

## **Building Operator Certification™: Improving building performance through operator training and certification**

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### **Synopsis**

This paper reviews a growing national training and certification program for building operators and discusses the role certified operators can play in ensuring persistence of energy savings from commissioning projects.

### **About the Authors**

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### **Introduction**

Building operators have responsibility for maintaining and operating facilities to the owner's specifications and overall satisfaction. They can play a valuable role in supporting the work of the commissioning provider and in maintaining persistence of energy savings over the life cycle of the building.

This paper discusses how operator training and certification in energy efficient O&M practices can improve the performance of commercial buildings. It provides an overview of a growing national certification for operators called Building Operator Certification™ (BOC) which offers competency-based training in building systems maintenance and optimization. The paper then explores how operator training can complement and enhance retrocommissioning projects by enlisting operators in aspects of commissioning and by preparing them for sustaining building performance post-commissioning.

### **What is BOC?**

BOC is a competency-based training and certification for building operators designed to improve the energy efficiency of operation and maintenance practices in commercial buildings. Operators earn certification by attending training sessions and completing project assignments in their facilities. The certification provides a credential for their

professional development while also offering employers a way to identify skilled operators. It is a growing national program first developed in the Northwest, and now operating in seventeen states. Today, over 1,700 operators hold BOC certification nationally.

BOC certification is provided at both a Level I and Level II. Each Level represents 60 or more hours of classroom training and a set of project assignments. Class topics for Level I include:

- Building Systems Overview
- Energy Conservation Techniques
- HVAC Systems & Controls
- Efficient Lighting Fundamentals
- Maintenance & Related Codes
- Indoor Air Quality
- Facility Electrical Systems

Level II course topics are:

- Preventive Maintenance (core)
- Advanced Electrical Diagnostics (core)
- HVAC Troubleshooting & Maintenance (core)
- HVAC Controls and Optimization (core)
- Advanced Indoor Air Quality (elective)
- Motors in Facilities (elective)
- Water Efficiency for Building Operators (elective)
- Mastering Electric Circuit Controls (elective)
- Introduction to Building Commissioning (elective)
- Electric Motor Management (elective)
- Enhanced Automation and Demand Response

The primary target audience for BOC training and certification is facilities engineering and maintenance personnel responsible for operating and maintaining the electrical, HVAC, and lighting equipment in their buildings on a daily basis. A secondary audience is other professionals such as energy managers, utility employees, and supervisors of operations and maintenance functions. Eighty-six percent of BOC students sampled in the Northwest work as building operators. They hold job titles such as maintenance worker, HVAC tech, electrician, facilities coordinator, and building engineer. The remaining work as managers or advisors with titles such as maintenance supervisor, facility manager, energy manager, and utility manager.

## **BOC Operates Coast to Coast**

BOC was developed in 1996 as a market transformation venture with funding from the Northwest Energy Efficiency Alliance (Alliance). In 2000, the program was spun off from the Alliance to operate as a self-supporting business venture under the administration of the Northwest Energy Efficiency Council (NEEC), a non-profit association of the energy efficiency industry. NEEC's plan for BOC entailed growing the program nationally to serve regions beyond the Northwest. BOC was packaged as a

turnkey program and licensed to interested organizations. Today, five organizations hold licenses and are offering BOC to customers across seventeen states.

Table 1 shows BOC partners and their territory. By early 2004, BOC was serving 3,000 building operators in seventeen states. Over 1,700 operators had been certified and awareness of BOC had grown to 50 percent among employers of building operators in the Northwest (Peters 2002).

**Table 1. BOC's National Reach: Partner Organizations and Service Areas**

Program Inception	BOC Partner	Service Area
Northwest Building Operators Association		Idaho and Montana
Northwest Energy Efficiency Council	1997	Washington
Northeast Energy Efficiency Partnerships in conjunction with NYSERDA and Long Island Power Authority	2000	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont
Northwest Energy Education Institute/Lane Community College	2001	Oregon
Sacramento Municipal Utility District	2001	Sacramento, CA
Energy Center of Wisconsin	2001	Wisconsin
Midwest Energy Efficiency Alliance	2002	Illinois, Minnesota, Ohio
Pacific Gas & Electric, San Diego Gas & Electric, Southern California Edison, Southern California Gas*	2002	California, excluding Sacramento County

\* These utilities sponsor a statewide coordinated BOC program in California under the auspices of the CPUC. NEEC provides administration of the program.

