOU's service territories. Thus, the sample consisted of 32 students from the SCE service territory, 20 from the PG&E service territory, and 6 from

the SDG&E service territory. Inter-utility comparison was not a goal of the research and resource limitations precluded the attainment of a high confidence/precision at the utility level.

2.2.3 Supervisor Population and Sample

The surveys asked students to provide the name, title, and contact information of the supervisors most familiar with their work. The population and interview sample of students' supervisors is shown in Table 2.3. Although 39 students were able to provide names of supervisors they believed able to comment on the value of the BOCT training to their organization, five of these names were not viable leads (including one contact denying supervisory responsibility, one contact who had taken the series and who is included in the student sample, one contact named by two students, and two contacts the evaluation team was unable to locate at the facility.)

Table 2.3: Supervisor Population and Sample Disposition

POPULATION & CHARACTERISTICS	TOTAL
Students' Supervisor Population	39
Not Reachable	5
Available Population	34
Completed Interviews	25
Completed Interviews as a Percent of Available Population	74%
Confidence/Precision*	95/10

* Confidence/ precision intervals based on estimated available population.

2.2.4 Nonparticipants

The evaluation team also obtained from the NEEC BOCT director the list of building O&M supervisors who had received program marketing materials (letters, brochures, and, in some cases, follow-up phone calls)—over 8,300 records. These records had been compiled by NEEC from a variety of sources, including membership in organizations serving building and facility managers, schools, and hospitals. The evaluation team selected from the list a random sample of about 600 names. The nonparticipant records were then filtered to resemble participants in job title and business activity of their organization.

To do this, the evaluation team examined the job titles and their organization's business activities (e.g., office, retail) of Level I students surveyed for the evaluation of the 2002 BOCT Program. From the sample of 600 individuals, the team removed records for those whose job titles did not include the terms "maintenance," "facilities," "engineer," "supervisor," or "manager" (terms included in the titles of 80% of the 2002 surveyed Level 1 participants.) The team also eliminated a portion of records corresponding to business types that were considerably

more prevalent in the nonparticipant sample than in the participant sample, so that the nonparticipant sample might more closely resemble that for participants. For example, schools appear in the master list at about four times the rate that they appear among participants. For each record the team removed, it added another record randomly drawn from the master list of about 8,300 nonparticipants. The team reiterated the filtering and replacement process until the final sample of about 600 randomly-drawn records resembled the participant sample in job title and business type.

As a final step, the evaluation team eliminated duplicates from the nonparticipant sample and, after comparing the sample with the complete participant list, eliminated any participating organizations.

The evaluation team reached the quota of 58 respondents after placing up to six calls to 538 contacts (out of the sample frame of 600 contacts), as shown in Table 2.4.

Table 2.4: Disposition of Nonparticipant Sample

DISPOSITION OF SAMPLE	COUNT	PERCENT
Completed Interview	58	11%
Not Qualified / Language Barrier	16	3%
Bad Number (Disconnected, Fax)	80	15%
Couldn't Reach (Busy, No Answer, Maximum Attempts, Answering Machine)	198	37%
Refused / Incomplete	32	6%
Appointments Not Needed	154	28%
Total	**538**	**100%**

2.3 SURVEY INSTRUMENTS

Five interview guides were developed to support the evaluation of the 2004-2005 Statewide BOCT Program, covering the following actors: Level I students (participants); Level I students' supervisors; nonparticipant building operations supervisors; utility and BOCT Program (NEEC) staff; and BOCT instructors.

2.3.1 Survey of BOCT Level I Students

A telephone survey of BOCT students was performed, which took approximately 20 minutes. It addressed:

1. Satisfaction with, and assessment of the value of the course series;

2. Assessment of the influence of BOCT training on students' workplace interactions;
3. Anticipated demand for the program (Level I and II trainings for their colleagues);
4. Frequency with which students undertake selected O&M activities taught in the BOCT training;
5. Energy efficiency projects undertaken or underway; and
6. Equipment and energy use responsibilities of staff and facility characteristics.

The survey instrument is roughly equally comprised of questions concerning experiences with the BOCT training and questions addressing specific O&M activities. The nonparticipant survey posed the same set of O&M behavior questions.

To develop the O&M behavior questions, the evaluation team spoke with ten BOCT instructors—who collectively teach all seven of the Level I courses—to identify key energy-related O&M activities they would like to see their students undertaking on a regular basis. The team asked the instructors to suggest how these actions might be described (phrased) in the survey.

The evaluation team compared the identified energy-related O&M activities with data collected in 2005 in the Pacific Northwest on the saturation of a large number of O&M activities.[3] The team excluded from the current survey instructor-identified measures having high saturation among the general nonresidential population. Thus, the team restricted its attention to O&M activities that might be observed to increase as a result of BOCT training. Finally, in the interest of facilitating the assignment of energy savings estimates to the BOCT Program (a task outside the scope of this process evaluation of an information program),[4] the team excluded some instructor-identified O&M activities for which it could find no savings estimates within the energy efficiency literature.

The remainder of the survey instrument was developed from the interview guides used in the evaluations of the 2002 and 2003 Statewide BOCT Program. These documents had the advantage of being field-tested and of having been demonstrated to support the evaluation of issues relevant to the current study. Appendix E provides the instrument used to query the Level I students in the 2004-2005 Statewide BOCT Program.

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[3] Quantum Consulting, Inc., 2006. *Commercial Buildings Operations and Maintenance Market Assessment.* See www.nwalliance.org/research/marketresearchreports.aspx, report #06-162. Prepared for the Northwest Energy Efficiency Alliance (NEEA). Quantum Consulting was subsequently purchased by Itron. The Itron staff involved in this process evaluation of the BOC conducted the O&M study for NEEA.

[4] See the California Public Utility Commission, *Energy Efficiency Policy Manual,* October 2001.

The survey instruments for building operators included the question: "Since your training [for nonparticipants: during the last year], has your facility begun or completed any projects or initiatives aimed at increasing energy efficiency, such as installing energy-efficient equipment, performing energy audits, or installing monitoring equipment?" This line of inquiry bears some discussion.

The BOCT Program focuses its attention on teaching students how to operate equipment and how to maintain it for best performance, including at its highest energy efficiency. Key to this objective is teaching students how the various building systems function together—for better or worse. That is, they are taught how a given operation of one system affects, potentially negatively, the performance of another system. Included in each module is a discussion of the current most advanced technologies with respect to energy efficiency and other criteria. By increasing the knowledge of the building operators, the program increases their ability to advocate for high-performing equipment. However, the course does not directly teach students to conduct retrofits.

As discussed in *Program Background*, above, BOC got its start through several years of funding by NEEA. As part of its program development efforts, NEEA conducted seven evaluations of its program, several of which sought to understand whether the training was influencing the energy-efficiency of building operators' behaviors. The first of these evaluations sought to attribute energy savings to retrofit projects conducted by students as a result of their training. The evaluators concluded this approach was not useful, in part because the training is not designed to specifically promote retrofits, but rather to train operators to handle all sorts of situations, including retrofits. But the approach encountered analytical difficulties as well.

Most students who said they were involved with retrofit projects subsequent to their training told the evaluators the project's impetus was independent of the training. They reported, however, that as a result of the training, they decided to expand the scope of the project or to increase the efficiency of the equipment being installed, or they felt better prepared to direct the project or contribute to its design. Thus, students often credited the training with affecting the success of the project and the magnitude of the energy savings, but seldom credited the training with actually influencing their facility's decision to replace equipment. A few students, however, did report that as a direct result of their training, they undertook a lighting retrofit or expanded a retrofit to include another facility. The savings from these few lighting retrofit projects that students credited solely to the BOC program were large in comparison with the program costs, so large, in fact, that it didn't make sense to generalize from these projects to the expected impact of subsequent training sessions. Program savings estimated from students' retrofit projects were about 40 times larger than program planning estimates, as determined from a study

of the training in the Pacific Northwest.[5] In addition, these large savings estimates varied directly with the small numbers of students reporting the retrofit projects, such that, were the sample of students surveyed to include one additional or one fewer student reporting a retrofit project, the savings attributed to the program would vary tremendously.

2.3.2 Survey of Supervisors of Level I Students

The telephone survey instrument for supervisors of Level I students was comparable to that for the students to facilitate comparison of responses across the two groups. The supervisor survey did not explore energy-related O&M activities undertaken by the students, as the students themselves were considered the best source of information on this subject. Appendix E provides the instrument used to query the supervisors of Level I students in the 2004-2005 Statewide Program. The survey took about 12 minutes to implement.

2.3.3 Surveys of Nonparticipating Building Operations Supervisors

The nonparticipant survey, given in Appendix E, was directed to O&M supervisors who can authorize outside training or who contribute to training decisions. It addressed:

1. Types of training attended by the supervisor and staff;
2. Decision factors considered in sending staff to training;
3. Likelihood of sending staff to the BOCT course, and number of staff that might be sent;
4. Frequency with which the supervisor and their staff undertake selected O&M activities taught in the BOCT series;
5. Energy efficiency projects undertaken or underway; and
6. Equipment and energy use responsibilities of staff and facility characteristics.

Questions on energy-related O&M activities, efficiency projects, and equipment and energy use responsibilities were phrased the same on the student and nonparticipant surveys to enable a direct comparison of responses. The survey took about 12 minutes to implement.

[5] See Research Into Action, Inc. and Stellar Process, Inc., *Market Progress Evaluation Building Operator Certification, No. 3 (May 2000),* prepared for the Northwest Energy Efficiency Alliance, www.nwalliance.org/research/reports/00052.pdf.

2.3.4 Surveys of Utility Program Managers, BOCT Program (NEEC) Staff, and BOCT Instructors

Appendix E also contains the two interview guides used by the current evaluation to obtain the views and experiences of the utility and NEEC BOCT managers and the BOCT instructors. The telephone interviews with utility and NEEC program managers were wide-ranging. Interviews lasted about 20 to 30 minutes and addressed the following issues:

1. Program manager and staff involvement and concerns;
2. Program delivery and logistics;
3. Program marketing, strategy, and demand;
4. Course content, instructors, and students;
5. Efficiency-related O&M practices taught; and
6. Program successes and challenges.

The BOCT instructors were interviewed before any other group. The instructor interviews carefully addressed the O&M measures instructors would most like to see their students engage in as an outcome of their BOCT training. Instructors addressed the frequency with which each behavior optimally should occur and they identified methods building operators might employ in conducting the efficiency-related O&M practices. The interviews also addressed their experiences conducting the BOCT courses, course logistics, and their views on the strengths and weaknesses of the BOCT Program. Interviews lasted about 20 to 30 minutes. The information was used to inform the development of the student, supervisor, and nonparticipant survey instruments, and to inform the process assessment of program operations.

2.4 DATA COLLECTION AND ANALYSIS

The evaluation team used the following methods and approaches to ensure it obtained a representative sample, adequate response rates, and reliable data, from which it could reach sound conclusions.

The data from utility program staff, BOCT program staff, and BOCT instructors were obtained during telephone interviews. The questions asked in these interviews were primarily open-ended and varied somewhat among respondents, as the interviewer tailored questions in response to answers already given. The survey instruments for these groups are more accurately viewed as discussion guides. The information from these telephone interviews was tracked via word-processing software.

These data from the utility staff, program staff, and instructors were analyzed using qualitative data methods. Themes common to more than one respondent were identified, as well as information that provided context for interpreting the data from students and supervisors.

Data from the BOCT Level I students, their supervisors, and nonparticipants were collected during telephone interviews using a computerized survey instrument. The participating student and supervisor survey instruments and data sets were created using SPSS's *Data Entry Builder* module. The nonparticipant survey data were collected through CATI-interviewing on behalf of Research Into Action by Itron, Inc. Up to six calls were placed to each contact.

The first steps in data analysis were to clean the data and recode selected variables, such as creating categorical variables from open-ended responses, creating "top-two boxes" responses from five-point scale data, and creating separate variables corresponding to the response elements in questions where multiple answers are permitted.

The middle step in data analysis was to conduct simple frequencies to understand the information in aggregate.

The last data analysis steps involved identifying and executing more complex analyses, such as comparisons of the frequency with which students and nonparticipants reported undertaking efficiency-related operations and maintenance activities. In these steps, the evaluation team considered the implications of the program theory and its field implementation, as well as any concerns raised by interviewed staff, and explored the data in light of these implications and concerns.

This evaluation was written based on the findings from the interviews with program managers and instructors, and from the simple frequencies and more complex analyses of the participant (student and supervisor) and nonparticipant data.

3 TRAINING OBJECTIVES AND PARTICIPANT RESPONSE

This chapter discusses the training objectives, as described by the ten interviewed BOCT instructors, and participant response to the training, as determined from surveys of 58 BOCT Level I students and 25 of their supervisors. Because previous evaluations of the Statewide BOCT Program extensively addressed participant experiences, this evaluation covers participant experiences in less detail and focuses more on O&M behaviors, which are discussed in Chapter 5.

3.1 INSTRUCTORS' TRAINING OBJECTIVES

The BOCT Level I curriculum aims to provide students with an understanding of how a facility functions as an integrated system. The training starts with a "building systems overview" to acquaint students with basic properties of energy and energy transfer, and with how a facility's shell and electro-mechanical equipment function and interact to provide comfort and services to the occupants. After providing a framework for understanding a building as a whole, the series moves into an exploration of each of the component parts.

In describing what they hope students learn from their classes, BOCT instructors commonly say they hope to teach students to "think differently" about their buildings, to increase their understanding, and, as a consequence, change their behaviors in ways small and large. The BOCT curriculum is not a checklist of operations and maintenance activities. It is designed to provide students with the understanding necessary to operate the equipment in their specific facility for optimal performance, occupant comfort, and energy efficiency.

Students learn how to calculate an energy use index (EUI) and how to benchmark their facility against other similar buildings. Working with the EUI and tracking consumption over time, students can begin identifying and prioritizing the systems that have the highest potential for savings.

An instructor of *Efficient Lighting Fundamentals* described how the course goes beyond teaching students to retrofit their facility lighting: "Lighting certainly has some immediate energy efficiency possibilities. We tell them up front you could go out tomorrow and reduce your costs if you want to. But primarily, the time in class is spent making them aware that they can investigate their own situations and make a difference."

One instructor of several course topics offered the following: "The more students understand the operation of the equipment and their systems, the better they can make O&M decisions. You'd be surprised at the number of operators who know they need to change the filter, but do not understand the role the filter plays or what else they need to do."

An instructor of the energy conservation course summarized the value of BOCT: "I believe the number-one improved behavior of the class is confidence in the ability to do their job. With this instilled confidence comes a newfound opportunity to search for energy improvements in their operational routine. I have seen this extensively occur through responses from students that have kept up with me by e-mail. Before the class, the students would take for granted the recommendations of their peers or consulting engineers. After the class, they have a perspective that allows them to question, if not challenge, the logic of the problem."

The instructor gave an example of a former student responsible for overseeing modifications to a thrift store with outlets throughout the country. After taking the course series, the student evaluated the engineering plans and identified significant errors in the original design. He was able to incorporate energy-saving features in the resulting modification. Because the stores in the region where he worked all had essentially the same design, the changes he made were also made at several other locations.

Instructors point out that while there may not be much in the BOCT that students are hearing for the very first time, nonetheless, the coursework presents the information in a way the students usually haven't considered. It reinforces information they may not have thought of in a long time. "Much of the course material goes beyond the operational process and introduces the basic physics of the reasons for the process they are familiar with," continued the instructor whose student influenced his store's design.

"The course presents multiple types of mechanical systems, of which they may have only seen one. They then understand several options of operations from a systems perspective. The result of this type of course—which is presenting the basic physics of HVAC systems, types of mechanical systems, equipment types, and operational procedures—is a new level of ability to reason or problem-solve."

Building equipment is changing very rapidly, largely due to advances in controls technology. One instructor characterized the building operations industry as "changing faster than in any other industry, except perhaps bio-med. The computerized integration of machinery is creating technology leaps every six months. The operators are exposed to these automation and communication technology quantum jumps in every area of equipment that they are responsible for, and they are given the least amount of training of any trade that I am aware of."

As energy efficiency professionals have recognized, energy-efficient equipment and controls will not, in themselves, generate energy savings. The building operator is the key link in producing the savings. People who spend time in facilities tell stories of staff passing by

equipment that is not operating correctly, yet not assuming responsibility for correcting it.[6] For example, variable speed pumps may be operating continuously rather than at a reduction. Motivated by an understanding of the effects of poorly functioning equipment, instructors believe course graduates are more likely to take the initiative and correct problems.

Instructors hope that firms will increasingly recognize the value of trained building operators: "To really allow this new generation of operating engineers to produce the energy savings that the equipment makes them capable of means allowing them to be more involved in the process of decision-making. They should be involved with the design team from the beginning. They should also be recognized within the facility as the experts of operation and energy savings potential."

3.2 PARTICIPANTS' ASSESSMENTS

Interviews with 58 BOCT students and 25 of their supervisors confirm participants are benefiting from the course in a manner consistent with instructors' hopes and expectations.

Both students and supervisors most frequently cited the breadth and variety of topics covered by the series as the most appealing aspect of the training (Table 3.1).

Students also valued the credibility of certification, while supervisors noted the quality of instructors and professionalism of the course. In comments made spontaneously throughout the interview, five students stated the BOCT training had made them more aware of what was going on at their facility, while two students mentioned that they continue to reference materials from the class.

Consistent with findings from previous studies of the Statewide BOCT and BOC programs implemented elsewhere, interviewed students and supervisors reported high levels of satisfaction with the training received in BOCT courses. When asked to rate their satisfaction on a five-point scale where "1" is not at all satisfied and "5" is very satisfied, 91% of students and 92% of supervisors rated their satisfaction a "4" or a "5."

[6] For example, David Hawk of J.R. Simplot Company told an anecdote of six people in his facility repeatedly passing a steam leak without stopping to fix it. Presentation on March 9, 2006, as part of the Industrial Efficiency Initiative sponsored by the Northwest Food Processors Association.

Table 3.1: Appealing Aspects of BOCT Training (Multiple Responses Allowed)

ASPECT**	STUDENTS (N=33)*	SUPERVISORS (N=25)*
Breadth/Variety of Subject / Good Overview of Different Aspects	36%	36%
Applicability	21%	16%
Learn Ways to Save Energy and Money	15%	12%
Professional Course / Endorsed By Other Organizations / Credibility of Certification	15%	12%
Utility Endorsement	15%	—
Recommended by Colleagues	15%	—
Quality of Instructors	6%	16%
Convenient (Schedule or Location)	6%	12%
Learn About Regulations/Codes	6%	3%
Learn New Equipment/Methods	6%	—
Network with Colleagues	3%	8%
Not Aware of Any Comparable Training	3%	8%
Value/Cost Effectiveness of Training	—	9%

* Total responses exceed 100% because multiple responses were allowed.

** The question was open-ended. Twenty-five students declined to answer, either because someone else had made the decision for them to attend or because they had no specific response. The question was *"Do you recall what it was about the BOCT training program that made it stand out from other training options as an appealing choice for your training needs?"*

Both students and supervisors believed the BOCT training contributed to positive outcomes, with nine out of ten contacts indicating the student used or applied BOCT concepts at their facility (see Table 3.2). Additionally, four out of five students reported that as a result of the BOCT training, they have greater confidence in their ability to respond to a request for a demand response. About two-thirds of students and three-quarters of supervisors expressed the opinion that since attending the BOCT course, the building operators offer more productive contributions to O&M discussions. Majorities of both groups believed BOCT students have had more productive interactions with contractors since taking the course.

Table 3.2: Agreement that BOCT Training Leads To Specified Outcomes

OUTCOME	PERCENT AGREEING*	
	STUDENTS (N=58)	SUPERVISORS (N=25)
Have Used or Applied Concepts Taught	93%	88%
Have Greater Confidence in Ability to Respond to a Request for Demand Response	81%	—
Have More Productive Contributions to O&M Discussions	65%	76%
Have More Productive Interactions with Contractors	62%	56%
Actions Have Increased Comfort	—	76%
Actions Have Generated Energy Savings	—	72%
Actions Have Generated Money Savings	—	72%

* Rated as "4" or "5" on a five-point scale.

Most BOCT students are also sharing the information and concepts they learn with co-workers and with people outside their firms, as shown in Table 3.3. Those who had discussed BOCT concepts with people outside their firms said they were unaware as to whether these people had subsequently initiated any energy-efficient projects on the basis of the information exchanged.

Table 3.3: Shared Concepts with Co-Workers

SHARED CONCEPTS LEARNED	STUDENTS (N=58)
Yes, with Coworkers	**76%**
Yes, with People Outside the Firm	**28%**

Sixty percent of students reported they have advanced on the job since taking the BOCT training and more than half of these respondents credited the BOCT with contributing to their job advancement (rating the likelihood a "4" or "5"; Table 3.4). However, most such respondents made it clear that their training was one of a number of factors involved in their advancement.

Table 3.4: Post-Course Job Advancement

JOB ADVANCEMENT	STUDENTS (N=58)
Job Advancement of Any Type	60%
Increase in Responsibility	31%
Increase in Title	26%
Increase in Pay	35%
Credited BOCT with Contributing to Job Advancement (among those reporting advancement—n=22)*	55%

* The intended sample was the 35 students reporting any type of job advancement. Due to a coding error in the survey instrument, the question was asked of just 22 students reporting some type of job advancement.

About three-quarters of students did not think any of the courses could be improved upon (Table 3.5). Of the one-quarter indicating courses that had room for improvement, students most frequently mentioned the *HVAC Systems and Controls* course, yet no clear pattern emerged from their comments regarding how the course might be improved. Among the ten students advocating improvement to the HVAC course, three students mentioned the difficulty of the material and the need for additional time to focus on challenging aspects. Two students offered the opposite comment: the course was too basic or did not provide new information. Three students specifically requested more time and detail be focused on controls and control programming, yet this comment was given both by students who felt overwhelmed and those feeling "under-whelmed" by the information given on controls. Students gave similar comments on the *Facility Electrical Systems* course, with some wanting an increase and others wanting a decrease in level of course difficulty.

Table 3.5: Courses With Room for Improvement (Multiple Responses Allowed)

COURSE TITLE	STUDENTS (N=58)*
No Course Indicated	74%
HVAC Systems & Controls	17%
Efficient Lighting Fundamentals	9%
Facility Electric Systems	10%
Energy Conservation Techniques	3%
Building Systems Overview	0%
Environmental Health and Safety Regulations	0%
Indoor Air Quality	0%

* Total responses exceed 100% because multiple responses were allowed.

Representative comments of those thinking the courses were too challenging or insufficiently challenging include:

- *"The course needed to be more thorough, I didn't grasp it."*
- *"Sometimes we didn't have enough time to grasp [content], like controls programming… but the classes were great."*
- *"It's set up for someone that doesn't know anything."*

Recommendations offered for the training series as a whole included providing students with materials to study before each class, providing more information about electives, and sending course reminders and follow-up information on certification to supervisors (two supervisors).

3.3 FUTURE DEMAND FOR BOCT TRAINING

Two-thirds of students reported they are planning to attend Level II training (Table 3.6). Students' supervisors' reports confirm that many of these students will attend Level II, though at a somewhat lower frequency (56%). About two-thirds of both students and supervisors expect other staff from their facilities to enroll in either level of the BOCT courses.

Table 3.6: Future Attendance

EXPECTATION	STUDENTS (N=58)	SUPERVISORS (N=25)
Student Will Attend Level II Training	64%	56%
Organization Will Send Other Staff to Either Level I or Level II	67%	64%

Among contacts who predicted that their organization would not send additional staff to either Level I or Level II training, some indicated that everyone at their facilities who are appropriate for the training have already been trained (four students and two supervisors). The next most common reason was funding and budget constraints (a response given by four students, but no supervisors), followed by the response that the organization couldn't spare the staff time necessary to send more building operators to training (four supervisors). Other contacts did not offer specific reasons.

Just over half of the students and three-quarters of the supervisors who indicated their organizations are likely to send additional staff to training estimated one or two more staff members would enroll (Table 3.7).

