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Final Report

EVALUATION OF THE 2002 STATEWIDE BUILDING OPERATOR CERTIFICATION AND TRAINING PROGRAM

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EXECUTIVE SUMMARY

This report provides a process evaluation of the 2002 Statewide Building Operators Certification and Training (BOC) Program. Research into Action, Inc. conducted the evaluation under contract with Pacific Gas and Electric Company (PG&E) on behalf of the four large California investor-owned utilities (IOUs): PG&E, San Diego Gas & Electric Company, Southern California Edison, and Southern California Gas Company. The BOC curriculum was developed by the Northwest Energy Efficiency Council (NEEC), which implements the program for the four large IOUs.

The BOC program is an educational course for commercial and industrial building operators and facility managers.[1] It teaches building personnel how to operate and maintain their systems for energy-efficiency, optimal performance and occupant comfort. One of the courses within the series is dedicated to energy efficiency concepts and methods, and all courses promote energy-efficient equipment and operation and maintenance activities.

The four large IOUs in California offered the first BOC course series in October 2002, six months after the directive authorizing the program was issued by the California Public Utilities Commission (CPUC; D.01-11-066). Eight course series were offered in seven locations throughout the state in 2002, training 219 building operators.

The evaluation method for this report included surveys and interviews with 67 BOC students, 30 of these students' supervisors, four utility BOC program managers and three NEEC staff (BOC instructors and managers). The findings from these surveys and interviews are detailed in the body of this report and summarized in the concluding chapter. The evaluation's conclusions and recommendations arise from the findings and are presented here.

CONCLUSIONS

This evaluation was designed to answer several key questions:

[1] The BOC is one of many energy efficiency programs managed by the large IOUs that are funded by California ratepayers under the auspices of the California Public Utilities Commission (CPUC).

1. Are participants satisfied with the product?

Yes, students and supervisors are satisfied with the Building Operators Certification and Training Program. High satisfaction was evident in the participants' responses to a variety of questions: program satisfaction, likelihood of taking Level II training, willingness to recommend the program to others, and application of methods taught in the course.

2. Is there a market? Who is the market?

There appears to be a large market for BOC in California, based on the large number of commercial buildings with O&M staff. (The current study did not conduct an assessment of the general market; conclusions are based on interviews with program managers, instructors and participating students and supervisors.) Satisfied 2002 BOC 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 BOC program did not differ by facility type or by location within the state.

3. How many O&M staff might attend the BOC training from a participating facility, on average?

On average, each participating facility sent 1.55 students to the program in 2002; students and supervisors of the participating facilities estimate that an additional 1.7 to 1.9 students are likely to attend future series. Thus, facilities choosing to participate in the BOC program are likely to train, on average, between three and four students over a period of several years.

4. Will the market bear the cost?

The supervisors indicated a willingness to pay the full cost of the BOC training. Two-thirds of supervisors who provided an estimate of what their organization would be willing to pay for the BOC training indicated an amount equal to, or greater than $1,175.

5. Is the BOC curriculum appropriate for California?

Seven percent of students commented that they would have liked the 2002 BOC curriculum to be better tailored to California conditions. Revisions were made to the 2003 curriculum that are not assessed in this evaluation of the

2002 program. However, one specific concern raised by utility program managers—that the curriculum placed too great an emphasis on boilers—can be touched on. Of the students attending in 2002, 73% reported working on boilers. By comparison, 82% reported working on furnaces and 72% reported working on chillers.

6. Should the classes be offered independently of certification?

Students value the certification that is earned through the BOC 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. If students were interested in the training alone, their satisfaction would not vary with the market presence of BOC. Supervisors also reported valuing the certification, but with less frequency than did students.

7. How does utility involvement contribute to the success of a BOC program in California?

Students and supervisors appreciate the utilities' involvement in BOC and relate it to their satisfaction with the program. More than one-quarter of students and supervisors would be less satisfied with BOC or less likely to send additional staff were the utilities less involved in the program; about one-half of students and supervisors said that increased utility involvement would increase their satisfaction with the program. 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.

8. Does the BOC program appear to impact building operator actions?

Yes, the BOC program appears to impact the actions of building operators. Students reported applying information learned in BOC training, saving energy and undertaking, recommending or influencing energy efficiency projects based on what they had learned. Supervisors confirmed these reports.

9. Does BOC appear to have synergies with other utility programs?

Students reported that their participation in the BOC training has increased the likelihood that their organizations will participate in energy efficiency programs and will make energy efficiency investments. For example, they reported the BOC program has increased their awareness of demand

responsiveness. Supervisors confirmed these reports. Utility program staff believe it addresses a niche unmet by other programs, yet is complementary to them. With BOC, the efficiency message gets to "both ends of the market."

10. Are BOC program administration and marketing effectively supporting the training in California?

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.

11. Does the experience to date warrant moving ahead or terminating the BOC program?

The 2002 program experience warrants moving ahead with Statewide BOC. Although the 2003 program has yet to be assessed, the 2003 course series have been fully subscribed. 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 BOC series. Participants find value in the certification generated by the training and in the utilities' sponsorship and involvement. Students report the BOC training has influenced their O&M activities and 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.

RECOMMENDATIONS

1. Market the BOC series as courses for line staff, as designed.

The BOC training targets line staff, although in this first year 70% of students were supervisors. Building operators with more than ten years experience and supervisory responsibility in facilities of one million square feet or more should be advised to take the course only if they want to assess its suitability for their subordinates, as only one-half of such students reported benefiting from the series. Position the series as high quality training for a *reasonable* price.

2. To complement the clear presentation of energy efficient methods, plainly identify the course content relating to demand responsiveness.

To improve students' understanding of how to incorporate new demand responsiveness strategies in their building's operations, the utilities should identify what information students should know on demand response in general (such as what events trigger such a condition and how their facilities would be notified) and what strategies they want students to implement (such as to participate in a utility demand response program, develop a facility-specific plan, or take spur-of-the-moment actions from an established list). Finally, the utilities should decide which classes should cover the concept and strategies explicitly and which can address them more implicitly or in passing.

3. Develop a long-term vision for BOC in California.

As a certification program, which is valued by the 2002 participants, BOC must be supported by a long-term market presence. The current implementation efforts have the potential to lay a firm foundation for an ongoing program.

4. Evaluate the 2003 BOC program.

Important issues for a 2003 evaluation include the following:

- Evaluate student and supervisor satisfaction with the BOC Level II series and re-certification classes; assess whether the series and classes are sufficient to maintain a viable certification program.
- Assess changes made to 2003 Level I curriculum to respond to California conditions.
- In order to track program achievements and market penetration over time, maintain a table of BOC program activity indicators, as shown for 2002 in Table ES.1.

In summary, the California Statewide BOC Program is off to a strong start. Participant response is highly favorable, the training appears to be successful in promoting energy efficiency and stimulating interest in utility efficiency programs, and program implementation is smooth.

Table ES.1

BOC PROGRAM ACTIVITY INDICATORS FOR 2002

PERFORMANCE INDICATOR	2002 BASELINE RESULTS
Number of Level I Series Taught	8
Number of Level II Series Taught	–
Students Enrolled in Level I Series	219
Students Certified for Level I Series	158
Students Enrolled in Level II Series	–
Students Certified for Level II Series	–
Drop-Out Rate	3%*
Average Number of Students per Class in Level I Series	27.4
Average Number of Students per Class in Level II Series	–
Planned Courses Cancelled Due to Lack of Registrants	0
Average Number of Times Planned Start Date is Postponed Pending Additional Registrations	0
Organizations Sending Staff to the BOC Training	142
Average Number of Staff Sent per Facility	1.5
Professional Association/ Government Sponsors**	2
Institutions Offering Continuing Education Courses for Re-Certification of BOC	3
Newsletters Sent to Graduates	1
Case Studies	0

* *Estimated from survey data, 67 respondents.*

** *Includes Building Owners and Managers Association (BOMA), International Facility Managers Association (IFMA), and Federal Energy Management Program (FEMP).*

1. INTRODUCTION

This report provides a process evaluation of the 2002 Statewide Building Operators Certification and Training Program. Research into Action, Inc. conducted the evaluation under contract with Pacific Gas and Electric Company (PG&E) on behalf of the four large California investor-owned utilities (IOUs): PG&E, San Diego Gas & Electric Company, Southern California Edison, and Southern California Gas Company.

PROGRAM BACKGROUND AND OBJECTIVES

The Building Operators Certification and Training (BOC) 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 O&M staff could receive training and education that would increase their capabilities, improve 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 (the Alliance) in 1997. The California utilities have licensed the course from NEEC and contracted with them for its implementation.

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 course spans two days) are:

- Building Systems Overview
- Energy Conservation Techniques
- HVAC Systems and Controls (2 days)

- Energy Efficient Lighting
- Building Maintenance Codes
- Indoor Air Quality
- Facility Electrical Systems

Level II courses and certification are available for students wishing to further their training.

As offered by the four investor-owned utilities in California, per the directive of the California Public Utilities Commission (CPUCD.01-11-066), the BOC program educates operators of commercial buildings on "short- and long-term peak demand and energy savings strategies."[2]

San Diego Gas and Electric (SDG&E) ran the NEEC BOC program on a pilot basis in 2001. It was first offered in California on a full-scale, statewide basis in 2002.[3] That year, SDG&E and PG&E each began two Level I series, Southern California Edison (SCE) offered three series, and Southern California Gas (SoCalGas) offered one series. SoCalGas customers had the option of attending the SCE-sponsored classes, as well.

The NEEC BOC course is now offered in sixteen states. NEEC provides BOC in Washington and has implementation partners who deliver the program in the other states. However, NEEC has made an exception to its policy of delivering the course only in its home state of Washington and delivers the California statewide program.

Detailed participant satisfaction studies and impact evaluations have been conducted in two regions where the course has been offered for multiple years: the

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2 Building Operator Certification is categorized by the CPUC as an information program, intended to provide customers with information regarding generic (not customer-specific) conservation and energy efficiency opportunities. The program serves the nonresidential market sector that is composed of facilities used for business, commercial, agricultural, institutional and industrial purposes. BOC is open to customers of any size that employ building operations and maintenance staff. In practice, these customers are typically large or medium nonresidential customers. Large nonresidential customers are those with an annual electric demand greater than 500 kilowatts (kW), or whose annual or annualized gas consumption is greater than 250,000 therms, or both. Medium nonresidential customers have annual electric demand between 100 kW and 500 kW, or annual or annualized gas consumption between 50,000 and 250,000 therms, or both.

3 A statewide program is one available in the service territories of all four large IOUs, with identical implementation characteristics in all areas, including incentives and application procedures.

Pacific Northwest, for the Northwest Energy Efficiency Alliance; and the Northeast, for the Northeast Energy Efficiency Partnership (NEEP).[4]

BUILDING OPERATOR TRAINING ACTIVITIES

2002 Statewide BOC Activities

In mid-April 2002, the CPUC authorized funding for a statewide building operators training program. The state's four investor-owned utilities collaborated in issuing a Request for Proposals (RFP) to implement the program, with San Diego Gas & Electric taking the lead.

By July 2002, the utilities had received responses to the RFP. Four proposing teams made presentations to the utility representatives. The proposals were evaluated and scored according to criteria previously established. The utility representatives then discussed their individual assessments of the proposals and collectively selected NEEC to implement the statewide program.

After the contract was signed, NEEC worked with the utilities to obtain customer lists of organizations that the utility representatives thought should be notified about the program. In addition, NEEC notified commercial establishments that it identified through other means.

The first BOC class was taught on October 15, 2002, just six months after the CPUC authorized the program. Eight BOC course series were initiated in 2002, as shown in Table 1.1. A total of 219 students attended the eight series.

California State University, San Marcos offers continuing education units to BOC participants nationally.

[4] These studies are referenced in Appendix D.

Table 1.1

BOC SERIES INITIATED IN 2002

UTILITY	START DATE	END DATE	CITY	FACILITY
PG&E	11/2/02	5/13/03	San Francisco	Pacific Energy Center
PG&E	11/13/02	5/14/03	Stockton	Energy Training Center
SCE	10/22/02	4/22/03	Irwindale	Customer Technology Application Center
SCE	10/23/02	4/17/03	Irvine	Hyatt Regency
SCE	11/6/02	4/23/03	Ontario	Marriott Hotel
SDG&E	10/15/02	4/15/03	San Diego	National University
SDG&E	11/5/02	4/24/03	San Diego	National University
SoCalGas*	10/16/02	4/16/03	Downey	Energy Resource Center

* *SoCalGas customers can attend at SCE training locations*

2003 and 2004 Statewide BOC Activities and Plans

Eleven Level I BOC courses are being held under the statewide program in 2003, as shown in Table 1.2. The SDG&E program manager reported that, due to budget constraints, his utility offered one course in 2003, down from the two it offered in 2002.

Level II series are taught in San Francisco at PG&E's Pacific Energy Center from September 3, 2003, through February 3, 2004, and in Irwindale at SCE's CTAC from September 4, 2003, through February 5, 2004.

The PG&E program manager indicated the utility plans to offer between six and eight BOC course series per year as a "steady-state" implementation level. PG&E is considering two new locations for 2004, in order to make classes accessible to students within a one-hour driving distance.

The SCE program manager reported that the utility plans to offer an additional set of BOC courses in the agricultural community of Tulare in 2004, where the utility has a training center.

Table 1.2

BOC SERIES INITIATED IN 2003

UTILITY	START DATE	END DATE	CITY	FACILITY
PG&E	6/24/03	12/9/03	San Francisco	Pacific Energy Center
PG&E	6/25/03	12/3/03	Stockton	Energy Training Center
PG&E	10/15/03	4/21/04	San Jose	Equity Office Properties
PG&E	10/16/03	4/22/04	San Francisco	Pacific Energy Center
SCE	7/8/03	1/13/04	Irvine	Hyatt Regency
SCE	7/22/03	1/27/04	Irwindale	Customer Technology Application Center
SCE	9/7/03	3/17/04	Ontario	Marriott Hotel
SCE	9/16/03	3/16/04	Santa Monica	Radisson Harley Hotel
SCE	10/8/03	4/14/04	Long Beach	Hyatt Long Beach Hotel
SDG&E	7/9/03	1/4/04	San Diego	National University
SoCalGas*	7/23/03	1/28/04	Downey	Energy Resource Center

* *SoCalGas customers can also attend at SCE training locations.*

Building Operator Training Activities Prior to the 2002 Statewide BOC

SDG&E undertook two sets of building operator training activities prior to the launch of the Statewide BOC Program in 2002. First, for three years in the early 1990s, SDG&E partnered with the University of California, San Diego (UCSD) to offer a course addressing the energy-efficient operation of buildings. Second, in 2001, SDG&E conducted a pilot of the BOC program now offered statewide.

In the early 1990s, SDG&E partnered with UCSD to incorporate an emphasis on energy efficiency into an existing formal academic program offered by the school. The series consisted of three courses—taught one course per semester, one night per week. The series culminated in a certificate. According to SDG&E staff, the program attracted about 100 students a year. The tuition was around $1,600, of which SDG&E paid about 50% as a scholarship. UCSD ran the program. Again according to SDG&E staff, the agreement ended when SDG&E could no longer

provide the scholarships. (In response to a CPUC order to fund a statewide advertising program in 2000, SDG&E shifted the money it had allocated to this course into the advertising program.) UCSD continues the program without the SDG&E scholarships. The SDG&E staff reported that UCSD currently trains about 50 students a year in the program.

In the late 1990s, SDG&E became familiar with the NEEC BOC program and with the successes NEEC reported. SDG&E conducted a pilot of the NEEC BOC curriculum in 2001. In the pilot, the NEEC course was taught by instructors provided by SDG&E. The students, all working in city government buildings, attended for free and received BOC certification. SDG&E paid NEEC half of the license price for the curriculum, with the understanding that they could subsequently pay the remaining 50% to purchase the license for unlimited use as a NEEC partner.

SDG&E conducted an evaluation of the pilot.[5] Students and instructors provided both positive and negative feedback. One instructor's concluding remarks provide a good example of positive feedback: "I am convinced this is a great program. Building operators have major responsibilities, little support and limited means to improve skills and awareness. I believe that if we continue marketing, the classes will continue to grow as we have seen." Negative feedback included that mistakes were found in the curriculum and that the curriculum could be better tailored to state and local conditions. The evaluation identified a key challenge: how to recruit the "blue shirt, hands on guys with a least one year's worth of building operations experience." Most of the pilot attendees were over-qualified for the curriculum.

While SDG&E's pilot testing of the BOC program was underway, the CPUC issued its directive that the large IOUs should implement a building operator training program. As a result, a Request for Proposals was issued and NEEC was selected to provide statewide BOC classes.

EVALUATION OBJECTIVES

This process evaluation of BOC's first year of operation is part of California's ongoing energy efficiency market assessment and evaluation (MA&E) work. It provides an early, qualitative evaluation of program impacts by seeking BOC students' assessments of whether and how their actions on the job have changed in

[5] The evaluation reports are referenced in Appendix D.

response to what they learned in the BOC training. The goals of this evaluation are to:

- Document satisfaction with the BOC program from the perspectives of participants and their supervisors;
- Assess recommendations for course process and content improvements from the perspectives of participants and course implementers;
- Provide guidance on whether the program should be continued in the future; and
- If continuation is warranted, recommend any modifications to the program suggested by the evaluation findings and recommend any additional evaluation issues warranting investigation.

Data collection for the evaluation was conducted four months after six of the eight classes had ended, and three months after the two remaining classes had ended. The program's reporting requirements dictated that the data collection follow close on the heels of course completion.

