

Building Operator Certification: Improving commercial building energy efficiency through operator training and certification

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ABSTRACT

Building Operator Certification (BOC) is a competency-based certification for building operators designed to improve the energy efficiency of 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. Developed as a market transformation venture with funding from the *Northwest Energy Efficiency Alliance*, evaluation research has shown BOC participants are saving money and energy in their facilities, and awareness among major employers is growing. BOC is now expanding to serve other regions of the country including the Northeast, California and Wisconsin. It is being offered as a turnkey program to interested organizations and utilities and can be operationalized within a year to serve customers quickly. It also serves as a platform for other energy efficiency initiatives such as building commissioning, EnergyStar benchmarking, and resource conservation manager. This paper will discuss the development and implementation of the Building Operator Certification, market response to BOC in the Northwest and Northeast, and energy saving and customer service benefits.

INTRODUCTION

Building Operator Certification (BOC) began life as a utility-funded training program led by two state agencies in the Northwest – the Idaho Department of Water Resources and the Washington State Energy Office. Called Building Operator Training (BOT), the program was launched in 1988 to increase energy efficiency in commercial buildings by improving operation and maintenance practices of building operators. The focus of training was on keeping equipment well tuned and maintained for optimum performance, and reviewing operation to ensure equipment was functioning as designed and at appropriate times.

BOT training offered single classes on energy intensive systems in the building such as HVAC

systems and lighting. Attendance grew in the early years to an annual high of 800 operators participating in BOT training in 1994. This level of demand spurred interest in developing the BOT training into a more cohesive professional certification for building operators. The Idaho program began to offer a certification through the Idaho Building Operators Association (IBOA) while the WSEO set out to research the market.

FROM BUILDING OPERATOR TRAINING TO A PROFESSIONAL CERTIFICATION

Professional certification is an established practice in many professions, but for building operators it was new and needed testing in the marketplace. WSEO set out to do that in 1995 by surveying some 5,700 building operators and managers in the region, (WSEO, 1996). The findings showed strong support for certification with almost all building managers saying it would be very or somewhat useful. The results gave WSEO sufficient confidence to begin the task of designing and piloting a certification program. In 1996, the Washington legislature eliminated WSEO. The Northwest Energy Efficiency Council (NEEC), a business association of energy efficiency companies, offered to take on the pilot program effort and applied to the Northwest Energy Efficiency Alliance (the Alliance) for funding of the pilot effort.¹

¹ The Alliance and NEEC are two key players in BOC. Because of similarities in their names, the organizations are often confused. The Northwest Energy Efficiency Alliance (the Alliance) funded development of BOC in Oregon and Washington. The Alliance is a non-profit group of utilities, government agencies, and business and public interest organizations supporting market transformation. The Northwest Energy Efficiency Council (NEEC) developed and administered BOC in Oregon and Washington. NEEC is a business association of the energy efficiency industry.

Table 1. BOC Level I Class Topics and Projects

BOC Level I Topics (56 hours of classroom training)	On-Site Project Assignments
BOC 101 – BUILDING SYSTEMS OVERVIEW BOC 102 – ENERGY CONSERVATION TECHNIQUES BOC 103 – HVAC SYSTEMS AND CONTROLS BOC 104 – EFFICIENT LIGHTING FUNDAMENTALS BOC 105 – MAINTENANCE AND RELATED CODES BOC 106 – INDOOR AIR QUALITY BOC 107 – FACILITY ELECTRICAL SYSTEMS	FACILITY FLOOR PLAN ENERGY USE PROFILE HVAC OPERATIONS REVIEW LIGHTING SURVEY ELECTRICAL SYSTEM SKETCH & MAINTENANCE LIST

Creating the Certification

In 1997, with funding from the Alliance, NEEC set out to complete the pilot certification program WSEO had started. A plan was developed for creating the new product – BOC – and bringing it to market as a cost-recovery enterprise in three years. The key elements of plan included the following which are discussed in further detail below:

- Certification Program Design
- Marketing Strategy
- Evaluation

Certification Program Design.