Table 3.7: Number of Potential Students

HOW MANY OTHER STAFF TO ENROLL	STUDENTS (n=39)	SUPERVISORS (n =16)
One or Two	59%	75%
Three	10%	6%
More than Four	31%	13%
Don't Know	0%	6%
Total	**100%**	**100%**

3.4 TIME AWAY FROM WORK AND TRAVEL TIME

About three-quarters of students and supervisors preferred the current class schedule of one day a month for seven months over a more condensed schedule of two consecutive days per month for three to four months (Table 3.8).[7]

Table 3.8: Preferred Class Schedule

SCHEDULE PREFERENCE	STUDENTS (n=58)	SUPERVISORS (n=25)
Two Days Per Month for Three to Four Months	21%	12%
One Day Per Month for Seven to Eight Months	74%	72%
Don't Know	5%	16%
Total	**100%**	**100%**

The majority of supervisors (60%) reported that the distance to the training site did not limit staff enrollment at their organization (rating "1" or "2" on a five-point scale). The nine supervisors reporting the traveling distance to be a limitation (ratings of "3", "4", or "5") considered how close to the facility in driving time the training would need to be to attract more staff. The most common answer, given by five of eight who offered opinions, was travel time of approximately no more than one hour.

The detailed analysis of driving times and distances, below, shows that demand for training appears to drop sharply at about one hour's travel time between employer and training location.

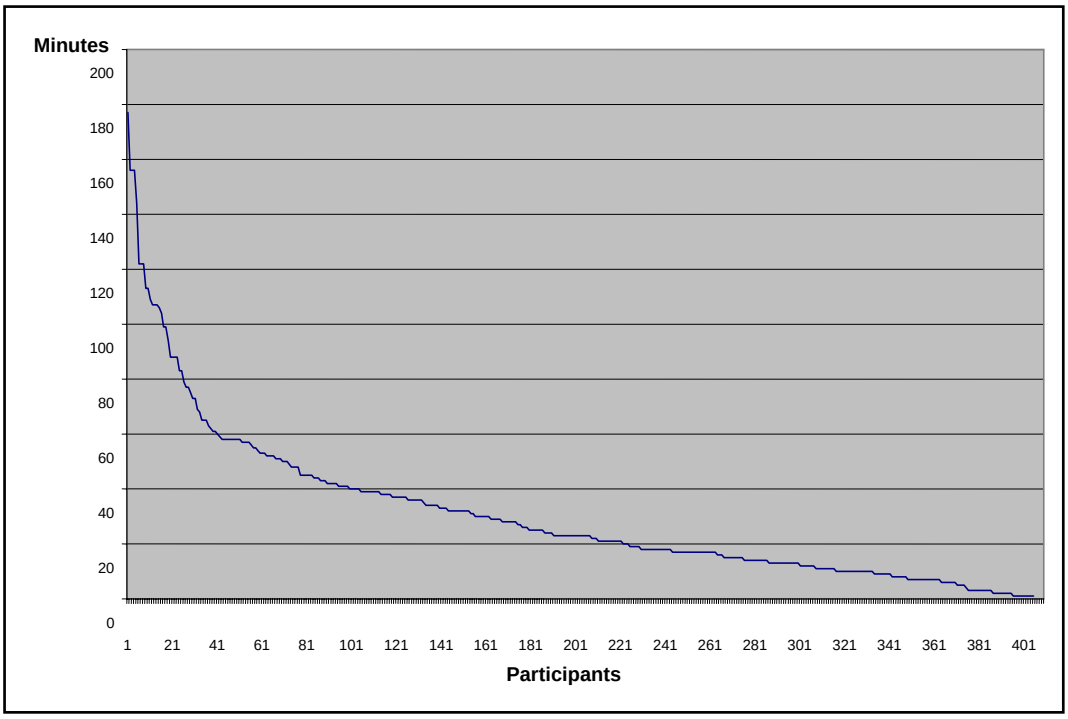
[7] Previous research on the Statewide BOC had asked participants to consider additional options, yet these two schedules had appealed to the largest proportions of contacts.

Just under 10% of the roughly 400 BOCT Level I students in 2004-2005 drove more than one hour.

To gain a better understanding of how far students are willing to travel, travel times, and distances from the students' employment locations to the Level I training locations where they attended were computed using the distance and time estimate features of the Internet mapping site MapQuest®. The analysis was conducted for all 2004-2005 Level I students, based on enrollment records; it was not limited to the students responding to the survey. However, students attending a training held at their place of employment (such as those attending from a university where the training was held or from the China Lake Naval Air Weapons Station) were omitted from the following analyses and graphs.[8]

Figure 3.1 and Figure 3.2 graphically depict the commuting time and distance for the 2004-2005 Level I students. A little more than 90% of students travel less than one hour between their workplace and their training sites.

Figure 3.1: BOC I Commuting Time for 2004-2005 Level I Students (N=405)



8 In addition, the analyses omit three students for whom the evaluation team had no address for their places of employment.

Figure 3.2: BOC I Commuting Distance for 2004-2005 Level I Students (N=405)

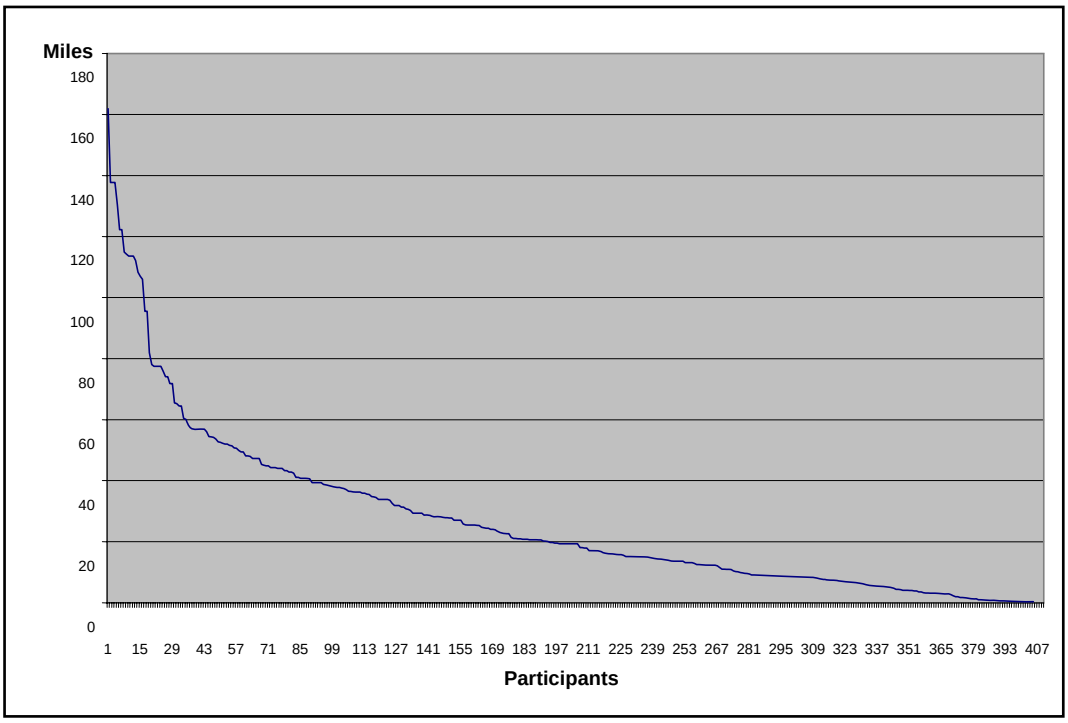


Table 3.9 shows the employer locations that had no close training locations. The analysis suggests a potential need for additional training sites, especially in or near Bakersfield. It should be noted, however, that of the 39 students whose workplace and training location were more than one hour apart, one-third (12 students) had the option of a training location within one hour of their workplace. These students clearly chose their training locations based on considerations other than employer's distance to the training site. Perhaps the training sites they attended were closer to their places of residence than the site that was closest to their workplace, or the perhaps the choice of location was driven by when the training was offered. When these 12 students are excluded from the analysis, over 93% of the 2004-2005 Level I students attended training within one hour's drive from their workplace.

Students traveled the greatest distances, on average, to attend trainings in the relatively rural locations of Stockton and Fresno (Eureka, also a rural location, is discussed subsequently). The median travel time for students attending the Stockton location was 52 minutes, and the median travel time to attend the Fresno training was 45 minutes. These times compare to a cumulative median travel time of 23 minutes for attendance at all of the Level I trainings, excluding the China Lake training, which required no travel between the workplace and training location.

Table 3.9: Employer Locations for which Closest Training Location Was More than One Hour Away, for 2004-2005 Level I Students

EMPLOYER LOCATION	TRAINING LOCATION STAFF ATTENDED	COMMUTE TIME (MINUTES)
SOUTHERN CENTRAL VALLEY LOCATIONS		
Bakersfield Area	Fresno	105
Bakersfield Area	Oxnard	122
Edwards Air Force Base	Ontario	83
Edwards Air Force Base	Downey	144
Edwards Air Force Base	Irvine	156
Palmdale	Riverside	77
Palmdale	Ontario	83
Palmdale	Irvine	115
Palmdale	Temecula	122
NORTHERN CENTRAL VALLEY LOCATIONS		
Jackson	Stockton	65
Lincoln	Stockton	77
Oroville	San Francisco	177
Roseville	Stockton	73
NORTHERN CALIFORNIA LOCATIONS		
Fairfield	San Francisco	57
Fairfield	Stockton	63
Moss Landing	San Jose	68
Salinas	San Jose	79

The evaluation team suspects the short median travel time of 13 minutes for the Eureka location, the most rural of all of the training locations, resulted in part because the location is so remote from other population centers that travel from any other center to Eureka was not practical. Furthermore, the Eureka series was presented at College of the Redwoods. This location was less than one mile from the offices of the 10 students (among the 23 total Eureka students) who were employed by the City of Eureka, Humboldt County, Eureka City Schools, Humboldt State University, and College of the Redwoods.

Students' average commutes to the BOCT training sites compare favorably with the average workers' commutes to work (according to the U.S. Census Bureau) in every locale except Stockton, where the average commute to the training was roughly twice that of the average commute to work (Table 3.10).[9]

Table 3.10: Average Commutes to Work and to BOCT Training Sites for 2004-2005 Level I Students

LOCALE	AVERAGE COMMUTE IN MINUTES	
	WORK (US CENSUS)	BOCT (N=405)
Los Angeles	29.0	32.2*
Oakland	26.3	12.9
San Diego	23.4	19.6
San Francisco	28.5	33.8
San Jose	23.8	24.0
Stockton	25.6	50.7

* As no classes were held in Los Angeles, this is the combined average for the classes held in Anaheim, Downey, Irvine, and Torrance. Average commutes to work for nearby Long Beach is 25.9 minutes and for Santa Ana is 25.3 minutes.

Appendix B provides detailed analyses of time and distances traveled to each training site, identifying the shortest and longest commutes, as well as the average, standard deviation, and median commutes. The appendix also provides the quartiles for the time and distances traveled.

3.5 SUMMARY

The BOCT curriculum appears to be meeting the needs of the building operators that attend the training.

BOCT instructors emphasized their focus on helping students to understand their facilities as an integrated system, within which the component systems interact effectively or at cross-purposes. The instructors explain the physics and physical relationships underpinning the systems and the technologies discussed. Building on this foundation, which is crucial for appropriate problem-solving, they discuss how to operate and maintain equipment for the greatest energy efficiency and optimal building performance.

[9] U.S. Census Bureau American Community Survey 2003.

Students and supervisors agree BOCT provides students with a strong understanding of how to operate and maintain their facility's equipment. Students and supervisors were overwhelmingly pleased with the BOCT training; very few contacts could offer suggestions for improvement and even fewer registered complaints. Suggestions and complaints typically reflected a mismatch between the skill of the student and the level of instruction in the BOCT course, with some students wanting to pursue subjects at greater depth and detail and other students wanting more time to digest the information presented.

Students and supervisors reported the BOCT training yielded such benefits as the students: having greater confidence in their ability to respond to a request for a demand response, being more productive in O&M discussions occurring in-house and with contractors, and taking actions to increase occupant comfort and save energy and money.

More than two-thirds of the students and all of the supervisors make or contribute to decisions about sending staff to outside training, and roughly two-thirds of students and supervisors reported both that the current student would likely continue the training by taking the Level II series and that other building operators working for the organization would likely take BOCT training. Of those contacts indicating no additional staff would likely take the training, most said either that all appropriate staff had been trained or that their staffing constraints precluded staff taking time off from their regular activities.

Recommendations offered for the training series as a whole included providing students with materials to study before each class, providing more information about electives, and sending course reminders and follow-up information on certification to supervisors. Contacts like the current structure of one course per month.

The distance-and-time-traveled analysis conducted via the Internet mapping site MapQuest® indicates commute times between workplace and training location of under one hour for just over 90% of students. These findings suggest that training locations need to be within one hour's commute from the intended target market. The analysis also suggests a potential need for additional training sites, especially in or near Bakersfield.

4 NONPARTICIPANT RESPONSE TO BUILDING OPERATOR TRAINING

This chapter explores the potential demand for and barriers to the Statewide BOCT Program among respondents whose firms have not sent building operators to the training (nonparticipants). The evaluation team interviewed 58 operations and maintenance supervisors who have authority to send staff to training or who influence training decisions.[10] All of the nonparticipant contacts reported influencing training decisions, with 88% explicitly having the authority to send staff to outside training.

Three factors need to be present for supervisors to decide to send staff or themselves to the training: 1) they need to be aware of the training; 2) they need to believe they will benefit from the training; and 3) they need to have the opportunity to take part in the training.

4.1 AWARENESS OF BOCT

Although the nonparticipant sample was drawn from the list of contacts to whom the program managers had marketed the training, just under one-third (29%, or 17 contacts) reported they had heard of the Building Operators Certification and Training program. Among those who had heard of the BOCT Program, most had heard through contact with their utility, via a mailing or email, or through a boss or co-worker (Table 4.1).

Table 4.1: How Nonparticipants Heard About the BOCT Program (Multiple Responses Allowed)

HOW HEARD ABOUT BOC	NONPARTICIPANTS (N=17)*
Utility (Representative, Seminar, Personal Contact)	29%
Mailing / Fax	24%
Email	18%
Boss or Co-worker	18%
Flyer	6%
Phone Call	6%
Friend / Colleague	6%

* Total responses exceed 100% because multiple responses were allowed.

[10] See Chapter 2, *Methodology*, for more details on the sample selection and disposition.

In contrast to the findings from the process evaluation of the 2003 program, nonparticipants from institutional establishments (government offices, schools and colleges, and hospitals and medical facilities) were as likely as other nonparticipants to be aware of BOCT.

4.2 BELIEF BOCT MAY OFFER A BENEFIT

The BOCT Program offers training leading to certification for building operators. Interviewed nonparticipants believe training in general is useful for their building operations and maintenance staff, with 86% of contacts rating its value highly (a rating of "4" or "5" on a five-point scale). Nonparticipants' statements that they value training is evidenced in their acquisition of training during the last three years. Over half (57%, or 33 contacts) said they or their staff had received training leading to certification, most commonly in the areas of HVAC, electrical, refrigeration, and energy efficiency (see Table 4.2). Half of the nonparticipants reporting training and certification described a variety of training experiences categorized in Table 4.2 as "Other". These responses were each given by only one contact, and included: air compressors, security systems, swimming pool maintenance, overhead crane operations, forklifts, asbestos, mold, and telephones.

Table 4.2: Types of Certification Among Nonparticipants Reporting Training (Multiple Responses Allowed)

TYPE OF CERTIFICATION RECEIVED	NONPARTICIPANTS (N=33)*
HVAC	46%
Electrical	21%
Refrigeration	18%
Energy Efficiency	15%
Building/Facilities Management	9%
Fire Safety/Alarm/Response	9%
OSHA	6%
Other	55%

* Total responses exceed 100% because multiple responses were allowed.

After hearing a brief description of the BOCT training, nearly three-quarters of nonparticipants (71% , or 41 of 58 contacts) indicated they would consider attending or sending staff. This proportion is roughly the same as the proportion of the 17 nonparticipants already aware of the BOCT prior to hearing it described who said they had considered sending themselves or their staff to the training (77%, or 13 of 17 contacts). Of those who would consider sending someone to the BOCT, about half (or 39% of the total sample) estimated they might send one or two staff

members, and another 30% (21% of the total sample) estimated they might send three to five staff (Table 4.3).

Table 4.3: Number of Staff Nonparticipants Might Send to BOCT Training

NUMBER OF STAFF MIGHT SEND	NONPARTICIPANTS (N=58)
None	29%
One	7%
Two	32%
Three through Five	21%
Six through Ten	5%
More than Ten	1%
Don't Know	5%
Total	**100%**

About half of respondents (56%) indicated their management had a high level of concern that facility operations may be wasting energy, rating management concern a "4" or "5" on a five-point scale.

4.3 OPPORTUNITY FOR / BARRIERS TO TRAINING

Nonparticipants who are aware of the BOCT Program and believe it may offer benefit to their organization need to have opportune conditions in order to do the training. By far, the greatest barrier to seeking the training for themselves or their staff is limited staff resources, which make it very difficult for the organization to spare the workers while they attend the training. This barrier to participating in the training was noted by 57% of nonparticipants, nearly twice the number mentioning the next most commonly described barrier (see Table 4.4). Also related to staff time away from the facility, an additional 5% of nonparticipants indicated the length of the training was a potential problem. Recall from Chapter 3 that students' supervisors who were not planning to send additional staff to the BOCT courses similarly cited staff limitations as the single greatest barrier.

Nonparticipants' descriptions that their organizations are running very lean and can't spare staff for training is one the evaluation team is very familiar with, both from prior BOCT evaluations and indeed from virtually all of its process evaluation work in the nonresidential sector. Respondents describe conditions where there is insufficient time to adequately address assigned tasks, much less take on new tasks such as training or energy efficiency projects.

Table 4.4: Barriers to BOC Training Among Nonparticipants (Multiple Responses Allowed)*

REASON	NONPARTICIPANTS (N=58)
Lack of Time / Staff Availability	57%
Lack of Money / Budget	24%
Didn't Know Enough About It to Decide	19%
No Need for Training	10%
Subject Matter not Relevant / No benefit to company	7%
Length of Training (too long)	5%
Bad Location	4%
Difficult to Get Approval	3%

* Total responses exceed 100% because multiple responses were allowed.

The next biggest obstacle, following lack of staff availability, is lack of budget[11] available to send operations and maintenance staff for outside training, a condition reported by 34% of nonparticipants.

Some nonparticipants who first heard about the BOCT Program during the survey reported they did not know enough about it to consider sending staff; this response was given by 27% of the nonparticipants not previously aware of the training (19% of the entire nonparticipant sample). This finding suggests the program marketing materials are successful in conveying to those who read them the purpose and benefits of the training.

There were no other differences between "aware" and "unaware" nonparticipants in their comments on potential barriers to training their staff.

In response to open-ended questions of what might get in the way of them sending any staff to the BOCT, about 10% of the nonparticipants (6 of 58) indicated their staff did not need training, and an equal proportion indicated they did not think the training offered much that would be useful to their organization. Finally, only 2 of the 58 nonparticipants mentioned that the location of the training might be a barrier, suggesting training location is not top-of-mind for most nonparticipants.

The evaluation team directly explored several other aspects of training having the potential to affect participation in the BOCT Program, which are subsequently discussed and include: the

[11] Nonparticipants were asked about budget for training in 2006.

role of the utility, the location and driving distance to the trainings, and the cost of the training series.

About half of nonparticipants (54%) said that utility sponsorship of the BOCT Program increased their confidence in the value of the training. Only one contact reported that the utility affiliation with BOCT decreased his confidence in the value of the training, and the remaining 45% reported that the utility sponsorship had no affect on their confidence.

Three-quarters of nonparticipants (79%) felt that driving an hour or less to attend a training session was reasonable. Table 4.5 provides the frequency of the categorical responses. Nonparticipants' responses suggest that BOCT series lose nearly four out of five (33% + 45% = 78%) potential participants located more than one hour from the training location.

Table 4.5: Maximum Reasonable Driving Time to Attend Training

DRIVING TIME	NONPARTICIPANTS (N=57)*
30 Minutes or Less	33%
Between 30 and 60 Minutes	45%
Between 60 and 90 Minutes	12%
Over 90 minutes	10%
Total	**100%**

* Sample excludes one nonparticipant who responded "don't know." Total exceeds 100% due to rounding.

The distribution of actual commute times experienced by students, as reported in Section 3.4, compares very favorably to nonparticipants' stated preferences, shown in Table 4.5. About 60% of students commuted in 30 minutes or less, about 30% commuted between 30 and 60 minutes, about 5% commuted between 60 and 90 minutes, and about 5% commuted over 90 minutes.

The evaluation team asked contacts to consider courses in two locations, one of which is located at the maximum driving time the respondent considered reasonable, and the other located at about half that distance, but at a higher cost. Given this scenario, about half (47%) said they would pay more for a closer class.

Over two-thirds (69%) of nonparticipants thought the $1,100 cost of the seven-day training seemed reasonable. Responses did not differ by whether the nonparticipant had a training budget or not, nor by whether they had heard of the BOCT Program prior to the survey.

4.4 SUMMARY

Just under one-third of interviewed nonparticipants recalled having previously heard of BOCT. They value outside training for building operations and maintenance staff and over half reported

that they or their staff had received training in the last three years that had lead to certification in some aspect of building operations and maintenance. These opinions about training and training experiences suggest employers will be receptive to additional opportunities to train their operations and maintenance staff.

The nonparticipants responded positively to a description of the BOCT Program provided to them, with 70% indicating they would consider sending staff to the training. For half of nonparticipants, utility sponsorship of the BOCT Program increased their confidence in the value of the program. The most significant barrier to training is lack of staff resources, which precludes staff from taking time off from their regular activities, the same reason most commonly given by participants' supervisors who were not planning to send additional staff to training.

Two-thirds of nonparticipants thought the price of the BOCT series seemed reasonable for a seven-day training. BOCT students' *actual* commute times, as presented in Chapter 3, compare very favorably with nonparticipants' preferences for commute times. Courses at locations more than one hour from firms will lose four out of five prospects on the basis of travel time alone.

5 O&M BEHAVIORS OF STUDENTS AND NONPARTICIPANTS

This chapter explores the question of whether the surveyed BOCT students engage in energy-efficient operations and maintenance practices more frequently than surveyed nonparticipants.

5.1 INTRODUCTION

The surveys for both students and nonparticipants asked how frequently the building operators performed twelve specified energy-efficient O&M activities, as well as their specific methods of conducting some of these behaviors. (See Appendix D for a discussion of methodological issues associated with the phrasing of these questions and the implications for subsequent research.)

Students were asked the frequency with which *they* undertook a given action; nonparticipants (who were all supervisors) were asked the frequency with which *they or their staff* undertook the action. The phrasing of the nonparticipant behavior questions therefore cast a wider net into the respondents' organizations than did the questions for students, and so overstates the actions of nonparticipants as a comparison for student actions.

However, and importantly, the methodology does not control for possible differences in energy-efficiency O&M behaviors between the student and nonparticipant groups prior to the students' training. This study does not provide for a direct comparison of the pre-training behaviors of the BOCT students with those of nonparticipants nor, equivalently, a comparison of any change in O&M behaviors over a specified period (i.e., a year) that would span pre- and post-training of students.

Even so, the study does provide a few comparisons of the student and nonparticipant population that relate to, although do not directly measure, their O&M efficiency behaviors (recall that the training provides students with information useful to advocating for and conducting retrofit projects, but does not specifically teach retrofit projects, but rather ongoing operations and maintenance activities). These relevant comparisons are:

- Energy efficiency projects the contact reported being engaged in (students, since their training; nonparticipants, in the last year)
- Responsibilities for energy use monitoring and control, and energy bill-paying
- Responsibilities for specific equipment types
- Supervisory responsibilities
- Years experience in O&M

- Business activity of facility
- Size of facility (in floor space, number of buildings, and number of O&M staff)

Regarding energy efficiency projects in which they were engaged, although a greater proportion of students than nonparticipants reported such activity (85% versus 74%), the differences were not statistically significant. This suggests the student and nonparticipants groups are similar with respect to energy efficiency activities. Table 5.1 shows the types of projects in which each group were engaged.