An impact evaluation (measurement of energy savings) of the training program is not appropriate until after students have had a chance to integrate what they've learned from the course series into their work routine. In the two locations where impact studies have been done, building operators' behaviors were assessed for most students a year or more after they had completed the course.[6]

The CPUC's *Energy Efficiency Policy Manual* identifies the policy objectives for energy efficiency programs, both information-only programs and programs with quantifiable energy savings. The BOC program effectively meets several of these objectives. These include:

1. **Addressing Market Failures or Barriers.** Among the barriers listed by the manual, the BOC program has the potential to address the following:
    - *Lack of Consumer Information about Energy Efficiency Benefits* – operations and maintenance staff may not be aware that proper O&M methods can ensure the existing equipment stock makes

[6] See Appendix D for previous studies conducted of the BOC. Report No. 7, prepared for the Northwest Energy Efficiency Alliance, and the report prepared for the Northeast Energy Efficiency Partnership include impact studies.

efficient use of electricity and gas, nor be aware of what constitutes effective O&M methods. The BOC program provides this information.

- *Lack of Efficiency Service Providers in the Market* – Prior to the Statewide BOC program, only the University of San Diego provided training roughly comparable, in a course previously developed in collaboration with SDG&E. The BOC program adds a service provider with training locations throughout the state.[7]

- *Barriers to the Entry of New Efficiency Service Providers* – The utilities have the best data available on the energy demand and consumption of the state's nonresidential establishments, as well as facility contact information. They also have established relationships with energy decision-makers at large facilities and knowledge of which facilities have obtained utility-conducted training relating to energy use. Energy-efficiency training providers seeking to enter the market face a barrier when they are unable to partner with the utilities, as they have high marketing costs due to low market recognition or credibility. The BOC program creates a partnership between the service provider and the utilities.

- *Additional Barrier to Entry of New Service Providers* – The price the market will bear for training is established by the competitive interaction of training organizations that offer a great number and variety of courses in a large number of places. These organizations specialize in training or are membership organizations that include training among their member services. A stand-alone training program incurs higher costs than a training program whose organization can reap economies of scale and/or can subsidize the cost of the training from other revenue streams. Through the utilities' participation, the BOC program can be delivered using their infrastructure in terms of facilities and customer contact information—which benefits from the utilities' organizational economies of scale—and from direct utility subsidies. This enables

[7] The Association of Energy Engineers offers certification training to facility energy managers rather than general facility O&M staff. The training arm of the Building Owners and Managers Association (BOMI) provides "designation" programs for system maintenance administrators that have a small energy efficiency component. The International Facility Management Association (IFMA) offers certification training to facility managers. Thus, none of these training opportunities focus on the efficient operation and maintenance of facilities. The BOC program qualifies as continuing education credits for both the BOMI and IFMA certificates.

BOC, which would otherwise likely be a more expensive, stand-alone training program, to be priced competitively with courses offered by large training organizations.

2. **Offering Synergies and Coordination with Other Programs.** Although the CPUC explicitly defined the synergy as occurring with programs run by entities other than utilities—which the BOC program does not do—the program does offer synergies with other nonresidential energy-efficiency programs offered by the utilities. Thus, it has the potential to have an impact beyond the O&M activities that it directly targets.

3. **Energy and Gas Savings, Peak Demand Savings and Cost-Effectiveness.** These objectives relate to resource acquisition programs, not information-only programs such as BOC is classified. To confirm such savings and cost-effectiveness, an impact evaluation must be used, rather than the process evaluation approach employed in the current study. We note that previous evaluations of BOC in other regions of the country have found energy and gas savings from the program.[8] One of these evaluations was used in a cost-effectiveness analysis by the sponsoring organization, which concluded the program was cost-effective. Such an impact evaluation could be done in 2003 or 2004.

4. **Equity Considerations—Reaching Hard-to-Reach or Underserved Markets.** The BOC program attracts medium and large nonresidential facilities, which do *not* constitute a hard-to-reach or underserved market. However, an evaluation of the BOC program in the Northeast suggests that BOC students in facilities as small as 29,000 square feet can save enough electricity and gas in one year to pay the full course tuition. In addition, the BOC program provides an opportunity for nonresidential customers of any size that are not in a position to make a capital investment in energy-efficient equipment to nonetheless improve the energy efficiency of their operations.

Potential energy (resource) savings and equity benefits hinge on the BOC program providing resource savings. The Statewide BOC is currently classified by the CPUC as an information-only program and is being evaluated as such. The potential

[8] See Appendix D for previous studies conducted of the BOC. Report No. 7 prepared for the Northwest Energy Efficiency Alliance and the report prepared for the Northeast Energy Efficiency Partnership include impact studies.

program benefits identified here are taken from previous research findings for BOC implemented elsewhere. After a future impact evaluation is done on the California BOC series, it may be possible to ascribe energy savings to the California BOC.

The *Energy Efficiency Policy Manual* from the Energy Division of the CPUC provides requirements for the evaluation of an information-only program, which guide the current study. These are:

1. Providing ongoing feedback, and corrective and constructive guidance regarding the implementation of programs;

2. Measuring indicators of the effectiveness of specific programs, including testing of the assumptions that underlie the program theory and approach;

3. Assessing the overall levels of performance and success of programs; and

4. Helping to assess whether there is a continuing need for the program.

In addition, the Policy Manual includes an evaluation objective that the current study touches on: "providing up-front market assessments and baseline analysis, especially for new programs." This objective is addressed by studies conducted in 2001 by SDG&E (see Appendix D for citations) and through the current study in its research on:

- The number of additional staff that participating facilities might send to BOC training;
- Participating supervisors' willingness to pay for the program;
- Previous O&M training received by O&M staff;
- The responsibilities of O&M staff; and
- Utility program staffs' views on potential market size.

ORGANIZATION OF THE REPORT

This remainder of this report is organized as follows.

- *Chapter 2: Methodology* describes the survey instruments, sampling plan and data collection and analysis methods used in this evaluation.

- *Chapter 3: Student and Employer Assessment of the BOC Program* provides survey findings on satisfaction with the BOC program, assessment of its usefulness, importance of utility involvement, importance of training that leads to certification, and student and supervisor recommendations for improving the BOC program.

- *Chapter 4: Indicators of Potential Program Demand* seeks to provide a sense of the success of BOC in terms of the potential demand for the program and supervisors' willingness to pay for BOC training. It also addresses the ways that students and supervisors learned about BOC.

- *Chapter 5: Influence of the BOC Training* presents students' and supervisors' perceptions of the influence the BOC training has had on students and their organizations, including its influence on the likelihood the organization will participate in utility energy efficiency programs. The chapter concludes with a description of students' facilities and O&M organizations.

- *Chapter 6: Program Implementation* provides the perspectives of utility BOC program managers, instructors and NEEC staff on the various facets of program implementation.

- *Chapter 7: Summary of Findings, Conclusions and Recommendations* identifies the key findings from the research, draws conclusions based on those findings and makes recommendations for the BOC program and subsequent program evaluations.

- *Appendices A* through *C* provide the data collection instruments.

- *Appendix D* provides citations to research related to the current study.

2. METHODOLOGY

An evaluation plan was prepared to govern this evaluation, which conforms to the *Energy Efficiency Policy Manual* requirements for information-only programs. This chapter is organized into the following sections, which provide a synopsis of the evaluation plan:

- Survey Instruments
- Sampling Plan
- Data Collection and Analysis Approach

SURVEY INSTRUMENTS

Five data collection instruments were used in the evaluation of the 2002 Statewide Building Operators Certification and Training Program. These instruments are given in Appendices A through C and include:

- Survey for BOC Students (Participants)
- Survey for Supervisors of BOC Students
- Interview Guide for BOC Program Staff
- Interview Guide for BOC Instructors
- Interview Guide for Utility BOC Management Staff

Survey of BOC Students

A telephone survey of BOC students was conducted, taking approximately 20 minutes. It addressed five main areas:

1. Satisfaction with, and assessment of the value of the course series;
2. Views on the utility's role in the training;
3. Anticipated demand for the program (Level I training for colleagues; Level II training for themselves);

4. Assessment of the impact of the program on their O&M activities; and

5. Description of their responsibility for building operations by end-use and associated square footage.

The survey instrument was developed from the interview guide used in the evaluation of the BOC program offered by NEEP, providing the advantage of a field-tested survey instrument as the starting point for the California evaluation. The NEEP instrument was revised and updated to address the following issues unique to California:

- Suitability of the course content relative to California building operation needs and the desirability of further course content modifications to meet these needs;
- Students' understanding of "demand response" energy activities and the influence of the BOC program on their confidence to respond appropriately to a call for a demand response;
- Assessment of whether students' BOC participation has increased the probability that their facilities will participate in energy-efficiency programs or undertake investments in efficiency;
- The value of certification, beyond the usefulness of the training;
- Prospects for ongoing demand for BOC in California; and
- The benefit of utility sponsorship of the BOC training.

The final survey instrument reflected comments made by the statewide Measurement and Evaluation Project Advisory Committee (PAC) on the draft. The CPUC staff reviewed the survey instrument and had no comments. The instrument was then pre-tested and revised slightly, based on the responses of the first few respondents.

Survey of Supervisors of BOC Students

The telephone survey instrument for supervisors of BOC students was comparable to that for students to facilitate comparison of responses across the two groups. After eliminating the questions posed to students concerning the organization of their facilities' O&M staffs, the supervisor survey took about 15 minutes to implement.

The supervisor instrument was refined following the same process used for the student survey. PAC comments on the draft were incorporated and the survey was further refined through pre-testing.

Survey of BOC Course Implementers and Utility Program Staff

The telephone interview guides for BOC course implementers and utility program staff were wide-ranging. Interviews lasted from about 30 to 60 minutes and addressed the following issues:

- Course content relative to California building operation needs;
- How instructors teach "demand response" energy activities, compared with efficiency activities, and their views of how students understand the concepts;
- Student preparation for course content;
- Process issues concerning delivery and logistics (including hiring and training instructors, site coordinators);
- Assessment of marketing; and
- Sense of market potential.

In addition, and as explored with students and supervisors, the implementers/staff instruments assessed the potential market for the BOC program and the utilities' role in sponsoring it, including:

- Sources of first-year program success (pent-up demand, large California population, utility sponsorship, and utility infrastructure) and implications for program demand in subsequent years; and
- The benefit of utility sponsorship of the BOC training compared with NEEC offering the training without utility involvement.

SAMPLING PLAN

Table 2.1 provides the evaluation's sampling plan.

Table 2.1

RESEARCH SAMPLE PLANNED AND COMPLETED

TARGET GROUP	POPULATION	TARGET SAMPLE SIZE	COMPLETED SAMPLE SIZE
BOC Implementation Manager	1	1	1
Course Instructors	9	2	2
Utility BOC Managers	4	3	4
Students	219	60-70	67
Supervisors of Interviewed Students	50-70	30-35	30

Student surveys were not restricted to those receiving certification, or even to those completing the course series. The sample was drawn from the list of all registered students. The list included student name, phone number, company name, address, course taken, and whether the student was certified.

The 219 students came from approximately 139 unique facilities, corresponding to 1.5 students per facility. We sought to conduct interviews with no more than one student from each facility. Table 2.2 shows, by utility, the population of students and number of unique facilities. SCE and SoCalGas are combined because 60% of the number reported was served by both utilities, while one or the other served the remainder. The table also gives the number of students who were not reachable for reasons such as having left the job they were in at the time of the training or having inaccurate contact information on file.

We completed interviews with more than 50% of the facilities sending students to the BOC training. Our completed sample of 67 students comes from 62 unique facilities and can be broken down into five categories by utility. Considering total students, not simply unique facilities, we surveyed just over half (53%) of Pacific Gas and Electric's students, one-third of Southern California Edison's students, 29% of San Diego Gas and Electric's students, and 26% of the students of Southern California Gas. About one-quarter (28%) of the student respondents were served by both Southern California Edison and Southern California Gas.

Table 2.2

STUDENT POPULATION AND SAMPLE DISPOSITION

TARGET GROUP	STUDENT POPULATION	UNIQUE FACILITIES	NOT REACHABLE	REACHABLE UNIQUE FACILITIES	COMPLETED SAMPLE SIZE/ PERCENT OF FACILITIES
Pacific Gas & Electric	36	28	6*	22	19 86%
Southern California Edison and/or SoCalGas	115	80	11	69	33 48%
San Diego Gas & Electric	51	31	3	29	15 52%
Other	14	–	–	–	0
Total	219	139	19	120	67 56%

* *Includes one refusal.*

During the interviews, we asked students to provide the name, title and contact information of their supervisors—the person most familiar with their work. Students provided 43 names of current supervisors. We contacted all of the supervisors identified and completed interviews with 30 of them. This completion rate was comparable to what we experienced in previous BOC evaluations: approximately one supervisor will complete a survey for every two students surveyed. The population and interview sample of supervisors by utility is shown in Table 2.3.

Table 2.3

STUDENTS AND SUPERVISORS: POPULATION AND SAMPLE

UTILITY	STUDENTS		SUPERVISORS	
	POPULATION	SAMPLE	POPULATION*	SAMPLE
Pacific Gas & Electric	36	19	14	11
Both Southern California Edison and Gas	69	19	11	6
Southern California Edison Only	27	9	5	2
Southern California Gas Only	19	5	2	2
San Diego Gas & Electric	51	15	11	9
Other	14	0	0	0
Total	219	67	43	30

* *Population of supervisors for the interviewed sample of students*

DATA COLLECTION AND ANALYSIS APPROACH

Students attending the BOC course series and their supervisors were interviewed between August 21 and September 26, 2003. Interviews with the utility BOC managers, course instructors and the BOC implementation manager were conducted between mid-April and mid-October 2003.

Data from the BOC students and their supervisors were collected during telephone interviews using a computerized survey instrument. The survey instruments and data sets were created using SPSS's *Data Entry Builder* module. As the phone surveys were conducted, responses were entered, via the software, directly into a SPSS data set. Separate data sets were created for students and supervisors.

The first steps in data analysis were to clean the data and create a database with the responses. The next step was to conduct simple frequencies to understand the information in aggregate. The last data analysis steps involve identifying and executing more complex analyses, such as comparisons of subgroups of students. In particular, we sought to understand whether students' assessment of the BOC training differed according to the utility that serves them.

The data from the utility BOC managers, course instructors and the BOC implementation manager consisted primarily of open-ended responses to discussion questions posed in the interview guide. The data from these respondents are notes in text form. These data were analyzed using qualitative data methods. Themes common to more than one respondent were identified, as well as information that provides context for interpreting the data from students and supervisors.

This report is based on findings from interviews with the utility BOC managers, course instructors and the BOC implementation manager, and from the simple frequencies and more complex analyses of the student and supervisor data.

2. Methodology

3. STUDENT AND EMPLOYER ASSESSMENT OF THE BOC PROGRAM

This chapter presents student and employer assessment of the BOC program, as revealed from their responses to the telephone surveys. It is organized into the following sections:

- *Student Characteristics* describes the experience level of the students attending the Statewide BOC Program in 2002.
- *Satisfaction with and Usefulness of the BOC Program* describes students' and supervisors' satisfaction with the program and an assessment of its appropriateness and usefulness.
- *Importance of Utility Involvement in the BOC Program* describes students' and supervisors' satisfaction with the utilities' role in BOC.
- *Importance of BOC Certification* provides indicators of the value that BOC certification—beyond training—has for students and supervisors.
- *Student and Supervisor Recommendations* provides their comments and suggestions for changing the BOC program or its implementation.

STUDENT CHARACTERISTICS

The BOC students typically had extensive experience in building operations and maintenance (Table 3.1).

Table 3.1

STUDENTS' YEARS OF EXPERIENCE IN BUILDING OPERATIONS

EXPERIENCE IN BUILDING OPERATIONS	STUDENTS (N=67)
Two through Five Years	20%
Six through Ten Years	22%
Eleven through Twenty Years	36%
More than Twenty Years	22%

The number of years the students had been working in building operations ranged from 2 to 38, with an average experience of 14 years. Almost three-fifths (58%) of the students had more than ten years' of building operations and maintenance experience.

In addition to lengthy experience, most of the students had received prior training in building operations. Roughly four-fifths (82%) said they have taken other job-related training. When asked to name the one or two courses (other than BOC) that had been most useful on the job, students most frequently mentioned training on HVAC systems (22% of mentions, Table 3.2). Next most common were mentions of training on electrical systems and building automation. Another 65 additional training experiences on a wide variety of subjects were reported by students to be among the one or two most useful courses they had taken. These topics included chillers, cogeneration, boilers, pneumatic controls, variable-speed drives, supervision and management, indoor air quality and air handling, water treatment, safety, robotics, video surveillance, locksmith training, mold, energy efficiency, deregulation, design, maintenance and gas-fired equipment.

Table 3.2

MOST COMMON OTHER TRAINING RELATED TO STUDENTS' JOBS (MULTIPLE RESPONSES ALLOWED)

KIND OF OTHER TRAINING	STUDENTS (N=67)	SUPERVISORS (N=30)
HVAC	22%	17%
Electrical	15%	17%
Building Automation/Controls	12%	27%

Responses of the supervisors supported the high percentage of other training reported by students. Almost three-quarters (70%) of the supervisors said they had sent their employees to some kind of job-related training other than BOC. Supervisors named building automation or controls as the most common subject of other training; HVAC and electrical training were tied for the next most frequently mentioned. Other kinds of training to which supervisors said they had sent their employees included basic boiler operation, water treatment, property management, energy efficiency, locksmith training, management training, indoor air quality, refrigeration and swimming pool certification.