The BOC program was patterned after a traditional professional certification model of training and testing leading to a certificate of completion. It offers certification at two levels: Level I emphasizes energy efficient building maintenance practices, while BOC Level II emphasizes equipment troubleshooting and maintenance for efficient operation. To achieve certification, participants must attend BOC classes, and complete written exams and

in-facility project assignments. Upon successful completion, operators receive a certificate of BOC certification. The certificate provides a credential for their professional development while also offering employers a way to identify skilled operators.

In-facility project assignments are a unique element of the BOC program. Developed in response to the initial WSEO market research which strongly favored a competency-based certification, the projects allow operators to demonstrate competency in key concepts covered in class while also building a set of useful records about the facility which serve as a foundation for a preventive maintenance program.

Marketing Strategy.

At the core of BOC’s implementation plan, was its marketing strategy. The strategy set targets for growing program enrollment and recognition, then offered a promotion plan for achieving the targets. The promotion plan was built around five key activities featured in Table 2.

Table 2. Five Key Marketing Strategies

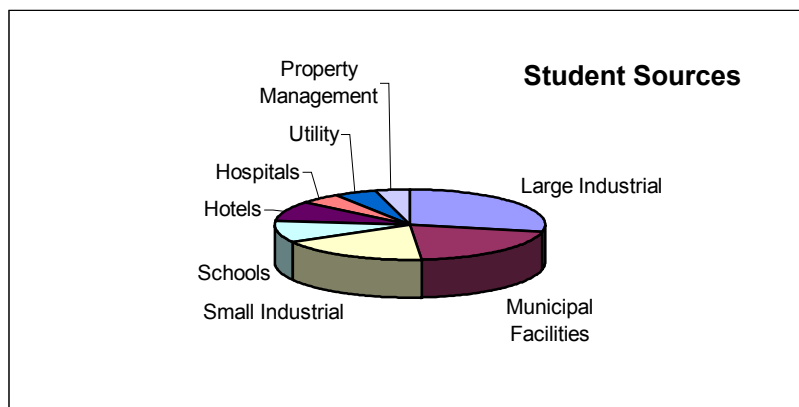
Marketing Activity	Implementation
Endorsements by Major Employers	Major regional employers endorsed BOC as a valuable program. They included Boeing, U.S. Navy, Washington State General Administration, and a large association of school facility operators.
Accreditation	BOC curriculum was submitted for approval for continuing education credits by respected institutions such as the Department of Labor & Industry and community colleges.
Membership in Facility Management Associations	Membership and participation in facility association meetings, annual conferences and trade shows provided opportunities to present BOC to employers of operators. Examples include local chapters of IFMA, BOMA, ASHE, and school/municipal facility associations. ²
Partnerships with Local Utilities	Local utilities host BOC informational meetings for commercial customers to build awareness and enrollment. Over fifteen utilities and facility associations in Washington and Oregon have partnered with

² International Facility Management Association (IFMA), Building Owners and Managers Association (BOMA), and American Society for Healthcare Engineering (ASHE).

	NEEC to offer BOC to their customers. Partnerships included cash and in-kind support such as training facilities, recruitment for registration, scholarships for students, and instruction of selected classes.
News Media	Profiles of BOC graduates are placed in facility association and employer newsletters. Course series schedules and lists of graduates also appear.

The target markets for BOC include employers and operators from a range of commercial facilities including manufacturing, property management, education, health care, facility services, government, municipalities, hospitality and utilities. Figure 1 provides a breakout of facility types represented by students in BOC.

Figure 1. Types of Facilities Where BOC Students are Working



Evaluation.

Third-party evaluation played a significant role in development of the BOC program in the Northwest. The Alliance contracted with Research Into Action, Inc. to identify market and program improvement opportunities, as well as impact evaluation components to assess market transformation. As the program expands to other regions, the evaluation findings in the Northwest offer a good foundation for assessing opportunities elsewhere. Highlights of the evaluation findings are reported in the sections below.