Table 5.1: Projects Aimed at Increasing Energy Efficiency

REBATE RECEIVED	STUDENTS (N=58)	NONPARTICIPANTS (N=58)
INITIATED ENERGY EFFICIENCY PROJECT		
Facility Began or Completed Projects Aimed at Increasing Energy Efficiency	85%	74%
PROJECT TYPE (MULTIPLE RESPONSES ALLOWED)*		
Lighting	60%	40%
Air Conditioning	33%	14%
Controls	28%	21%
Motors (including fans)	21%	30%
Energy Audit	14%	9%
Chillers/HVAC	7%	5%
Boilers	5%	14%
Benchmarking	2%	7%
Monitoring (including installation of equipment)	3%	14%
Other Equipment, Projects, or Initiatives	19%	14%
PROJECT COMPLETE		
Project Complete	57%	43%
RECEIVED UTILITY REBATE		
Received Rebate	46%	40%
INFLUENCE OF BOCT TRAINING		
BOCT Training Had Influence on the Project**	46%	—

* Total responses exceed 100% because multiple responses were allowed.

** Response of "4" of "5" on a 5-point scale.

Students were significantly more likely (chi-squared test, p <0.05) than nonparticipants to have conducted or initiated energy efficiency projects for lighting and air conditioning; comparable proportions of students and nonparticipants engaged in each of the other types of projects described. Roughly equal proportions (just under half) of students and nonparticipants reported their organization received a rebate for the efficiency project. About half of students attributed their BOCT training with having an influence on the project (rating a "4" or a "5" on a five-point scale), although a statistically higher proportion of those with air conditioning projects said this was the case than those with other types of projects.[12]

This finding that students with air conditioning efficiency projects were more likely than those with other types of projects to cite the influence of the BOCT suggests the possibility that the BOCT material relating to air conditioners is more effective than material on other equipment types in promoting energy efficiency, although other explanations for this finding are possible.[13]

Students and nonparticipants do not differ in the extent to which they monitor their facility's energy use or have responsibility for controlling or reducing energy use (Table 5.2).

Table 5.2: Facility Energy Responsibilities (Multiple Responses Allowed)*

RESPONSIBILITIES INCLUDE:	STUDENTS (N=34)**	NONPARTICIPANTS (N=58)
Monitoring Energy Use	82%	83%
Controlling or Reducing Energy Use	94%	88%
Paying or Approving Payments of Energy Bills	29%	50%

* Total responses exceed 100% because multiple responses were allowed.

** Sample restricted to those students that are supervisors.

Only respondents who indicated that they were responsible for the type of system addressed by a set of O&M activities were asked questions regarding those activities. Similar proportions of students and nonparticipants were responsible for motors, boilers, economizers, and variable

12 The question asked: "Please rate the extent to which your BOCT training had an influence on the project—such as the decision to go ahead at this time or the type of equipment or size of the project." This phrasing was consistent with the findings of an early evaluation of the BOCT that suggested the training's influence on energy efficiency programs affected the scope, timing, or effectiveness of student's role in the project, but rarely the decision to replace equipment.

13 The data collected in the current study was sufficient only to explore the alternative possibility that student characteristics might be correlated with the finding, such as the possibility that students with less experience or working at smaller facilities are both more likely than other students to have undertaken air conditioning projects and to have said the BOCT influenced their project. This possibility was rejected, as student characteristics were not associated with the projects undertaken.

frequency drives; nonparticipants were more likely than participants to have responsibility for cooling and compressed air systems (Table 5.3).

Table 5.3: O&M Responsibilities (Multiple Responses Allowed)

RESPONSIBILITY	STUDENTS* (N=56)	NONPARTICIPANTS* (N=58)
Motors	69%	78%
Cooling System	66%	86%
Boiler System	61%	69%
Economizers	55%	51%
Compressed Air Systems	52%	71%
Variable Frequency Drives	50%	64%

* Total responses exceed 100% because multiple responses were allowed.

The interviewed students and nonparticipants are roughly similar with respect to various indicators of their job responsibilities, as shown by the data presented in Appendix C. The appendix also provides context for understanding the work environments of the respondents by reporting the number of O&M staff they supervise, their years of experience in building operations, the business activities of their organizations, and the size of their facilities in terms of square footage, number of buildings, and number of O&M staff.

In summary (see Appendix C for details), students and nonparticipants are comparable in whether they work in commercial facilities or industrial facilities. Although a higher proportion of students than nonparticipants come from industrial facilities, the difference is not statistically significant. Similarly, students and nonparticipants are roughly similar with respect to the size of their facilities and size of O&M staff serving the facilities. Students tend to come from larger facilities (in terms of square footage and number of buildings) than nonparticipants, and yet are members of O&M staffs that are somewhat smaller than those of nonparticipants, although neither of these differences are statistically significant.

About two-thirds of students had more than ten years of experience in building operations. Of the 22 students who are themselves supervisors, 67% had more than ten years in building operations, a proportion that does not differ significantly from the 78% of surveyed nonparticipants, who were screened to only include supervisors. However, nonparticipants were significantly more likely than supervising participants to have more than twenty years in building operations (chi-squared test, $p < 0.05$).

A reader of the draft report for this study suggested the possibility that the greater experience of nonparticipants might be one factor explaining their nonparticipant status—that is, a factor explaining why they have not participated in the BOCT. (Recall that the nonparticipant sample

was drawn from the list of contacts to which the program is marketed.) Yet when a firm is considering the value of the BOCT for its staff, it is common that supervisors attend. This is reflected in the current participant sample, of which more than half supervise staff. The BOCT Program's long-term market is line staff, and indeed two-thirds of the students interviewed for this study expected their organization will send additional staff to the BOCT. Thus, the finding that nonparticipants are more likely than students to have more than twenty years experience in building operations does not imply they are unsuitable contacts for marketing efforts.

More than half of the students had operations and maintenance staff that reported to them, with the mean number of their supervised staff being eleven. About half of the students' supervisors, as well as about half of the nonparticipants (who were screened to all be supervisors), managed more than ten O&M staff.

5.2 FREQUENCY OF UNDERTAKING TWELVE EFFICIENCY-RELATED O&M ACTIVITIES

Based on reported actions, students undertake efficiency-related O&M activities significantly more frequently than nonparticipants. Chi square tests were used to assess the significance of observed differences. Comparisons for which the tests' p values were less than or equal to 0.05 are judged significant; comparisons are judged marginally significant when the tests' p values exceed 0.05, yet are less than 0.10.

For eight of the twelve O&M activities explored in the survey, students reported conducting the activity more frequently than non-students ($p < 0.05$). These activities are:

- Checking the boiler combustion system
- Inspecting the steam traps
- Testing for proper damper modulation
- Checking and recalibrating chilled water loop controls
- Lubricating motor, fan, and pump bearings
- Inspecting bearings on belt alignments on motors for fans and pumps
- Inspecting the compressed air system for leaks
- Monitoring the compressed air system for power use, pressure, and temperature

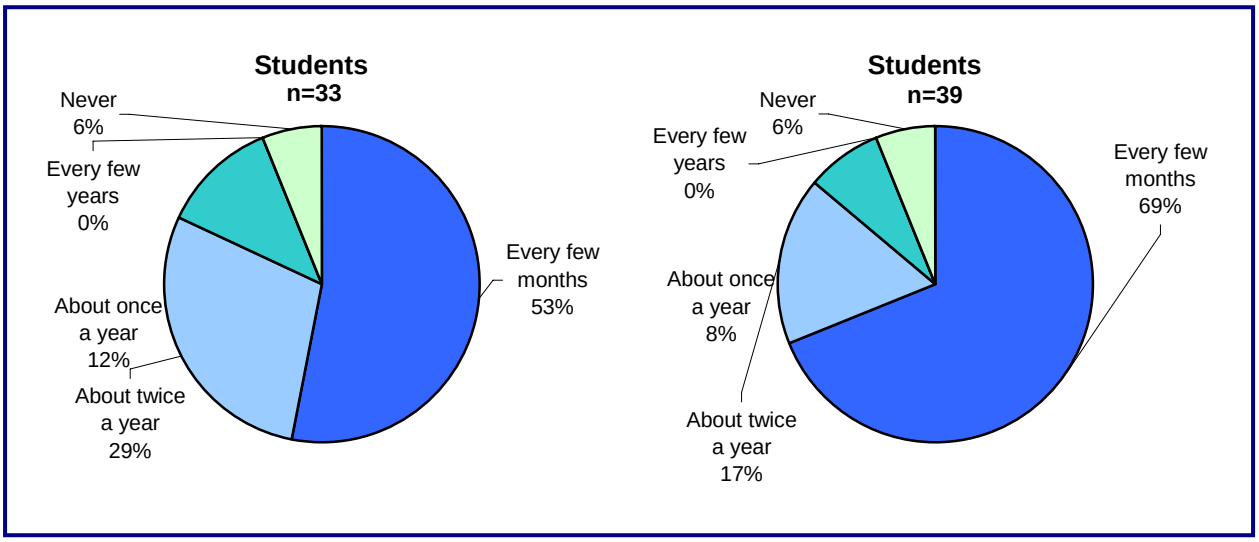
Two efficiency-related O&M activities tended to be performed more often by students, although the differences were only marginally significant ($p < 0.10$). These activities are: checking for leaks in the supply and return air duct system, and checking refrigerant pressures and temperatures on package units.

Finally, for two of the twelve efficiency-related O&M activities, students and nonparticipants reported conducting the activities with similar frequencies (no significant differences). These activities are: cleaning chiller evaporator and condenser tubes, and testing and adjusting the variable frequency drives until they properly match the loads.

These results are illustrated in twelve figures. The figures present pie charts comparing the reported frequencies with which students and nonparticipants undertake each activity. The first set of pie charts, Figure 5.1 through Figure 5.8, illustrate the efficiency-related O&M activities for which students were significantly more likely ($p < 0.05$) than nonparticipants to report frequently undertaking the action. This finding is all the more striking because participants answered the O&M question "How often do *you* …", while nonparticipants answered the question "How often do *you or your staff*…". The question phrasing was intended to reach deep into the nonparticipants' organizations, thereby providing a conservative comparison for BOCT students.

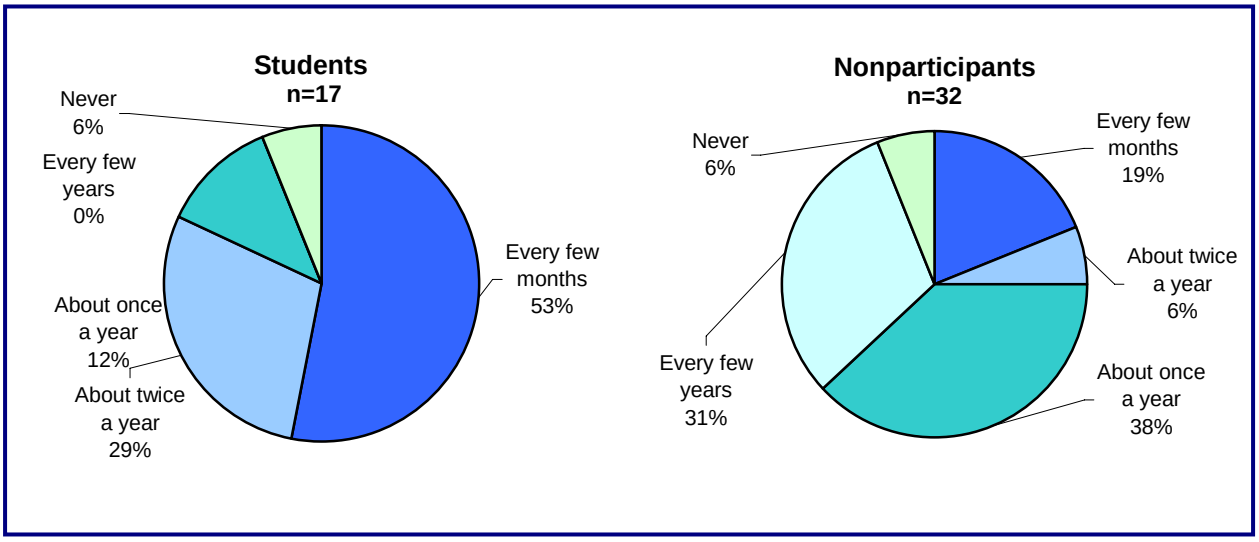
Note that each question on how frequently the O&M action is taken was posed only to those contacts who indicated they were responsible for the equipment to which the action applies. Each figure identifies the number of students and nonparticipants responsible for the targeted equipment.

Figure 5.1: Students Check the Boiler Combustion System More Frequently than Nonparticipants



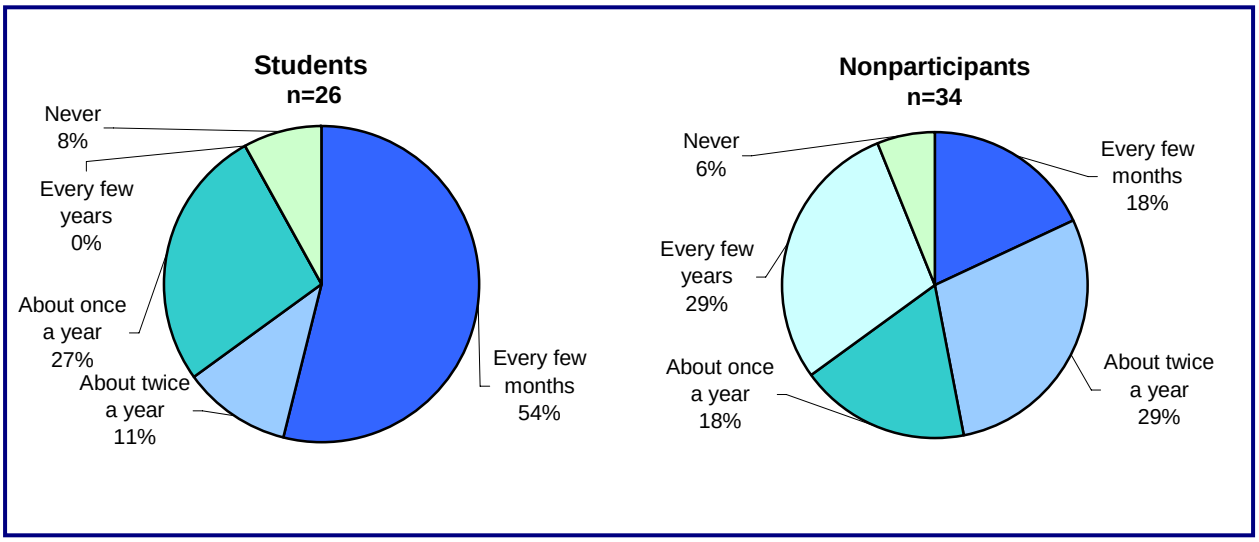
Note: Chi squared test of frequency data, $p = .002$.

Figure 5.2: Students Inspect Steam Traps More Frequently than Nonparticipants



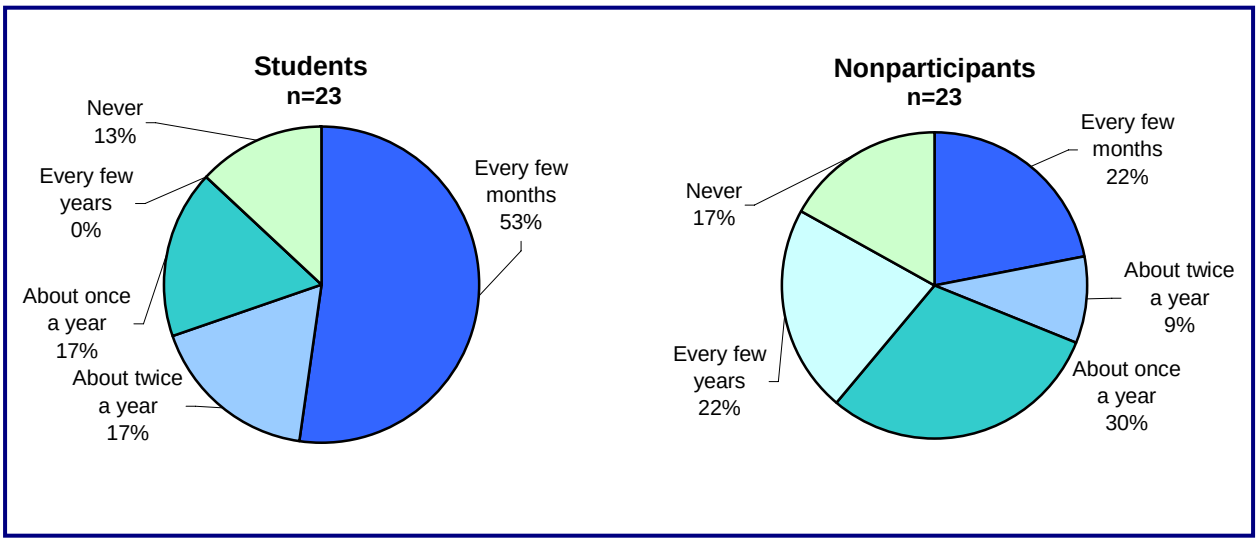
Note: Chi squared test of frequency data, p = .003.

Figure 5.3: Students Test for Proper Damper Modulation More Frequently than Nonparticipants



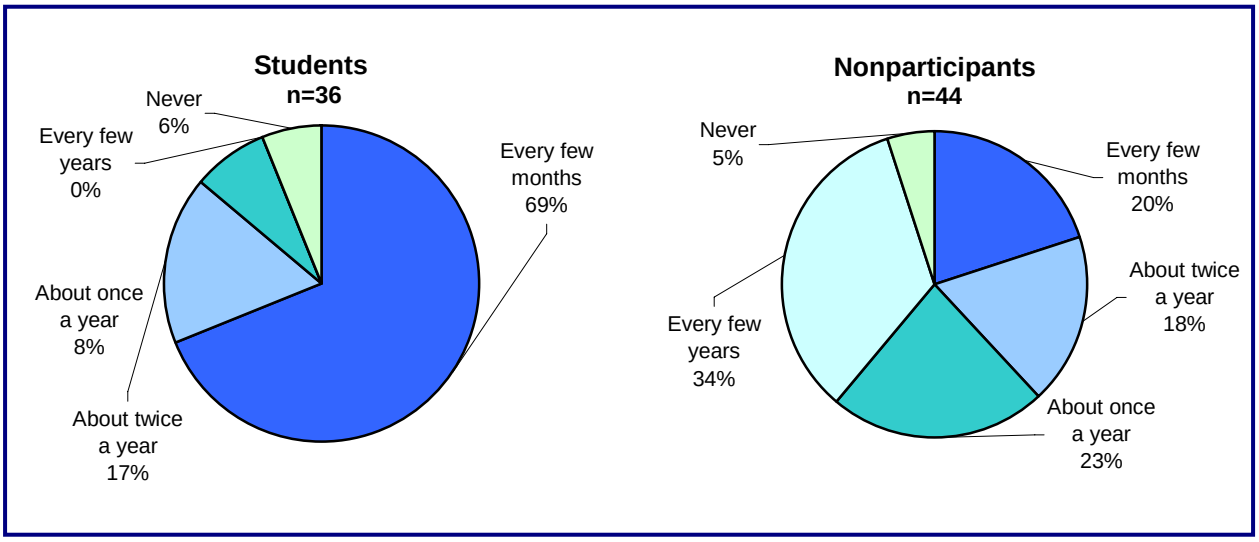
Note: Chi squared test of frequency data, p = .003.

Figure 5.4: Students Check and Recalibrate Chilled Water Loop Controls More Frequently than Nonparticipants



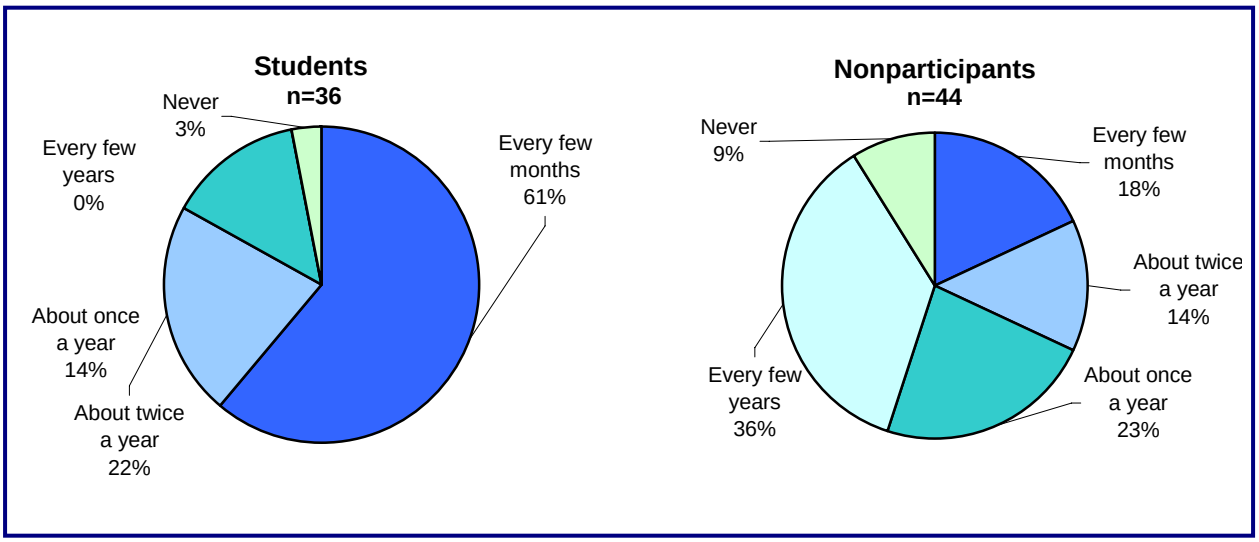
Note: Chi squared test of frequency data, p = .05.

Figure 5.5: Students Lubricate Motor, Fan, and Pump Bearings More Frequently than Nonparticipants



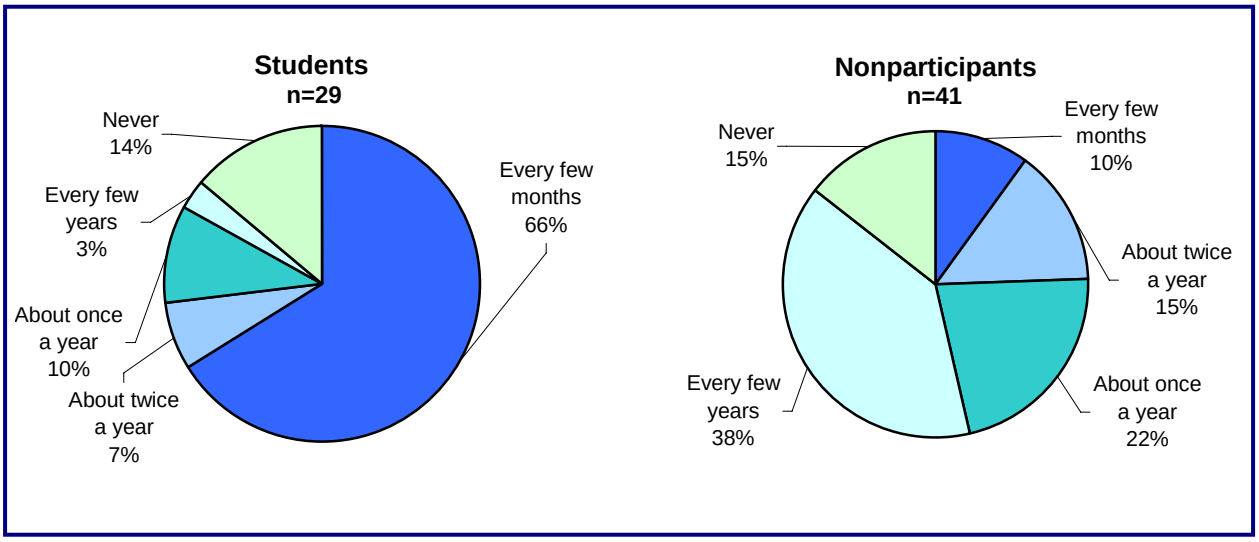
Note: Chi squared test of frequency data, p = .000.