As a third indicator of the experience level of the 2002 BOC students who were interviewed, almost three-quarters (70%) said they supervise other operations or maintenance staff members (Table 3.3). These students have an average of seven O&M staff reporting to them.

Table 3.3

NUMBER OF OPERATIONS AND MAINTENANCE STAFF SUPERVISED BY STUDENTS

NUMBER OF STAFF SUPERVISED	STUDENTS (N=67)
None	30%
One through Three	27%
Four through Ten	28%
More than Ten	15%

In summary, the BOC students:

- Had high levels of on-the-job experience (averaging 14 years);
- Had previously received formal training in some aspect of building operations and maintenance (82% of students); and
- Were supervisors (70% of students, supervising an average of seven employees).

Thus, the typical BOC student in the statewide program's first year of operation had more experience, knowledge and responsibility than the course's target audience. Even so, as is shown in the following section, satisfaction with the course is high.

SATISFACTION WITH AND USEFULNESS OF THE BOC PROGRAM

Satisfaction with the BOC Training

Ninety percent of the students said they were satisfied or very satisfied with the training they received (Table 3.4). Their comments are replete with adjectives such as "excellent," "wonderful," "great," "useful" and "awesome." Even the two students who said they were dissatisfied with the series praised the teachers, the curricula and the program's existence. Both of these students had twelve or more years of building operations and maintenance experience; both were supervisors of nine or more employees and both worked in facilities with 17 or more buildings. Their dissatisfaction was not with the training itself, but rather arose from their expectation that the BOC courses targeted a more technically proficient audience.

Table 3.4

STUDENTS' SATISFACTION WITH BOC TRAINING

SATISFACTION RANKING	STUDENTS (N=67)
5 (Very Satisfied)	63%
4	27%
3	8%
2	1%
1 (Not At All Satisfied)	1%

Appropriateness of the BOC Training

A review of students' comments offers a snapshot of the effectiveness of the series in attracting appropriate trainees. In their comments, 15% (10) of the students indicated they thought the information offered in the series was too basic (Table 3.5). On the other hand, 12% (8) of the students said they would have liked more time for some of the course material, suggesting the material may have been too advanced for them. Thus, for almost three-quarters (73%) of the students, the course material seems to have been at an appropriate level.

Table 3.5

TARGETED LEVEL OF BOC COURSE SERIES APPROPRIATE FOR STUDENTS

COMMENT	STUDENTS (N=67)
Course Material at Appropriate Level	73%
Course Material Too Basic	15%
Course Material Perhaps Too Advanced (Some information covered too quickly)	12%

Nearly half (43%) of the students said the course series was *very appropriate* for their facility and an equal proportion described it as *appropriate* (a rating "5" or "4" respectively, on a five-point scale, Table 3.6). Ten percent (7) of the students gave the course series a rating midway on the scale. Three of the students rated the course series only *marginally appropriate* (a rating of "2"). None of the students said the course series was *not at all appropriate* for their facility.

Table 3.6

APPROPRIATENESS OF BOC FOR STUDENTS' FACILITIES

APPROPRIATENESS RANKING	STUDENTS (N=67)	SUPERVISORS (N=30)
5 (Very Appropriate)	43%	60%
4	42%	20%
3	10%	10%
2	5%	0%
1 (Not At All Appropriate)	0%	0%
Too Soon to Tell/ Don't Know	–	10%

Three-fifths of the supervisors said the course series was *very appropriate* for their employee, and another one-fifth said the series was *appropriate*. Of the remaining

20%, half (three supervisors) rated the series neither *appropriate* nor *inappropriate*, and the other half said they did not know or it was too soon to tell.

Students' comments elaborate on their assessment of the BOC training's appropriateness to their facilities. Table 3.7 provides these comments in the context of their stated appropriateness ratings.

Table 3.7

STUDENTS' COMMENTS COMPARED TO THEIR RATING OF APPROPRIATENESS OF BOC FOR THEIR FACILITIES

COMMENT	STUDENTS' APPROPRIATENESS RATING				TOTAL	PERCENT (N=67)
	5	4	3	2		
Course Series Appropriate for Facility	29	14	0	0	43	65%
Inappropriate for Facility Type	0	3	0	0	3	5%
Inappropriate for Facility Age (Too Old)	0	1	1	0	2	3%
Inappropriate for Facility Size (Too Small)	0	1	1	0	2	3%
Other or Unspecified	0	9	5	3	17	25%

Four of the students said the information in the course was not directly applicable to their facilities because their buildings were too old or too small. Three students said the course information was not directly applicable to their particular facilities—a warehouse and municipal structures with diverse buildings and building uses. Of the other comments made by students, one related to the limitations of the student's job description and the other to the appropriateness of the courses for California. This latter topic is explored more fully below.

Usefulness of the BOC Training

Over 80% of the students described six of the seven BOC classes as useful to the systems and equipment they use; the exception was *Building Maintenance Codes*, which was said to be useful by 69% of students (Table 3.8). A total of six students rated one or at most two classes *not useful*. These students explained either that

that they already knew the material in question or that the course was not applicable to their facility.

Table 3.8

USEFULNESS/RELEVANCE OF BOC COURSE TOPICS

TOPIC	USEFUL/RELEVANT		SOMEWHAT USEFUL/RELEVANT		NOT USEFUL/RELEVANT	
	STUDENTS (N=67)	SUPERVISORS (N=29)	STUDENTS (N=67)	SUPERVISORS (N=29)	STUDENTS (N=67)	SUPERVISORS (N=29)
Building System Overview*	87%	93%	13%	7%	0%	0%
Energy Conservation Techniques	91%	93%	9%	7%	0%	0%
HVAC System & Controls	84%	93%	15%	7%	1%	0%
Energy Efficient Lighting	82%	69%	15%	17%	3%	14%
Building Maintenance Codes	70%	72%	21%	28%	9%	0%
Indoor Air Quality	91%	76%	9%	20%	0%	4%
Facility Electrical Systems*	84%	82%	16%	14%	0%	4%

* *Percentages of supervisors based on 28 respondents. For each course, one or two supervisors responded "don't know."*

Two-thirds or more of the supervisors said the seven BOC course topics were relevant to the work of their employee who took the training. Supervisors' responses indicate energy-efficient lighting was the course least frequently believed to be relevant to the work of their employees; even so, 67% of the supervisors endorsed the lighting course as relevant. Five supervisors responded that one or more of the course topics were not relevant to their employees' work. Four of these named energy-efficient lighting as not being relevant, yet one of these supervisors went on to say that his student had completed an energy efficient lighting project as a result of taking the BOC course.

IMPORTANCE OF UTILITY INVOLVEMENT IN THE BOC PROGRAM

Almost one-half (48%) of the students said they would be *more satisfied* with the BOC courses if their utility were more involved in the training and an almost equal number (46%) said they would *feel the same* (Table 3.9). About one-quarter (27%) of the students said they would be *less satisfied* with the training if their utility were not involved in the program. Although the remaining students (73%) said it would make no difference to them who offered the training, no students offered suggestions for other organizational sponsors. When asked corresponding questions, the supervisors roughly echoed the responses of the students.

Table 3.9

IMPORTANCE OF UTILITY INVOLVEMENT IN BOC

INDICATOR OF IMPORTANCE	STUDENT RESPONSES	SUPERVISOR RESPONSES
More Satisfied If Utility More involved in Training	48%	N/A
More Likely to Send Employees If Utility More involved in Training	N/A	43%
Less Satisfied if Utility not Involved with the Program	27%	N/A
Less Likely to Send Employees if Utility not Involved with the Program	N/A	30%

Twenty students offered 24 specific suggestions for ways in which they would like to see their utility more involved with the BOC training. These suggestions addressed seven issues. The most frequent suggestions, each made six times, were for some sort of financial assistance or incentive—either with tuition assistance or lower rates for companies with BOC-trained employees—and suggestions for specific additions to the series' content. These included topics of cogeneration, distribution, high-voltage safety, equipment staging, and comparisons of energy use for different kinds of equipment. Other suggestions for additional utility involvement included more information on the energy efficiency programs available to them, more promotion of the training, more hands-on opportunities during the training, offering Level II classes and simply offering more classes.

Seven supervisors offered eight different suggestions for additional utility involvement in the BOC training. Supervisors' most frequent suggestions were

regarding course content and included adding benchmarks for payback periods, product updates and rebate program information. Other suggestions included offering financial discounts or incentives, helping to teach the courses, more in-depth training, more advertising (promotion) of the training and separate certificates for each course.

IMPORTANCE OF BOC CERTIFICATION

More than three-quarters (79%) of the students said they have received the BOC certificate of training (Table 3.10). This compares to 87% of the supervisors saying their employee had received their BOC training certificate.

Table 3.10

VALUE OF BOC CERTIFICATE

INDICATOR OF VALUE OF BOC CERTIFICATION	STUDENTS (N=67)	SUPERVISORS (N=30)
Student Received Certificate	79%	87%
Believe Certificate Will Advance Career	85%	N/A
Believe Certificate Will Enhance Employee's Value	N/A	87%
Have or Would Mention Certificate on Resume	96%	N/A
Have or Would Recommend Training to Others	93%	90%
Aware of Cross-State Recognition of Certificate	75%	53%
Cross-State Recognition of Certificate Important (See Table16)	58%	30%

The reasons given by students for not having received the certificate were neglecting to send in the application for the certificate (seven students), or failure to finish the course work (five students). Of the latter, two students said they were not planning to complete the courses because they already knew the information presented in the series. These were the two students mentioned earlier who had twelve or more years of building operations and maintenance experience, who were supervisors of nine or more employees and who worked in facilities with seventeen or more buildings.

Eighty-five percent of the students said they believe the certificate will help them to advance in their current job or to find a new job when they look for one. A similar proportion (87%) of the supervisors said having the certificate would enhance their employees' value to their company. Almost all (96%) of the students said they would mention the certificate on their resume if they were looking for another job. About four-fifths (79%) of the students had recommended the BOC training to someone doing the same type of work they do, and another 13% said they would recommend the program if they were asked about it. Roughly one-third (30%) of the supervisors said they have recommended the course to a colleague, and another three-fifths (60%) said they would recommend the training if asked about it.

Three-quarters of the students were aware that the BOC certificate is recognized in 16 states. Almost three-fifths (58%) of the students said this cross-state recognition is *important* to them, and two-fifths said it is *very important* to them (Table 3.11).

Table 3.11

IMPORTANCE OF CROSS-STATE RECOGNITION OF BOC CERTIFICATE

IMPORTANCE	STUDENTS (N=67)	SUPERVISORS (N=30)	RESPONSES OF SUPERVISORS WHO ALSO WERE STUDENTS (N=6)
5 (Very Important)	40%	13%	50%
4	18%	17%	17%
3	21%	17%	17%
2	12%	20%	0%
1 (Not at All Important)	9%	30%	17%

More than half (53%) of the supervisors were aware of the recognition of BOC certification in 16 states. Only about one-third (30%) of them said such interstate recognition is important them. However, it is noteworthy that of the respondents interviewed as supervisors, the six who were also students of the training rated the importance of interstate recognition of the courses more highly than the group of supervisors as a whole. Specifically, about two-thirds (67%) of the supervisor/students said interstate recognition of the certificate is important to

them. (Responses from these six respondents were not duplicated in the student sample.)

The number of students who would be less satisfied with the BOC training if no certification were offered at its conclusion echoed the number who said the certificate is important to them. Specifically, 60% of the students said they would be *less satisfied* with the training if no certificate were offered (Table 3.12). The remaining 40% of students said they would be *equally satisfied*; none reported they would be *more satisfied* if no certification were offered for the training.

Table 3.12

OTHER INDICATORS OF IMPORTANCE OF BOC CERTIFICATE*

INDICATOR OF IMPORTANCE	STUDENT RESPONSES	SUPERVISOR RESPONSES
Less Satisfied without Certification	60%	N/A
Less Likely to Send Employees without Certification	N/A	37%
Less Satisfied if Training Discontinued in a Few Years	55%	N/A
Less Likely to Send Employees if Training Discontinued in a Few Years	N/A	27%
More Satisfied If Training Offered for Duration of Career	55%	N/A
More Likely to Send Employees If Training Offered for Duration of Career	N/A	27%

* *Identical percentages for complementary questions do not describe identical individuals.*

As other indicators of the importance of the certification—distinguished from simply the training or course content—more than half (55%) of the students said they would be *less satisfied* with the training if they knew it were going to be discontinued in California in a few years. An equal number said they would be *more satisfied* with the series if they knew it was going to be offered in California for the rest of their careers.[9]

[9] Equal number is a coincidence—specific students included in each group differ, although many are the same.

About one-third (37%) of the supervisors said they would be less likely to send employees to the BOC training if no certification were offered at its conclusion. Roughly one-quarter (27%) said they would be less likely to send employees if they knew the training were going to be discontinued in California in a few years, and a like number said if they knew the training were going to be offered for the duration of their employee's career, they would be more likely to send employees to the training in the future.[10] These responses are consistent with the supervisors' rating of the importance of the certificate to them, discussed earlier, and suggest the training is more important to a majority of supervisors than is the certification, at least in the first year of the BOC program in California.

STUDENT AND SUPERVISOR RECOMMENDATIONS

Several suggestions for improving the courses were offered by the students. Respondents from both student and supervisor samples also suggested, in responding to other questions, other ways in which they would like to see the training series changed. Regarding course change suggestions, similar responses to different questions may be grouped into three categories: 1) suggestions for procedural or process changes; 2) suggestions for substantive course changes; and 3) demand for more courses (Table 3.13).

Table 3.13

SUGGESTIONS FOR IMPROVING BOC TRAINING (MULTIPLE RESPONSES ALLOWED)

TYPE OF SUGGESTION	STUDENTS (N=67)	SUPERVISORS (N=30)
Process/Procedural	31%	15%
Substantive	19%	13%
Availability of BOC	20%	3%

[10] Equal number is a coincidence—the specific supervisors included in each group differ.

Process/Procedural Changes

Six students suggested some sort of financial assistance or incentive be offered, either with tuition assistance or lower electricity rates for companies with BOC-trained employees. Four students suggested screening program participants to achieve classes of more equally knowledgeable participants and two suggested the courses be made mandatory for building operators (Table 3.14). Other student suggestions for procedural or process changes included more promotion of the training and offering the opportunity to test out of some courses.

Table 3.14

PROCESS/PROCEDURAL SUGGESTIONS FOR IMPROVING BOC TRAINING (MULTIPLE RESPONSES ALLOWED)

SUGGESTION	STUDENTS (N=67)	SUPERVISORS (N=30)
More Financial Assistance/Incentive	9%	3%
More Promotion of the Training	6%	6%
Screen Class Participants	6%	–
Make BOC Certificate Mandatory	3%	–
Allow Testing Out of Individual Courses	1%	–
Offer Certificates for Each Course	–	3%
Utility Staff Help Teach the Courses	–	3%

Supervisors' suggestions included offering financial discounts or incentives, having utility staff help to teach the courses, more advertising (promotion) of the training and providing separate certificates for each course in the series. Each of these suggestions was made once.

Substantive Changes

Making the training more appropriate for California building operators was the single most common substantive course change suggestion made by students (five), specifically regarding building codes, boilers and HVAC requirements relative to

differing climatic conditions, energy conservation programs and environmental impact surveys. One supervisor also mentioned the course material should be more oriented to address California's climatic conditions (Table 3.15).[11]

Table 3.15

SUBSTANTIVE SUGGESTIONS FOR IMPROVING BOC TRAINING (MULTIPLE RESPONSES ALLOWED)

SUGGESTION	STUDENTS (N=67)	SUPERVISORS (N=30)
More California Content	7%	3%
More Efficiency Program Information	3%	3%
Other Specific Course Content	9%	6%
More Hands-On Training	3%	–

Other suggestions included the addition of material on cogeneration, distribution, high-voltage safety, equipment staging and comparisons of energy use for different kinds of equipment. Two students suggested the addition of more information regarding energy-efficiency programs in the courses and two suggested a more hands-on approach to the training. Supervisors' most frequent suggestions concerned adding information to the series, such as additional information on rebate programs, benchmarks for payback periods and product updates.

Availability of BOC

The comments reflecting high demand for the BOC training were the third most common of the suggestions made by students (Table 3.16). Nine students suggested the BOC Level II training be held at locations nearer to the students. Two students suggested the courses be held more often. One supervisor suggested that more in-depth training be offered (tallied in the table as "Offer More Courses").

[11] Although some students specifically mentioned the information the BOC contains on boilers as evidence that the course could be better tailored to California, 73% of students report working on boilers (see Table 5.11.) In addition, classes on boilers were included in student reports of the one or two most valuable training classes they have had other than the BOC (see discussion preceding Table 3.2).

Table 3.16

SUGGESTIONS CONCERNING AVAILABILITY OF BOC (MULTIPLE RESPONSES ALLOWED)

SUGGESTION	STUDENTS (N=67)	SUPERVISORS (N=30)
Hold Level II Courses Nearer to Level I Course Locations	13%	–
Offer More Courses	7%	3%

4. INDICATORS OF POTENTIAL PROGRAM DEMAND

This chapter seeks to provide a sense of the success of the BOC program in terms of the potential demand for the training as revealed through the survey findings. The chapter has the following sections:

- *Number of Prospective BOC Enrollments* describes student and supervisor interest in Level II BOC training and provides estimates of the number of operators from students' facilities that might attend future Level I series.
- *Supervisors' Willingness to Pay for BOC Training* presents supervisors' responses to what they are willing to pay for the series.
- *Ways Students and Supervisors Learned about the BOC Program* describes the methods by which participants heard of the training.

