

**Course Number:** BOC 100

**Course Title:** Building Operator Certification Level I

**Course Hours:** 74

### **Course Description**

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This 12-week course series teaches building operators to find practical, low-cost and no-cost efficiency solutions by working with existing systems. BOC Level I provides an overview of the building envelope and reviews the design, operation and maintenance of energy-using systems and equipment. The course is organized into the following 6 core classes and 1 elective that cover various topics, all related to the overall objectives.

#### **Weeks 1 and 2: BOC 1001 Energy Efficient Operation of Building HVAC Systems**

This two-week class provides an overview of the Building Operator Certification program and fundamentals of building systems. The class focuses on the operation and maintenance of building envelopes, central heating, cooling, air and ventilating systems in buildings. Emphasis is placed on group problem-solving and exercises with respect to preventive maintenance. An in-facility project provides hands-on practice in drawing or reproducing a simple floor plan of a building and locating the major components and sub-components of the building ventilation, heating, and cooling systems. The finished floor plan should provide a well-organized, general sense of system design in the operator's facility and serve as documentation for noting present system operating conditions, health and safety risks, and performance problems.

#### **Week 3: BOC 1002 Measuring and Benchmarking Energy Performance**

This class is divided into two sessions. The first session will cover the necessary information required for a building operator to determine an initial assessment of the energy performance of their facility. The second session will describe how the operator can then use the initial assessment to compare his or her facility against similar buildings to determine if improvements are necessary and in what areas those improvements can be made. Finally, existing tools and programs that can provide assistance to the building operator will be discussed.

## **Week 4: BOC 1003 Efficient Lighting Fundamentals**

Participants will learn lighting fundamentals and principles of efficient lighting including: evaluation of lighting levels; fixture and control technologies; retrofit and redesign options; and required maintenance to reduce energy use associated with lighting while maintaining recommended lighting levels needed for productivity and safety.

## **Week 5: BOC 1004 HVAC Controls Fundamentals**

This class provides an introduction to automatic control systems for building mechanical systems and equipment and HVAC control sequences and programming. Participants will learn to target possible inefficiencies in their HVAC systems and to evaluate potential problems as part of an enhanced operation and maintenance program. Participants are introduced to Building Automation Systems (BAS) and the graphic user interface as a cost-effective tool to review real time data to identify problems and verify proper performance for air handling and central plant systems. The class covers the development and use of key performance indicators (KPIs) to ensure persistence of performance.

## **Week 6: BOC 1005 Indoor Environmental Quality**

This class introduces the basic causes of indoor environmental quality (IEQ) problems and begins to develop a method of diagnosis and solution. Students will gain an understanding of the dynamic components of indoor environmental quality in relation to source control, occupant sensitivity and ventilation. Emphasis will be placed on communications with building occupants for reliable investigations without aggravating existing issues.

## **Week 7: BOC 1006 Common Opportunities for Low-Cost Operational Improvement**

Participants will learn typical areas and problems with different systems types and equipment and the relevant diagnostic tools and techniques to identify common opportunities that offer the greatest energy savings potential.

## **Week 8: BOC 1008 O&M Practices for Sustainable Buildings**

Participants will learn O&M best practices for green or high-performance buildings including exterior site issues, water efficiency, cleaning products, material and supply purchasing, energy, and indoor environmental. Participants will learn to identify and apply O&M practices for improving the performance of both existing buildings and newly-designed green buildings. Emphasis is placed on group discussion with respect to sustainability strategies.

## **Prerequisites**

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It is highly recommended that program participants have a high school diploma or GED, and:

- Two-plus years of experience working in operations and maintenance of a commercial or institutional facility, OR
- A minimum of one year of experience working in operations and maintenance of a commercial or institutional facility AND one year of technical college level education in commercial or industrial facilities operations and maintenance, OR
- Two-plus years of experience in energy management of commercial, institutional or industrial facilities with a focus on operations and maintenance.

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The following textbooks/materials are required for successful completion of this course:

- BOC Level I Project Workbook
- BOC 1001 Student Handbook
- BOC 1002 Student Handbook
- BOC 1003 Student Handbook
- BOC 1004 Student Handbook
- BOC 1005 Student Handbook
- BOC 1006 Student Handbook
- BOC 1008 Student Handbook

## **Course Rationale**

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- Trained and motivated building technicians can reduce utility costs at facilities by at least 5 to 15 percent. One of the key jobs to ensure energy efficiency in buildings is through building maintenance and operations. This requires in-depth training from an established program that has proven success.