Figure 5.6: Students Inspect Bearings & Belt Alignments on Motors for Fans & Pumps More Frequently than Nonparticipants



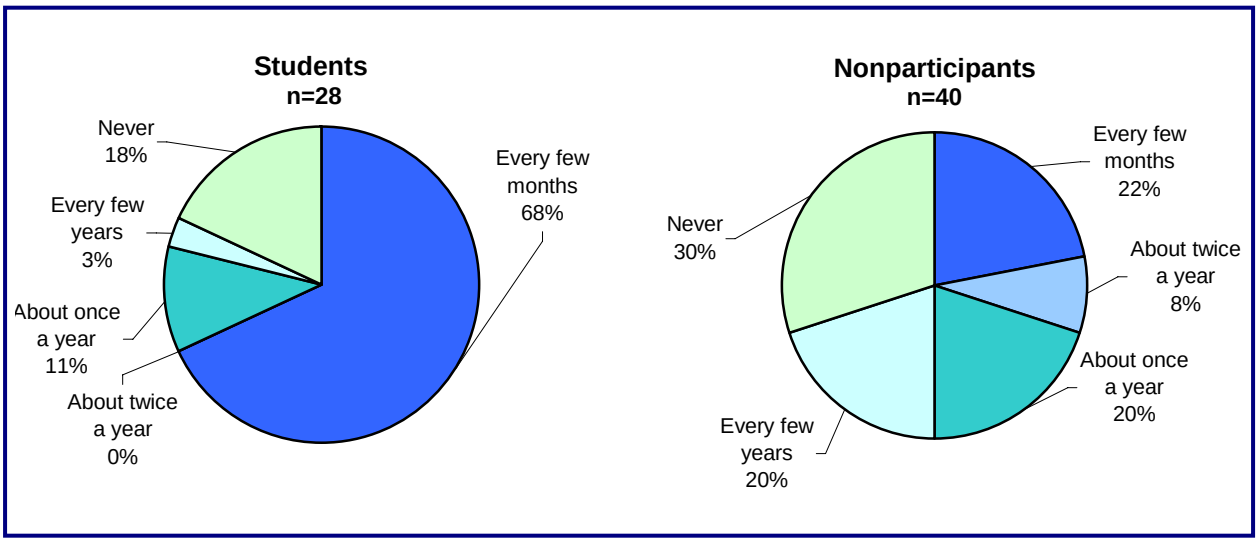
Note: Chi squared test of frequency data, p = .000.

Figure 5.7: Students Inspect the Compressed Air System for Leaks More Frequently than Nonparticipants



Note: Chi squared test of frequency data, p = .000.

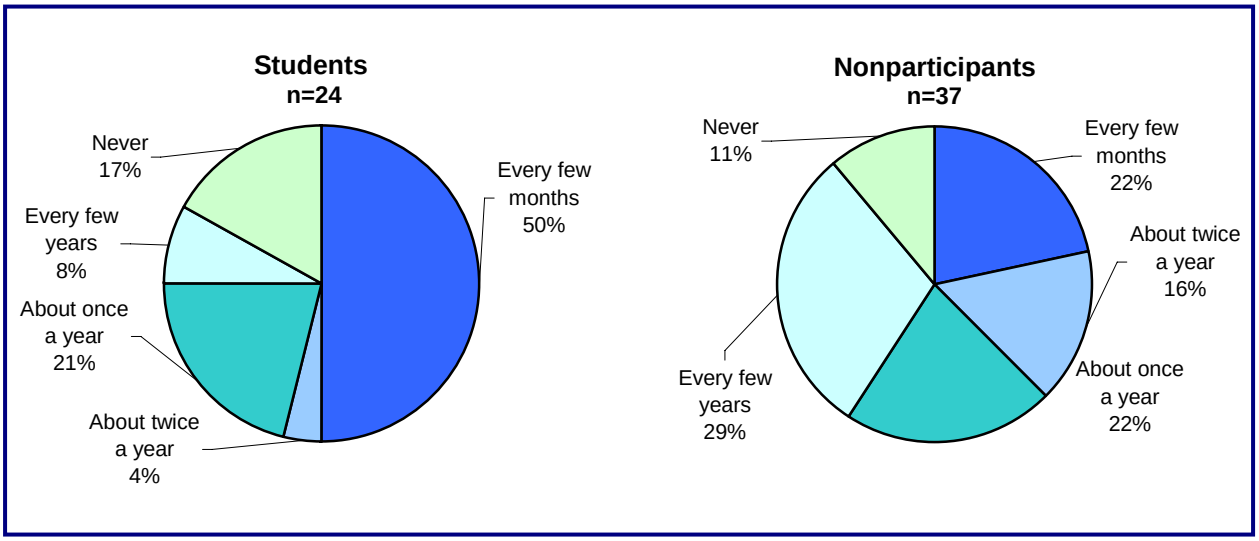
Figure 5.8: Students Monitor Compressed Air Systems for Power Use, Pressure, & Temperature More Frequently than Nonparticipants



Note: Chi squared test of frequency data, p = .004.

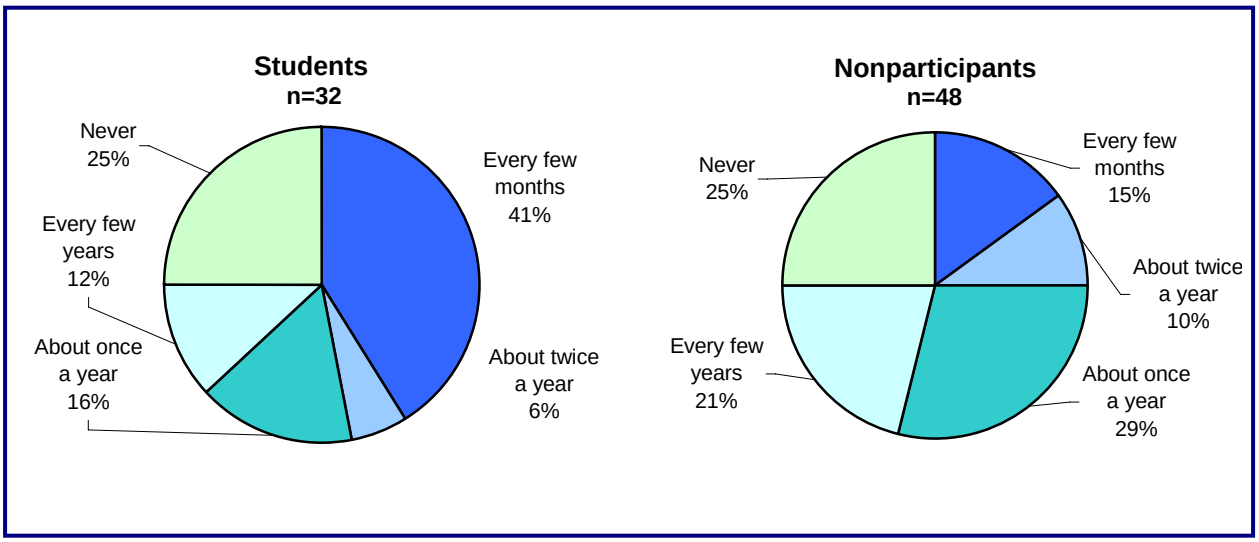
The second set of pie charts, Figure 5.9 and Figure 5.10, illustrate the efficiency-related O&M activities for which students tended to be more likely than nonparticipants to report frequently undertaking the action, with the differences being marginally significant ($p < 0.10$).

Figure 5.9: Students Appear to Check Refrigerant Pressures & Temps on Package AC Units More Frequently



Note: Chi squared test of frequency data, p = .063.

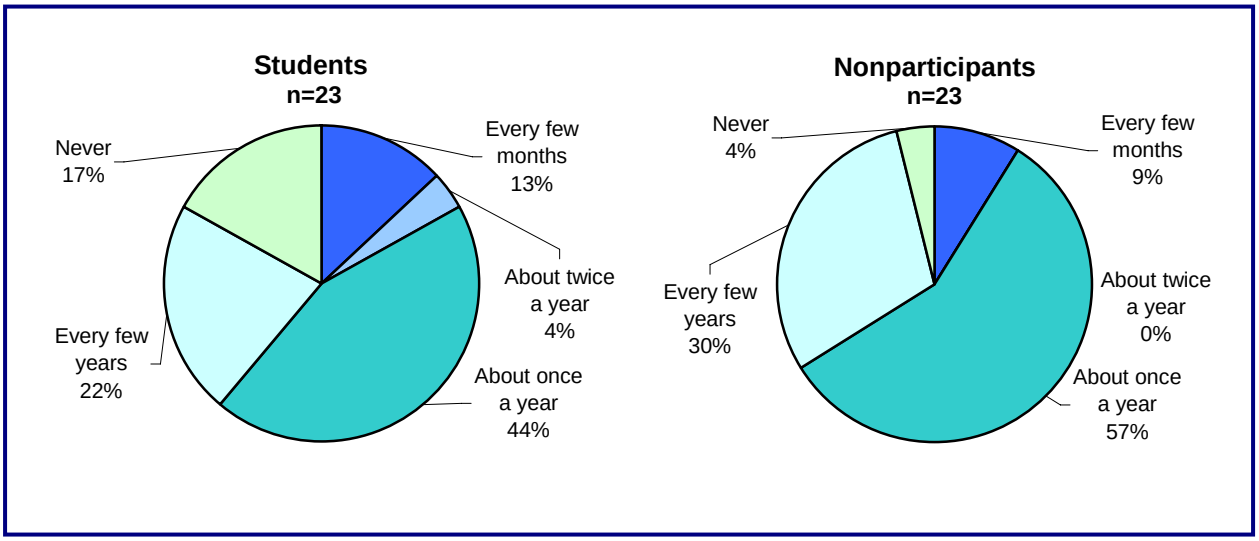
Figure 5.10: Students Appear to Check for Leaks in Supply & Return Air Ducts More Frequently than Nonparticipants



Note: Chi squared test of frequency data, p = .098.

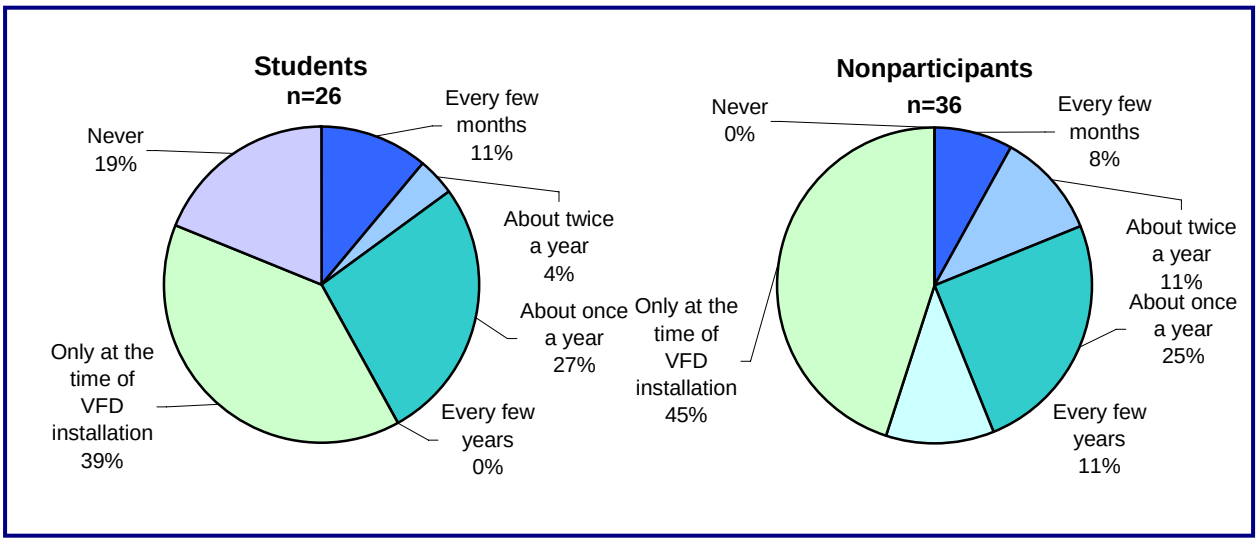
The third set of pie charts, Figure 5.11 and Figure 5.12, illustrate the efficiency-related O&M activities for which students and nonparticipants reported similar frequencies of undertaking the action.

Figure 5.11: Students and Nonparticipants Clean Chiller Evaporator & Condenser Tubes with Similar Frequency



Note: Chi squared test of frequency data, p = .445.

Figure 5.12: Students and Nonparticipants Test & Adjust VFDs to Match Loads with Similar Frequency



Note: Chi squared test of frequency data, p = .355.

The evaluators furthered the analysis by conducting statistical tests (chi-squared tests) to determine other significant differences between student and nonparticipant behavior. The evaluators compared the numbers of students and nonparticipants taking a given O&M action one or more times in a three month period. They went on to compare the numbers of each group taking a given action one or more times in a six month period, in a twelve month period, and in a twenty four month period. As shown in Table 5.4 (a key to the table is given in the table note), the differences between students and nonparticipants are most evident in the numbers taking O&M actions within a three month period. As the length of the period increase, more and more nonparticipants report taking the action, and the difference between the behaviors of students and nonparticipants diminishes. Indeed, most members of both groups claim to take each O&M action at least once in a span of 24 months.

Table 5.4 suggests there is little significant difference between students and nonparticipants with respect to whether they ever take a given action; that is, the table suggests eventually virtually all building operators get around to doing this or that activity. And this may well be the case. However, the evaluators wish to point out that social desirability bias can emerge in survey results when people are asked whether or not they do something they perceive as desirable. It is easy for a respondent to save face and say, in effect, "oh, of course, I do that every now and then." The evaluators intentionally designed the survey to reduce the likelihood of social desirability bias by asking respondents to provide detailed descriptions of their behaviors.[14]

[14] For a discussion of social desirability bias and techniques to minimize it in survey research, see M. McRae, "'Sure you do. Uh-huh': Improving the Accuracy of Self-reported Efficiency Actions." *Proceedings of the 2002*

continued…

These details are incorporated into the questions asking how often they perform the O&M action (the survey reads the response options: "would you say every few years, about once a year, about twice a year, every few months, or never"), as well as reflected in the follow up questions that probe methods used to conduct the O&M activity (see the survey instruments in Appendix E.)

Table 5.4: Summary of Differences in O&M Actions between Students and Nonparticipants

O&M ACTIVITY	BUILDING OPERATOR TAKES ACTION ONE OR MORE TIMES:			
	IN A 3 MONTH PERIOD	IN A 6 MONTH PERIOD	IN A 12 MONTH PERIOD	IN A 24 MONTH PERIOD
Check Boiler Combustion System	●	●	●	
Inspect Steam Traps	●	●	●	
Test for Proper Damper Modulation of Outdoor Air Dampers	●	○	●	
Check and Recalibrate Chilled Water Loop Controls	●	●	●	
Lubricate Motor, Fan, and Pump Bearings	●	●	●	
Inspect Bearings and Belt Alignments on Motors for Fans and Pumps	●	●	●	
Inspect Compressed Air System for Leaks	●	●	●	
Monitor Compression System Power Use, Pressure, and Temperate	●	●	●	
Check For Leaks In Supply and Return Air Duct System	●	●	○	
Check Refrigerant Pressures and Temperatures In Package Units	●	○	○	
Clean Chiller Evaporator and Condenser Tubes	○	○		
Testing and Adjusting VFDs Until They Match Loads	○	○	○	●

Table Key: Cells in Table 5.4 are marked with symbols for the comparisons where students were more likely than nonparticipants to report taking the action (given by the row) at the stated frequency (given by the column). The symbol ● indicates significant differences (chi-squared test, $p < 0.05$); the symbol ⊙ indicates marginally significant differences ($p < 0.10$); the symbol ○ indicates students were more likely than nonparticipants, but not to a significant degree. A blank cell indicates no apparent difference in the prevalence of students and nonparticipants reporting a given frequency of O&M activity.

ACEEE Summer Study on Energy Efficiency in Buildings. American Council for an Energy Efficient Economy. Washington, D.C. August 2002.

5.3 PROPORTION OF THE 12 O&M ACTIONS TAKEN IN EACH TIME PERIOD

The information presented in the preceding section shows that students take the BOCT-taught O&M actions more frequently than nonparticipants. They also take more O&M actions than nonparticipants, as shown in Table 5.5.

Table 5.5: Proportion of the 12 O&M Actions Taken in Each Time Period

TIME PERIOD	STUDENTS	NONPARTICIPANTS
About Every Few Months	51%	18%
About Twice a Year	66%	31%
About Once a Year	83%	57%

5.4 OTHER BEHAVIORAL CHANGES REPORTED BY STUDENTS

About three-fourths (73%) of students said their training has increased the likelihood they would encourage energy efficiency (a rating of "4" or "5" on a five-point scale—see Table 5.6) and half the students (52%) had also advocated for energy efficiency-related projects or equipment their organizations have yet to initiate. When asked to specify what types of projects they had advocated for, ten students mentioned a lighting-related project, eight mentioned controls, and six mentioned motors. Of those who had advocated for efficiency projects that had yet to be initiated, about three-fourths (79%) believe their organization might pursue the project in the future, while the remainder indicated the project idea was rejected.

Table 5.6: Increased Likelihood of Encouraging Efficiency

AGREEMENT	STUDENTS (N=56)
"5" – Strongly Agree	43%
"4" – Somewhat Agree	30%
"3" – Neither Agree nor Disagree	25%
"2" – Somewhat Disagree	0%
"1" – Strongly Disagree	2%
Total	**100%**

5.5 METHODS USED IN O&M ACTIVITIES

The students and nonparticipants discussed the methods they used to conduct three types of O&M activities: ongoing review of building energy use, checking and adjusting the boiler combustion system, and detecting leaks in compressed air systems.[15]

Students employed more methods than non-students for checking and adjusting the boiler combustion system and detecting leaks in compressed air systems—results that were statistically significant.

In checking and adjusting the boiler combustion system, students were significantly more likely than nonparticipants (chi square, $p<0.05$) to do two or three of the following: visually inspect boiler flame and soot accumulation; analyze flue gas composition; check gas consumption; or perform other actions verified by the evaluators to be pertinent to boiler O&M.

In detecting leaks in compressed air systems, students were significantly more likely than nonparticipants (chi square, $p<0.05$) to do two or three of the following: inspect the system and listen; monitor flow balances; use a portable ultrasonic acoustic detector; check pressure gauges; or perform other actions verified by the evaluators to be pertinent to air compressor O&M.

No statistically significant differences were found between the actions of students and nonparticipants in conducting ongoing and repeated looks at building energy use, such as benchmarking or indexing. Both groups indicated they do one or more of the following actions: review utility bills; monitor sub-loads; record and trend sub-loads; regularly review trended data on energy management systems; or use some other benchmarking or indexing system.

Finally, no statistically significant differences were found between students and nonparticipants responsible for compressed air systems, regarding whether they record the values and conduct baseline monitoring of compressed air operating parameters as part of O&M practices (about half of both groups reported doing so).

5.6 SUMMARY

Surveyed students undertake the explored energy-related O&M activities more frequently than surveyed nonparticipants, a finding that is statistically significant. In addition, students employed more methods than nonparticipants in maintaining their boiler and compressed air systems, results that also were statistically significant.

[15] The surveys also included a question addressing methods of checking chiller control operations, but an error in the programming of the student instrument for computer-assisted interviewing precluded the collection of this data.

The comparison between the actions of students and nonparticipants was not symmetrical, with a bias favoring nonparticipants. Students were asked "how often do *you* do X", while nonparticipants were asked "how often do *you or your staff* do X". Note that while the findings in this chapter suggests the BOCT training influences students' behaviors, it does not establish this causality, as students may have differed from the nonparticipant comparison group prior to the training.

For both student and nonparticipant groups, roughly 80% of their facilities had recently begun or completed projects aimed at increasing energy efficiency.

The O&M activities explored in the research were those the instructors described as the key energy-efficiency actions they taught. The evaluators excluded from this list O&M activities shown by a prior study to be frequently undertaken by high proportions of building operators.

As the interval of time during which the activity is reported as undertaken increases from every few months to once a year, the difference between student and nonparticipant activities decreases.

In addition to the findings on specific O&M activities, about three-fourths of students said their training has increased the likelihood they would encourage more energy efficiency at their facilities. About one-half of the students who said an energy efficiency project was completed or underway credited the BOCT with having influenced the project.

6 PROGRAM OPERATIONS

This chapter presents findings from the in-depth interviews with BOCT program managers from the three electric investor-owned utilities, with two NEEC program implementation staff (the program director and marketer), and with ten BOCT instructors. The discussion focuses on new developments since the process evaluations of the 2003 and 2002 program years.

6.1 PROGRAM MARKETING, DEMAND, AND STRATEGY

NEEC is primarily responsible for program marketing; the utilities supplement NEEC's efforts. In particular, NEEC calls on them to actively seek recruits at any time enrollment at a planned series appears to be insufficient to warrant course delivery.[16]

The basic marketing approach remains unchanged since the program launch. NEEC sends a course invitation and BOCT brochure to the people on a list it has developed of firms with building operations and maintenance staff. The genesis of the list came from an association that serves this population, although NEEC continually adds contacts obtained from other sources. As of the end of 2005, the list contained over 8,300 names.

To increase its outreach, NEEC joined a number of organizations whose membership overlaps with the target market for BOCT training—such as those serving health care facilities and schools—and includes the memberships of these organizations on its marketing list.

The invitations inform recipients that they can attend a short informational meeting to learn more about the course series. These meetings are typically held about one-and-a-half months prior to the scheduled training. NEEC conducts such meetings at locations throughout California. One of NEEC's two senior partners conducts the meetings. Often the utility program manager or other utility staff attend the meeting and speak out, making clear the utility believes in the value of the training.

NEEC's marketing manager is responsible for filling the classes. He conducts the mailings, sets up the informational meetings, communicates with customers, and coordinates with the utilities on the recruitment of participants. He also promotes the BOCT Program at trade shows.

The process evaluation of the 2003 program included a recommendation that the utilities increase their marketing of BOCT to complement NEEC's activities, as each group (the utilities

[16] The program implementation contract between the utilities and NEEC specifies a minimum number of 20 attendees per course.

and NEEC) is most effective at different types of marketing. The utilities have integrated the promotion of the BOCT training into their own marketing efforts in a variety of ways. All of the utilities include the Statewide BOCT Program on their Web sites. Two utilities have incorporated it into their energy resource centers and list the BOCT training on the calendar of events that is sent to their customers on a quarterly basis. The program is also marketed by including mention of the training in widely publicized calendars of training events, in industry trade publications about trade-specific trainings, and in utility-sponsored seminars and meetings.

The utility managers ask the account representatives to market the program; account representatives vary in the degree to which they respond. According to the managers, a few appreciate that the program as offering their customers a valuable chance to keep current with changing equipment and energy efficiency technologies. A few view it as one means of stimulating customers to undertake efficiency projects.

One utility developed its own brochure to promote the program, however this step was not without controversy. Another contact expressed concern about that unilateral approach, believing all Statewide BOCT Program publicity materials for general circulation should reference all of the participating utilities to foster recognition of the program as a statewide effort. In fact, from a marketing viewpoint, the statewide character of the program was bolstered during 2004-2005 with the addition to the promotional materials of the Sacramento Municipal Utility District (SMUD) as one of the program sponsors.

Contacts believe the marketing to date has been effective, evidenced by the fact that all but one of the series has been filled and offered as planned. Classes typically are hardest to fill the first time they are offered in a given location. However, NEEC has noticed that attendance at course informational meetings has declined during the past two years.