### Market Effects of BOC Training and Certification

Third party evaluation played a significant role in the development and implementation of the BOC program. The Alliance contracted with Research Into Action (RIA) to

interview building operators and their employers to assess the program's value and impact in the Northwest market. The research consisted of follow-up interviews with students and their employers, interviews with non-participants, and an analysis of survey data to determine energy and non-energy benefits. NEEP contracted with RIA in 2002 to conduct a similar assessment of the BOC program in the Northeast. And in 2003, RIA conducted an evaluation for Pacific Gas & Electric (PG&E) of the California BOC program. Research in all three markets concluded that BOC is having effects in the marketplace: BOC participants are saving energy and money in their facilities; BOC certification is enhancing the stature of facilities departments with BOC-trained operators; BOC is serving as a platform for utility efficiency programs; and finally, awareness and recognition of BOC is growing. Each of these is discussed further below.

### Energy Savings

BOC-trained operators engage in a variety of efficiency behaviors from optimizing operations and preventive maintenance to reading meters and reviewing utility bills (Peters, 2001). They are 29 percent more likely than non-trained operators to take steps to optimize operations such as confirming economizer operations and recording new and changed control settings, and record occupancy schedules for lighting and mechanical systems. They are also more attentive to preventive maintenance which ensures the capacity of energy-using equipment to run efficiently. They are more likely to keep a maintenance log for lighting equipment (37%), repair the gaskets on doors for air handlers (41%), and check the condition of damper seals regularly (39%).

Based on these behavioral activities, the Alliance and NEEP research developed estimates for electrical energy savings from BOC-trained operator actions in their facilities. The NEEP research also developed estimates for natural gas and water savings. The Alliance estimated electrical energy savings of 172,000 kWh per participant annually, or \$12,300 at national electricity rates. The NEEP estimate for electricity savings was 107,473 kWh per participant annually. (NOTE: This figure is lower than the Alliance's estimate which might be explained by differences in assumptions; for example, the NEEP estimate was based on a review of 11 energy conservation measures taught in BOC training. It is likely that savings are also accruing from actions not measured.) The NEEP research also estimated natural gas savings of 1,310 MMBtu per participant annually, and water resource savings of 108,585 gallons annually.

### Enhancing Stature of the Facilities Department

For many employers, BOC serves as a way to build the stature of the facilities department in the organization. BOC offers an avenue for cross training in important skill areas – HVAC systems, building systems overview, energy conservation and indoor air quality – which leads to employee versatility and enhanced team work. One-quarter to one-half of students and supervisors report they have received comments from occupants, a supervisor, co-workers, or a contractor about improvements in troubleshooting and problem solving.

*“The morale of the trades people has improved because the training was excellent. They get better recognition. We have tripled the number of suggestions for facility improvement and we have implemented each one. They got great ideas from the training.” (Employer Comment, Alliance BOC Evaluation, 1999)*

In the Northeast and Northwest, employers state nearly unanimously (98%) they will recommend BOC to their peers. More than 80 percent say they will look for BOC certification on resumes of job applicants. Of the BOC graduates themselves, 90 percent plan to renew their certification in the future, and close to 50 percent of graduates have seen an increase of job responsibilities and compensation since earning certification (Peters, 2002). This figure is lower in the Northeast which may be due to the shorter life of the program (2 v. 6 years) in that region.

#### Feeder to Utility Efficiency Programs

BOC is actively supported and marketed by utilities in regions where it is offered. And while utility support of BOC has been integral to its success in the marketplace, benefits have accrued to utilities through enhanced customer relationships and participation in their efficiency programs. In the Northwest and California, utility sponsors achieved high visibility with customers through BOC by hosting informational meetings and training classes at their facilities, and by presenting utility program offerings in training sessions. About three-quarters of students and 57 percent of supervisors in California report that participation in BOC will increase the likelihood their company will participate in utility efficiency programs (Peters, 2003).

Building owners who send staff to BOC can also look to their staff to initiate new energy projects and to contribute to larger projects such as major lighting retrofits, HVAC equipment upgrades, and commissioning and retro-commissioning projects. BOC-trained operators are 20 percent more likely to provide their supervisors with ideas for energy savings opportunities several times a year.