NUMBER OF PROSPECTIVE BOC ENROLLMENTS

Three-quarters of the students said they are planning to attend the Level II BOC courses (Table 4.1). Two-thirds of the supervisors said they are planning to encourage their employee to attend the Level II BOC training.

Table 4.1

PROSPECTIVE ENROLLMENT IN BOC TRAINING

ENROLLMENT INDICATOR	STUDENTS (N=67)	SUPERVISORS (N=30)
Planning, or Encouraging Employee, to Attend Level II	75%	67%
Expect Other Employees to Attend BOC Training	55%	43%
Don't Know if Others Will Attend BOC Training	16%	13%
Average Number of Prospective Students Estimated per Respondent*	1.75-1.9	1.7

* *Average across all respondents, including those expecting no additional students.*

More than one-half (55%) of students said they expect others from their company to attend a BOC Level I training program. The estimated numbers of prospective attendees ranged from one to 20 per facility, and the total number of prospective attendees was estimated by students to be from 117 to 129. These numbers correspond to an average estimate of about 1.75 to 1.9 prospective students for each BOC participant interviewed. Anecdotally, of those who said they expect some of their other staff members to attend the training, several mentioned funding limitations may delay the additional training by a year or more.

Two-fifths (12) of supervisors said they expect other employees from their facility to attend the Level I Training. Thirteen supervisors did not expect any of their other employees to attend the training; five supervisors did not know whether any other employees would attend, yet one of these supervisors thought that as many as three employees might do so. Nine of the 12 supervisors who expect other employees from their facility to attend the training said, on average, they expected just over four employees to attend. Two of the 12 said they did not know how many employees might attend, and the remaining supervisor said he had 50 employees eligible to attend the Level I training. Applying the average of four employees to these three latter respondents results in an average of about 1.7 employees per supervisor sampled.

Of the 24 students who offered reasons why other employees would not go to the BOC training, more than two-fifths (42%, ten students) gave financial reasons such as budget limitations or their company's unwillingness to pay for the training (Table 4.2). Five of these 24 students said their staff is too small for them to be able to send more people through a course. Of these five, three said the total operations and maintenance staff at their facilities consisted of four or fewer employees.

Table 4.2

IMPEDIMENTS TO SENDING OTHER EMPLOYEES TO BOC TRAINING

REASON	STUDENTS (N=67)	SUPERVISORS (N=30)
Financial Issues	15%	20%
Small Staff Size	7%	13%
Staff Not Ready for Training	–	17%
Other	7%	13%

The two students at facilities with more than four operations and maintenance employees said their facilities were understaffed for their size. Other reasons given by students to explain why other staff from their facilities would not be attending the training were internal management or personnel issues and, in one case, the pending closure of the facility.

Of the 12 supervisors who said they expect other employees from their facilities to attend the BOC training, one-quarter of them (3) expressed financial caveats about sending them. Financial concerns were also expressed by some of those who do not plan or do not know whether they will be able to send other employees to the training. Altogether, six supervisors mentioned this concern. Other reasons for not sending additional employees to the training were given as well. Four supervisors said their staff was too small for others to attend. Three of these had a total operations and maintenance staff of only one or two employees. Five supervisors expressed a concern not mentioned by students, which was that their remaining employees were not sufficiently skilled or knowledgeable to benefit from the training. Another reservation of supervisors in sending additional employees was that their staff was already sufficiently trained—pending staff turnover and staff downsizing.

SUPERVISORS' WILLINGNESS TO PAY FOR BOC TRAINING

Two-thirds (67%) of the supervisors named a specific dollar amount when asked how much their company would be willing to pay for a staff person to attend the BOC training. These responses ranged from $200 to $4,000. The average amount stated was $1,192, and the median of the amounts given was $900. Two-fifths of the supervisors said their company would be willing to pay $1,175 or more for the training (Table 4.3).

Table 4.3

COMPANY WILLINGNESS TO PAY FOR BOC TRAINING

SUPERVISORS' ESTIMATE OF AMOUNT COMPANY WILLING TO PAY	SUPERVISORS (N=30)
Willing to Pay $1,175 or More	40%
Unwillingness to Pay $1,175	27%
Did Not Know What Amount Company Willing to Pay	33%

Of the supervisors who gave an amount (rather than replying "don't know"), 60% said their company would be willing to pay $1,175 or more.

WAYS STUDENTS AND SUPERVISORS LEARNED ABOUT THE BOC PROGRAM

As shown in Table 4.4, most students heard about the BOC training from their utility, either directly from a utility representative (25%), from a utility flyer received in the mail (24%), or from a utility-sponsored seminar (12%). One-fourth (27%) of the students heard about the course from a supervisor or coworker. Other ways in which students heard about the training were from a mailer or advertisement, and from a friend or colleague. One student heard about the program from a professional or trade organization, one heard about it from a school or college, one learned of the program from the Internet, and one could not recall how he heard about the training.

Table 4.4

MEANS OF LEARNING ABOUT THE BOC TRAINING (MULTIPLE RESPONSES ALLOWED)

LEARNED OF BOC TRAINING FROM…	STUDENTS (N=67)	SUPERVISORS (N=30)
Supervisor/Coworker/Employee	27%	33%
Utility Representative	25%	37%
Utility Mailing	24%	20%
Utility Seminar	12%	3%
Mailing/Advertisement	24%	10%
Colleague/Friend	3%	0%
Other/Could Not Recall	6%	6%

Most (60%) of the supervisors heard about the BOC training from their utility as well. One-third of them heard about the program from an employee or co-worker. Others heard about the courses from a mailing and the Internet.

About three-quarters (76%) of the students said they had seen written material describing the program before attending (Table 4.5). Only two-fifths of the supervisors recalled seeing such material before their employee took the training. These written descriptions were seen in flyers, brochures, course syllabi, other unspecified utility literature and on the Internet.

Table 4.5

WRITTEN MATERIALS DESCRIBING PROGRAM SEEN BY STUDENTS (MULTIPLE RESPONSES ALLOWED)

WRITTEN MEDIUM	STUDENTS (N=67)	SUPERVISORS (N=30)
Flyer	37%	13%
Brochure	25%	13%
Syllabus/Agenda	16%	3%
Other Unspecified Utility Literature	14%	–
Internet	12%	3%
Unknown	8%	6%

Most of the students who had seen written materials (including websites) said the written materials gave them a good understanding of the course series and its potential value to them (82% of students who had seen written materials). Of the eight students (12% of all students) who said the written material they saw did not give them a good understanding of the course, three said the flyer failed to convey how basic the course was. In contrast, one student said the website failed to convey how good the program was. Two students suggested the brochure should have more detail about each course, but this expressed lack of detail did not diminish their enthusiasm for the program as shown by their other responses. All but one of the supervisors who had seen written materials describing the training said the material had conveyed a good understanding of the courses and of their potential value to the respondent's organization.

5. INFLUENCE OF THE BOC TRAINING

This chapter presents students' and supervisors' perceptions of the influence the BOC training has had on students and their organizations. This process evaluation did not attempt to quantify the energy-saving impacts from the BOC program. However, as this chapter demonstrates, both students and supervisors believe the BOC training has been effective in increasing the energy efficiency behaviors of the students, as well as in enhancing overall O&M performance.

The chapter includes the following sections:

- *Influence of BOC on On-the-Job Behaviors* describes student and supervisor perceptions of whether the training has changed students' work behaviors.
- *Influence of BOC on Efficiency Projects and Program Participation* describes student and supervisor perceptions of whether the training has influenced students' involvement in energy efficiency projects and the likelihood the facilities will participate in efficiency programs. This section discusses the issue of demand responsiveness.
- *Influence of BOC Varies by Student Characteristics* demonstrates that the most technically-proficient students find the BOC training less useful than others, yet one-half of them still find it helpful. (Recall that the typical BOC student here has more experience, knowledge and responsibility than the target audience.)
- *Students' Facilities and Operations and Maintenance Organizations* describes the facilities and organizations that students work in and influence.

INFLUENCE OF BOC ON ON-THE-JOB BEHAVIORS

Since taking the BOC training, more than 90% of the students said they have used some of the methods or concepts taught in the course (Table 5.1). Almost three-quarters (72%) of students said that includes doing new things in their jobs they did not do prior to taking the course, and more than one-half (61%) said that of the job activities they did prior to taking the course, they now do some of them more regularly or frequently. Forty percent of students said they both did new activities and did former activities more frequently as a result of their BOC training.

Table 5.1

INFLUENCE OF BOC ON ON-THE-JOB BEHAVIORS

INDICATOR OF STUDENT PERFORMANCE	STUDENTS SAYING YES (N=67)	SUPERVISORS SAYING YES (N=30)	SUPERVISORS WHO DON'T KNOW OR SAY IT'S TOO SOON TO TELL (N=30)
Used Concepts Taught in Series	93%	60%	30%
...Including Doing New Job Activities	72%	50%	8%
...Including Doing Former Job Activities More Frequently Now	61%	33%	2%
Has Improved Job Performance	75%	47%	20%
Has More Confidence on the Job*	N/A	77%	13%
Has Saved Energy	79%	50%	43%
Has Saved Money	78%	50%	37%
...Including Saving Money in Troubleshooting or Using Contractors	46%	23%	23%
Interacts More Productively with Contractors*	N/A	47%	37%
Has Advised in Equipment Operation or Replacement Decisions	78%	70%	7%
Has Improved Occupants' Comfort	67%	40%	53%

* *Question asked of supervisors only.*

Three-quarters of the students said their job performance has improved since taking the BOC series. Similar numbers of the students said that by using things learned in the course series, they have been able to save energy (79%) and money (78%) for their facilities and improve the comfort of the occupants of the facilities in which they work (67%).

Almost one-half (46%) of the students said they have saved money for their facility in troubleshooting or in the use of contractors. More than three-quarters (78%) of the students surveyed have used what they learned in the courses to advise in decisions regarding equipment operation or replacement.

More than three-quarters (77%) of the supervisors said their employee has more confidence on the job since taking the BOC training, and almost one-half (47%) said their employee interacts more productively with contractors since taking the training.

Supervisors reported lower levels of awareness of these various indicators than the students. However, this discrepancy may merely reflect that it takes longer than three to four months (the time between the training and the surveys) for supervisors to be convinced of a change in staff behavior. This interpretation is supported by the finding that the proportions of supervisors answering "no" to the indicators was comparable to the proportions of students. (These proportions can be inferred from Table 5.1 for students as the difference between 100% and the percent saying "yes" and for supervisors as the difference between 100% and the percent saying "yes" plus the percent saying "don't know/ too soon to tell.")

INFLUENCE ON EFFICIENCY PROJECTS AND PROGRAM PARTICIPATION

More than three-quarters (78%) of the students said they have been able to undertake, recommend or influence energy-efficiency projects at their facility as a result of the BOC training (Table 5.2).

Table 5.2

ENERGY-EFFICIENCY PROJECTS INFLUENCED BY BOC TRAINING (MULTIPLE RESPONSES ALLOWED)

PROJECT	STUDENTS (N=67)	SUPERVISORS (N=30)
Lighting	42%	43%
HVAC Systems	31%	23%
System Automation	10%	3%
Variable-Speed Drives	7%	–
Cogeneration	4%	3%
Miscellaneous and Unspecified	12%	10%
Total Reporting Projects Influenced	78%	57%

Most of these projects involved lighting or heating/air conditioning systems. Other projects included timers or other system automation, variable-speed drives for motors, cogeneration projects, domestic water use systems, installation of photovoltaic cells and sealing the building from outside air and water.

Supervisors saw their employees' BOC experience as having less influence on projects than the employees reported. Nonetheless, almost three-fifths (57%) of the supervisors said their employee who attended the course series has undertaken, recommended or influenced an energy-efficiency project with the knowledge gained from the course. Supervisors echoed the students regarding the most commonly-influenced type of projects, namely, lighting. Other projects reported by supervisors were HVAC systems (including chiller and cooling tower projects), an energy management system and a cogeneration project.

More than four-fifths (81%) of the students think their training has increased the likelihood that their company will make energy-efficiency investments (Table 5.3). About three-quarters (73%) think it has increased the likelihood that their company will participate in utility energy efficiency programs. Somewhat fewer—about one-half (55%)—recalled a discussion, during the course series, of actions to be taken in the event a demand response is called for by the State or the utility. About one-third (34%) of the students said the training increased their confidence in their ability to take the appropriate actions in the event of a call for a demand response.

Table 5.3

INFLUENCE OF BOC ON FUTURE EFFICIENCY AND DEMAND RESPONSE ACTIONS

INDICATOR	STUDENTS (N=67)	SUPERVISORS (N=30)	SUPERVISOR SAID ALREADY TAKING ACTION (N=30)
Increased Likelihood of Company Making Energy-Efficiency Investments	81%	60%	17%
Increased Likelihood of Company's Participation in Utility Energy-Efficiency Programs	73%	57%	30%
Recalled Discussion of Demand Response	55%	23%	N/A
Greater Confidence in Ability to Respond Appropriately to Call for a Demand Response	34%	23%	N/A

Three-fifths of the supervisors said their employee's BOC training has increased the likelihood of their company making energy-efficiency investments and almost that many (57%) said the training increased the likelihood of their company's participation in utility energy-efficiency programs. Although these numbers are lower than the corresponding numbers for students, this may reflect a difference between supervisors and their employees in their knowledge of ongoing company activities. When the supervisors' numbers are added to the numbers of supervisors who said their company is already taking the particular action in question, the totals relate more closely to the numbers reported by students.

INFLUENCE OF BOC VARIES BY STUDENT CHARACTERISTICS

We examined whether students' assessments of the BOC training's influence on their on-the-job behaviors differed by the utility that serves them. At the most simple analytical level, it appeared that students served by SCE or SoCalGas attributed less influence to the BOC training than did students served by PG&E or SDG&E. However, further investigation revealed factors at play that were independent of the utility.

Before presenting the findings, the analytical method needs to be described. It was not possible to analyze SCE students separately from SoCalGas students, as both SCE and SoCalGas served 19 of the 33 students interviewed. We analyzed PG&E and SDG&E separately. We found no significant differences between student responses and subsequently combined PG&E and SDG&E in the analysis.

The students answered two primary questions in providing an assessment of BOC influence. The first question was whether they had applied any of the methods or concepts taught in the series and the second was whether they thought their job performance had improved as a result of the BOC training. The answers to these two questions were combined into a composite variable to form the dependent variable for the analysis of utility effect. Students who answered yes to both questions were coded as believing the BOC program had had a positive effect on their on-the-job behaviors (48 students). Those who answered no to both questions were coded as believing the BOC training did not have an effect on their behavior (3 students). When students gave contradictory answers to these two questions, we examined their responses to the follow-up questions of whether, as a result of BOC training, they had engaged in new behaviors or whether they had engaged more frequently in activities they had previously done. When the response to either of these questions was yes, the contradictory answers were resolved as indicating "yes, the BOC training had a positive effect" (8 students). When the responses to *new behaviors* and *more frequent behaviors* were either *no* or *don't know*, the

contradictory answers were resolved as indicating, "No, the BOC training had no effect" (8 students).

As stated, while a simple analysis suggested that students from SCE and SoCalGas less frequently attributed a positive influence to BOC training, a more complex analysis shows other factors at work. First and foremost, students with less than ten years' experience in operations and maintenance were unanimous in saying the BOC training had a positive influence on their on-the-job behaviors.

Among students with ten or more years of experience, whether or not they supervised other staff was a key characteristic relating to their assessment of the BOC training. Of the 12 students with ten or more years O&M experience who did *not* supervise other staff, 10 described the BOC course as having a positive influence and two said it did not. (One of the two students who said the BOC course had not enhanced his on-the-job behavior subsequently reported that he did not work on any of the twelve types of equipment we asked about and reported on in Table 5.11.)

Of the 34 students with ten or more years O&M experience and supervisory responsibility, 25 described the BOC training as having a positive influence and nine said it did not. Examining these students further, we find that those from facilities less than one million square feet are more likely than those from larger facilities to ascribe a positive influence to the BOC training (18 of 21 students). Experienced students (10 plus years in O&M) with supervisory responsibility at large facilities (more than one million square feet) are the least likely to say that the BOC course has had a positive influence. Even so, of this latter, highly experienced and responsible group of students, about one-half (7 of 13) said that attending the BOC training had improved their on-the-job behaviors.

Table 5.4 presents these findings by utility, showing how the simple finding of differences in BOC influence among students from different utilities is better understood as differences in BOC influence among students with differing characteristics.

Table 5.4

STUDENT ATTRIBUTION OF POSITIVE INFLUENCE OF BOC BY STUDENT CHARACTERISTICS

BOC HAD POSITIVE EFFECT ON ON-THE-JOB BEHAVIORS	UTILITY SERVING STUDENT	
	PG&E OR SDG&E	SCE OR SO CAL GAS
Students with Less than 10 Years O&M Experience	100% (9 or 9)	100% (12 of 12)
Students with 10 or More Years O&M Experience, No Supervisory Responsibility	100% (5 of 5)	71% (5 of 7)
Students with 10+ Years Experience, Supervisory Responsibility, Facilities Less than 1 Million SF	87% (13 of 15)	83% (5 of 6)
Students with 10+ Years Experience, Supervisory Responsibility, Facilities More than 1 Million SF	60% (3 of 5)	50% (4 of 8)
All Students	88% (30 of 34)	79% (26 of 33)

FACILITIES AND ORGANIZATIONS IN WHICH STUDENTS WORK

Participants' Facilities

Information on the characteristics of participating customer facilities is useful in marketing the program and in ensuring the course content is relevant to the facilities in which students work.