As described in Chapters 3 and 4, the most significant barrier to participation is time away from the job, due to very lean workforces. This was also a finding from the process evaluation of the 2003 program year. NEEC is considering these two conditions in tandem: how to increase attendance at informational meetings and how to increase participation in the training.

To these ends, NEEC is pursuing several approaches. One, NEEC is considering offering the course through “Web-casting,” or online training. Two, NEEC is investigating marketing the program through brown-bag informational meetings at employers’ locations. This approach would also be a step to addressing the decline in attendance at the informational meetings. Three, NEEC plans “to go deeper” with the California Association of School Business Officials (CASBO), that is, to work at their local section level to reach their membership. Four, NEEC intends to expand its coordination with local and regional groups, such as the Redwood Coast Energy Authority (RCEA) and the Ventura County Regional Energy Alliance (VCREA). Such cooperation effectively expands the mailing list and exposure for the BOCT Program.

NEEC is seeking to identify large employers who have the capability to send seven or more people to a training session, as well as employers who will host the series on their premises. (The

latter is consistent with a recommendation made by the process evaluation of the 2003 program year.) To effectively engage with large employers, as contacts noted, it will be important to motivate utility account representatives to become even more active partners in the promotion of the courses. Contacts expressed the view that the utilities—which are the organizations who have the best knowledge of the potential market for the training in California—may have to take additional, if not full ownership of the program's marketing activities in order for it to fulfill its "huge potential," as one utility contact described it.

Two of the ten interviewed instructors suggested marketing approaches for the program. One suggested promoting the courses through vendors and the other suggested promoting the training to customers interested in LEED (Leadership in Energy and Environmental Design, a program of the U.S. Green Building Council).

The program Web site (*www.theboc.info*) constitutes a key marketing component and marketing activities direct people to the Web site. On the Web site, people can sign up for a free informational Web-cast on the training, read descriptions of the course offerings, determine the training location nearest them and when classes will be offered, and read testimonials and case studies illustrating the value of the training.

The Web site identifies seven organizations that provide continuing education credits for completed courses; one of these organizations (International Facility Management Association, or IFMA) accepts course credits for building operators seeking IFMA's Facility Management Professional designation.

BOC training is offered in 20 states and the Web site lists the sponsors in these states.

A tour of the Web site, and especially the references to the many organizations and sponsors, highlights a confusion facing the marketing of the Statewide program. Of all the organizations with any association to the program, only the California investor-owned utilities refer to the program as the BOCT. The program Web site, 19 states of the 20 implementing states, and all of the organizations that recognize the training refer to the program as the BOC. Even within California, the Sacramento Municipal Utility District (SMUD), which also offers the training, refers to it as the BOC.

The Statewide nomenclature imprints a parochialism that seems at odds with a national certification program. The unique program name may be confusing to California employers reading the resumes of certified building operators who completed BOC training in other states, although this issue was not explored with employers surveyed by the current research.

6.2 UTILITY SPONSORSHIP

The 2004-2005 program benefited from having a single set of program managers; the prior years were marked by turnover among the managers. Among the benefits of this continuity in program

personnel was the development of a more "comfortable" working relationship between the parties.

The process evaluation of the first program year, 2002, found the then-program-managers to be noncommittal about the Statewide BOCT Program, which led to the recommendation to "develop a long-term vision for BOCT in California to give on-going value to the certification and training." This has now occurred through the utilities' decision to move BOCT under the umbrella of their energy resource centers, from which all utility training and information programs will be offered.

At the time of the interviews for this research (mid-2006), two of the utilities had completed the transition of BOCT to their energy resource center; the transition was underway at the third utility. While these moves result in yet another change in program management, they nonetheless suggest the utilities now have a long-term vision for the Statewide BOCT Program. Subsequent program evaluations will need to explore how BOCT fares under the auspices of the utilities' energy resource centers.

The utility contacts expressed high regard for the training, expressing that it has value consistent with their utility's other educational programs. According to contacts, most of the utilities' educational programs are oriented to contractors and the design community; the Statewide BOCT Program is the only training for building operators and engineers. (Indeed, the program was developed in response to a dearth in training for this target market.) One of the utility managers reported he is challenging those with whom he works to develop more programs for building operators and engineers.

The utility managers described valuable non-energy benefits of BOCT. One contact describe the amount spent by his utility annually for the training as "far less than the benefits [the utility] receives in improving relationships with customers and making the utility a trusted partner of the customer." It was also mentioned that the BOCT training helps the utility account representatives "fulfill their obligation to see that their customers receive the latest energy efficiency information and suitable training."

6.3 PROGRAM DELIVERY AND LOGISTICS

Registration for the BOCT training is centralized through the NEEC office, making the registration procedure uniform for students in all utility service territories throughout California. Similarly, course content does not vary by utility or location. All of the utilities "on a case-by-case basis" offer tuition subvention, typically for employees of schools and nonprofits, and especially when needed "to get class numbers up."

Most of the locations used in the 2004-2005 trainings had been used previously and have become established training locations. The program manager for PG&E, which has by far the largest service territory, has taken an active role in expanding the training locations it offers its customers. For new locations, the manager has worked with the account representatives to find

customers that might host the training. Others who play a role in course site selection include regional energy partnerships. For example, it was reported the RCEA (serving the north coast) was the driver in getting the BOCT training to occur in Eureka.

The instructors described different advantages and disadvantages of each of the four types of course locations: utility energy resource centers, hotel meeting rooms, educational facilities, and private, sponsor-provided locations. For example, hotel locations excel in food quality, in the ability to seat students facing each other in circles to facilitate discussion, and in adequate parking. Yet for providing supports to training, university locations and utility resource centers were described as more advantageous, with energy resource centers mentioned as being "ideal" because of the information, displays, and "teaching tools" relating to equipment operation and energy efficiency. Parking at energy centers was also mentioned as a positive attribute. The energy centers and the closed location (Port Hueneme) offered the advantage of tours of energy-efficiency demonstration projects and facilities.

Site coordinators work in Northern and Southern California to handle all issues regarding the facilities. The site coordinators free the instructors to simply show up and teach. The interviewed instructors appreciated the work the site coordinators have done in preparing the sites and the classes for the instructors' teaching role. With one reported exception (which was part of a larger problem that had already been addressed by the time of these interviews), audio-visual equipment had been available when needed and the on-site paperwork with the students had been handled expeditiously by the site coordinators.

Indeed, the site coordinators handle all student activities that span the course series (which may be each taught by different instructors), such as taking attendance, answering questions, clarifying homework assignments, collecting and grading the assignments, and administering the final test. Instructors credit the site coordinators with saving significant class time. The instructors also said the site coordinators provide the students with valuable continuity as they move from course to course throughout the BOCT series.

The role of the site coordinators has reportedly not changed since the prior program evaluations. However, there was a personnel change in the Northern California site coordinator, which created problems, according to contacts. NEEC identified the cause of the personnel change and was reported to be taking steps to minimize such occurrences. While NEEC may have influence over such personnel changes, it does not have full control, a condition the parties have to learn to accept.

One of the utility managers expressed the opinion that BOCT implementation entails "too much overhead" and cited as evidence the use of a course logistics manager in addition to the instructors. Paradoxically, later in the interview, that contact reported, "It's an easy program to manage. NEEC takes care of the details, finding meeting rooms, etc."

Two of the program managers expressed concern that tuition is charged for the training, rather than the classes being offered free-of-charge like the other utility training programs. Although

one cannot know in advance the extent to which the cost of the BOCT is indeed a problem when the program is implemented by the energy resource centers, the findings from the three evaluations of the BOCT suggest the cost of the training is not a barrier to participation.

As described in previous chapters, the current study found that about two-thirds of participating organizations plan to send additional staff to training and over two-thirds of nonparticipants thought the price sounded reasonable. The study of 2003 Level II participants reported a majority of participants described the course as so valuable they would have been willing to have paid the course fee themselves. The study of the 2002 program had findings comparable to these.

6.4 UTILITY PRESENCE DURING TRAINING

The 2003 process evaluation included a recommendation to increase utility presence at BOCT trainings, including staff appearance at trainings and provision of program materials at training sites other than the utilities' energy resource centers.

To foster utility staff attendance, NEEC has implemented a system of reminders of course times and schedules to utility staff, along with the suggestion that a utility representative make a twenty-minute presentation during *Energy Conservation Techniques* (BOC 102) to present information about utility energy efficiency programs and initiatives. This approach seems to be effective. All of the utility contacts reported they or another utility representative are making these presentations, a finding confirmed by four of the five interviewed instructors who taught BOC 102. In one case, a utility representative had provided tours of the building and of a demonstration project. However, utility staff were not present when the course was not held at energy-center locations.

Of the five interviewed instructors who did not teach BOCT 102, only one reported utility staff participation in his classes. He said, "They always come in to see how it's going, and I ask them to talk to the class for five or ten minutes about their energy conservation programs." The four remaining instructors reported there was no utility staff participation in their classes, although two of these said utility staff had occasionally dropped in on, or audited their classes.

Only two of the ten instructors reported their students received materials about utility energy efficiency programs during the classes. Both of these instructors mentioned brochures and USB memory sticks. One of these instructors said the materials were handed out by a utility representative, while the other said it was by the site coordinator. All but one of the remaining eight instructors reported their students received no materials about utility programs during their classes.

6.5 COURSE CONTENT AND CURRICULA UPDATING

Most instructors reported the course materials were suitable for their students. For example, one instructor, whose response typified those of the others, mentioned the students are a diverse group—from 20-year veterans to newcomers—and went on to say the coursework does "a pretty

good job of hitting the middle." (Students' characteristics and experiences with BOCT training, presented in Chapters 3 and 5, confirm this assessment.)

However, one instructor of *Environmental Health and Safety Regulations* reported he had not seen "the people who are best suited for the information. I see people one level below that. Not the people who are managerially responsible for health and safety."

Instructors reported they have the opportunity to provide feedback to NEEC via conference calls with NEEC and other instructors. They also reported feeling free to contact NEEC when they felt they need to—"whenever I have an idea or something comes up." The instructors reported NEEC has been responsive to their feedback.

According to NEEC, the core BOCT curriculum is designed to offer instructors the flexibility to use their own supplemental materials to cover topics in more depth, to provide new information about technology and practice, and to provide their own real world examples of local facilities. NEEC encourages instructors to expand on the core material to make it their own. NEEC's intent is that instructors be able to keep the material current and lively between editions.

Each course in the BOCT curriculum (both Level I and Level II) is updated on what is typically a two-to-three-year cycle, as shown in Table 6.1 for the Level I courses. Modifications to the cycle derive from feedback from instructors and BOCT partners, such as the California utilities. The updating procedure involves selection of a lead curriculum developer to work with NEEC to identify the scope of the update. NEEC also involves a team of interested BOCT instructors from all active BOCT regions to serve as reviewers.

Table 6.1: Level I Curricula Revisions

MODULE	EDITION	LAST UPDATE	NEXT REVIEW
BOC 101 – *Building Systems Overview*	Third	2001	2008
BOC 102 – *Energy Conservation Techniques*	Fourth	2006	2008
BOC 103 – *HVAC Systems & Controls*	Fourth	2004	2008
BOC 104 – *Efficient Lighting Fundamentals*	Fourth	2004	2008
BOC 105 – *Environmental Health & Safety Regulations*	First California Version	2005	2007
BOC 106 – *Indoor Air Quality*	Third	2003	2008
BOC 107 – *Facility Electrical Systems*	Third	2006	2008

NEEC described plans to begin a full review of all courses in December 2006 to correct typographical errors, printing, and reproduction issues, with plans to incorporate the changes by the end of January 2007. Edition numbers will not change, but all orders beginning in February

2007 will incorporate these changes. Instructors will be given CDs with updated presentation files reflecting any changes.

When asked by the evaluation team if the BOCT curricula needed any changes to better address the needs of California students, six of the ten interviewed instructors had no suggestions. The ten instructors included a single instructor of *Indoor Air Quality*, who said the course "badly needs an update for the entire country." The interviewed instructors also included a single instructor of *Efficient Lighting Fundamentals*, who believes the lighting curriculum needs to be updated "continually" to capture advances in the field. Most of the interviewed instructors taught multiple courses, including five instructors who taught *HVAC Systems & Controls.* One of these five instructors thought the curriculum puts too much emphasis on boilers and needs instead a greater discussion of cooling, although the other four did not offer any recommendations. One instructor who teaches multiple courses said that his students raise questions about the California energy code that he can't adequately address.

A review conducted by the evaluators of the 2004-2005 Level I participant list suggests a market the BOCT may be only lightly penetrating. Roughly 20% of the attendees appear to have Hispanic surnames. In the current research, as well as in prior studies of the BOCT, the surveyors encountered a few participants whose first language is Spanish and who clearly struggle to communicate in English. The BOCT might attain greater penetration of the California building operators market were it offered for a Spanish-speaking audience. As noted elsewhere in this report, although more than half of the current participants are supervisors, the BOCT's intended audience is line-staff and the majority of participants indicated their organization will be sending additional staff to training. The evaluators suspect the language barrier is greater among line staff than among supervisors. The review of the participant list, coupled with anecdotal evidence and census data, suggest that Spanish is the second-most common language spoken by California building operators.[17]

6.6 VIEWS ON MARKET SIZE

The contacts agree the long-term prospects of the BOCT Program in California are good. The reasons for their optimism include its ability to help the utilities' customers meet best practices for the operation and maintenance of equipment installed through the utilities' rebate programs. The contacts also believe there remains a significant untapped market for the program. Representative comments include: there is a "tremendous need," a "huge potential," and "we

[17] According to the US Census 2005 population estimates the California population is comprised of 44% non-Hispanic whites, 35% Hispanic, 12% Asian, and 7% African American, in addition to other groups. Note that these statistics describe race and ethnicity and do not describe language fluency. Source: US Census Bureau: *State and County QuickFacts*, revised January 12, 2007 (http://quickfacts.census.gov/qfd/states/06000.html).

have only seen the tip of the iceberg." In particular, property management firms, hospitals, local school districts, and universities were mentioned as being under-represented at the trainings.

6.7 STATUS OF PRIOR EVALUATION RECOMMENDATIONS

NEEC and the sponsoring utilities have fully or partially addressed each of the recommendations made in the 2002 and 2003 evaluations of the Statewide BOCT, as shown in Table 6.2.

Table 6.2: Current Status of Recommendations from the 2002 and 2003 Evaluations

RECOMMENDATION	CURRENT STATUS (PER 2006 RESEARCH)
2002 PROGRAM YEAR – LEVEL I PROGRAM	
Market the Level I series as courses for line staff, as designed, discouraging highly experienced operators.	NEEC has modified the BOCT brochure and Web site to emphasize recommended years experience for Level I and II (see *http://www.theboc.info/eligibility.html*).
Plainly identify course content relating to demand responsiveness. The utilities should identify for NEEC California-specific information relating to when and how demand-response events are called and strategies they want students to implement.	Neither NEEC nor the utility program managers identified any content that was added to the BOCT Level I curricula on the topic of demand response. NEEC developed a Level II module in 2004 that has subsequently been offered annually. The 2004-2005 evaluation suggests the current Level I training may be adequate. While 34% of the 2002 students agreed BOCT led to them having greater confidence in their ability to respond to a request for a demand response, 81% of the 2004-2005 students so reported.
Develop a long-term vision for BOCT in California to give on-going value to the certification and training.	As of mid-2006, the utilities either had moved or were planning to move BOCT implementation to their energy resource centers. This movement places the BOCT firmly within the utilities' portfolio of information service programs.
Evaluate the Level II BOCT.	Completed for the 2003 program year.
2003 PROGRAM YEAR – LEVEL II PROGRAM	
Offer additional advanced training.	NEEC developed *Enhanced Automation and Demand Reduction* (BOC 216) in 2004 and is currently developing a module on strategies for sustaining the building performance improvements achieved from commissioning and operational enhancement activities. NEEC publicizes in its bi-annual BOC Bulletin (for graduates and their employers) advanced training that would qualify BOCT graduates for the continuing education points necessary for license renewal, including training provided by the utilities' own energy education centers (i.e., PEC, ETC, CTAC, ERC and the Food Service Technology Center).

Continued

RECOMMENDATION	CURRENT STATUS (PER 2006 RESEARCH)
Increase utility presence at BOCT trainings, including staff appearance at trainings and provision of program materials at training sites other than utilities' energy resource centers.	To foster utility staff attendance, NEEC implemented a system of reminders of course times and schedules to utility staff, along with the suggestion that a utility representative make a twenty-minute presentation during *Energy Conservation Techniques* (BOC 102) on energy conservation to present information about utility energy efficiency programs and initiatives. Utility contacts reported they or another utility representative are making these presentations, confirmed by four of five interviewed instructors who teach BOC 102. Trainings not held at the centers typically lack both involvement of utility staff and a good display of energy efficiency program information.
Increase utility marketing of BOCT (to complement NEEC's efforts), comprehensively including the BOCT in the marketing of other training efforts.	The movement of BOCT implementation to the utility energy resource centers was designed so that the BOCT would be marketed and supported by the utilities on par with their other information programs. The change was too recent to allow an investigation of its effects. Program managers reported a variety of activities they repeatedly engage in to promote participation in the BOCT. The specific marketing activities and level of BOCT promotion differs among the utilities. All utilities increase their participant recruitment efforts when notified by NEEC that a planned series is low on students. In 2005-2006, utility account managers played a significantly more active role in marketing to BOC customers, which resulted in greater participation, particularly in the outlying areas of Sonoma, Humboldt, and San Diego counties.
Target institutional customers in marketing efforts to counter low levels of awareness found among this group.	NEEC joined two leading professional associations representing state higher education (Pacific Coast Association of Physical Plant Administrators) and K-12 (California Association of School Business Officials—CASBO) to raise awareness of BOCT through networking events, conferences, and newsletters. NEEC was invited to present information about BOCT at the past two annual meetings of CASBO. The current evaluation finds institutional customers are as aware of the BOCT as other customers.
Continue to seek opportunities to hold trainings at the site of large employers.	The following trainings have been at employers' sites: China Lake Naval Air Weapons Station (2004, Level I), Equity Office Properties in San Jose (2004, Level I; 2005, Level II); Port Hueneme Naval Facility (2005, Level I); and California State University Northridge (2005, Level I). This is a growing trend for the Statewide BOCT, as evidenced by four on-site course series scheduled in 2007 at San Jose State University, UC Santa Barbara, Camp Pendleton, Lemoore Naval Air Station, and Pt. Hueneme (Level II).
Address site-related issues described in the report.	NEEC is using academic learning center facilities provided by National University and the California State University and University of California campus systems to offer BOCT course series in locations other than the utility energy centers. These facilities offer state-of-the art AV equipment and classroom facilities. In some instances, NEEC uses hotel meeting room facilities to offer BOCT. NEEC provides a "driving directions" page on its Web site year round (*http://www.theboc.info/ca/directions_ca .html*). Students also receive driving directions with their initial registration confirmation.

6.8 SUMMARY

The Statewide BOCT is a mature program, with a mature delivery system. The 2004-2005 period was a stable one in terms of utility program management. During 2006, as research was being conducted for this process evaluation, the utilities were in the process of incorporating BOCT

into their energy resource centers, through which they administer their other information and training programs. This change is likely to be the most significant of any that have occurred since the program's launch in California in 2002 and satisfies the recommendation made in the evaluation of the 2002 program that the utilities develop a long-term vision for the BOCT Program.

While all contacts view the potential demand for the program as huge, customer attendance at the informational meetings held to promote BOCT has declined. Thus, a key implementation issue, recognized by the NEEC and utility managers, is the need to expand marketing. As one means toward that goal, and consistent with a prior evaluation recommendation, NEEC is seeking to identify large employers who will host the series on their premises, as well as employers who have the capability to send seven or more people to a training session. Contacts noted that utility account representatives could play a role here. NEEC is also conscious of previous evaluation findings that the most significant barrier to participation is time away from the job, due to very lean workforces. Some of NEEC's plans to increase attendance at informational meetings and to increase participation in the training address this barrier of staff availability.

The program's acronym—the BOCT—is potentially a source of confusion for marketing the Statewide program, as the Web site supporting the training and the course titles refer to the BOC. In addition, SMUD refers to the training as the BOC, as do the other 19 implementing states and the organizations the accept continuing education credits for the training.

A review of the list of 2004-2005 Level I participants, coupled with anecdotal information from the surveyors, suggests a potential market the BOCT has yet to tap: building operators whose first language is Spanish.

Interviewed contacts identified no problems with program delivery or logistics. The utility managers are pleased with NEEC's implementation of the program. Instructors are happy with the role played by the site coordinators, who both free-up instructors' time for teaching and provide students with continuity between the courses, which typically are taught by six different instructors.

In response to a recommendation from a previous evaluation, NEEC initiated a way to make it easier for utility managers to plan to have a utility representative present the utility's energy efficiency programs at the *Energy Conservation Techniques* course. Instructors of that course confirm that utility representatives have attended these courses when they are held at the utility's energy resource center, but have not attended when the courses are held elsewhere. Further, only two of the ten instructors reported their students received materials about utility energy efficiency programs during the classes.

NEEC and the sponsoring utilities are making use of the program's process evaluations and have fully or partially addressed each of the recommendations made by the two prior evaluations.

7 FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter is composed of two main sections. The first section discusses the key research findings and their implications. The second section presents the study's conclusions and recommendations.

7.1 SUMMARY AND DISCUSSION OF FINDINGS

The Statewide BOCT is a mature program, with a mature delivery system. The 2004-2005 program period was a stable one in terms of utility program management and program operations.

7.1.1 Training Objectives and Participant and Nonparticipant Response

BOCT instructors emphasize their focus on helping students to understand their facilities as an integrated system. They provide the foundation necessary for effective problem-solving as they discuss how to operate and maintain equipment for greatest energy efficiency and optimal building performance (Section 3.1). Students and supervisors agree BOCT increases students' ability to effectively and efficiently operate and maintain their facilities' equipment (Section 3.2). Students and supervisors were overwhelmingly pleased with the BOCT training (Sections 3.2 and 3.3). Contacts like the current structure of one course per month (Section 3.4).

The nonparticipants responded positively to a description of the BOCT Program provided to them, with 70% indicating they would consider sending staff to the training (Section 4.2). For half of nonparticipants, utility sponsorship of the BOCT Program increased their confidence in its value (Section 4.3).

Two-thirds of nonparticipants thought the price of the BOCT series seemed reasonable for a seven-day training (Section 4.3).

7.1.2 Indicators of Training Effectiveness

Surveyed students undertake the explored energy-related O&M activities more frequently than surveyed nonparticipants, a finding that is statistically significant (Chapter 5). Note that while this finding suggests the BOCT training influences students' behaviors, it does not establish this causality, as students may have differed from nonparticipants prior to the training (Section 2.1).

7.1.3 Student and Instructor Recommendations for the BOCT

Over 70% of students expressed complete satisfaction with each of the courses and could offer no suggestions for changes (Section 3.2). Most student comments expressing dissatisfaction

owed it to a mismatch between the students and the material, with roughly equal proportions of students thinking the amount of time warranted additional information (i.e., "go faster") and thinking the amount of information warranted additional time (i.e., "go slower") (Section 3.2).

Utility program managers have expressed concern the training spends too much time on boilers (2002 BOCT evaluation, as summarized in Section 1.2). Students did not raise any objections to the boiler material (Chapter 3). One of five interviewed instructors who taught *HVAC Systems & Controls* thought boilers take up too much class time, but the other four instructors of this class did not volunteer an opinion about the boiler information (Section 6.5). Of interviewed building operators, 61% of students reported responsibility for boilers, as did 69% of nonparticipants (Section 5.1). This compares with 66% of students and 86% of nonparticipants reporting responsibility for cooling systems (Section 5.1). The evaluators do not feel the findings point to a problem with the BOCT's boiler content, but should this remain a concern to program managers, a future study should explicitly explore this issue and not rely on open-ended remarks.