GROWING BOC REGIONALLY, THEN NATIONALLY

NEEC offered the first Level I BOC course series in Washington in 1997. The series filled quickly with 30 registrations. Since then, NEEC has offered more than twenty course series in locations throughout Oregon and Washington. In four year's time, over 1,200 operators have enrolled in BOC in the Northwest, and 600 are certified.³

While NEEC was growing BOC in the Northwest, interest in operations and maintenance certification was forming in other regions of the country, most notably the Northeast, California, and the Midwest. Expansion of BOC offered the benefit of enabling operators to carry the credential to other regions and have it recognized by local employers.

In 1999, the Northeast Energy Efficiency Partnerships, Inc. (NEEP)⁴ entered into a partnership agreement with NEEC to expand BOC to the Northeast states. NEEP launched their first course series in Massachusetts in April 2000 which was fully subscribed; by year end, they had registered 94 operators and completed 5 course series (Table 3.). The following year, the Sacramento Municipal Utility District (SMUD) and the Energy Center of Wisconsin (ECW) made plans to offer BOC in their service areas in 2001.

³ There is a discrepancy between enrollees and certified operators because successful completion of all of the coursework requires an average of ten months from registration.

⁴ NEEP is a non-profit entity based in Lexington, MA supporting regional energy efficiency initiatives.

Table 3. Growing BOC in the Northwest and Northeast

STATES	1997	1998	1999	2000	2001	CUMULATIVE	
						Enrolled 1200	Certified 600
Northwest	X	X	X	X	X		
New England				X	X	306	145
Sacramento, CA					X	20	NA
Wisconsin					X	NA	NA

A Turnkey Program

Today, BOC is being offered as a turnkey program to utilities and other organizations interested in offering the service to commercial customers. The program comes with a recognized brand, a set of fully-developed and tested curriculum materials, and a proven marketing strategy for building recognition with employers. It can be operationalized within its first year to offer service to customers quickly. It is also designed for near to full cost recovery of training and certification expenses.

Market Response

Market response to BOC in the Northwest and Northeast has been strong as evidenced by a number of findings in the third-party evaluation research conducted by Research Into Action, Inc. Registration and certification targets were achieved or exceeded in both regions. NEEP had overwhelming success in its first year, doubling targets to meet demand.

NEEP has set four year targets through 2003 for growing the program. Market awareness of BOC in the Northwest was 30% after less than two years (Peters, 1999). Student satisfaction is high – 85% are extremely satisfied or satisfied with the curriculum. Almost all students interviewed plan to put BOC on their resume (96%). Ninety-eight percent of employers are willing to pay for the course series and recommend it to other supervisors. Ninety-two percent of employers sending operators to BOC plan to look for BOC on resumes when hiring.

PROGRAM IMPACTS IN THE WORKPLACE

The evaluation team also found BOC has “staying power” in the workplace. One year following certification, evaluators conducted a long term follow up survey with students and employers and found the following impacts.

- Over 80% of the students reported saving money or improving the comfort of building occupants as a result of information they learned in the BOC series (Table 4.).
- Similarly, for those BOC students who had changes in their job after the BOC, close to 50% attributed increased job responsibilities and compensation to the BOC (Table 5.).
- Results from the interviews with employers also support the value of the course series. Over 80% reported that the training was useful to their employees and over 46% reported that they had observed differences in the way the employee did their job after the course series. Comments from the employers on these issues tended to be very positive, praising their employees improved job performance and job commitment following the course series.

**Table 4. Student Ability to Save Money & Improve Comfort (Long Term Follow Up)
(N=34)**

BENEFIT	NUMBER	PERCENT
Both Saved Money and Improved Comfort	18	52.9%
Saved Money	5	14.7%
Improved Occupant Comfort	5	14.7%
Neither Saved Money nor Improved Comfort	6	17.6%
TOTAL	34	100%

**Table 5. Student Job Changes and Role of BOC (Long Term Follow Up)
(N=34)***

JOB CHANGES	YES	PERCENT OF SAMPLE	CREDIT GIVEN TO BOC	PERCENT OF THOSE CHANGING
Change in Job Title	5	14.7%	1	20.0%
Increased Responsibilities	16	47.1%	9	56.3%
Increased Compensation	17	50.0%	9	52.9%
Change in Job Location	2	5.9%	0	0.0%

* Multiple responses allowed.