Regarding the principal uses of these facilities, the most common was office space. This was the principal use of one-third (34%) of the students' facilities (Table 5.5). Various industrial uses comprised the next most common activity (18%).

Table 5.5

PRINCIPAL ACTIVITY OCCURRING IN PARTICIPANTS' FACILITIES

ACTIVITY	PERCENT (N=67)
Office	33%
Community Service/Religious/Municipal	12%
Retail (Non-Food)	10%
Healthcare/ Hospital	8%
College/University	6%
Warehouse	5%
School	3%
Hotel/Motel/Lodging	3%
Restaurant	1.5%
Industrial **....Chemicals** **....Metals** **....Electronics & Equipment** **...Other**	20% 8% 5% 1.5% 6%

The number of buildings comprising the facilities in which the students worked ranged from one to more than 200 (Table 5.6). About four-fifths (81%) of the students work in facilities that have more than one building. Almost one-fifth (19%) of the students work in facilities with more than 25 buildings, and three of those work in facilities with more than 100 buildings.

Table 5.6

NUMBER OF BUILDINGS IN STUDENTS' FACILITIES

NUMBER OF BUILDINGS	STUDENTS (N=64)
One Building	19%
Two through Five Buildings	28%
Six through Ten Buildings	11%
11 through 25 Buildings	23%
26 through 100 Buildings	14%
101 or More Buildings	5%

The 67 students worked for 62 different facilities. Nearly 90% of the students (58) were able to provide an estimate of the size of their facilities, which ranged from 25,000 square feet to more than 200 million square feet (Table 5.7). The number of facilities with 500,000 square feet or less (47%) was roughly equal to the number of facilities with more than 500,000 square feet (53%).

Table 5.7

SIZE OF STUDENTS' FACILITIES

SIZE IN SQUARE FEET	PERCENT (N=58)
Less than 100,000 Square Feet	12%
100,001 through 500,000 Square Feet	35%
500,001 through One Million Square Feet	17%
More than One Million Square Feet	36%

To lay the groundwork for a future impact evaluation of the Statewide BOC program, we developed an estimate of the amount of square footage in a facility per O&M staff.[12] According to the interviewed students, the average square footage per O&M staff is 70,000. However, smaller facilities have proportionately less square footage per staff (i.e., have a higher concentration of staff) and larger facilities have more. Thus, the median value is lower than the average and is equal to 40,000. We approached the question from a third direction. The median of the student reported square footage per O&M supervisor was 250,000, and the median number of supervisors was five, suggesting that 50,000 square feet per building operator provides a good indication of size-to-staff ratio.[13]

This indicator of square footage per operator can support the estimation of program impacts per student. However, as is detailed in the next section, O&M staff are not organized to be responsible for an equal division of floor space.

Students' Operations and Maintenance Organizations

The size of the operations and maintenance staff at the students' facilities ranged from one to 350 (Table 5.8). More than one-half (51%) of the students work in facilities with an operations and maintenance staff of ten or fewer employees. Nine students work in facilities with a building operations and maintenance staff of more than 100.

[12] Calculated for each student as reported facility square footage divided by reported number of O&M staff. This value was then averaged across the students.

[13] Based on the smaller supervisor sample, the average square footage per O&M staff is 63,000 and the median is 30,000. Working from square footage per supervisor and number of staff per supervisor, the ratio of means gives 60,000 and the ratio of medians gives 29,000.

Table 5.8

SIZE OF OPERATIONS AND MAINTENANCE STAFF IN STUDENTS' FACILITIES

OPERATIONS AND MAINTENANCE STAFF SIZE	STUDENTS (N=67)
One through Ten Employees	51%
11 through 25 Employees	18%
26 through 50 Employees	12%
51 through 100 Employees	6%
101 or More Employees	13%

According to the students, the number of supervisors at their facilities ranged from one to an estimated 50, but for more than three-fifths (61%) of the facilities represented by the students, the number of supervisors was three or fewer (Table 5.9).

Table 5.9

NUMBER OF SUPERVISORY OPERATIONS AND MAINTENANCE STAFF IN STUDENTS' FACILITIES

NUMBER OF SUPERVISORS	STUDENTS (N=64)
One through Three	61%
Four through Ten	24%
More than Ten	10%

Students said the most common way in which operations and maintenance staff are organized at their facilities is by skill level (e.g., repair staff, maintenance staff, operations staff). Roughly one-half (52%) of the facilities were organized this way (Table 5.10). Other ways in which staff are organized was by the equipment for which they were responsible, their location in the facility and by their trade. Seven

percent (five) of the students said all operations and maintenance staff at their facility work on everything and are therefore not organized by any of the three criteria explored in the survey. Two-thirds (67%) of the students said they are assisted in their duties by other operations and maintenance staff of the same skill level as themselves.

Table 5.10

ORGANIZATIONAL STRUCTURE OF OPERATIONS AND MAINTENANCE STAFF AT STUDENTS' FACILITIES (MULTIPLE RESPONSES ALLOWED)

OPERATIONS AND MAINTENANCE STAFF ORGANIZED BY…	STUDENTS (N=67)
Skill Level	52%
Equipment Responsibilities	27%
Location in Facility	25%
Trades	13%
Staff Works on Everything	7%
Unknown	4%

As shown in Table 5.11, ventilation fans topped the list of equipment the students most frequently said they work on (96% of students). Other equipment maintained by more than 90% of the students included motors (93%) and air handling equipment (91%). Outside water use was the least common of the students' surveyed activities, although more than one-half (55%) said they work on such systems. Eighty-five percent of the students said the equipment they work on serves 100% (rather than only a portion) of the facility in which they work. Ninety-three percent of the students said other operations and maintenance staff assist them in working on these various types of equipment.

Table 5.11

STUDENTS' SPECIFIC EQUIPMENT RESPONSIBILITIES (MULTIPLE RESPONSES ALLOWED)

RESPONSIBLE FOR…	STUDENTS (N=67)
Ventilation Fans	96%
Motors	93%
Air Handling Equipment	91%
Water Heating System	84%
Packaged or Unitary Cooling Equipment	82%
Furnace or Heating System Other than a Boiler	82%
Air Compressor	79%
Boiler	73%
Chiller	72%
Plumbing Fixtures	69%
Cooling Tower	64%
Outside Water Use	55%

5. Influence of the BOC Training

6. PROGRAM IMPLEMENTATION

This chapter discusses the implementation of the 2002 Statewide BOC program. The findings came from in-depth interviews with utility BOC program managers, BOC instructors and NEEC program managers. The sample is shown in Table 2.1.[14]

The chapter is organized into the following sections:

- *Launching the Statewide BOC Program*
- *Marketing*
- *Administration*
- *Instructors and Curriculum*
- *Utility Presence in the Classroom*
- *Overall Assessment*, including program strengths, concerns, and long-term prospects.

LAUNCHING THE STATEWIDE BOC PROGRAM

The CPUC decision authorizing the program spoke in general terms about a training program for building operators. Nonetheless, several utility program managers had the impression that the CPUC was intending the NEEC course. Utility managers expressed having been surprised that the CPUC decision identified a specific program (operator training) rather than a program category, as are delineated in the *Energy Efficiency Manual*. This specificity seemed at odds with the program's statewide budget of $1 million, an amount dwarfed by the other efficiency programs.

The utilities moved quickly to launch the program after the mid-April 2002 CPUC directive. Prior to the directive, NEEC had submitted an unsolicited proposal to the utilities that targeted using what a utility program manager termed a "high-profile" California-based implementation partner. The utilities rejected this proposal on the

[14] In order to preserve the anonymity of informants, all are referred to with the pronoun "he."

grounds that it was too expensive. The implementation partner would have received significantly more money than NEEC for the BOC license fee.

In response to the CPUC directive, SDG&E coordinated the development of an RFP seeking a training curriculum and implementer. The utilities received four "very viable" responses to the RFP. Evaluation criteria were set and, after hearing the bidders' oral presentations, each utility evaluated the proposal. Then utility program managers talked over their evaluations and selected NEEC to implement the program.

NEEC's proposal in response to the RFP cost much less than the unsolicited one it had submitted previously. Regarding the difference in price, one utility program manager said, "A lot more work would have been done by the NEEC team under the first proposal. There is no doubt that the earlier approach would have generated more classes, but was too expensive."

It needs to be noted that the implementation arrangements of the BOC differ between California and every other state in which the NEEC BOC curriculum is offered. With exception of its home state of Washington, where NEEC implements the BOC program, NEEC has sold the license to use the curriculum to an implementation partner. These partners include the Northeast Energy Efficiency Partnership, the Energy Center of Wisconsin, the Midwest Energy Efficiency Alliance, the Northwest Energy Education Institute, and the Sacramento Municipal Utility District, in addition to others. These partners implement the program, from finding and training instructors and site coordinators, to marketing and course registration, to instruction and grading. NEEC provides the course materials and the certification of graduates. By contrast, in California NEEC conducts the implementation. The California utilities have not purchased a license, but instead pay NEEC for services delivered. NEEC is paid a fee per course series; the contract stipulates performance adders to encourage full class sizes.

NEEC has been "stretched" to implement the BOC program. In 2002, NEEC implemented eight series in California and is conducting twelve in 2003. In contrast, NEEC implements four series per year in its home state of Washington.

MARKETING

NEEC had responsibility for marketing the BOC program, yet received considerable assistance in 2002 from the utilities. It followed the approach it uses to implement BOC in Washington.

NEEC purchased a list of firms with building operations and maintenance staff from an association that serves this population. It then sent a course invitation and BOC brochure to the people on the list. The mailing informed the recipients that they might attend a short informational meeting to learn more about the course series. These meetings are typically held about one and one-half months prior to the scheduled training. Between the program launch in the second half of 2002 and mid-June 2003, NEEC conducted nine such meetings at locations all over California. One of NEEC's two senior partners conducted the meetings. Often, the utility program manager or other utility staff attended the meeting and spoke out, saying something to the effect of: "It's a great program. We are behind this."

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 BOC program at trade shows.

The utilities also mailed out the course invitation and brochure or sent email announcements to their own customer lists. For example, they mailed to customers that had participated in training and informational programs held at the utilities' training centers.

The utilities' logos appeared on the mailing envelopes and, in at least one case, on the invitation letter. All of the utilities have strict non-endorsement policies and the legal counsel of at least one cautioned their program manager about liability issues. Yet this manager and that of another utility expressed the opinion that the utility's logo is necessary because it is the utility that has market clout, not NEEC. One manager elaborated, "We are trying not to let the BOC trade on our name. Yet we do want to leverage our reputation. Because the BOC focuses on energy, the utility gives the program great credibility. It's a utility offering, at a utility facility. This is a huge endorsement."

Account Executives at the utilities were also informed about the program and their promotional activities generated a number of students for the courses. At one of the utilities, an Account Executive (AE) serving hospital customers became a strong advocate for the course. One program manager persuaded an AE to attend the course with one of his customers. Some AEs see the course as an opportunity to serve their customers and so actively promote it, while others seem to ignore it. The AEs are protective of their customers; thus, a program manager reported that it is hard to directly market to large customers without the AE's involvement.

Utility program managers also reported that the courses are included on the utility website and on the calendar of upcoming trainings, they are mentioned at the end of

related training classes, and included in the list of resources maintained by the energy efficiency tool-free phone line staff.

NEEC uses additional avenues to promote BOC. In time for the 2003 program, it has a Memo of Understanding with the Federal Energy Management Program (FEMP), run by the US Department of Energy. FEMP entered into the agreement to pursue its interest in providing federal government buildings with information on energy efficiency and it is helping NEEC to reach the government sector in California. At the time of the interview with NEEC staff in June 2003, discussions were underway for holding a closed-enrollment course at Camp Pendleton.

Given the multiple marketing activities, customers may have learned about the program from more than one source. Multiple exposures to information are considered by marketing professionals to increase the likelihood of obtaining participants.

The price for students to enroll in the 2002 Statewide BOC training was $950. This price is somewhat lower than the $1,175 that NEEC charges when it implements the series in Washington. When a facility sends more than one operator to a given course series, the fee for the first student is $950 and the fee for subsequent students is discounted. In 2002, the discount was 50%, for a fee of $475 per additional student; in 2003, it is $650.

On a very limited basis, each utility is able to offer a discount off the $950 course to customers that would not be able otherwise to send students (i.e., making a "hardship" determination). However, the defining characteristic of a statewide program is that it is administered uniformly throughout the state, which includes a uniform incentive. One utility program manager expressed the desire to offer schools a discount, but said the money was not available in the budget to do so. Another utility program manager suggested that his utility might strategically offer a discount to certain customers based on marketing considerations.

As one utility program manager noted, NEEC is "caught in the middle" between what it costs to offer the BOC training and the typical price for other training programs set in the competitive market by firms large enough to reap production economies of scale. The experience in the San Diego area with the course offered by UCSD may suggest that the training is price-elastic. About 100 students enrolled each year when SDG&E offered a 50% scholarship, compared to about 50 students per year since SDG&E ended the scholarship.

BOC courses must have at least 20 students registered. With fewer than 20, NEEC must receive approval from the utility to go ahead with the course. In 2002, NEEC

had no problems with small class sizes. For one 2003 series at one utility, students were signing up at a lower than expected rate. The Account Executives at that utility made calls to customers and filled the series.

Utility program staff reported that they were happy with how NEEC promoted the 2002 BOC program.

ADMINISTRATION

The BOC program is managed on a day-to-day basis by the BOC administrator, who works in Seattle with the BOC marketing manager and the two NEEC principals, who provide overall project management. The BOC administrator registers the students, maintains the student database, grades student exams and reports their grades, and issues certificates.

In California, NEEC has hired two part-time staff on contract to coordinate each class within the series. One staff member is located in San Francisco and coordinates the series held in PG&E's service territory and the other is located in San Diego and coordinates the series held in the southern California utility service territories. The site coordinators attend each class and greet the students, thereby providing a continuous point of contact throughout the series, as the instructors change with the course. The site coordinators ensure the room is set up appropriately. They hand out course texts and tests, collect students' projects and exams, send materials to NEEC for grading and report to students on their grades. They track student attendance. Instructors reported that the site coordination was working well.

Several of the course series have been held in utility training centers, as shown in Table 1.1. These training centers have equipment displays and demonstrations, and tools such as light meters and data loggers. Information on utility efficiency programs and services is on display and available for the taking. Instructors and students alike praised the training centers. The other facilities used for the BOC series offer quality accommodations, but not the benefit of information, equipment and tools pertinent to energy efficiency. Students and instructors expressed appreciation for the quality of the facilities and the hospitality (food).

SoCalGas customers have the option of taking the course at the utility's training center in Downey or at any of SCE's training locations. This arrangement makes it possible for gas customers who live far from Downey to attend BOC training at a convenient location. SoCalGas gets credit for these students with respect to the CPUC mandate. The assignment of credit is invisible to the participant.

INSTRUCTORS AND CURRICULUM

NEEC ran the 2002 Statewide BOC program using instructors from its courses in Washington state. The very short time between the award of the contract to NEEC and the launch of the first series precluded NEEC from hiring instructors who live in California. As of mid-June 2003, NEEC had approved ten California building professionals to instruct the BOC classes. These ten instructors attended a *Teach the Teachers* training session. NEEC will have each professional teach one course and then assess whether to continue employing the individual as a BOC instructor.

As was true for obtaining local instructors, there was not time between the award of the contract and the launch of the first course for NEEC to modify the written class material for California. In NEEC's standard partnership agreement, in place in every state except California, the implementation partners modify the curriculum as needed for their region. In California, there is no implementation partner; NEEC has the implementation responsibilities.

The 2002 BOC training launched with NEEC's standard curriculum, augmented with handouts to address the needs expressed by the utilities. The handouts addressed, among other topics, gas absorption cooling, gas-fired refrigeration and enhanced automation for demand responsiveness. The instructors, as they taught the classes, commented on any differences between the materials and the California situation.

The utilities wanted the curriculum to include content relevant both to California and to the local area where the course is taught, addressing differences in climate, building and equipment stock, building codes and Air Quality Management District requirements. For example, the utilities asked that the course's heating fuel focus be shifted from oil to natural gas. In addition, the CPUC and the utilities want the BOC training to include information that can assist facilities in making adjustments to their electrical load should the state call for a demand response. The utilities have emphasized enhanced automation—the modification of building controls to appropriately drop load—as a method whereby customers can obtain demand responsiveness.

Information on demand responsiveness was included as relevant throughout the course series, not as a separate topic. Of the two instructors interviewed for this evaluation, one reported explicitly using the phrase *demand response*, while the other did not. The latter instructor said he lightly touches on the subject of technologies that shift demand; he said the distinction between demand and usage was made in the second course in the series. Some utility program managers and instructors envision that demand responsiveness might be an appropriate stand-

alone topic for a Level II course or a continuing education course (supporting re-certification).

Although SDG&E's pilot of the NEEC BOC program identified inaccuracies in the curriculum, the SDG&E program manager who attended the series and evaluated the pilot summarized that: "I think the curriculum is probably 95% accurate. It has lots of good information." Nonetheless, he thought the course credibility was undermined by errors in the written materials, which were brought to students' attention whenever the instructors corrected the material. He hoped that each of the utilities would conduct a technical evaluation of the curriculum.

In addition to addressing issues raised by the utilities, NEEC substantially revised the HVAC and lighting curricula in 2003 to reflect recommendations made by the training consultant NEEC hired to conduct the *Teach the Teachers* training. "The information in the HVAC class gives the biggest bang for the buck in Southern California," said a utility program manager that participated in the curriculum revision. An instructor familiar with the newly revised lighting curriculum thought it was now "much more up to date."