Recommendations offered for the training series included providing students with materials to study before each class, providing more information about electives, and sending course reminders and follow-up information on certification to supervisors (Section 3.3).

7.1.4 Location, Training Venues, and Logistics

Both the student and nonparticipant findings strongly suggest that few building operators are willing to travel more than one hour for BOCT training (Sections 3.4 and 4.3).

An analysis of student commute times indicate they are on par with typical commute times in their regions (Section 3.4). Only 10% of the roughly 400 2004-2005 participants traveled more than one hour to the training (Section 3.4). The distribution of actual travel times compares favorably to travel preferences expressed by nonparticipants (Section 4.3).

The BOCT Program appears to be working well with respect to delivery and logistics (Chapter 3 and Section 6.3). The utility managers are pleased with NEEC's implementation of the program (Chapter 6). Instructors are happy with the role played by the site coordinators, who both free-up instructors' time for teaching and provide students with continuity between the courses, which typically are taught by six different instructors (Section 6.3).

NEEC has been responsive to a recommendation from a previous evaluation concerning utility presence at the trainings and took steps to facilitate utility representatives' attendance (Section 6.4 and 6.7). The utilities, however, have partially, but not fully, met the 2003 evaluation recommendation. Instructors confirmed representatives have attended when the courses are held at the utility's energy resource center, but have not attended when the courses are held elsewhere (Section 6.4).

7.1.5 Statewide Program

The Statewide BOCT Program appears to be operated uniformly throughout the service territories of the investor-owned utilities (Chapter 6). Course instruction and logistics are uniform throughout the Statewide program, as is the NEEC-conducted marketing. One utility reported developing a utility-specific program brochure, yet no problems were evident from this approach (Section 6.1). The move of the program to the utilities' energy resource centers should further strengthen uniform utility marketing activities (Section 6.2).

The Northern California service territory is larger than the other IOU territories and consequently, the program manager and NEEC have worked to increase the number of training locations, including pursuing customer-sited locations (Section 6.3). The time and distance analysis conducted for 2004-2005 Level I students strongly suggests the BOCT should be offered in the Bakersfield area (Section 3.4).

During 2006, as research was being conducted for this process evaluation, the utilities were in the process of incorporating the BOCT Program into their energy resource centers, through which they administer their other information and training programs (Section 6.2). This change is likely to be the most significant of any that have occurred since the program's launch in California in 2002 and satisfies the recommendation made in the evaluation of the 2002 program that the utilities develop a long-term vision for BOCT (Sections 6.2 and 6.7).

Two of the program managers expressed concern that tuition is charged for the training, rather than the classes being offered free-of-charge like the other utility training programs. Although one cannot know in advance the extent to which the cost of the BOCT is indeed a problem when the program is implemented by the energy resource centers, the findings from the three evaluations of the BOCT suggest the cost of the training is not a barrier to participation (Section 6.3).

7.1.6 Marketing and Barriers to Participation

Organizations that have sent staff to past training sessions continue to be a good market for future trainings, as roughly two-thirds of students and supervisors both reported that the current student would likely continue the training by taking the Level II series and that other building operators working for the organization would likely take BOCT training (Section 3.3).

Although all interviewed nonparticipants were drawn from NEEC's marketing list and had been contacted by NEEC at least once, and perhaps many times, just under one-third of interviewed nonparticipants recalled having previously heard of the BOCT Program (Section 4.1). This awareness level suggests the outreach materials sent to people on the marketing list might need to be varied (perhaps periodically) to catch recipients' attention.

Consistent with a prior evaluation recommendation, NEEC is seeking to identify large employers who will host the series on their premises, as well as employers who have the capability to send

seven or more people to a training session (Section 6.1). Contacts noted that utility account representatives could play a role here (Section 6.1). It will be interesting to see whether the movement of the program to the energy resource centers decreases, increases, or has no effect, on the involvement of account representatives.

A prior process evaluation recommended that the utilities increase their marketing support for BOCT, which appears to have occurred (Sections 6.1 and 6.7). The utility managers described a variety of marketing activities. At least one of these activities, however, was a source of some disagreement among the managers: the development of a utility-specific program brochure (Section 6.1). The current research did not uncover any negative consequences of the utility-specific brochure and investigation of this issue was not included in the research design.

As found by previous process evaluations of the BOCT Program, and as recognized by the NEEC and program managers, the single greatest barrier to participation continues to be lean O&M teams that make it difficult for organizations to spare staff for training (Sections 3.3 and 4.3, and findings from the 2003 evaluation, summarized in Section 1.2). Both participants (students and their supervisors) and nonparticipants identified this more than any other factor as limiting their ability to send staff to the training. Some of NEEC's plans to increase attendance at informational meetings and to increase participation in the training address this barrier of staff availability, such as holding the brown-bag informational meetings at employers' locations and considering offering the course through "Web-casting," or online training (Section 6.1).

The report also identifies other possible barriers to participation. For example, the report discusses the possibility that language might be a barrier to course attendance by operators whose first language is English and the possibility that the program acronym—BOCT—is confusing to people who access the program Web site or have other connections with the national program, which goes by the acronym BOC.

Finally, it will be interesting to monitor the evolution of program marketing under the auspices of the energy resource centers. As of the time the evaluation team was conducting interviews with program managers, BOCT was already included in the energy center's training schedules and standard promotional approaches (Sections 6.1 and 6.2). The move to the energy centers offers the program what appears to be an appropriate, long-term home. However, the program requires both utility marketing and the intensive marketing activity of the implementation contractor (Section 6.1 and recommendation from 2003 evaluations, summarized in Section 6.7). The next program evaluation might explore how the utilities and NEEC can balance the continued marketing needs.

7.2 CONCLUSIONS

The evaluation team reached the following conclusions in answer to key research questions for the BOCT process evaluation.

1. **Are the process findings consistent with the developmental stage of the Statewide BOCT Program?**

   The Statewide BOCT is a mature program, launched by the IOUs in 2002 and previously launched in other states; consistent with a mature program, the findings point to areas where the program can be fine-tuned or enhanced, but do not reveal any substantive issues for the program. The program has stable, uniform operations throughout the state that are meeting the needs of program participants. Program marketing has been sufficient to fill the courses and attract students from a variety of business types. Demand for the program appears high. The next section of the report provides the recommendations for program enhancements.

2. **What changes are planned for the Statewide BOCT Program and what issues might the program managers anticipate?**

   At the time of this research, the program was in transition to the utilities' energy resource centers for implementation. This move is anticipated to increase the thoroughness with which the utilities market the program. However, the BOCT Program and its marketing differ in some respects (such as charging a tuition for the course and asking the help of account representatives to identify customer candidates for on-site trainings) from the typical resource center offerings and, while no problems are anticipated due to the transition, it is these points of difference that are most likely to challenge the program managers in the near term.

3. **Have the program managers and implementers responded to prior evaluation recommendations and is there room for any additional improvement?**

   The program managers and implementers have taken steps to address recommendations made in prior evaluations; one prior recommendation points to room for additional improvement. Utilities appear to be increasing their presence during BOCT training, yet according to instructors, there are classes for which students don't receive materials (e.g., brochures, USB memory sticks) on the utilities' energy efficiency programs. In addition, courses held in locations other than the energy resource centers are least likely to be visited by a utility representative or to have energy efficiency materials distributed.

4. **What are reasonable travel times for BOCT students and are additional training locations needed?**

   Few students travel further than one hour from place of employment to the training centers and few nonparticipants expressed a willingness to travel one hour; at least one additional training location is needed. In the 2004-2005 program years, the plurality of students traveling more than one hour worked for businesses in the

Bakersfield area, suggesting Bakersfield would be a good location for a training center. In addition, some students traveled long distances in Northern California, suggesting additional training centers may be needed there.

5. **What are the current market barriers to training?**

   The greatest barrier to BOCT is lean operations and maintenance organizations that cannot afford to have staff away from the facility. In addition, only about one-third of interviewed building operations supervisors were aware of BOCT, in spite of the fact that all of the supervisors had received (often repeated) emails and brochures from NEEC advising them of the training. Fortunately, a finding from a prior evaluation was not found by the current research: institutional customers were as likely as other nonparticipants to be aware of the BOCT Program.

   It appears the market for BOCT might be limited by language barriers, as some of the study findings suggest a Spanish-language version might be useful for the building operators market.

   Finally, the program name—BOCT—imparts a parochial flavor on what is otherwise a national program (BOC) and is even inconsistent within California, as SMUD also uses the term BOC. This nonstandard nomenclature may be a source of confusion for prospective attendees who visit the program Web site.

6. **Is the curriculum suited to California?**

   The course curricula appear to be well-suited to California, yet ongoing improvements could be made. Although program managers have expressed concerns about the amount of course information devoted to boilers, the current study did not determine this to be a problem. The next section of the report provides the recommendations for course enhancements.

7. **Are there any indications that building operators apply the concepts they have learned and reap energy savings in their buildings?**

   The reported O&M behaviors of students and nonparticipants *suggest* the BOCT training leads to energy savings. However, the resources available for the current research were not sufficient to conduct an analysis capable of *concluding* the training results in energy savings; an alternative hypothesis is that building operators that take the training already do more energy efficiency actions (prior to training) and it is their interest in efficiency that leads them to take the course.

8. **Do the current study findings suggest areas or approaches for future research?**

The current study suggests several areas that warrant further investigation and also have implications for the research methodology.

One, an impact evaluation is necessary to conclude whether or not the BOCT Program generates energy savings. Two, whether or not an impact evaluation is conducted, further research could shed light on common O&M behaviors, particularly some of the unexpected behavior patterns reported by students in the current study. Three, it will be interesting to monitor the evolution of program marketing under the auspices of the energy resource centers, particularly examining how the utilities and NEEC balance the continued marketing needs. Four, further research would be needed to directly explore the extent to which language is a market barrier and the potential market size for a Spanish-language course. Five, while the current research did not support the concern that the curriculum places too much emphasis on boilers, it did not conclusively reject the concern; targeted research could yield more conclusive findings. Six, in common with all research, the current research produced some unexpected findings, such as the finding that students with air conditioning efficiency projects were more likely than those with other types of projects to cite the influence of the BOCT. Additional research would be needed to better understand any unexpected findings the program managers find worthy of pursuit. Finally, the current study has implications for methodology with respect to an exploration of O&M behaviors, such as how to assess the efficiency implications on operators' behaviors when they report a piece of equipment is designed so that it does not require the behavior in question or when they report they continually monitor equipment but only take action "when needed".

7.3 RECOMMENDATIONS

1. **The program managers should monitor the BOCT Program during the first few years it is implemented by the energy resource centers for signs of difficulty in making the transition,** noting in particular the division of marketing efforts between NEEC and the utilities, the involvement of account representatives in identifying customer candidates for on-site trainings, and the compatibility of this fee-based training with the free trainings offered by the centers. While the current research does not suggest any of these elements will be problematic, these three areas are the most likely stress points in the transition of BOCT to implementation by the resource centers.

2. **The program managers should further increase the utilities' presence at trainings held away from the energy resource centers.** The move of the BOCT to implementation by the resource centers should be sufficient to ensure that the students of every series held at the centers receive materials on the utilities' energy efficiency programs. The program managers should ensure that such materials are also available to students of all series held away from the resource centers. To this end, the utilities and NEEC should establish set procedures for providing students with efficiency program information, such as delineating the materials to be provided, drafting a basic script for

conveying information orally, and designating a course—perhaps the second class, *Energy Conservation Techniques*—during which the information will be presented.

3. **The BOCT should be offered in the Bakersfield area.**

4. **The program managers and implementers should select training locations within one hour's drive of commercial areas anticipated to be able to support cost-effective training.** A geographic analysis of commercial employment patterns—such as general commercial/industrial employment levels or employment within targeted business types or business sizes—would identify the areas still needing to be served by the BOCT. Training should be offered in those areas that can be served for a cost less than or commensurate with the projected value of energy-saving of the training to the utilities. When the indirect impact evaluation research is conducted (see recommendation 9), the results of this research can be used to identify cost-effective training locations for which the anticipated life-cycle savings of the training more than off-set the net Public Goods Charge cost of the training.

5. **The most commonly reported market barrier is formidable and largely beyond the influence of the program implementers—lean organizations that cannot afford to have staff away from the facility; nonetheless, NEEC should continue its efforts to serve these organizations.** NEEC should continue considering ways to reach the "lean organization" market, such as NEEC's current exploration of Web-based training. Although this evaluation and the proceeding one both found that participants and nonparticipants prefer the current seven-day, once-a-month structure to fourteen half-day sessions, the implementers might consider how the market would respond to an offer of a "swing shift" training from 3 pm to 9 pm. Students would need to be served a light dinner (e.g., submarine sandwiches) during a short break.

6. **NEEC and the utilities should continue efforts to expand marketing, including efforts to attract the participation of large employers to offer the training on-site**. NEEC should explore ways to vary the visual or other presentation format of marketing materials sent to building supervisors on its marketing list, to attract the attention of supervisors who have received prior communications from NEEC without taking sufficient time to understand the training opportunity. Marketing materials might highlight the finding that just over half of nonparticipating supervisors indicated their managements were concerned that facility operations might be wasting energy. Consider pursuing marketing recommendations offered by course instructors: to promote the training through vendors and to customers interested in LEED (Leadership in Energy and Environmental Design, a program of the U.S. Green Building Council); and continue to promote the program to past participants, as they indicate they will seek advanced BOCT training and their organizations will likely send other staff to the training.

7. **The program name should be changed from BOCT to BOC, the term used elsewhere in California and the rest of the nation, and on the program Web site.**

8. **NEEC should consider the recommendations offered by students and their supervisors,** which include providing students with materials to study before each class, providing more information about BOCT electives, and sending supervisors class reminders and follow-up information on certification.

9. **The CPUC should consider conducting the research necessary to estimate energy savings resulting from the BOCT training.** The current research suggests the training yields energy savings. Were this finding to be validated by an impact evaluation, the utilities would have information useful for determining how many students to train each year and whether a proposed training location might warrant the additional costs incurred to offer training there. The research design would need some means of confirming that the observed differences in O&M behaviors between students and nonparticipants is attributable to the training and not to pre-training differences between the groups. Impact evaluators are advised to discuss the findings of the current research with BOCT instructors and seek their opinions as to how to distinguish pro-active energy efficiency behavior from a more passive response to equipment performance, as discussed in detail in Appendix D.

10. **Future program evaluations should address outstanding issues from the current research.** The issues potentially having the greatest programmatic implications include program processes (especially marketing) as the program is implemented by the resource centers, an estimation of the size of the building operators market comprised of Spanish-speakers, and issues pertinent to the BOCT curriculum as highlighted in Conclusion 8.

APPENDICES

APPENDICES

A OTHER BOC PROGRAM EVALUATIONS

In addition to the evaluations conducted of the Statewide BOCT Program, the following evaluations of the BOC program implemented in other parts of the country have been conducted.

For the Pacific Northwest, evaluation reports can be found on the Web site of the Northwest Energy Efficiency Alliance (NEEA): *www.nwalliance.org/resources/evalreports.asp*. On that page, the reports are accessible under the category *Building Operator Certification*. There are seven documents, all prepared for NEEA by Research Into Action:

- *Market Progress Evaluation Report, No. 7 – Executive Summary (9/01) E01-088*
- *Market Progress Evaluation Report, No. 6 – Executive Summary (3/01) E01-077*
- *Market Progress Evaluation Report, No. 5 – Executive Summary (5/00) E00-052*
- *Market Progress Evaluation Report, No. 4 – Volume 2 (7/99) E99-031 (Appendices are separate)*
- *Market Progress Evaluation Report, No. 4 – Volume 1 (5/99) E99-027*
- *Market Progress Evaluation Report, No. 3 – Executive Summary (10/98) E98-015*
- *Market Progress Evaluation Report, No. 2 – Executive Summary (5/98) E98-007*

For the Northeast, *Impact and Process Evaluation: Building Operator Training and Certification (BOC) Program,* was published in June 2005 and prepared for the Northeast Energy Efficiency Partnerships by RW Analytics. Research Into Action conducted an earlier study of the program: *Evaluation of the Building Operators Certification (BOC) Program in the Northeast*, September 2002. Both reports can be can be found on NEEP's Web site at*: www.neep.org/files/BOCstudy.pdf*.

An article on the BOC Program and its energy impacts in the Pacific Northwest and the Northeast ("Education that Changes Behavior: The Impacts of the BOC Program") was published by the 2003 International Energy Program Evaluation Conference. M. McRae and J. Peters of Research Into Action are the primary authors. An article on the BOC program—"What Building Operators Are Saying about BOC Training"—written for the *American Council for an Energy-Efficient Economy 2006 Summer Study* by M. McRae and B. Mayo may be found on the Web site: *http://www.theboc.info/pdf/BOC_ACEEE06_report.pdf*.

B TRAVEL TIMES AND DISTANCES FOR 2004-2005 BOCT STUDENTS

To gain a better understanding of how far students are willing to travel, travel times and distances from the students' employment locations to each of the Level I training locations were computed using MapQuest®. The analysis was conducted for all 2004-2005 Level I students, based on enrollment records; it was not limited to the students responding to the survey.

The quartiles for time and miles traveled between workplace and the training site are given in Table B.1. Quartiles describe the breakpoints in time and miles that break the sample into 25% of the population. (The following quartiles report whole minutes and miles, not fractional ones, and thus comprise approximately 25% of the sample, but not precisely.)

Table B.1: Quartiles for Time and Miles Traveled Between Workplace and Training Site for 2004-2005 Level I Students

QUARTILES	BREAK POINTS	NUMBER OF STUDENTS (N=405)
TIME TRAVELED		
1	1 through 12 minutes	105
2	12 through 23 minutes	111
3	24 through 40 minutes	90
4	41 through 177 minutes	99
MILES TRAVELED		
1	1 through 8 miles	104
2	9 through 19 miles	105
3	20 through 38 miles	101
4	39 through 162 miles	95

Table B.2 shows, for each training site, the shortest and longest commutes from work to the site, as well as the average commute, the standard deviation, the median commute (the mid-point value below which—and above which—half of the observations lie).

Table B.2: BOC I Commuting Time (Minutes) for 2004-2005 Level I Students (N=405)

CITY	SHORTEST	LONGEST	AVERAGE	MEDIAN	STANDARD DEVIATION	NUMBER OF COMMUTES IN EXCESS OF 90 MINUTES
Anaheim	7	58	27	18	17.0	0
Downey	11	144	33	29	22.2	1
Eureka	0	24	9	13	8.0	0
Fresno	8	113	54	45	42.9	8
Irvine	0	156	33	25	38.9	4
Irwindale	6	43	27	28	12.0	0
Oakland	0	51	14	8	14.4	0
Ontario	6	94	43	39	23.5	1
Oxnard	7	122	28	17	32.1	2
Riverside	5	88	40	20	33.3	4
San Diego	3	75	20	15	14.5	0
San Francisco	3	177	34	29	36.5	2
San Jose	8	79	24	20	15.4	0
Stockton	8	77	51	52	20.9	0
Temecula	3	122	33	30	28.7	1
Torrance	0	50	23	15	17.9	0

Table B.3 shows, for each training site, the number of students attending the site, the greatest and shortest distances students traveled from work to the site, and the median distance.

Table B.3: Level I Driving Time and Distance

TRAINING LOCATION	STUDENTS	GREATEST DISTANCE (MILES)	SHORTEST DISTANCE (MILES)	MEDIAN DISTANCE (MILES)
Anaheim	12	52.6	3.6	14.4
China Lake	38	0.0	0.0	0.0
Downey	33	130.5	5.5	23.5
Eureka	23	17.9	0.0	8.2
Fresno	21	113.6	6.2	44.0
Irvine	52	137.7	0.4	19.9
Irwindale	29	42.8	3.9	27.1
Oakland	22	44.9	0.0	3.7
Ontario	26	82.0	3.2	37.8
Oxnard	25	122.3	3.2	13.2
Riverside	14	77.5	1.4	16.5
San Diego	29	76.0	1.6	9.9
San Francisco	26	161.9	0.6	22.7
San Jose	48	78.1	4.8	16.3
Stockton	19	74.1	4.4	47.3
Temecula	19	114.2	1.8	29.4
Torrance	11	45.3	0.0	8.9
All Except China Lake	**409**	**161.9**	**0.0**	**19.3**
All Locations	**447**	**161.9**	**0.0**	**15.7**

Table B.4 and Table B.5 present the information in Table B.3 organized by Southern and Northern California training locations. The cumulative median travel time to attend all Southern California trainings, except the China Lake training, was 23 minutes, slightly longer than the cumulative median travel time to attend the Northern California trainings, which was 19 minutes. Nevertheless, both median travel times were under one-half hour.

Table B.4: Level I Southern California Driving Time and Distance

TRAINING LOCATION	STUDENTS	GREATEST DISTANCE (MILES)	SHORTEST DISTANCE (MILES)	MEDIAN DISTANCE (MILES)	MEDIAN TIME (MINUTES)
Anaheim	12	52.6	3.6	14.4	19
China Lake	38	0.0	0.0	0.0	0
Downey	33	130.5	5.5	23.5	29
Irvine	52	137.7	0.4	19.9	25
Irwindale	29	42.8	3.9	27.1	28
Ontario	26	82.0	3.2	37.8	39
Oxnard	25	122.3	3.2	13.2	17
Riverside	14	77.5	1.4	16.5	20
San Diego	29	76.0	1.6	9.9	15
Temecula	19	114.2	1.8	29.4	30
Torrance	11	45.3	0.0	8.9	15
All Except China Lake	**250**	**137.7**	**0.0**	**19.9**	**23**
All Southern CA Cities	**288**	**137.7**	**0.0**	**15.8**	**21**

Table B.5: Level I Northern California Driving Time and Distance

TRAINING LOCATION	COUNT	GREATEST DISTANCE (MILES)	SHORTEST DISTANCE (MILES)	MEDIAN DISTANCE (MILES)	MEDIAN TIME (MINUTES)
Eureka	23	17.9	0.0	8.2	13
Fresno	21	113.6	6.2	44.0	45
Oakland	22	44.9	0.0	3.7	8
San Francisco	26	161.9	0.6	22.7	29
San Jose	48	78.1	4.8	16.3	20
Stockton	19	74.1	4.4	47.3	52
All Northern CA Cities	**159**	**161.9**	**0.0**	**15.2**	**19**

C RESPONDENT CHARACTERISTICS

This appendix provides findings on the number of O&M staff supervised by survey contacts and their years of experience in building operations. The appendix also includes a description of the business activity of contacts' firms and a description of their facilities (square footage, number of buildings, and number of O&M staff working at the facilities).

This information provides context for understanding the work environments of the interviewed students and nonparticipants. The students and nonparticipants are roughly similar with respect to the characteristics explored.

More than half of the students (58%) had operations and maintenance staff that reported to them, with the mean number of their supervised staff being eleven (Table C.1). About half of the students' supervisors, as well as about half of the nonparticipants (who were screened to all be supervisors), managed more than ten O&M staff.

Table C.1: Supervisory Responsibilities

NUMBER OF O&M STAFF SUPERVISED	STUDENTS (N=58)	SUPERVISORS (N=25)	NONPARTICIPANTS (N=58)
None	42%	0%	3%
One through Three	17%	16%	30%
Four through Ten	22%	36%	22%
More than Ten	19%	48%	45%
Total	**100%**	**100%**	**100%**

About two-thirds of students (63%) had more than ten years' of experience in building operations (Table C.2). Of the 22 students who are themselves supervisors, 67% had more than ten years in building operations, a proportion that does not differ significantly from the 78% of surveyed nonparticipants, who were screened to only include supervisors. However, nonparticipants were significantly more likely than supervising participants to have more than twenty years in building operations (chi-squared test, $p < 0.05$).