Energy Saving Benefits

Does BOC training help operators improve comfort and save money in their facilities? This question and others were asked as part of the long term follow up investigation. Although definitive data on program impacts are not available, using participant data and Alliance assumptions, the evaluation team made the following conclusions about energy savings.

The BOC program produces energy savings in three ways:

- A better understanding of building operations procedures, an improved ability to supervise

contractors, and a general improvement in their job skills,

- Projects addressing IAQ problems or general energy conservation activities, and
- Large energy conservation projects such as described in Table 6.

More than 90% of sampled students reported an improvement in their understanding and skills; 68% said they had been able to save their employer money by applying the training concepts. In addition, 26% reported IAQ projects or general energy conservation activities.

Table 6.
ENERGY CONSERVATION PROJECTS DESCRIBED BY PARTICIPANTS

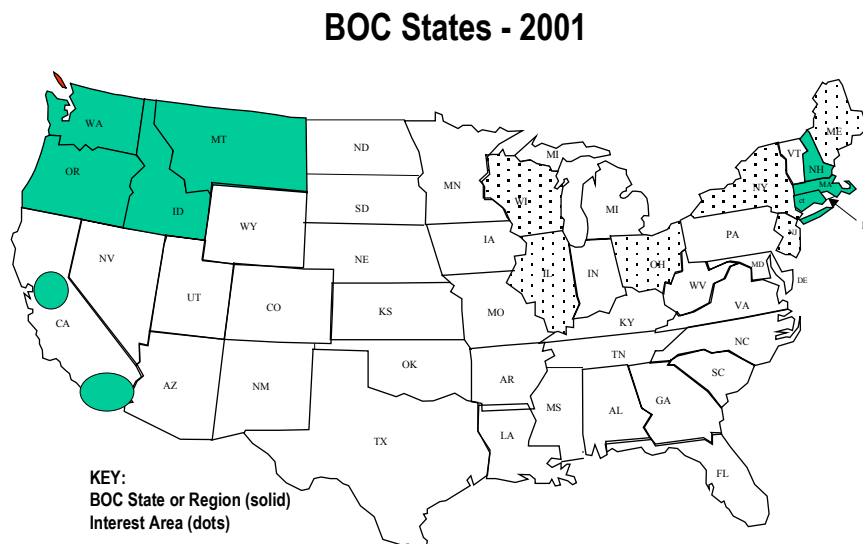
PROJECT	ESTIMATED SAVINGS	KWH EQUIVALENT	PERCENT OF INITIAL PROGRAM SAVINGS ESTIMATE
Three Lighting Retrofits	100,000 kWh	100,000 kWh	5%
EMS Installation on a Large Facility	37,000 MMBtu	10,844,080 kWh	539%
ESCO Retrofit for Campus	200,000 MMBtu	58,616,647	2900%

Using participant data and some Alliance planning assumptions, the report estimated the BOC impacts exceeded the initial planning estimate by a factor of five. Considering participant projects and their savings estimates, program impacts for gas and electricity combined could exceed 40 times the initial planning estimate (see Table 7).

Table 7.
PROGRAM IMPACTS AS ESTIMATED FROM PLANNING ASSUMPTIONS AND BOC DATA

VARIABLE	PLANNING ASSUMPTION	ESTIMATE REVISED TO REFLECT BOC DATA
Average Facility Size	11,900 sq. ft.	104,000 sq. ft.
Average Annual Electricity Consumption	20 kWh/sq. ft	20 kWh/sq. ft.
Expected Savings Fraction	2.5%	2.5%
Computed Per-Facility Average Annual Impact	5,950 kWh	52,000 kWh
Unique Facilities per Participant	1	0.55
Computed Per-Participant Savings	5,950 kWh	28,600 kWh
Number of Participants Completing BOC Series by September 1999	338	338
Computed Program Annual Impact as of September 1999	2,011,100 kWh	9,666,800 kWh

Figure 2. States Offering a BOC Program



Recognition and Accreditation of BOC

Formal recognition and accreditation of BOC in marketplace has grown since the program’s inception in 1996. Organizations can *accredit* BOC for their membership which means they offer credit hours or continuing education units for BOC classes. Organizations can also *recognize* the course. Recognition means the organization formally

endorses the program as a professional development opportunity for employees or members.