UTILITY PRESENCE IN THE CLASSROOM

Each of the sponsoring utilities had somewhat different levels of involvement in the classroom in 2002. The utilities implicitly participated in every course series that was located in an established utility training center. These centers have efficiency program and informational brochures and demonstration equipment and tools.

The SDG&E program manager attended every 2002 class sponsored by his utility. However, this individual retired in mid-2003. He noted that he had more time assigned to the program than his successor will have and he did not expect his successor to attend all the classes as he had. The program manager reported that he spoke to the BOC students about the utility's programs and services on the last day of the series. He anticipated that his successor would give this information to students on the first day of the 2003 series. He added, "Most of our students were recruited by the Account Executives. They know about our programs. It's the smaller customers that need this information."

The SCE program manager was assigned responsibility for the program in early 2003. Nonetheless, he had sat in on one BOC class in 2002. An instructor reported that an SCE staff member came briefly and spoke to the class at the outset of the 2002 series.

The SoCalGas program manager, who was assigned responsibility for the program at the end of 2002, was planning to attend all of the 2003 classes. "In particular, I was interested in the orientation. I wanted to hear what students said they were hoping to get from the course. And what they said fit with what we are offering." The program manager engages the students in one-on-one conversations during the breaks. "I was able to hear about the specific situations of some students and I could offer them the efficiency program that meets their needs." The program manager plans to bring program literature to the remaining classes.

In 2002, a SoCalGas staff member made a 30-minute presentation on gas absorption cooling and gas-fired refrigeration during the *HVAC Systems and Control* class taught in Downey.

The PG&E program manager or another utility staff person welcomed students on the first day of each series. The program manager or another staff person also attended one class in each series to give a short—about 30-minute—talk about PG&E's commercial efficiency programs. Explained the program manager: "There has been very little direct PG&E involvement on purpose. When we talk about our programs, we offer legitimate training, not advertising."

The two instructors interviewed for the evaluation reported that as the BOC program progressed, fewer series and classes had visits from utility staff. The instructors expressed surprise that utility staff were not more engaged with the students, talking about the utility's services. According to one instructor: "It makes no difference to me whether utility staff are there or not. But they don't take an active role. If I were an account rep, I'd be there handing out my card."

According to the other interviewed instructor: "The utilities are very gracious. They provide the facilities. But they make no marketing pitch. They used to take every opportunity to say to their customers, 'We're here for you,' but no longer. I always tell the students, 'Your utility is a major resource for energy efficiency rebates, audits and commissioning.' But I didn't even have any program brochures to hand out."

OVERALL ASSESSMENT

Strengths

The 2002 BOC program was considered by all informants to be a success. The program launched quickly. Marketing and outreach went according to plan. All courses were fully subscribed "with the normal amount of effort." No problems occurred that required the attention of the utility program managers. Utility

managers received no complaints from customers. Program implementation is streamlined. The utility program managers value its simplicity. Utility program managers who sat in on classes agreed that the instructors were generally knowledgeable and well informed. The managers reported that most of the instructors encouraged participation, which the utility managers strongly support.

One utility program manager summarized: "I think the program is working extremely well—better than I anticipated."

At the time the evaluation interviews were conducted in mid-2003, utility program managers reported that the 2003 course series were quickly filling. One manager reported: "We got more students this year than last. Word of mouth is working well. I had people call me way in advance, asking when the next training would be." Utility managers also view the success of the Level II series, as apparent by the fall of 2003, as indicative of the success of the program as a whole. Said one manager: "I was amazed at how many people signed up for Level II. I was skeptical that there would be enough interest to offer the series after only one year of the Level I series."

Several of the utility program managers had heard customer testimonials for the BOC course. Some of these stories were heard first-hand, from the customer, and others were told to the program manager by Account Executives. The testimonials included stories of efficiency projects students found and undertook as a result of the series and stories of professional advancement.

Similarly, instructors reported receiving positive feedback from students. As with the utility managers, some of the stories were heard first-hand from the students and others were told to the instructors by the site coordinators. One instructor reported hearing from students that their employer had made attending the BOC training a requirement for raises and promotions. One instructor reported that he had been called into a few of the students' facilities—after the class had ended—to consult. He added, "And in every class there are one or two guys working on projects that ask me for advice."

A significant strength of the BOC program is that it fills a gap in the market targeted by the utilities' other efficiency programs, which address the design community, the owner and the "sophisticated" operator—such as the chief operations manager. One manager said: "The BOC serves the hands-on people. There is just not much else available for this group. Our other programs target the facility decision-makers. If we get the message of energy efficiency to both ends of the spectrum like this, the message will meet in the middle and we'll accomplish a lot more."

One instructor summed up the BOC program's strength: "We are reaching a hard-to-reach audience. We are taking the information to them, giving them practical knowledge they can use right away. They get bombarded with information from energy service companies (ESCOs), manufacturers, and contractors and they don't know if it's unbiased. Our information is." Though the BOC training is targeted to the "blue shirt" operator who lacks extensive experience, instructors report they are able to give experienced students unbiased information about the latest equipment, which the students often lack.

Another strength of the program is its statewide implementation. There are a large number of training centers in use by the program, making training readily accessible to most potential students. Students, instructors and the utility staff all think the use of utility training centers greatly enhances the program. All informants spoke of the benefit of the training materials—demonstration equipment and tools—available at the locations. Students and instructors also appreciated the quality of the classrooms, the equipment (such as laptop computers) available in the classrooms and the quality of the hospitality (the food) provided.

The staggered start dates of the course series worked well (see Table 1.1). Students who missed a class had an opportunity to make it up within a week at a location frequently no more than one hour away.

Challenges

The interviews identified challenges relating to the implementation of the BOC program that can be grouped into two sets: one set is those that have surfaced everywhere the program has been implemented; the other set is specific to its implementation in California. The subsequent section discusses BOC's long-term prospects in California. Some of the information presented in that section might also be viewed as challenges facing the program.

Three concerns mentioned by interviewers have been noted by previous evaluations of the BOC program implemented elsewhere in the country. One, there is the issue of finding the right level of person to attend the training. Two, there is the issue of whether the course tries to cover too much, or perhaps omits important information. Three, there is a concern that the course is not as interactive as is optimal for adult learning.

Typically, in the first years that the BOC program is offered in an area, the classes are comprised largely of highly experienced building operators. This arises in part because supervisors attend the course to determine if it's suitable for their staff, and because the program marketing typically makes use of existing utility-customer

relationships, which are between utility staff and higher-level customer staff. The downside of experienced staff taking the BOC course is that an impression is created that the curriculum needs to be changed to better meet the needs of such participants. To address three of the concerns—a desire for more information, or for hands-on activities, or to better fit the large volume of information to the relatively short course—would require more classroom hours or a drop in information included in the course. The utility and NEEC staff interviewed for this evaluation held various views on curriculum and the teaching methods. Perhaps the best assessment of both is obtained from the opinions of students, discussed in the preceding chapters.

Four concerns expressed by those interviewed relate to the BOC program's implementation in California. Instructors noted they taught several students for whom English was not their native language, and who appeared to struggle with the course as a result. In the student surveys conducted for this evaluation, an interviewer encountered one student for whom language was a barrier to completing the survey.

One instructor reported that it was common for students to be tardy to class; he laid the blame on the traffic conditions in Southern California.

Utility program managers raised the concern that the curriculum needs to address both California and local conditions, as determined by building codes and Air Quality Management District requirements. While NEEC augmented the curriculum in 2002, most changes were to occur for 2003. The 2003 program is outside the scope of the current evaluation.

The NEEC manager spoke of the challenge posed by having four contracts for what is a single, statewide program, noting that it often takes time for the utilities to agree on an approach. For example, it took several months before they reached an agreement on the BOC price.

Long Term Prospects for the BOC Program in California

Three of the four utility program managers interviewed expressed the view that the market potential for the BOC program was huge. Their comments include the following.

- *"There are about 300,000 building operators in the state. I believe the program has tremendous potential. I think the need and the market are there."*

- *"The potential is thousands and thousands. I think a steady-state level of program implementation for us will be at least eight series a year, and I think we could do that indefinitely."*

- *"I think the program will go beyond the minimal three years. I see it as ongoing. I'm encouraged by the market response we've seen so far."*

An instructor echoed these views: "There appears to be a huge potential and need for certification. Energy costs aren't going down, and most of the students I talk to say they take the BOC to learn how to lower their energy costs."

One utility program manager expressed a different viewpoint: "Given the California economy, I think the program will fizzle in five years. It will fizzle unless we make changes to the program, especially to the Level II and the re-certification courses. If NEEC does not provide good follow-up to Level I, the BOC will die out."

The other utility managers did not express this view. A second manager did state that California's budget crisis made it difficult for public facilities to pay for training. Yet this manager did not agree with the forecast that the BOC program would not continue, nor did any other manager express the view that NEEC's follow-up to the Level I series needed significant improvement. However, as the current evaluation was focused on the 2002 program, it may be that the other managers are taking a "wait and see" position concerning the Level II and re-certification curricula.

The long-term prospects of the BOC program in California appear to be vulnerable to several conditions noted by the interviewed utility managers and NEEC staff.

BOC appears to be vulnerable to cancellation with only a single champion of the program at the CPUC. As discussed, some of the utility program managers mentioned their surprise that the specific program—and a very small program at that—was explicitly called out in the CPUC directive, and their sense was that the CPUC was implying that the NEEC curriculum be used. This treatment of the program suggested to some of the utility managers that the NEEC BOC program had a champion at the CPUC. As a consequence of having perhaps a single champion, the program is more vulnerable to political change than other programs that arise from general CPUC policy.

Comments of the utility managers suggest they feel that NEEC's role as sole provider of the curriculum puts them at a disadvantage. No one identified any recurring problems from NEEC's monopoly position; they attributed their impression to the high price of NEEC's initial proposal.

NEEC, on the other hand, initially sought to have an entity other than itself implement the program in California and continues to seek an implementation partner to which it would license the curriculum. NEEC's model for BOC is to partner with an organization that implements the program, ideally with utility assistance, while the program creates a market presence during its first three or so years. NEEC staff expressed the concern that the program is now in its second year in California; yet without an implementation partner, no infrastructure is being built to support a potentially self-sustaining program.

The four utilities appear to have varying levels of commitment to the BOC program. Several program managers and NEEC staff expressed this opinion, and the differing BOC futures envisioned by the program managers lends support to that assessment. The market reach of the BOC program may be more sensitive to interruptions in program implementation than an energy efficiency rebate program. Because the BOC is a certification program, it holds long-term value for participants and prospective participants only if it has a continuing market presence.

Now that BOC has launched, the utility program managers want to see proof that the program is effective, and they want continuous improvement.

Regarding effectiveness, managers have asked: "Are students taking efficiency actions, above and beyond what the other programs accomplish?" "Is certification valued?" Some managers have suggested proof that certification is valued will be evident when building owners include the certification in hiring criteria.

For continuous improvement, utility managers spoke of wanting to exceed students' expectations, to yearly increase the number of operators trained, and to increase the influence the BOC training has on operators' activities. An idea offered for increasing the influence of the BOC program is to establish a forum (e.g., web-based) for an ongoing dialogue among students where they could pose operational challenges to each other and, as a group, solve problems they encounter. The utilities or BOC implementer could monitor the discussion and identify problems that most often challenge building operators.

7. SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This final chapter is organized into three sections:

- Summary of Findings
- Conclusions
- Recommendations

SUMMARY OF FINDINGS

2002 Statewide BOC Accomplishments

- Eight BOC course series were offered in 2002 at seven locations;
- The 2002 BOC program trained 219 students; and
- BOC training began six months after the CPUC directive authorizing the program.

BOC Students and Their Facilities

The students in the first year of the statewide BOC program typically were skilled staff. They:

- Had high levels of on-the-job experience (averaging 14 years);
- Had received formal training in some aspect of building operations and maintenance (82%); and
- Were supervisors (70%, supervising an average of seven employees).

A majority of students worked in large facilities of:

- Five buildings or more (53%);
- 500,000 square feet or more (53%); and

- Eleven O&M staff or more (49%), with four or more O&M supervisors (39%).

Majorities of students worked on a variety of equipment:

- Air handling equipment, fans and motors (over 90%);
- Water heating, unitary cooling and furnace equipment (over 80%); and
- Air compressors, boilers and chillers (over 70%).

Facilities typically have one O&M staff person per 50,000 square feet. Smaller facilities have proportionately more O&M staff and larger facilities have proportionately fewer.

Satisfaction with the BOC Training

Students expressed satisfaction with the BOC training. Students:

- Were satisfied with the course series (90%);
- Thought the training was appropriate for their facility (85%); and
- Found the information in the various courses to be useful to their work in some way (91% to 100%, depending upon the topic).

Most supervisors expressing an opinion stated satisfaction with the BOC, although substantial numbers of supervisors indicated it was "too soon to tell." The supervisors of the students:

- Thought the training was appropriate for their employee (80%); and
- Agreed that the course material was in some way useful to their employee's work (87% to 100%, depending upon the topic).

Majorities of both students and their supervisors:

- Expect the student to attend the Level II BOC training (75% of students, 67% of supervisors); and
- Have recommended or would recommend the training to others (93% of students, 90% of supervisors).

For each student that attended BOC training in 2002, 1.7 to 1.9 additional students from their facility are expected to attend, according to both students and supervisors.

Forty percent of supervisors expressed a willingness to pay the current cost of the BOC training. Of supervisors who answered the question with a dollar amount, rather than a response of *don't know*, 60% were willing to pay the current training cost. This compares favorably with findings on willingness to pay for the Pacific Northwest and the Northeast BOC programs.[15]

Value of BOC Certificate and Utility Involvement

A majority of students value the BOC *certificate*—not simply the training. Supervisors do, as well, but expressed these views less frequently.

- The certificate is believed to advance the student's career (85% of students) and enhance the student's value to the organization (87% of supervisors); and
- Students would be less satisfied with the training were a certificate not offered (60% of students), or if BOC training were discontinued in a few years (55% of students).

Nearly half of students and supervisors would like more utility involvement in the BOC program or would be less satisfied were the utilities to reduce their involvement.

- Students would be more satisfied with greater utility involvement in the program (48%) and less satisfied with less utility involvement (27%); and
- Supervisors would be more likely to send other staff to the BOC training were the utilities to be more involved (43%) and less likely to send other staff were the utilities to be less involved (30%).

[15] Findings from research conducted previously by the authors for the Northwest Energy Efficiency Alliance and the Northeast Energy Efficiency Partnership. See Appendix D for citations.

Influence of the BOC Training

The BOC training has already had an impact upon the practices of the building operators who took the course. Specifically, by applying lessons learned in the training, the students:

- Have used concepts taught in the series (93%);[16]
- Are doing new things in their jobs they did not do prior to the training (72%);
- Are doing some of their pre-existing job activities more frequently or regularly than they did before taking the training (61%);
- Have saved energy at their facility (79%);
- Have saved money for their facility (78%); and
- Have more confidence on the job (as seen by 77% of supervisors).

Experienced building operators who supervise staff and work in large facilities are the least likely to report a positive influence from the BOC course. Even so, more than 50% of these students reported a positive benefit, which did not differ across the utilities.

Information learned in the BOC training has:

- Led students to undertake, recommend or influence energy-efficiency projects at their facilities (78% of students, including 42% describing lighting projects and 31% describing HVAC projects, some of whom described both);
- Increased the likelihood the students' companies will make energy-efficiency investments (81% of students, 60% of supervisors);
- Increased the likelihood the students' companies will participate in utility energy-efficiency programs (73% of students, 57% of supervisors); and

[16] Up to 53% of supervisors (depending on the question) replied that it was "too soon to tell" the influence of the BOC on their students' on-the-job behaviors.

- Increased student awareness of demand responsiveness actions (55% of students) and confidence in their ability to respond appropriately when an action is called for (34% of students).

Program Marketing and Implementation

The following characterized BOC program marketing and implementation:

- Marketing and outreach went according to plan; all courses were fully subscribed "with the normal amount of effort."
- The utility training facilities provide an excellent location for the BOC training because of the equipment and information on site; students and instructors appreciated the high quality of all locations where the BOC series was held.
- The 2002 BOC curriculum was augmented with handouts to address California-specific concerns; revisions were made to the 2003 curriculum.
- Program implementation is streamlined; the program is simple for the utility managers to operate.
- Staggered course start-times worked well and provided students with accessible options for making up missed classes.
- Some students, not facile with the English language, struggled in the course, according to instructors.

CONCLUSIONS

This evaluation was designed to answer several key questions:

1. Are participants satisfied with the product?

Yes, students and supervisors are satisfied with the Building Operators Certification and Training Program. High satisfaction was evident in the participants' responses to a variety of questions: program satisfaction, likelihood of taking Level II training, willingness to recommend the program to others, and application of methods taught in the course.

2. Is there a market? Who is the market?

There appears to be a large market for BOC in California, based on the large number of commercial buildings with O&M staff. (The current study did not conduct an assessment of the general market; conclusions are based on interviews with program managers, instructors and participating students and supervisors.) Satisfied 2002 BOC 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 BOC program did not differ by facility type or by location within the state.

3. How many O&M staff might attend the BOC training from a participating facility, on average?

On average, each participating facility sent 1.55 students to the program in 2002; students and supervisors of the participating facilities estimate that an additional 1.7 to 1.9 students are likely to attend future series. Thus, facilities choosing to participate in the BOC program are likely to train, on average, between three and four students over a period of several years.

4. Will the market bear the cost?

The supervisors indicated a willingness to pay the full cost of the BOC training. Two-thirds of supervisors who provided an estimate of what their organization would be willing to pay for the BOC training indicated an amount equal to, or greater than $1,175.