Table C.2: Years of Experience in Building Operations

EXPERIENCE	STUDENTS (N=55)*	STUDENTS THAT ARE SUPERVISORS (N=22)	SUPERVISORS (N =25)	NONPARTICIPANTS (N=58)
Five Years or Less	15%	12%	40%	8%
Six through Ten Years	22%	21%	8%	14%
Eleven through Twenty Years	43%	46%	28%	31%
More than Twenty Years	20%	21%	24%	47%
Total	**100%**	**100%**	**100%**	**100%**

* Three students declined to answer this question.

Students' supervisors typically had less direct O&M experience than the students (see Table C.2). In fact, 68% of supervisors said they do not perform building operations and maintenance activities in addition to their supervisory responsibilities. (This latter finding is consistent with the finding that 22% of students were not able to name a supervisor they thought was able to comment on the value of the BOCT training.)

Interviewed students and nonparticipants are comparable in whether they work in commercial facilities or industrial facilities. Although a higher proportion of students than nonparticipants come from industrial facilities, the difference is not statistically significant (Table C.3).

Table C.3: Principal Activity Occurring In Respondents' Facilities

ACTIVITY	STUDENTS (N=58)	NONPARTICIPANTS (N=58)
COMMERCIAL ACTIVITIES		
Schools, Colleges, or Universities	20%	14%
Office Building (includes government offices)	16%	12%
Hospitality	9%	7%
Government (community services)	7%	12%
Medical and Health Care (including medical offices)	2%	19%
Grocery Store	2%	—
Other Commercial / Don't know	2%	5%
Total Commercial	**58%**	**69%**

Continued

ACTIVITY	STUDENTS (N=58)	NONPARTICIPANTS (N=58)
INDUSTRIAL ACTIVITIES		
Manufacturing/Industrial: Electronics and Equipment	9%	—
High Tech (facilities with clean rooms)	8%	2%
Manufacturing/Industrial: Chemicals, Petroleum, Plastic, Rubber	7%	9%
Heavy Industry or Fabrication	5%	12%
Other Industrial	13%	8%
Total Industrial	**42%**	**31%**

Similarly, interviewed students and nonparticipants are roughly similar with respect to the size of their facilities and size of O&M staff serving the facilities. Students tend to come from larger facilities (in terms of square footage and number of buildings) than nonparticipants, and yet are members of O&M staffs that are somewhat smaller than those of nonparticipants, although neither of these differences are statistically significant (Table C.4).

Table C.4: Size of Respondents' Facilities

SIZE CATEGORY	STUDENTS	NONPARTICIPANTS
ESTIMATED SQUARE FOOTAGE (N=46, 53)		
Less than 100,000 Square Feet	24%	34%
100,001 through 500,000 Square Feet	41%	28%
500,001 through One million Square Feet	13%	17%
More than One Million Square Feet	22%	21%
Total	**100%**	**100%**
NUMBER OF BUILDINGS IN FACILITY (N=50, 45)		
One to Five Buildings	26%	42%
Six to Ten Buildings	24%	20%
Eleven to Twenty Buildings	18%	6%
Twenty-one to Fifty Buildings	16%	16%
Over Fifty Buildings	16%	16%
Total	**100%**	**100%**

Continued

NUMBER OF O&M STAFF AT FACILITY (N=53, 58)		
One through Ten People	47%	35%
Eleven through Twenty-Five People	23%	17%
Twenty-Six through Fifty People	15%	17%
Fifty-One through One Hundred People	6%	12%
More than One Hundred People	9%	19%
Total	**100%**	**100%**

D METHODOLOGICAL DISCUSSION AND SUBSEQUENT RESEARCH

UNDERSTANDING THE FREQUENCY OF O&M BEHAVIORS

This study asked building operators how often they conducted specified O&M behaviors. The study used a set of closed-ended questions with categorical responses to facilitate the comparison of responses between students and participants. The questions asked respondents how often they did a certain action and invited them to respond: "never," "about every few years," "about once a year," "about twice a year," and "about every few months" (Appendix C).

Respondents' spontaneous comments suggest the response categories did not allow for three situations. One, a number of students indicated they conducted a given action daily.[18] Two, a number of students indicated the action was not needed for the type of equipment at their facility—for example, the designated parts were enclosed in equipment designed not to need the specified maintenance action. Three, a number of students indicated they perform the maintenance action when some aspect of the system that they closely monitor indicates there is a problem.

The pre-specified categorical responses did not handle these cases very well. In the current study, the first response (i.e., takes action daily) was coded as the most frequent of the categories—"about every few months." The other two responses were coded as the least frequent of the categories—"never"—based on the interpretation that the described behavior doesn't reflect an energy efficiency action.

Subsequent research into building operator behavior should provide for an exploration of these types of responses with the BOCT instructors. The evaluators anticipate various scenarios relating to these responses. Regarding the equipment students described as not needing the queried O&M action, there is the possibility the equipment is new and, if so, the possibility that operators who have attended BOCT training influenced their firm's decision to purchase such equipment. Regarding the performance of a specified behavior "when there is a problem," further exploration may suggest either the absence of efficiency behavior (the interpretation used in this study) or suggest operators are diligent in their monitoring and take an action only when warranted. If their monitoring activity is suitable for identifying factors that degrade efficiency,

[18] Respondents' in Quantum's study of O&M behaviors also indicated they took actions on a daily or continuous basis, responses that were not included in the standardized response set. See Quantum Consulting, Inc., 2006. *Commercial Buildings Operations and Maintenance Market Assessment. www.nwalliance.org/research/marketresearchreports.aspx*, report #06-162.

and if action is taken when efficiency is degraded, then this approach to a specified O&M activity would result in the equipment's optimum energy performance.

ESTIMATING ENERGY IMPACTS FROM TRAINING

The current study interviewed BOCT instructors to investigate appropriate O&M measures for inclusion in the student and nonparticipant surveys. Subsequent research would be advised to repeat this approach, building on the current study by getting feedback from instructors on the findings of self-reported efficiency behaviors and asking instructors for any recommendations that might improve the validity of these measures as indicators of BOCT effectiveness.

A subsequent study will need to consider what constitutes the appropriate frequency measure. The current evaluation found differences between students and nonparticipants at all three frequency levels—"at least as often as about every few months," "at least as often as about twice a year," and "at least as often as about once a year." The greatest differences found between students and nonparticipants was in the first category—"at least as often as about every few months." A subsequent study should discuss these frequency findings with instructors and seek their views on the frequency measure that best reflects BOCT instruction.

Regarding energy savings associated with efficiency measures, subsequent research might conduct a meta-analysis of past studies that have produced O&M savings estimates, including studies of retro-commissioning, such as a study still underway of monitoring-based commissioning for the University of California and California State University Investor-Owned Utility Partnership.

Finally, a study seeking to estimate the energy impacts of BOCT training will need to either confirm that the pre-training O&M behaviors of students are indistinguishable from the O&M behaviors of nonparticipants, or will need pre-post design in which the change in O&M behaviors of students (before and after training) is compared with the change in O&M behaviors of nonparticipants during a similar expanse of time.

E SURVEY INSTRUMENTS

STATEWIDE BOCT PROGRAM 2004-2005: STUDENT SURVEY

Note to reader: Variable names have been added in [brackets] after the question number and before the question text, to serve as a code book for the student and nonparticipant database, which accompanies this report as a project deliverable. The database is comprised of both student and nonparticipant responses. Variable names beginning with S signify student (respondent) characteristics; those beginning with F signify facility characteristics; those beginning with P signify project information; and those beginning with OM signify O&M behaviors. Variables starting with the same initial letter are then numbered sequentially in the order they appear in the survey.

Nonparticipant records included variable names beginning with P to signify nonparticipant (respondent) characteristics (see the nonparticipant survey instrument). The other variables are named consistent with the student data (F, P, and OM). For example, there is a single set of OM variables (OM1 through OM27) containing data for both students and nonparticipants.

1. **[S1] STUDENT NAME:** _____
2. **[S2] LOCATION:** _____
3. **[S3] ID NUMBER:** _____

Introduction: I am ___ , from Research Into Action. (Utility)___ gave me your name as a person who has completed the Level I training of the Building Operator Certification Program. We are conducting an evaluation of the program and are following up with students to obtain their views of it. Do you have time to talk for about 15 minutes?

4. [S4] Do you conduct or direct operations and maintenance activities at your facility?
   Y__ N__ DK__ ***[If N or DK, thank and terminate]***

5. [S5] On a scale of 1-5, where 1 is not at all satisfied and 5 is very satisfied, how satisfied are you overall with the training you received?
   1__ 2__ 3__ 4__ 5__ DK__

6. [S6] Were there any courses that you think could be improved upon?
   Y__ N__ DK__

7. ***[If Q6=Y, else skip to Q9]*** Which ones? *(Don't read; check all that apply)*
   [s7a] 101: building systems overview __
   [s7b] 102: energy conservation techniques__
   [s7c] 103: hvac systems and controls__
   [s7d] 104: efficient lighting fundamentals__
   [s7e] 105: environmental health & safety regulations__
   [s7f] 106: indoor air quality__
   [s7g] 107: facility electrical systems__

8. [S8] How could they be improved?

   _____

Influence of BOCT on Work Activities

9. [S9] Aside from any activities you did as part of the coursework, have you used or applied at your facility any of the concepts or methods taught in the series?
   Y__ N__ DK__

10. [S10] Have you shared any of the concepts or methods you learned in the series with any of your co-workers or anyone outside your firm?
    yes coworkers__, yes people outside firm__, yes both__, no neither__, DK__

11. ***[S11] [If Q10= "yes, people outside firm" OR Q10="yes, both", else skip to Q13]*** As far as you know, have any of those discussions led to your colleagues initiating energy efficiency projects at their own facilities?
    Y__ N__ DK__

12. [P1] Since your training, has your facility begun or completed any projects or initiatives aimed at increasing energy efficiency, such as installing energy efficient equipment, performing energy audits, or installing monitoring equipment?
    Y__ N__ DK__

13. ***[If Q12=Y, else skip to Q18]*** What equipment, projects, or initiatives? *(Don't read; Check all that apply)*
    [P2] Lighting__
    [P3] Air Conditioning__
    [P4] Motors (including fans)__
    [P5] Controls__
    [P6] Chillers__
    [P7] Boilers__
    [P8] Energy Audit__
    [P9] Benchmarking__
    [P10] Monitoring (including installation of monitoring equipment)__
    [P11] Other__

14. [P12] ***[if Q13=Other, else skip to Q15]*** Other equipment, projects or initiatives:

    _____

15. [P13] Is the (activity, initiative, or project) complete?
    Y__ N__ DK__

16. [P14] ***[[If Q15=Y, else skip to Q19***] Did you get a rebate from your utility for this?
Y__ N__ DK__

17. [S17] Please rate the extent to which your BOCT training had an influence on the project—such as the decision to go ahead at this time or the type of equipment or size of the project. Please use a scale of 1-5, where 1 is no influence at all and 5 is very influential.
1__ 2__ 3__ 4__ 5__ DK__

18. [S18] Since your training, have you advocated for any energy efficiency equipment or projects that have not been initiated?
Y__ N__ DK__

19. [S19] ***[if Q18=Y, else skip to Intro to Q21]*** What energy efficiency equipment or projects did you advocate for?

_____

20. [S20] Do you think it might happen in the future?
Y__ N__ DK__

Intro to Q21: For the next two questions, please use a scale of 1-5, where 1 is strongly disagree and 5 is strongly agree

21. [S21] Your contribution to O&M discussions at your facility, your contribution is more helpful than.
1__ 2__ 3__ 4__ 5__ DK__

22. [S22] Your interactions with contractors are more productive now because of your BOCT training.
1__ 2__ 3__ 4__ 5__ DK__

23. [S23] The BOCT training has increased the likelihood that you will encourage your organization to take efficiency actions and participate in your utility's energy efficiency programs.
1__ 2__ 3__ 4__ 5__ DK__

24. [S24] The BOCT training has made you more confident about what actions your facility might take to reduce load, should the state or your utility call for a “demand response.”
1__ 2__ 3__ 4__ 5__ DK__

25. In the last year, have you experienced any job advancement in terms of responsibility, title, or pay? *(Don’t read; check all that apply)*
[S25a] responsibility increased__
[S25b] title increased__
[S25c]yes, increase in pay__
[S25d] don’t know/refused

26. [S26] ***[If Q25=Y (responsibility, title, or pay), else skip to Q27]*** Do you think it likely the BOCT training contributed to the advancement? Please use a 1 to 5 scale, 1=not at all likely, 5 = very likely
1__ 2__ 3__ 4__ 5__ DK__

Future Demand for BOC

27. [F1] About how many building operations and maintenance staff work at your facility in total, including both line and supervisory staff?

28. [F2] Do any operations and maintenance staff report to you?
Y__ N__ DK__

29. [F3] ***[If Q28=Y]*** How many? ___

30. [F4] Do you make or contribute to decisions about sending staff to outside training?
Y__ N__ DK__

31. [S31] [***if Q30=Y, else skip to Q32]*** Do you recall what it was about the BOCT training program that made it stand out from other training options as an appealing choice for your training needs?

O&M Behaviors

Now I have some more specific questions about some of your O&M practices.

32. [OM1] Do you carry out any type of ongoing or repeated look at building energy use, such as benchmarking or indexing?
Y__ N__ DK__

33. ***[If Q32=Y, else skip to Q35]*** Do you… *(Read; check all that apply)*
[OM2_a] review utility bills__
[OM2_b] monitor sub-loads__
[OM2_c] record and trend sub-loads__
[OM2_d] regularly review trended data on Energy Management System__
[OM2_e] Other__

34. [OM 2.5] ***[If Q33=other, else skip to Q35]*** Other benchmarking/indexing practice used:

---

35. [OM3] Do your responsibilities include the operation of a boiler system?
Y__ N__ DK__

36. [OM4] ***[If Q35=Y, else skip to Q40]*** How often do you check the boiler combustion system? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

37. ***[Intentionally omitted.]***

38. ***[If Q36 anything but never or DK, else skip to Q40]*** What methods do you use to check and adjust the boiler combustion system? *(Read; Check all that apply)* Do you...
[OM5a] visually inspect boiler flame and soot accumulation__
[OM5b] analyze flue gas composition__
[OM5c] other__

39. [OM5_verbatim] ***[If Q38=other]*** Other boiler system methods used:

---

40. [OM6] [***If Q35=Y]*** How often do you inspect the steam traps for need of repair or replacement? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

41. ***[Intentionally omitted.]***

42. [OM7] Are you responsible for the operation of the cooling system?
Y__ N__ DK__

43. [OM8]***[If Q42=Y]*** How often do you check for leaks in the supply and return air duct system? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

44. ***[Intentionally omitted.]***

45. [OM9]Does your system have economizers?
Y__ N__ DK__

46. [OM10]***[If Q45=Y]*** How often do you test for proper damper modulation in the outdoor air dampers? Would you say…
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

47. ***[Intentionally omitted.]***

48. [OM11]Are your building's cooling needs primarily met by a central chilled water plant or packaged AC systems?
Chilled water plant__ Packaged system__

49. [OM12] ***[If Q48=Chilled water plant, else go to Q55]*** How often do you check and recalibrate chilled water loop controls? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

50. ***[Intentionally omitted.]***

51. [19]***[If Q49 does NOT =never, else skip to Q53]*** Which of the following does your check of chiller controls include? ***(Read; Check all that apply)*** Does it include...
testing of sensor & valve function__ comparison of temperature set point against control points__
other activities__

52. ***[If Q51=other, else skip to Q53]*** Other chiller control checks:

_____

53. [OM14] How often do you clean chiller evaporator and condenser tubes? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

54. ***[Intentionally omitted.]***

55. [OM15] ***[If Q48=Packaged units, else skip to Q57]*** How often do you check refrigerant pressures and temperatures on your package units? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

56. ***[Intentionally omitted.]***

57. [OM16] What are the tonnages of the cooling units for which you are responsible*?(note – if both chiller and packaged, get tonnages for each)*

_____

[19] Due to a faulty skip pattern, this question was inadvertently skipped.

58. [OM17] Are you responsible for the operation of any motors, including any applications such as compressed air?
Y__ N__ DK__

59. [OM18] ***[If Q58=Y, else skip to Q61]*** How often do you lubricate motor, fan, and pump bearings? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

60. ***[Intentionally omitted.]***

61. [OM19] How often do you inspect bearings and belt alignments on motors for fans and pumps? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

62. ***[Intentionally omitted.]***

63. [OM20] Do you utilize variable frequency drives on any of your manufacturing equipment or HVAC system components?
Y__ N__ DK__

64. [OM21] [If 63=Y] How often do you do this testing and adjusting process? Would you say...
only at time of VFD installation__ every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

65. ***[Intentionally omitted.]***

66. [OM22] Are your responsible for the operation of compressed air systems?
Y__ N__ DK__

67. [OM23] ***[If Q66=Y, else skip to Q71]*** How often do you inspect the compressed air system for leaks? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

68. ***[Intentionally omitted.]***

69. ***[If Q67 is anything but never or DK, else skip to Q71]*** What methods do you utilize for leak detection? *(Check all that apply)* Do you...
[OM24_a] inspect network and listen__
[OM24_b] monitor flow balances__
[OM24_c] use of portable ultrasonic acoustic detector__
[OM24_d] OTHER__

70. [OM24_e] ***[If Q69=other]*** Other method for leak detection

---

71. [OM25] ***[If Q66=Y, else skip to Q74]*** How often do you monitor for system power use, pressure, and temperatures? Would you say...
every few years__ about once a year__ about twice a year__ every few months__ never__ DK__

72. ***[Intentionally omitted.]***

73. [OM26] ***[If Q71 is anything but never or DK, else skip to Q74]*** Do you record values and conduct baseline monitoring of these compressed air operating parameters as a part of O & M practices?
Y__ N__ DK__

74. [OM27] What is the horsepower of the motors for which you are responsible?

_____

75. [S75] Are you planning to take the Level II BOCT course series?
Y__ N__ DK__

76. [S76] Do you expect any other staff at your facility will enroll in either the Level I or Level II course series? (The two series cost the same.)
Y__ N__ DK__

77. [S77] ***[If Q76=Y, else skip to Q79]*** About how many? ___

78. [S78] ***[If Q76=N, else skip to Q79]*** Why not?

_____

79. [S80] Would it have been more convenient for you if the class had been offered...
two consecutive days per month for about 3-4 months__ the current schedule of one day per month for 7-8 months__ don't know__?

80. [S80] Do you have any suggestions for ways the BOCT training could be improved, or do you have any other thoughts about the training program you'd like to share?

_____

81. [S81] Who would be the best person at your organization, such as your supervisor, to ask for opinions about whether the Level I BOCT training is a good investment for the organization?

_____

82. [S82] Name: _____

83. [S83] Title: _____

84. [S84] What's the best phone number to reach him/her? _____

Operator Activities

My remaining questions concern your job responsibilities and activities.

85. [F5] How many years have you been in building operations? ___

86. [F6] Does your facility have more than one building?
Y__ N__ DK__

87. [F7***] [If Q86=Y, else skip to Q88]*** How many buildings are there?

_____

88. [F8] What is the approximate square footage of the total conditioned space of the buildings for which you have responsibilities?
_____ *(enter 98 if don't know)*

89. Do you have or share responsibility for*…(Read; check all that apply)*
[F9a] monitoring energy use at your facility__
[F9b] controlling or reducing energy use at your facility__
[F9c] paying or approving payments of energy bills__?

90. [F12] How would you characterize the principal business or activity performed at the buildings for which you have responsibility? (*Don't read; probe to code)*
grocery store__ government/community services (churches/courthouses/museums)__ hospitality__ medical__ office building (including government offices)__ residential (apts/condos)__ restaurant__ retail__ schools/colleges/universities__ other commercial__ chemicals/petroleum/plastics/rubber__ electronics and equipment__ food processing__ heavy industry/fabrication__ high technology (facilities with clean rooms)__ warehouse__ other industrial__

91. [F12_verbatim] ***[If Q90=other, else skip to Q92]*** Other principal business or activity:
_____

92. That's all of my questions, except to ask: If we are conducting additional research on the BOCT program, say next year, may we contact you again?
Y__ N__ DK__

Thank you for your time.

STATEWIDE BOCT PROGRAM 2004-2005: STUDENT SUPERVISOR SURVEY

Note to reader: Variable names are given by the question number; thus, the survey instrument serves as a codebook for the supervisor database, which accompanies this report as a project deliverable.

1. **SUPERVISOR'S NAME:** _____

2. **LOCATION:** _____

3. **ID NUMBER OF STUDENT SUPERVISED:** _____

Introduction: I am_____. Your employee, (Student), attended the Level II training of Building Operator Certification Program and gave me your name as his/her supervisor. We are conducting an evaluation of the certification program and are following up with students and their supervisors to obtain their views of the program. Do you have time to talk for about 15 minutes?

4. Based on what you have observed, has your employee's participation in the Level I BOCT program been useful on the job? Please answer using a "1" to "5" scale, where "1" means not at all useful and "5" means very useful. [not at all]
   1__ 2__ 3__ 4__ 5__ DK__

5. Have you noticed your employee using or applying any of the concepts or methods from the BOC?
   Y__ N__ DK__

6. As far as you know, has your employee shared anything he learned in the BOCT with you or any coworkers?
   Y__ N__ DK__

The next few questions are about things your employee may have been doing differently since their training. To answer, please use a scale of 1-5, where 1 is not at all likely and 5 is very likely.

How likely do you think it is that any of the things your employee may be doing differently have...

7. ...saved energy at your facility?
   1__ 2__ 3__ 4__ 5__ DK__

8. ...saved money?
   1__ 2__ 3__ 4__ 5__ DK__

9. …made facility occupants more comfortable?
   1__ 2__ 3__ 4__ 5__ DK__

For the next few statement we want to know how much you agree or disagree with some statements. Please use a scale of 1 to 5, where 1 is strongly disagree and 5 is strongly agree.

10. My employee's interactions with contractors are more productive now because of the BOCT training.
    1__ 2__ 3__ 4__ 5__ DK__

11. I ask for my employee's input on O&M decisions more often than before.
    1__ 2__ 3__ 4__ 5__ DK__

12. His contribution to O&M discussions is more helpful than before.
1__ 2__ 3__ 4__ 5__ DK__

13. Intentionally omitted.

14. Intentionally omitted.

15. Since your employee's training, has your facility installed any energy efficiency equipment or conducted any projects or initiatives aimed at increasing efficiency, such as audits, benchmarking, or monitoring? Y__ N__ DK__

16. [if Q15=Y, else skip to Q24] What equipment, projects, or initiatives? (Check all that apply)
Lighting__ Air Conditioning__ Motors (including fans)__ Controls__ Chillers__ Boilers__ Energy Audit__ Benchmarking__ Monitoring (including installation of monitoring equipment)__ Other__

17. [If Q16=Other, else skip to Q18] Other equipment, projects, or initiatives:_____

18. Is the activity, initiative, or project complete? Y__ N__ DK__

19. [If Q18=Y, else skip to Q20] Did your facility get a rebate for the project through a utility's energy efficiency program? Y__ N__ DK__

20. Did your employee have any influence on the project, such as influencing the equipment selection, or the scope, or timing of the project? Y__ N__ DK__

21. [If Q20=Y, else skip to Q22] How did he/she influence the project?
_____

22. On a scale of 1-5, where 1 is very unlikely, and 5 is very likely, how likely is it that the (activity/initiative/project) would have occurred if your employee had never attended the BOC? 1__ 2__ 3__ 4__ 5__ DK__

23. ***[Intentionally omitted.]***

24. Do you recall what it was about the BOCT training program that made it stand out from other training options as an appealing choice for your firm's training needs?
_____

25. ***[Intentionally omitted.]***

26. ***[Intentionally omitted.]***

27. ***[Intentionally omitted.]***

Future Demand

28. Are you planning to send your employee to the Level II BOCT course series?
Y__ N__ DK__

29. Do you expect your organization to enroll any other staff at your facility in either the Level I or Level II course series?
Y__ N__ DK__

30. ***[If Q29=Y, else skip to Q31]*** About how many? ____ [open]

31. ***[If Q29=N or DK, else skip to Q32]*** Why do you say that? [open]

---

32. On a scale of 1-5, where 1 is not at all and 5 is very much, how much does the driving distance to the training sites limit other staff from your firm from attending the BOCT training?
1__ 2__ 3__ 4__ 5__ DK__

33. ***[If Q32=4 or 5, else skip to Q34]*** How close to your facility would the training need to be to attract more staff?
___hours in driving time from your facility

34. Would it have been more convenient for you if the class had been offered...
__two consecutive days per month, for about 3-4 months __the current schedule of one day per month for 7-8 months __don't know?