*“We recently completed the second phase of a three phase HVAC project. I watched our [BOC-trained] technicians work hard to learn the new building management system, work out the bugs and modify the initial plan to meet the ever changing environment here at ELDEC. Not only has the crew worked on installing and commissioning the new systems, the entire project was coordinated in conjunction with the P.U.D. as part of their energy conservation program. The amount of research hours, performance calculations and time spent with the P.U.D. engineers is phenomenal.” (Lang Smith, Facilities Manager, ELDEC Corporation, 2002)*

## **BOC™ and Retrocommissioning: Different but Complementary**

BOC shares a common goal with Retrocommissioning (RCx) – to improve the energy performance of commercial buildings by addressing equipment operation and maintenance. Yet they use different approaches to achieve this goal. Retrocommissioning is a systematic process for commissioning existing buildings that did not receive commissioning during construction. It goes beyond O&M tune-ups by employing more rigorous methods of identifying problems and not only optimizing individual pieces of equipment and systems, but optimizing how systems function together (Haasl, 2002). The analysis is performed by an independent commissioning provider who works in tandem with a team comprised of the building owner and facility staff.

BOC's approach to the goal of improved energy performance focuses on the facility staff who maintain and operate the building. BOC uses a uniform, accredited training curriculum to develop the skills and knowledge of in-house operators to implement effective preventive maintenance programs and identify operational changes.

In each of these approaches, there is complementary activity. For example, participation by building operators prior to and throughout the retrocommissioning project can reduce overall costs to the owner. In-house staff can streamline the project and increase the effectiveness of the commissioning provider's time by engaging in a range of activities (Haasl, 2002) including gathering up-to-date building documentation, performing appropriate preventive maintenance tasks prior to retrocommissioning, making simple repairs and improvements as the project progresses, assisting with diagnostic monitoring and functional testing, and implementing selected improvements.

The BOC-trained operator can also play a pivotal role in maintaining the energy savings potential of the retrocommissioning effort. As reported above, BOC-trained operators are more likely than non-trained operators to engage energy efficiency practices. They have greater confidence in their abilities to operate their facilities and are more likely to initiate energy savings projects.

In California, the Sacramento Municipal Utility District (SMUD) operates BOC to augment their retrocommissioning program designed to save energy through low cost adjustments to building automation systems. While working with program participants, it became clear to SMUD that many building operators needed training in identifying energy efficiency measures, implementing efficiency projects, and maintaining the persistence of savings. To fill this need, SMUD implemented the BOC program in 2001. The results have been very positive, with trained building operators returning to their facilities and taking a proactive approach in identifying, implementing and maintaining operational improvements.

This evidence points to a reasonable expectation that BOC certified operators, properly included in the activity of the retrocommissioning process, will add persistence to the building effects of retrocommissioning. It stands to reason, that operators who have achieved a demonstrated level of competency and who have sought and achieved a

voluntary professional certification will do a better job of managing and operating the facility at the conclusion of the commissioning provider's work.

## **Future Directions**

BOC continues to expand its reach nationally. NEEC is introducing BOC to two new states in 2004: Colorado and Arizona. A pilot BOC course series will be offered in Colorado, and a BOC orientation meeting will be held in Arizona.

NEEC is also working to improve awareness and recognition of the BOC credential with major employers. through leading facility management professional associations such as the International Facility Management Association (IFMA) and the Building Owners and Managers Institute (BOMI). NEEC will build on partnerships formed with local chapters of these associations to leverage national association awareness. NEEC hopes to form strategic alliances with professional associations to offer BOC training to their members who have building operators.

Commissioning providers offer a promising ally in this arena through the Building Commissioning Association (BCA). In 2003, NEEC worked with members of the Building Commissioning Association (BCA) to develop and pilot a new class for BOC operators titled "Introduction to Building Commissioning" which discusses commissioning types and the role of the operator in working with the commissioning provider. BCA members are working with NEEC to deliver the class to markets in the western states.

## **Summary**

BOC operates coast to coast in seventeen states and recognition is growing nationally. Over 1,700 operators hold BOC certification today. Third party evaluation research conducted by the Alliance, Northeast Energy Efficiency Partnerships, Inc., and Pacific Gas & Electric shows that BOC affecting the marketplace with energy savings, improved stature for facilities departments, and increased awareness of utility energy efficiency programs. BOC-trained operators are saving energy and money in their facilities; they are also more likely than non-trained operators to take advantage of utility energy efficiency programs. Companies sending operators to BOC training are reporting improved overall job performance and enhanced stature for the facilities management department.

BOC offers opportunities to augment Retrocommissioning (RCx) activities in two key ways: reducing project costs and offering persistence of savings. Participation of building operators can streamline the project and increase the effectiveness of the commissioning provider's time by engaging in a range of activities. The BOC-trained operator can also play a pivotal role in maintaining the energy savings achieved by retrocommissioning over the life-cycle of the building. As BOC expands its reach nationally, strategic alliances with trade allies in the building commissioning profession offer opportunities to enhance the shared goal of improved building energy performance.

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