5. Is the BOC curriculum appropriate for California?

Seven percent of students commented that they would have liked the 2002 BOC curriculum to be better tailored to California conditions. Revisions were made to the 2003 curriculum that are not assessed in this evaluation of the 2002 program. However, one specific concern raised by utility program managers—that the curriculum placed too great an emphasis on boilers—can be touched on. Of the students attending in 2002, 73% reported working on boilers. By comparison, 82% reported working on furnaces and 72% reported working on chillers.

6. Should the classes be offered independently of certification?

Students value the certification that is earned through the BOC 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. If students were interested in the training alone, their satisfaction would not vary with the market presence of BOC. Supervisors also reported valuing the certification, but with less frequency than did students.

7. How does utility involvement contribute to the success of a BOC program in California?

Students and supervisors appreciate the utilities' involvement in the BOC training and relate it to their satisfaction with the program. More than one-quarter of students and supervisors would be less satisfied with BOC or less likely to send additional staff were the utilities less involved in the program; about one-half of students and supervisors said that increased utility involvement would increase their satisfaction with the program. 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.

8. Does the BOC program appear to impact building operator actions?

Yes, the BOC program appears to impact the actions of building operators. Students reported applying information learned in BOC training, saving energy and undertaking, recommending or influencing energy efficiency projects based on what they had learned. Supervisors confirmed these reports.

9. Does BOC appear to have synergies with other utility programs?

Students reported that their participation in the BOC training has increased the likelihood that their organizations will participate in energy efficiency programs and will make energy efficiency investments. For example, they reported the BOC program has increased their awareness of demand responsiveness. Supervisors confirmed these reports. Utility program staff believe it addresses a niche unmet by other programs, yet is complementary to them. With BOC, the efficiency message gets to "both ends of the market."

10. Are BOC program administration and marketing effectively supporting the training in California?

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.

11. Does the experience to date warrant moving ahead or terminating the BOC program?

The 2002 program experience warrants moving ahead with Statewide BOC. Although the 2003 program has yet to be assessed, the 2003 course series have been fully subscribed. 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 BOC series. Participants find value in the certification generated by the training and in the utilities' sponsorship and involvement. Students report the BOC training has influenced their O&M activities and 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.

RECOMMENDATIONS

1. Market the BOC series as courses for line staff, as designed.

The BOC training targets line staff, although in this first year 70% of students were supervisors. Building operators with more than ten years experience and supervisory responsibility in facilities of one million square feet or more should be advised to take the course only if they want to assess its suitability for their subordinates, as only one-half of such students reported benefiting from the series. Position the series as high quality training for a *reasonable* price.

2. To complement the clear presentation of energy efficient methods, plainly identify the course content relating to demand responsiveness.

To improve students' understanding of how to incorporate new demand responsiveness strategies in their building's operations, the utilities should identify what information students should know on demand response in general (such as what events trigger such a condition and how their facilities would be notified) and

what strategies they want students to implement (such as to participate in a utility demand response program, develop a facility-specific plan, or take spur-of-the-moment actions from an established list). Finally, the utilities should decide which classes should cover the concept and strategies explicitly and which can address them more implicitly or in passing.

3. Develop a long-term vision for BOC in California.

As a certification program, which is valued by the 2002 participants, BOC must be supported by a long-term market presence. The current implementation efforts have the potential to lay a firm foundation for an ongoing program.

4. Evaluate the 2003 BOC program.

Important issues for a 2003 evaluation include the following:

- Evaluate student and supervisor satisfaction with the BOC Level II series and re-certification classes; assess whether the series and classes are sufficient to maintain a viable certification program.
- Assess changes made to 2003 Level I curriculum to respond to California conditions.
- In order to track program achievements and market penetration over time, maintain a table of BOC program activity indicators, as shown for 2002 in Table 7.1.

In summary, the California Statewide BOC Program is off to a strong start. Participant response is highly favorable, the training appears to be successful in promoting energy efficiency and stimulating interest in utility efficiency programs, and program implementation is smooth.

Table 7.2

BOC PROGRAM ACTIVITY INDICATORS FOR 2002

PERFORMANCE INDICATOR	2002 BASELINE RESULTS
Number of Level I Series Taught	8
Number of Level II Series Taught	–
Students Enrolled in Level I Series	219
Students Certified for Level I Series	158
Students Enrolled in Level II Series	–
Students Certified for Level II Series	–
Drop-Out Rate	3%*
Average Number of Students per Class in Level I Series	27.4
Average Number of Students per Class in Level II Series	–
Planned Courses Cancelled Due to Lack of Registrants	0
Average Number of Times Planned Start Date is Postponed Pending Additional Registrations	0
Organizations Sending Staff to the BOC Training	142
Average Number of Staff Sent per Facility	1.5
Professional Association/ Government Sponsors**	2
Institutions Offering Continuing Education Courses for Re-Certification of BOC	3
Newsletters Sent to Graduates	1
Case Studies	0

* *Estimated from survey data, 67 respondents.*

** *Includes Building Owners and Managers Association (BOMA), International Facility Managers Association (IFMA), and Federal Energy Management Program (FEMP).*

APPENDICES

APPENDIX A

Interview Guide for Students

Appendix A

INTERVIEW GUIDE FOR
BOC PROGRAM STUDENTS 2002-2003

A. Student Name: _____

B. Series Taken: __ Level I __Level II

C. Location:_____

{Dataset includes recode of location variable into whether respondent is served by SCE or SoCalGas (=1) or PG&E or SDG&E (=0).}

D. Id Number: _____

Introduction: I am _____. UUUUUUUU__(Utility)___ gave me your name as a person who had completed the Building Operator Certification Program. We are conducting an evaluation of the certification program and are following up with students to obtain their views of the program. Do you have time to talk for about 15 to 20 minutes?

Assessment of Training

The BOC course included seven topics. I would like you to rate how useful to your work you found the course material relating to the systems and equipment you work with. As I list the topics, please say whether each one was "useful", "somewhat useful", or "not useful."

COURSE TOPIC	USEFULNESS TO STUDENT
Building system overview	1.
Energy conservation techniques	2.
HVAC system and controls	3.
Energy efficient lighting	4.
Building maintenance codes	5.
Indoor air quality	6.
Facility electrical systems	7.

8. How appropriate do you think the series was for your facility? Please answer using a "1" to "5" scale, where "1" means not at all appropriate and "5" means very appropriate.

[not at all] 1 2 3 4 5 [very] dk

9. Why do you say that?

[open] _____

10. [Probe, if "California" not stated:] Do you think your experience may be common among California building operators?
    N Y DK

11. [If Y:] Why?
    [open] _____

12. Is there anything you would like to say—either positive or negative—about the BOC classes that the course developers need to know to make sure it meets the needs of other California building operators who will take this class?
    [open] _____

13. How would you rate your overall satisfaction with the training you received? Please use a scale of "1" to "5," where "1" means not at all satisfied and "5" means very satisfied.
    [not at all] 1 2 3 4 5 [very] dk

14. Why do you say that?
    [open] _____

Impacts

15. Do you use or have you used or applied any of the methods and concepts taught in the courses?
    N Y DK

[If Q15 = N or DK, skip to Q18]

16. Does that include doing new things that you did not do prior to taking the class?
    N Y DK

17. Would you say, with regard to activities you already did before taking the class, that you do some of them more regularly or frequently now?
    N Y DK

18. Do you think your job performance has been improved since taking the course?
    N Y DK
    {Dataset includes composite variable of questions 15, 16, 17, and 18. A "1" indicates student reported either applying BOC methods (questions 15 through 17) and/or reported job performance improved (question 18). Composite variable used in analysis of how influence of BOC varies by student characteristics.}

Would you say that, by applying things you learned from the course, you have been able to...

19. ...improve occupant comfort?
    N Y DK

20. [If yes:] Have you received comments from building occupants, your supervisor, co-workers, or contractors to that effect?
N Y DK

Would you say that, by applying things you learned from the course, you have been able to...

21. ...save energy at your facility?
N Y DK

22. ...save money?
N Y DK

23. [If yes:] Have you saved money in trouble-shooting or in the use of contractors?
N Y DK

24. Have you advised in decisions about equipment operation or replacement?
N Y DK

25. As a result of your BOC training, have you been able to undertake any energy-efficiency projects at your facility, or recommend such projects, or influence a project in any way? I am thinking of such things as selecting or recommending energy-efficient new equipment, or participating in a utility program, or some other activity.
N Y DK

26. [If Y:] What?
[open] _____

27. [Probe:] Anything else?
[open] _____

28. Do you think your training in BOC has increased the likelihood that your company will participate in utility energy efficiency programs?
N Y DK

29. Do you think your training in BOC has increased the likelihood that your company will make investments in energy efficiency?
N Y DK

30. Did the training discuss any actions your facility might take should the state or your utility call for a "demand response"?
N Y DK

31. [If Y:] Do you think your training in BOC made you more confident about what to do if a "demand response" is called for?
N Y DK

Assessment of Marketing

32. How did you learn about the BOC program? [open; check all that apply and/or use verbatim response; multiple responses; probe: anything else?]

Supervisor or co-worker	1
Utility mailing or advertisement	2
Utility representative	3
Utility seminar	4
Colleague or friend	5
Conference or trade-show	6
Professional or trade association / publication	7
School/college	8
Internet	9
Mailing/Flyer/Advertisement	10
Other (describe)	11
Don't know	98

33. [If Other:] Describe:
[open] _____

34. Prior to taking the training, did you see any written materials describing the program?
N Y DK

35. [If Y:] What were they?
[open] _____

36. Did the written materials give you a good understanding of the course and its potential value to you?
N Y DK NA (not seen any materials)

37. [If N or DK:] How would the materials need to be changed to better convey the purpose and value of the course?
[open] _____

Professional Value of Training and Certification

38. Have you received or will you be receiving your BOC Certificate of training?
N Y DK

39. [If N or DK] Why not?
[open] _____

40. Did you know that the BOC Certificate is recognized in 16 or so states?
N Y DK

41. How important to you is this type of cross-state recognition? Please answer using a "1" to "5" scale, where "1" means not at all important and "5" means very important.
[not at all] 1 2 3 4 5 [very]

42. Do you think having a Building Operator Certificate will be good for advancing at your current job, or getting a new job if needed?
N Y DK

43. Have you recommended the Building Operator Certificate program to people doing the same type of work that you do?
N Y DK

44. [If N or DK:] Would you recommend the BOC program if someone were to ask you about it?
N Y DK

45. [If Q42 or 43 = Y:] What have you told them/ what would you tell them?
[open] _____

46. [If Q43 = N or DK:] Why do you say that?
[open] _____

47. Have you put a mention of the BOC certificate on your resume, or do you plan to if you look for another job?
N Y DK

Now I'd like you to consider some hypothetical changes to the BOC program. Think back on the answers you've just given about whether the BOC program has helped or might help your career, whether you would recommend the program, and whether you'll put the BOC certificate on your resume. Considering these things, please compare you satisfaction with the program as it currently is and with how satisfied you would be if any of the following changes were made.

48. If the BOC program offered the same training, but no certification -- would you be more satisfied than you are now, equally satisfied, or less satisfied than you are now?
More satisfied Equally satisfied Less satisfied

49. If your utility were not involved with the program, but instead the BOC training and certification were independently offered by a college or by a training or professional organization -- would you be would you be more satisfied than you are now, equally satisfied, or less satisfied than you are now?
More satisfied Equally satisfied Less satisfied

50. [If "more satisfied":] What organizations come to mind as potentially being good organization to sponsor the BOC program in California?
[open] _____

51. If you knew the BOC training and certification was going to be offered in California for only a few more years -- would you be would you be more satisfied than you are now, equally satisfied, or less satisfied than you are now?
More satisfied Equally satisfied Less satisfied

52. If you knew the BOC training and certification was going to be offered in California for the rest of your career -- would you be would you be more satisfied than you are now, equally satisfied, or less satisfied than you are now?

More satisfied Equally satisfied Less satisfied

53. If your utility were more involved with the BOC training and certification than it currently is -- more satisfied than you are now, equally satisfied, or less satisfied than you are now?

More satisfied Equally satisfied Less satisfied

54. [If "more satisfied":] What involvement would you like to see?

[open] _____

Future Demand for BOC

55. Are you planning to attend the Level II BOC course?

N Y DK NA—Have already taken BOC II

56. Do you expect any other staff at your facility will enroll in the Building Operator Certification Program?

N Y DK

57. [If Y:] About how many?

[open] _____

58. [If N or DK:] Why do you say that?

[open] _____

59. What training relating to your job have you taken other than the Building Operators Certification?

[open; If to many too list, ask for the one or two that have been most useful on the job] _____

Who would be the best person at your company, such as your supervisor, to ask for opinions about whether the BOC training is a good investment for the company?

60. Name: _____

61. Title: _____

62. What's the best phone number to reach him/her at? _____

Operator Responsibilities

63. How many years have you been in building operations?

[open] _____

{Dataset includes recode of years in building operations variable into whether respondent has been in O&M for less than ten years (=1) or ten or more years (=0).}

64. How many people at your facility work in the area of building operations and maintenance, including line staff and supervisory staff?

[open] _____

{Dataset includes recode of number of O&M staff into numeric value.}

65. How many of these people working in building operations and maintenance are supervisors?

[open] _____

{Dataset includes recode of number of O&M supervisors into numeric value.}

66. Do any operations and maintenance staff report to you?

N Y DK

67. [If Y:] How many?

[open] _____

68. Does your facility have more than one building?

N Y DK

69. [If Y:] How many buildings are there?

[open] _____

{Dataset includes recode of number of facility buildings into numeric value.}

70. Do you know or could you estimate the size of your facility (all buildings) in square feet?

N Y DK

[If Y:] What size? [open:]

71. SF (numerical response) _____

72. SF (verbatim response) _____

{Dataset includes:

- Recode of facility square foot into numeric value, based on response to Q71 and Q72.
- Calculation of square foot per O&M staff person (equal to Q71/72 numeric divided by Q64 numeric).
- Calculation of square foot per O&M supervisor (equal to Q71/72 numeric divided by Q65 numeric).
- Calculation of number of O&M staff per supervisor (equal to Q64 numeric divided by Q65 numeric).
- Recode of square footage variable into whether respondent's facility occupies one million square feet or more (=1) or less than one million square feet (=0).

73. I'd like to get an idea of how your staff are organized. Are they organized by...

1. ...the equipment they are responsible for (e.g., the cooling system).
2. ...the location in the facility where they work (e.g., the floors, the buildings)
3. ...the skill levels (e.g., repair staff, maintenance staff, operations staff)
4. ...some other way

74. [If "other", describe:] _____

75. Where are you in this organization? [e.g., what equipment do you work on, where in the facility, what skill level]?
[open] _____

76. Do other O&M staff assist you in working in this area/location/skill level?
N Y DK

Which of the following types of equipment are your responsible for?

77.	Boilers	N	Y	DK
78.	Other heating systems (e.g., furnaces)	N	Y	DK
79.	Water heating systems (domestic hot water)	N	Y	DK
80.	Chillers	N	Y	DK
81.	Cooling tower	N	Y	DK
82.	Other cooling equipment (e.g., packaged, unitary)	N	Y	DK
83.	Air handling equipment	N	Y	DK
84.	Ventilation fans	N	Y	DK
85.	Motors	N	Y	DK
86.	Air compressors	N	Y	DK
87.	Plumbing fixtures (domestic water use)	N	Y	DK
88.	Outside water use	N	Y	DK

89. Do other operations and maintenance staff assist you in working on this equipment?
N Y DK

About what portion of the facility do you work in, or is served by the equipment you work on?

90. % (numerical response) _____
91. SF (numerical response) _____
92. (Other response) _____

93. Is your establishment a commercial enterprise or is it in the government or quasi-governmental sector?
Commercial Government Other DK

94. [If "other" or "DK", describe:] _____

95. What is the main business or activity performed at this location? (probe to code)

Office	01
Retail (non-food)	02
College/University	03
School	04
Grocery Store	05
Convenience Store	06
Restaurant	07
Health Care/Hospital	08
Hotel/Motel/Lodging	09
Warehouse	10
Personal Service	11
Community Service/Church/Temple/Municipality	12
Industrial Electronic & Machinery	13
Industrial Mining, Metals, Stone, Glass, Concrete	14
Industrial Petroleum, Plastic, Rubber and Chemicals	15
Other Industrial	16
Agricultural	17
Condo Association/ Apartment Management	18
Other (describe)	98
Don't know/Refused	99

96. [If other, specify:] _____

97. Do you have any additional comments you would like to add on the BOC program?
[open] _____

98. If we are conducting additional research on the BOC program, say next year, may we contact you again?
N Y DK

Thank you for your time.

APPENDIX B

Interview Guide for Supervisors

Appendix B

INTERVIEW GUIDE FOR
BOC PROGRAM STUDENTS' SUPERVISORS 2002-2003

A. Supervisor's Name: _____

B. Series Taken: __ Level I __Level II

C. ID# of Student Supervised: _____

Introduction: I am_____. Your employee,_(Student)___, attended the 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?

Assessment of Training

The BOC course included seven topics. I would like you to rate how relevant you feel the course topics are to the systems and equipment that your employee works on. As I list the topics, please say whether each one was "relevant", "somewhat relevant", or "not relevant."

COURSE TOPIC	USEFULNESS TO STUDENT
Building system overview	1,
Energy conservation techniques	2.
HVAC system and controls	3.
Energy efficient lighting	4.
Building maintenance codes	5.
Indoor air quality	6.
Facility electrical systems	7.