35. Do you have any suggestions for ways the BOCT training could be improved, or do you have any other thoughts about the training program you'd like to share?

---

36. How many building operators do you supervise? ____

37. About how many building operations and maintenance staff are at your facility, including line and supervisory staff: ____

38. Of these, about how many are supervisors? ____

39. How long have you had involvement with building operations and maintenance? *(if necessary, both supervisory and direct responsibilities)*

---

40. In addition to your supervisory responsibilities, do you perform building operations and maintenance activities?
Y__ N__ DK__

41. Do you have or share responsibility for…*(check all that apply)*
__monitoring energy use at your facility __controlling or reducing energy use at your facility __paying or approving payments of energy bills ?

42. How concerned is your management about the possibility that facility operations may be wasting energy? Please use a scale of 1 to 5, where 1 = not at all concerned and 5 = very concerned
1__ 2__ 3__ 4__ 5__ DK__

43. That's all of my questions, except to ask: If we are conducting additional research on the BOCT program, say next year, may we contact you again?
Y__ N__ DK__

Thank you for your time.

STATEWIDE BOCT PROGRAM 2004-2005: NONPARTICIPANT SURVEY

Note to reader: Variable names have been added in [brackets] after the question number and before the question text, to serve as a code book for the student and nonparticipant database, which accompanies this report as a project deliverable. The database is comprised of both student and nonparticipant responses. Variable names beginning with N signify nonparticipant (respondent) characteristics; those beginning with F signify facility characteristics; those beginning with P signify project information; and those beginning with OM signify O&M behaviors. Variables starting with the same initial letter are then numbered sequentially in the order they appear in the survey.

Student records included variable names beginning with S to signify nonparticipant (respondent) characteristics (see the student survey instrument). The other variables are named consistent with the student data (F, P, and OM). For example, there is a single set of OM variables (OM1 through OM27) containing data for both students and nonparticipants.

1. **ID NUMBER:** _____

2. **CONTACT NAME:** _____

3. **LOCATION:** _____

Hello, This is _____ with _____, calling on behalf of YOUR ELECTRIC UTILITY from Itron Energy Management. THIS IS NOT A SALES CALL.

May I speak with _____ the manager of your building operations and maintenance responsible for the education and training of staff? This is strictly for research purposes, we are not trying to sell anything.

4. [F2] Do you conduct or direct operations and maintenance activities at your facility? (**Definition of building operations and maintenance:** staff responsible for the maintenance and operation of mechanical and electrical systems, such as air conditioning and lighting. Not staff primarily involved in janitorial, cleaning, landscaping, and grounds.)
   Y__ N__ DK__

5. ***[If N or DK]*** *Ask for contact at firm who does?* (name: _____; phone number: _____), *then thank and terminate.*

6. [F3] How many building operations and maintenance staff are you directly responsible for? _____

7. [F1] About how many building operations and maintenance staff work at your facility in total, including both line and supervisory staff? [***If "none" or "one", thank and terminate]*** _____

8. [N9] Have you or any of your staff had training in the last three years that led to certification in any area of building operations and maintenance?
   Y__ N__ DK__

9. [N10] ***[If Q8=Y, else skip to Q12]*** What types of certification have you or your staff received? *(Do not read; check all that apply)*
[N10c01] Building/Facilities Management __
[N10c02] Building Operators [Certification (BOC) __
[N10c03] Electrical__
[N10c04] HVAC__
[N10c05] OSHA__
[N10c06] Refrigeration__
[N10c07] Fire Safety/Alarm/Response__
[N10c08] Asbestos__
[N10c09] Indoor Air Quality__
[N10c10] Energy Efficiency__
[N10c11] Operating Engineering__
[N10c77] Other type of certification__

10. ***[If Q9=other, else skip to Q11]*** Other types of certification:

---

11. [N12] ***[If Q9 includes BOC, else skip to Q12]*** Is your Building Operators Certification from your utility, offering the certification through the Northwest Energy Efficiency Council (NEEC), or is it from some other group?
Y__ N__ DK__ [If Y, thank and terminate].

12. [N13] Do you have the authority to send staff to outside training?
Y__ N__ DK__

13. [N14] ***[If Q12=N or DK, else skip to Q14]*** Do you have influence in training decisions?
Y__ N__ DK__

14. [N15] ***[If Q12=Y or Q13=Y, else skip to Q59]*** Do you have a budget in 2006 to send operations and maintenance staff for outside training?
Y__ N__ DK__

15. [N16] Besides money, what other barriers preclude sending some people in your group to training? *(Do not read; check all that apply)*
Time Away From Facility__ Staff Turnover__ Location of Training__ Difficulty Convincing Management__ Language__ Employees in Diverse Locations__ Other__

16. ***[If Q15=other, else skip to Q17]*** Other barriers:

---

17. [N18] How valuable do you think it is for operations and maintenance staff to receive outside training from time to time? Please answer using a scale of 1 to 5, where 1 means “not at all valuable,” and 5 means “very valuable.”
1__ 2__ 3__ 4__ 5__ DK__

18. [N19] Are you aware of the Building Operators Certification offered by your utility (if necessary: presented by the Northwest Energy Efficiency Council (NEEC))?
Y__ N__ DK__

19. [N20] ***[If Q19=Y, else skip to Q26]*** How did you hear about the Building Operators Certification? *(Do not read; check all that apply)*
Mailing__ email__ advertisement__ flyer__ Phone call__ meeting__ personal contact__ Boss or co-worker__ Professional or trade association /conference/trade show/publication__ School/college__ Friend/colleague__ Other__

20. [If Q20=other, else skip Q22] Other way of hearing about the BOC:

---

21. [N22] Have you considered going yourself or sending any of your staff to earn building operators certification?
Y__ N__ DK__

22. [N23] ***[If Q21=Y, else skip to Q24]*** Can you tell me some of the reasons you have not sent any staff to earn building operators certification? *(Do not read; check all that apply)*
Lack of time/staff availability__ No need for training__ No money/budget__ Subject matter not relevant/No gain/No benefit to company__ Bad location__ Quality unknown or poor__ Length of training (too long)__ Didn't know enough about it to decide__ Difficult to get approval__ Other__

23. ***[If Q22=other, else skip to Q26]*** Other reasons for not sending staff to BOCT training:

---

24. [N25] ***[If Q22=N, else skip to Q26]*** Why haven't you considered sending any staff to earn a building operators certification? *(Do not read; check all that apply)*
Lack of time/staff availability__ No need for training__ No money/budget__ Subject matter not relevant/No gain/No benefit to company__ Bad location__ Quality unknown or poor__ Length of training (too long)__ Didn't know enough about it to decide__ Difficult to get approval__ Other__

25. ***[If Q24=other, else skip to Q26]*** Other reasons for not considering sending staff to BOCT training:

---

26. [N27] Let me tell you a little more about the Building Operators Certification and Training program your utility is offering. Building Operator Certification (BOC) is a competency-based training and certification for building operators—offering improved job skills and more comfortable, efficient facilities. Operators earn certification by attending training and completing project assignments in their facilities. Training topics include facility electrical, HVAC and lighting systems, indoor air quality, environmental health and safety, and energy conservation. Now that you've heard a little more about the training, would you consider going yourself or sending any of your staff to earn building operators certification?
Y__ N__ DK__

27. [N27NOC] ***[If Q26=No, REPEAT "BARRIERS" Q24, asking simply "Why not?" Use same response pre-codes. Then skip to Q 28]*** *(Do not read; check all that apply)*
Lack of time/staff availability__ No need for training__ No money/budget__ Subject matter not relevant/No gain/No benefit to company__ Bad location__ Quality unknown or poor__ Length of training (too long)__ Didn't know enough about it to decide__ Difficult to get approval__ Other__

[N28] ***[If Q26=Y, else skip to Q28]*** Including yourself, how many staff members do you think you might send? ____

28. [N28AC] ***[If answered Q27, REPEAT "BARRIERS" Q25, asking "What might get in the way of sending staff to earn a building operators certification?" Use same response pre-codes.]*** *(Do not read; check all that apply)*
Lack of time/staff availability__ No need for training__ No money/budget__ Subject matter not relevant/No gain/No benefit to company__ Bad location__ Quality unknown or poor__ Length of training (too long)__ Didn't know enough about it to decide__ Difficult to get approval__ Other__

29. [N29] How does the fact that YOUR UTILITY IS offering the training affect your confidence in the value of the program? Does it *(read)...*
Increase your confidence__ Not change your confidence__ Or decrease your confidence in the value of the program__?

30. [N31] What is the maximum driving time (one-way) you consider reasonable for attending training?
30 minutes (half hour) or less__ between 30 and 60 minutes (half-hour and hour)__ between 60 and 90 minutes (hour and one-and-one-half hours)__ between 90 minutes and two hours__ over two hours__ DK__

31. [N32] If a course you want your staff to attend were offered in two locations, one of which is at the maximum driving time you consider reasonable and the other is about half that distance. Would you be willing to pay a higher price for the closer course?
Y__ N__ DK__

32. [N33] The training program your utility currently offers consists of six, full-day courses. The cost is $1,100, which is less than $200 per day. Does this price seem reasonable to you?
Y__ N__ DK__

[32 through 58 intentionally left blank; numbering designed to facilitate comparison with student survey.]

Operator Activities

My remaining questions concern your job responsibilities and activities.

59. [F5] How many years have you been in building operations? _____

60. [F6] Does your facility have more than one building?
Y__ N__ DK__

61. [F7] ***[If Q60=Y, else skip to Q62]*** How many buildings are there? _____

62. [F8_verbatim] What is the approximate square footage of the total conditioned space of the buildings for which you have responsibilities?
_____ *(enter 98 if don't know)*

63. [N63] How concerned is your management about the possibility that facility operations may be wasting energy? Please use a scale of 1 to 5, where 1 = not at all concerned and 5 = very concerned
1__ 2__ 3__ 4__ 5__ DK__

64. [N64] Do you have or share responsibility for…*(read; check all that apply)*
monitoring energy use at your facility__ controlling or reducing energy use at your facility__ paying or approving payments of energy bills__?

65. [N65] Is the principal business or activity at this facility COMMERCIAL or INDUSTRIAL?
Commercial __ Industrial ___ DK ___

[N65C] What is the principal business activity?
grocery store__ government/community services (churches/courthouses/museums)__ hospitality__ medical__ office building (including government offices)__ residential (apts/condos)__ restaurant__ retail__ schools/colleges/universities__ warehouse__ other commercial__

[N65I] What is the principal business activity?
chemicals/petroleum/plastics/rubber__ electronics and equipment__ food processing__ heavy industry/fabrication__ high technology (facilities with clean rooms)__ other industrial__

65a. ***[If Q65= other, else skip to Q66]*** Other principal business or activity:

_____

66. [P1] During the last year, has your facility begun or completed any projects or initiatives aimed at increasing energy efficiency, such as installing energy efficient equipment, performing energy audits, benchmarking, or installing monitoring equipment?
Y__ N__ DK__

a. ***[If Q66=Y, else skip to Q67]*** What equipment, projects, or initiatives? *(Don't read; Check all that apply)*
[P1a]Lighting__
[P1b]Air Conditioning__
[P1c]Motors (including fans)__
[P1d]Controls__
[P1e]Chillers__
[P1f]Boilers__
[P1g]Energy Audit__
[P1h]Benchmarking__
[P1i]Monitoring (including installation of monitoring equipment)__
[P1j]Other__

b. [P2] Is the project/activity complete?
Y__ N__ DK__

c. [P3] Did your facility get a rebate for the project through your utility's energy efficiency program?
Y__ N__ DK__

O&M Behaviors

67. [OM1] Do you (or your staff) carry out any type of ongoing or repeated look at building energy use, such as benchmarking or indexing?
Y__ N__ DK__

68. [OM2_a] ***[If Q67=Y, else skip to Q80]*** Do you (or your staff) *…(read; check all that apply)*
[OM2_a]review utility bills__
[OM2_b]monitor sub-loads__
[OM2_c]record and trend sub-loads__
[OM2_d]regularly review trended data on Energy Management System__
[OM2_e]or something else?__

69. [OM2_verbatim][If Q70=other, else skip to Q72] Other benchmarking/indexing practice used:

_____

[Questions 70 through 79 intentionally omitted.]

80. [OM3] Do you or your staff's responsibilities include the operation of a boiler system?
Y__ N__ DK__

81. [OM4] ***[If Q80=Y, else skip to Q85]*** How often do you (or your staff) check and adjust the boiler combustion efficiency? Would you say (*read)*...
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

82. What methods do you (or your staff) use to check and adjust the boiler combustion system? *(Read, Check all that apply)* Do you (or your staff)...
[OM5_a] visually inspect boiler flame and soot accumulation__
[OM5_b] analyze flue gas composition__
[OM5_c] OTHER__

83. [OM5_other] ***[If Q82=other, else skip to Q85]*** Other boiler system methods used:

_____

84. [OM6] ***[If Q80=Y, else skip to Q85]*** How often do you (or your staff) inspect the steam traps for need or repair or replacement? Would you say...
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

85. [OM7] Are you responsible for the operation of the cooling system?
Y__ N__ DK__

86. [OM8] ***[If Q85=Y, else skip to Q96]*** How often do you (or your staff) check for leaks in the supply and return air duct system? Would you say *…(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

87. [OM9] Does your system have economizers?
Y__ N__ DK__

88. [OM10] ***[If Q87=Y, else skip to Q89]*** How often do you (or your staff) test for proper damper modulation of the outdoor air dampers? Would you say *…(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

89. [OM11] Are your building's cooling needs primarily met by a central chilled water plant or packaged AC systems?
Chilled water plant__ Packaged system__

90. [OM12] How often do you (or your staff) check and recalibrate chilled water loop controls? Would you say*…(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

91. [OM13][20] Which of the following does your check of chiller controls include*? (Read; Check all that apply)* Does it include *…(read)*

[20] A variable was not created for this question, as comparison data from students was not available.

testing of sensor & valve function__ comparison of temperature set point against control points__ other activities__

92. ***[If Q91=other, else skip to Q93]*** Other chiller control checks:

_____

93. [OM14] How often do you (or your staff) clean chiller evaporator and condenser tubes? Would you say…*(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

94. [OM15] ***[If Q93=Packaged units, else skip to Q101]*** How often do you (or your staff) check refrigerant pressures and temperatures on your package units? Would you say…*(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

95. [OM16] What are the tonnages of the cooling units for which you are responsible? _____

96. [OM17] Are you responsible for the operation of any motors, including any applications such as compressed air?
Y__ N__ DK__

97. [OM18] ***[If Q96=Y, else skip to END, thank and terminate]*** How often do you (or your staff) lubricate motor, fan, and pump bearings? Would you say…*(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

98. [OM19] How often do you (or your staff) inspect bearings and belt alignments on motors for fans and pumps? Would you say…*(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

99. [OM20] Do you (or your staff) utilize variable frequency drives on any of your manufacturing equipment or HVAC system components?
Y__ N__ DK__

100. [OM21] ***[If Q99=Y, else skip to Q101]*** How often do you (or your staff) go through a process of testing and adjusting the VFDs until they properly match the loads? Would you say …*(read)*
never__ only at time of VFD installation__ every few years__ about once a year__ about twice a year__ every few months__ DK__

101. [OM22] Are your responsible for the operation of compressed air systems?
Y__ N__ DK__

102. [OM23] ***[If Q101=Y, else skip to Q107]*** How often do you (or your staff) inspect the compressed air system for leaks? Would you say [read] ...
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

103. What methods do you (or your staff) utilize for leak detection? *(Read; Check all that apply)* Do you or your staff...
[OM24_a]inspect network and listen__
[OM24_b]monitor flow balances__
[OM24_c]use of portable ultrasonic acoustic detector__
[OM24_e]OTHER__

104. [OM24_e_verbatim] ***[If Q103=other, else skip to Q105]*** Other method for leak detection

_____

105. [OM25] ***[If Q101=Y, else skip to Q107]*** How often do you (or your staff) monitor for compression system power use, pressure, and temperatures? Would you say…*(read)*
never__ every few years__ about once a year__ about twice a year__ every few months__ DK__

106. [OM26] ***[If Q105 does NOT=never, else skip to Q107]*** Do you (or your staff) record the values and conduct baseline monitoring of system power use, pressure and temperature?
Y__ N__ DK__

107. [OM117] What is the TOTAL horsepower of the motors for which you or your staff are responsible?
_____

END: That's all of my questions. Thank you for your time.

STATEWIDE BOCT PROGRAM 2004-2005: INTERVIEW GUIDE FOR BOCT INSTRUCTORS

Background

1. Which BOCT courses do you teach? How many course series have you taught in California?

Key Energy-Efficient O&M Measures

2. What would you say are the three to five energy-efficient O&M measures that you hope each student would "take away" from your class and begin to implement?
3. How often should this activity be done, optimally?
4. [If applicable] What methods should one use to do this?

Delivery/Logistics

5. How are the course sites working out? Are there any changes you would like to see?
6. What is your assessment of the site coordinators? How does that work for you? Are there any changes you would like to see?
7. Does anyone for the utilities interact with the students? What do they do? Would you like greater or lesser involvement from the utilities?
8. What information do the students receive about other utility programs? Who presents the information? When and how is it presented? Is information about utility programs integrated into the course material in any way?

Marketing/ Strategy/ Demand

9. Do you have opinion about the long-term prospects for the course in California? [sense of market potential]
10. ***[Optional]*** Do you see any issues affecting the prognosis of the BOCT in California?

Course Content/ Students

11. Do any modifications in the curriculum need to be made for California students?
12. What feedback have the students given on the suitability of the curriculum to the buildings they work on?
13. Have you given NEEC any feedback on the curriculum?
14. What is your sense of how well students are suited to the class in terms of their prior experience/ knowledge?

Conclusion

15. What has worked best about the program? Have any problems surfaced? Do you have any concerns about offering and implementing the BOCT in California?

16. What are you hoping to learn from the evaluation?

17. May I call you back if I have additional questions?

STATEWIDE BOCT PROGRAM 2004-2005: INTERVIEW GUIDE FOR BOCT STAFF (NEEC)

Background/Program Contracting

1. Are you aware of any utility concerns about offering the BOC?
2. How many people from each utility have you worked with on the program during the past two years (2004-2005)? Have there been ways that the change in involved staff has affected program implementation?
3. Has your relationship with the utilities changed during the past two years (2004-2005)? What concerns have you had during that time? (I am not looking for confidential details. I'm just looking to understand the types of issues so that I can assess whether they are pertinent to the evaluation.) Did any of the utilities have unique concerns?

Delivery/Logistics

4. What is the process by which students enroll in the courses? Does it vary by training location?
5. How were the new course sites selected (Eureka, Fresno, Temecula, et al.)? How did the new sites work out? How do you assess demand for a give site, or for a potential site? Are there high-demand locations for which more frequent series are being planned? Are there low-demand locations for which less frequent series are being planned? Do you have plans for changing or adding sites?
6. Does anyone from the utilities interact with the students? Who? What are their roles? When are they present?
7. Have the site coordinators changed? Have their roles changed?
8. Has the kind or amount of information about other utility programs presented at the classes changed? Who presents the information? What type of information? Brochures and verbal presentation? When is the information given—each class in the series or selected classes? When during the class? Is information about utility programs integrated into the course material?

Marketing/ Strategy/ Demand

9. What is the course fee? Do any of the utilities offer incentives—discounts on the course fee?
10. How do potential students learn about the class? Any other ways?
11. During the past two years, has program marketing changed either in the delivery methods or in the parties doing the marketing?
12. How does the BOCT marketing take advantage of or coordinate with the marketing the utilities do for their other training or efficiency activities?
13. How satisfied are you with the current marketing activities? Are you considering any additional methods?

14. What factors do you think contributed to the good reception that the course has had thus far? What do you think are the long-term prospects for the course in California? [sense of market potential]

15. What issues do you see are affecting the prognosis of the BOCT in California?

Course Content/ Instructors/ Students

16. Have any modifications been made to the curriculum for California? Are there any aspects of the curriculum that you think (or the utilities have suggested) need to be changed?

17. What instructor input on the curriculum do you receive?

18. Has there been turnover among the instructors? Have more instructors been added? What training have the new instructors had in the BOC? Are there plans for expanding the number of instructors?

19. What kind of feedback from students have you received during the past two years? Has the student feedback varied from earlier feedback?

20. What is your sense of how well students are suited to the class in terms of their prior experience/ knowledge? Has this varied by course location? Have you observed any changes in the students' backgrounds or types of employers?

21. How prominently does the marketing material present each utility as the one making the course available? Is there any controversy at any of the utilities or expressed concerns about how closely the program should be linked to them?

Conclusion

22. Thus far, what has worked best about the program? Have any problems surfaced? Do you have any concerns about offering and implementing the BOCT in California?

23. What are you hoping to learn from the evaluation?

24. May I call you back if I have additional questions?

STATEWIDE BOCT PROGRAM 2004-2005: INTERVIEW GUIDE FOR BOCT UTILITY MANAGERS

Background

1. Does your utility have any concerns about offering the BOC?
2. How many people from your utility have been involved in the program since its launch? [continuity of program managers] ***[If more than one:]*** In what ways has the change in involved staff affected your utility's involvement?
3. ***[For PG&E only:]*** Has the transition of the program to management by the Pacific Energy Center (away from the energy efficiency program staff) gone smoothly? Have any issues been raised by the transition?
4. Has the program been useful to the market segment leads, i.e., to the account managers assigned to support specific market segments? ***[If so:]*** How has it been useful?

Delivery/Logistics

5. How were the course sites selected? How are the sites working out? Do you have any plans for changing or adding sites? How is it determined when the training will be offered at each location?
6. Who from your utility interacts with the students? What are their roles? Are any of them there throughout the course, or just at the beginning of each class?
7. Do the students receive any information about other utility programs? [If yes:] Who presents the information? What type of information? Brochures and verbal presentation? When is the information given? Each class in the series or selected classes? When during the class? Is information about utility programs integrated into the course material in any way?

Marketing/ Strategy/ Demand

8. How well does the BOCT fit with your portfolio of commercial programs and training activities? In what ways do you think the BOCT complements your utility's activities? In what ways do you think the BOCT in California benefits from your utility's involvement?
9. How prominently does the BOCT marketing material present your utility as the one making the course available? Is there any controversy or are there any expressed concerns at your utility about how closely the program should be linked to your utility? Does your utility engage in a number of training activities? ***[If yes]*** Are the same marketing methods used for all activities, or is the BOCT program marketed a little differently?
10. In what way is your utility involved in marketing the BOC? Who is involved? How do potential students learn about the class? Any other ways?
11. How satisfied are you with the current marketing activities? Do you think any additional methods are needed?
12. Do you offer incentives or discounts on the course fee?

13. What do you think are the long-term prospects for the course in your service territory? [sense of market potential]

14. What's your sense of how well the BOCT meets the needs of California commercial energy users? Of California building operators? Do you have a long-term vision for the program?

Course Content/ Instructors/ Students

15. Have you attended any of the classes? ***[If yes:]*** What has been your reaction to the instructor? To the course content?

16. Have any modifications been made to the curriculum to meet your needs? Are there any aspects of the curriculum that you think may not be sufficiently tailored to your needs?

17. How do you think the students are responding to the series?

18. Has anyone at your utility had a chance to look over the feedback students provide after attending the courses? What have you learned?

Conclusion

19. Thus far, what has worked best about the program? Have any problems surfaced? Do you have any concerns about the BOC?

20. What are you hoping to learn from the evaluation?

21. May I call you back if I have additional questions?