Today, over fourteen major employers, facility associations, and educational and regulatory institutions accredit or recognize BOC coursework and certification.

Table 8. Major Employers Recognize BOC

Employer	Type of Recognition
Washington State General Administration	Department’s professional development plan for facility personnel recommends BOC certification.
U.S. Navy – Everett, WA	Training plan for energy managers requires BOC.
K&S Property Management Boston, MA	Uses BOC to sell their services to potential real estate investors (“...in addition to the fine properties, we certify all our facility managers...”)
Marriott Hotels and Massachusetts General Hospital, Boston, MA	Internal promotions are based upon achieving a certain level of CEU’s. BOC is one of many selections available to Marriott and Mass General facility operators.
New Hampshire BIA and NH Governor’s Energy Office	Own and operate facilities throughout the state. Funding for O&M is based in part upon staff training. Prior to BOC, there was very little available.
Tri-Met Transit Portland, OR	Agency’s professional development plan for facility personnel recommends BOC certification.

Utility Customer Service Benefits

For utilities and consortiums such as NEEP and the Alliance, BOC offers opportunities to draw new customers into the fold of existing programs and to reach key customer groups with new energy efficiency initiatives. Table 9 provides examples of ways electric utilities are using BOC to launch or augment efficiency initiatives.

NEEP saw BOC as a good fit with an initiative it had launched in the fall of 1999 called the Resource-Efficient O&M Initiative. The initiative was an outgrowth of an O&M practices assessment conducted by RLW Analytics, Inc. (RLW)⁵ as well as recommendations from a NEEP-sponsored northeast regional workshop exploring options for a strategy to establish resource-efficient O&M as a sustained practice. The initiative will focus on a mix of different approaches with the first major offering being the O&M certification using the BOC curriculum. As the program grows, NEEP plans to add other products and services to work in conjunction with BOC such as utility-hosted training activities, contractor programs addressing O&M deficiencies, site-specific analyses via energy audits and assessments, perhaps in conjunction with the new EnergyStar® Buildings program, control strategies in cooperation with private industries, and technology-focused efforts involving recommissioning and chiller “tune-ups.”

Table 9. BOC and Electric Utility Energy Efficiency Initiatives

Electric Utility/Utility Consortium	Initiative
Northeast Energy Efficiency Partnerships, Inc.	BOC is foundation for the Resource Efficient O&M Initiative
Pacificorp, Seattle City Light, and Sacramento Municipal Utility District	Host BOC courses as a way to identify customers with energy efficiency projects and building commissioning candidates
Puget Sound Energy and Avista Utilities	Send facility staff to BOC to support Resource Conservation Manager (RCM) programs in customer facilities

Cost Recovery Benefits

BOC is designed to operate as a cost-recovery venture deriving revenues from student tuitions and certifications. NEEC achieved cost-recovery with BOC in three years, nearly doubling its revenue goals in 1999 in Washington and Oregon. BOC is the Alliance’s first market transformation venture to achieve cost-recovery in the marketplace (Putnam, 2000).

SUMMARY

The BOC program has achieved what is set out to do. In five years’ time, it established recognition in the marketplace, achieved financial self-sufficiency, and expanded its reach beyond the Northwest to serve other regions of the country. Evaluation research has demonstrated students are saving energy in their facilities and major employers are seeing BOC certification as a positive credential for employees. Electric utilities are using BOC as a platform for energy efficiency initiatives with commercial customers.

BOC’s plans for the future are focused in region and out. In Washington and Oregon, it will continue to work towards market transformation, some two to

four years off. Outside of the region, it will support its partnerships in other states while working to grow the program nationally using its turnkey

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⁵ In 1998, eight regional utilities (Boston Edison, Boston Gas, Commonwealth Energy, Eastern Utilities Association, New England Electric Systems, Northeast Utilities, Public Service Electric and Gas, and Unifil) sponsored a study by RLW to assess Operations & Maintenance (O&M) practices of commercial and industrial customers that affect energy efficiency.