8. How appropriate do you think the overall BOC course series was for your employee? Please answer using a "1" to "5" scale, where "1" means not at all appropriate and "5" means very appropriate.

   [not at all] 1 2 3 4 5 [very] dk

9. Based on what you have observed, has your employee's participation in the BOC 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 [very] dk

10. Why do you say that?
[open] _____

11. Are you aware of your employee using any of the methods and concepts taught in the courses?
N Y Too soon to tell Already proficient DK

[If Q11 is other than yes, skip to Q14]

12. Does that include doing new things that he/she did not do prior to taking the class?
N Y DK

13. Would you say that some of the activities your employee did before taking the class are now more frequently done by him/her?
N Y DK

14. Do you think your employee's job performance has been improved since taking the course?
N Y DK

Would you say that by applying things learned from the course your employee has been able to...

15. ...improve occupant comfort?
N Y DK

15a [If yes:} Have you received any comments from building occupants, your supervisor, coworkers or contractors that leads you to believe comfort has improved?
N Y DK

Would you say that by applying things learned from the course your employee has been able to...

16. ...save energy?
N Y DK

17. ...save money?
N Y DK

17a. [If yes:] Do you think your facility has saved money in trouble-shooting or in the use of contractors as a result of the BOC program?
N Y DK

Would you say that by applying things learned from the course your employee has been able to...

18. ...have more confidence on the job?
N Y DK

19. ...interact more productively with contractors?
N Y DK

20. Since taking the training, has your employee contributed more to decisions about equipment operations or replacement?
N Y DK

[Q21 – 23 intentionally omitted]

24. As a result of the BOC training, has your employee undertaken any energy-efficiency projects at your facility, or recommended such projects, or influenced a project in any way? I am thinking of such things as selecting or recommending energy-efficient new equipment, or participating in a utility program, or some other activity.
N Y DK

25. [If Y:] What?
[open] _____

26. [Probe:] Anything else?
[open] _____

27. Do you think your employee's training in BOC has increased the likelihood that your company will participate in utility energy efficiency programs?
N Y Too soon to tell Already fully participating DK

28. Do you think your employee's training in BOC has increased the likelihood that your company will make investments in energy efficiency?
N Y Too soon to tell Already making investments DK

29. Since the BOC training, has your employee discussed actions your facility might take in the event the state or your utility calls for a "demand response"?
N Y DK

30. [If Y:] Do you think your employee's training in BOC has made your organization better prepared to take appropriate action if a "demand response" is called for?
N Y DK

Assessment of Marketing

31. How did you learn about the BOC program? [open; check all that apply, and/or use verbatim below; probe: anything else?]

Employee, co-worker, or supervisor 1
Utility mailing or advertisement 2
Utility representative 3
Utility seminar 4
Colleague or friend 5
Conference or trade-show 6
Professional or trade association / publication 7
School/college 8
Internet 9
Mailing/Flyer/Advertisement 10
Other (describe) 11
Don't know 98

32. [If Other:] Describe:
[open] _____

33. Prior to your employee's training, did you see any written materials describing the program?
N Y DK

34. [If Y:] What were they?
[open] _____

35. Did the written materials give you a good understanding of the course and its potential value to your employee?
N Y DK NA (not seen any materials)

36. [If N or DK:] How could the materials be changed to better convey the purpose and value of the course?
[open] _____

Professional Value of Training and Certification

37. Has your employee received or will he/she receive a BOC Certificate of training?
N Y DK

38. [If N or DK] Why not?
[open] _____

39. Did you know that the BOC Certificate is recognized in 16 states?
N Y DK

40. How important to you is this type of cross-state recognition? Please use a scale of "1" to "5" scale, where "1" means not at all important and "5" means very important.
[not at all] 1 2 3 4 5 [very]

41. Do you think having the Building Operator Certificate will enhance your employee's value to your organization?
N Y DK

42. Have you recommended the Building Operator Certificate program to any of your colleagues in your organization or in other organizations?
N Y DK

42a. [If N or DK:] Would you recommend the BOC program if someone were to ask you about it?
N Y DK

43. [If Q42 or Q42a = Y:] What have/ would you tell them?
[open] _____

44. [If Q42a = N or DK:] Why do you say that?
[open] _____

I'd like you to consider whether you would be more or less likely to encourage building operators at your facility to attend the BOC program if any of the following changes were made to the program.

45. If the BOC program offered the same training, but no certification—would you be more likely, equally likely, or less likely than you are now to recommend building operators at your facility attend BOC training in the future?
More likely Equally likely Less likely

46. If your utility were not involved with the program, but instead the BOC training and certification were independently offered by a college or by a training or professional organization—would you be more likely, equally likely, or less likely than you are now to recommend building operators at your facility attend BOC training in the future?
More likely Equally likely Less likely

47. [If "more likely" :] What organizations come to mind as potentially being good organizations to sponsor the BOC program in California?
[open] _____

48. If you knew the BOC training and certification was going to be offered in California for only a few more years—would you be would you be more likely, equally likely, or less likely than you are now to recommend building operators at your facility attend BOC training in the future?
More likely Equally likely Less likely

49. If you knew the BOC training and certification was going to be offered in California for the rest of your employees' careers—would you be more likely, equally likely, or less likely than you are now to recommend building operators at your facility attend BOC training in the future?
More likely Equally likely Less likely

50. If your utility were more involved with the BOC training and certification than it currently is—would you be would you be more likely, equally likely, or less likely than you are now to recommend building operators at your facility attend BOC training in the future?
More likely Equally likely Less likely

51. [If "more likely":] What involvement would you like to see?
[open] _____

Future Demand for BOC

52. Are you planning on encouraging your employee to attend the Level II BOC course (if he/she hasn't already)?
N Y DK NA—Has already taken BOC II

53. Do you expect any other building operator staff at your facility will enroll in the BOC Program?

N Y DK

54. [If Y:] About how many?

[open] _____

55. [If N or DK:] Why do you say that?

[open] _____

56. Have you sent your employee to any job-related training other than the Building Operators Certification? [If too many to list, ask for the one or two that have been most useful on the job]

[open] _____

Willingness to Pay

57. How much would your company be willing to pay for a staff person to attend the 8-day, 7-course Building Operators Certification training series?

[open] _____

[If said "nothing/ not willing to pay", or if response is more than $1,175, skip to Responsibilities section. Otherwise, ask 58 & 59.]

58. Would you be willing to pay $1,175?

Yes	1
No	2
Don't know / Refused	9

59. [If No, DK:] Why do you say that? _____

Responsibilities

60. For how many years have you been in building operations?

[open] _____

61. How many building operators do you supervise?

[open] _____

{Dataset includes recode of the verbatim text response to number of operators supervised into a numeric variable.}

62. How many people at your facility work in the area of building operations and maintenance, including line staff and supervisory staff?

[open] _____

{Dataset includes recode of the verbatim text response to number of people in operations into a numeric variable.}

63. How many of those who work in building operations and maintenance are supervisors?
[open] _____
{Dataset includes recode of the verbatim text response to number of people in operations into a numeric variable.}

64. Do you know, or could you estimate, the size of your facility (all buildings) in square feet?
N Y DK

[If Y:] What size? [open:]

65. SF (verbatim response) _____

66. SF (numerical response) _____
{Dataset includes:
- Calculation of number of staff per supervisor (equal to Q62 divided by Q63),
- Calculation of number of square feet per supervisor (equal to Q65/66 divided by Q63),
- Calculation of number of square feet per O&M staff (equal to Q62 divided by Q65/66).}

About what portion of the facility does your employee work in, or is served by the equipment your employee works on?

67. % (numerical response) _____
68. SF (numerical response) _____
69. (Other response) _____

70. Is your establishment a commercial enterprise or is it in the government or quasi-governmental sector?
Company Government Other DK

71. [If "other" or "DK", describe:] _____

72. What is the main business or activity performed at this location? (probe to code)

Office	01
Retail (non-food)	02
College/University	03
School	04
Grocery Store	05
Convenience Store	06
Restaurant	07
Health Care/Hospital	08
Hotel/Motel/Lodging	09
Warehouse	10
Personal Service	11
Community Service/Church/Temple/Municipality	12
Industrial Electronic & Machinery	13
Industrial Mining, Metals, Stone, Glass, Concrete	14
Industrial Petroleum, Plastic, Rubber and Chemicals	15
Other Industrial	16
Agricultural	17
Condo Association/ Apartment Management	18
Other (describe)	98
Don't know/Refused	99

73. [If other, specify:] _____

74. Do you have any additional comments you would like to add on the BOC program?
[open] _____

75. If we are conducting additional research on the BOC program—say next year, may we contact you again?
N Y DK

Thank you for your time

APPENDIX C

Interview Guides for Staff

Appendix C

INTERVIEW GUIDE FOR
SDG&E PILOT BOC PROGRAM MANAGER

Pilot Questions

My first questions concern the pilot BOC program that SDG&E ran. I understand you used the NEEC curriculum, the course ran from October 2001 to April 2002 graduation, and there were 20 students completing the course requirements.

1. How did you implement the pilot? Who taught it? Where was it held? How did you market it or recruit students?

2. What were you hoping to learn by offering the course on a pilot basis? And what lessons did you learn, or what conclusions did you draw?

3. What were students' reactions to the pilot? Did you get any other feedback, perhaps from instructors or other SDG&E staff? What evaluation did you do of the pilot? May I have copies of any reports?

4. Did you make any changes to the BOC curriculum based on the pilot? Did you make any implementation decisions based on the pilot? Did you have any concerns based on the pilot experience that you brought into your planning for or experience with the full BOC rollout?

5. Are the students in the pilot eligible for certification?

INTERVIEW GUIDE FOR BOC UTILITY MANAGERS

Background/Program Contracting

1. Can you tell me the dates of the BOC courses you've had so far? [two total for SDG&E and PG&E; three for Edison] How do you decide when to offer a class?

2. How did the program come about in California? Why and when did your utility commit to offering the BOC program? Did your utility have any concerns about offering the BOC program?

3. Who was involved in writing the RFP? Did one utility take the lead? Is anyone who was involved in the RFP-stage of the program still involved? 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 effected your utility's involvement?

4. What issues did the group consider in writing the RFP?

5. Who responded to the RFP? What were the considerations that led you to accept NEEC's offer? How comparable were the other proposals to the proposal put forth by NEEC in terms of curriculum, implementation, and cost? What were the drawbacks of the other proposals?

6. How long did it take to reach a contract with NEEC? What concerns were negotiated? Can you briefly describe or categorize the concerns? (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 your utility have any unique concerns that were brought to the negotiations and contracting with NEEC?

Delivery/Logistics

1. How were the course sites selected? How are the sites working out? Do you have any plans for changing or adding sites?

2. 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?

3. 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

1. How do potential students learn about the class? Any other ways?

2. Who is involved in marketing? Who is responsible for ensuring the class is filled?

3. Does your utility engage in a number of training activities? [If yes] Are the same marketing methods used for all activities, or is the BOC program marketed a little differently?

4. How well does BOC fit with your portfolio of commercial programs and training activities? In what ways do you think the BOC program complements your utility's activities? In what ways do you think the BOC program in California benefits from your utility's involvement?

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

6. Do you offer incentives—discounts on the course fee?

7. How satisfied are you with the current marketing activities? Do you think any additional methods are needed?

8. What factors do you think contributed to the good reception that the course has had thus far? [pent-up demand versus long-term need] What do you think are the long-term prospects for the course in your service territory? [sense of market potential]

9. What's your sense of how well the BOC program 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

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

2. 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? [California buildings; "demand response" energy activities]

3. How many instructors are teaching the classes in your service territory? What are the plans for expanding the number of instructors?

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

5. What is your sense of how well students are suited to the class in terms of their prior experience/ knowledge? What is the background of the students taking the class? Are they typically line staff or supervisors? What business/ industry types do they tend to come from? Public or private?

6. Have the students provided any written feedback about the course? [If yes:] Has anyone at your utility had a chance to look over the feedback?

Conclusion

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

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

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

INTERVIEW GUIDE FOR BOC STAFF (NEEC)

Background/Program Contracting

1. Can you tell me the dates of the BOC courses so far? [Two total for SDG&E and PG&E; three for Edison] How do you decide when to offer a class?

2. How did the program come about in California? What's your understanding of why the utilities decided to commit to offering the BOC program? Are you aware of any utility concerns about offering the BOC program?

3. How many people from each utility have you worked with on the program since its launch? [continuity of program managers] In what ways have the change in involved staff affected the program implementation?

4. Do you know who responded to the RFP? What were your told about why your proposal was accepted?

5. How long did it take to reach a contract with the utilities? What concerns were negotiated? Can you briefly describe or categorize the concerns? (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 that were brought to the negotiations and contracting?

Delivery/Logistics

1. How were the course sites selected? How are the sites working out? Do you have any plans for changing or adding sites?

2. 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?

3. Who are the instructors? What training have they had in BOC?

4. Who are the site coordinators? What is their role? Is anyone else present during classes?

5. 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

1. How do potential students learn about the class? Any other ways?

2. Who is involved in marketing? Who is responsible for ensuring the class is filled?

3. Does the BOC marketing take advantage of or coordinate with the marketing the utilities do for their other training or efficiency activities?

4. 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?

5. What is the course fee? Do any of the utilities offer incentives—discounts on the course fee?

6. How satisfied are you with the current marketing activities? Do you think any additional methods are needed?

7. What factors do you think contributed to the good reception that the course has had thus far? [pent-up demand versus long-term need] What do you think are the long-term prospects for the course in your service territory? [sense of market potential]

8. What issues do you see are affecting the prognosis of the BOC program in California?

Course Content/ Instructors/ Students

1. Have any modifications been made to the curriculum for California? Have the instructors offered any feedback on the curriculum? How is the topic of "demand response" being handled? Are there any aspects of the curriculum that you think (or the utilities have suggested) need to be changed?

2. Who are the instructors? Is one set of instructors teaching the courses across all of the utilities? How were the instructors selected? Have they received any training in BOC? Have any issues come up relating to the instructors?

3. What are the plans for expanding the number of instructors?

4. Have you received any feedback on how the students are responding? Have the students provided any written feedback about the course? [If yes:] Has anyone at the utilities had a chance to look over the feedback?

5. What is your sense of how well students are suited to the class in terms of their prior experience/ knowledge? What is the background of the students taking the class? Are they typically line staff or supervisors? What business/ industry types do they tend to come from? Public or private?

Conclusion

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

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

May I call you back if I have additional questions?

INTERVIEW GUIDE FOR BOC INSTRUCTORS (NEEC)

Background

1. Which BOC courses do you teach? How many course series have you taught (distinguish between in California and in other locations)?

2. What background do you bring to teaching BOC?

Delivery/Logistics

1. How are the course sites working out? Are there any changes you would like to see?

2. Does anyone for the utilities interact with the students? What are their roles? Are any of them there throughout the course, or just at the beginning of each class? How does that work for you? Would you like greater or lesser involvement from the utilities, or is the current involvement about right? [If change desired:] What changes would you like to see?

3. Who are the site coordinators? What is their role? Is anyone else present during classes? How does that work for you? Are there any changes you would like to see?

4. 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

1. Have you received any feedback from students that has led you to form an opinion about the long-term prospects for the course in California? [sense of market potential]

2. Do you see any issues affecting the prognosis of the BOC program in California?

Course Content/ Students

1. Have any modifications been made to the curriculum for California? Do any need to be made? What feedback have the students given on the suitability of the curriculum to the buildings they work on?

2. How is the topic of "demand response" being handled? What is your sense of how well students understand the issue? What types techniques do you teach that will help them to maximize their facilities' demand responsiveness? How well do they understand these

techniques? How likely do you think it is that they will seek to increase their facilities' demand responsiveness?

3. Are there any aspects of the curriculum that you think (or the utilities have suggested) need to be changed? Have you given NEEC any feedback on the curriculum? [If yes:] What?

4. Have you received any feedback on how the students are responding? Have the students provided any written feedback about the course? [If yes:] Have you had a chance to look over the feedback?

5. What is your sense of how well students are suited to the class in terms of their prior experience/ knowledge? What is the background of the students taking the class? Are they typically line staff or supervisors? What business/ industry types do they tend to come from? Public or private?

Conclusion

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

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

May I call you back if I have additional questions?

APPENDIX D

Related Research

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RELATED RESEARCH

The current evaluation builds on the experiences and lessons learned from evaluations of the BOC course in the Pacific Northwest and in the Northeast.

For the Pacific Northwest, the evaluation reports can be found on the Northwest Energy Efficiency Alliance's website:

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 the Alliance by Research Into Action:

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

For the Northeast, the BOC evaluation report can be found on Northeast Energy Efficiency Partnership's website at:

www/neep.org/files/NE_BOC_EVAL.PDF

An article on the BOC program and its energy impacts in the Pacific Northwest and the Northeast can be found in the *2003 International Energy Program Evaluation Conference,* pages 725 to 732. M. McRae and J. Peters of Research Into Action, Inc. are the primary authors.

The *Energy Efficiency Policy Manual* prepared by the Energy Division of the California Public Utilities Commission, dated October 2001, guided the current evaluation.

SDG&E evaluated the pilot program it conducted in 2001 using the NEEC BOC curriculum, and conducted a baseline evaluation as well. The SDG&E BOC program manager provided the following documents to Research Into Action.

- *SDG&E BOC Pilot Program, Trainee Baseline Survey,* October 31, 2001
- *Building Operator Certification 2001 Pilot, Student Prior Job Training*
- *BOC Pilot Test Instructors Feedback* (interview with instructor on 3/20/02)
- *Building Operator Certification, Module #7 Indoor Air Quality, How Did We Do?* February 19, 2002.

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