## **Instructional Strategies**

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This course may employ the following instructional strategies to present information:

- Lectures
- Demonstrations
- Small group exercises and "report outs"
- Q&A sessions
- Questions are always encouraged

## **Course Outline**

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The parts/modules and their learning objectives are:

### **BOC 1001: Energy Efficient Operation of Building HVAC Systems**

- Recall eligibility and certification requirements for earning the Building Operator Certification (BOC®).
- Describe the building operator's role in achieving and sustaining energy-efficient building operation and recall current trends in the field of facility management.
- Describe how a building's systems and components correlate and interact with each other, with the building structure, its occupants, and the environment.
- Discuss the benefits of preventive maintenance and troubleshooting service records programs for HVAC equipment.
- Recall heat transfer methods and describe how climate influences load, operation, and maintenance of the building systems.
- Recognize various environmental conditions that emphasize or challenge optimum occupant comfort and productivity and the energy efficient performance of the building's air distribution systems (heating, cooling, and ventilation).
- Recall building assessment techniques and proven retrofit approaches to reduce energy use.
- Describe various energy sources currently in use for heating, cooling & ventilation and their impact on carbon dioxide emissions.
- Explain troubleshooting and optimization approaches for heating and cooling units, systematic diagnostic procedures, and determination of repair needs.
- *Assignment: Building Floor Plan*

### **BOC 1002: Measuring & Benchmarking Energy Performance**

- List major energy loads in commercial buildings
- Convert energy units to BTUs and calculate energy use intensity for his/her building.
- Cite the benefit of using spreadsheets to compute energy use intensities and construct energy profiles for fuels used in the building.
- Identify and prioritize conservation opportunities.
- Identify opportunities to improve operation and maintenance procedures.
- Benchmark a building.
- *Assignment: Benchmark a Building*

### **BOC 1003: Efficient Lighting Fundamentals**

- Optimize lighting levels and lighting energy use in a building by applying fundamental concepts of light, referencing industry standards and measuring light levels.

- Differentiate between types of lamps, ballasts, fixtures and controls and select appropriate lighting solutions for various spaces and applications.
- Identify energy and cost-saving lighting strategies, projects and technologies and perform potential cost savings, simple pay-back and return-on-investment calculations.
- Describe operations and maintenance (O&M) procedures for various lighting systems in typical commercial and institutional spaces.
- Identify potential lighting retrofit and re-lamping projects for typical commercial and institutional spaces and prioritize them based on cost and complexity.
- Recall local utility programs for energy efficient lighting projects.
- Conduct a lighting survey for a space in the building where you work.
- *Assignment: Lighting Survey*

### **BOC 1004: HVAC Controls Fundamentals**

- List the main devices in a basic control system.
- List at least two tasks required in the preventative maintenance of control systems.
- Differentiate between analog, low voltage, pneumatic and digital control processes.
- Interpret basic control drawings, sequence of operations, and DDC graphics to identify HVAC control applications and explain control processes.
- Analyze graphical user interfaces from a building's BAS system to gather data on building and system performance.
- Prepare screen check data forms to troubleshoot building and equipment level issues.
- Use BAS data to compare actual and expected modes of operation to verify operational efficiency.
- Identify BAS data inconsistencies using trend data to confirm system operations.
- Use key performance indicators in BAS data to troubleshoot system issues.
- *Assignment: HVAC Controls Review*

### **BOC 1005: Indoor Environmental Quality**

- Describe the key factors that determine indoor environmental quality in commercial buildings.
- Identify basic air handling equipment and implications for thermal comfort and indoor air quality.
- List the elements of a basic indoor environmental quality program and assist in creating one.
- Describe the relationship between moisture, mold, and ventilation.
- List the procedures to effectively manage indoor air quality concerns and complaints.
- Communicate effectively with occupants about IEQ issues.
- Identify a minimum of two information resources for managing IEQ.
- *Assignment: Occupancy Schedule*

## **BOC 1006: Common Opportunities for Low-Cost Operational Improvement**

- Develop a building systems operations map.
- Schedule building systems and equipment, and implement operational strategies to limit equipment on-time.
- Identify critical control sensors in a building and recognize symptoms of sensor error.
- Identify control strategies and equipment faults that lead to excessive reheat and recool.
- Recognize common symptoms of simultaneous heating and cooling.
- Recognize symptoms of poor outside air control and look for typical problems.
- Understand concepts of common HVAC systems and how the design makes them prone to certain problems causing excessive energy use.
- Recall how loggers are used for energy profiling, estimating savings potential, and troubleshooting.
- Identify applications for loggers and analyze logger data for operating hours, temperatures, loading, and other parameters.
- Recall how logger data is used to estimate savings potential.

## **BOC 1008: O&M Practices for Sustainable Buildings**

- Discuss the goals and benefits of sustainability and how it relates to operations and maintenance in green buildings.
- Identify the six key areas of sustainable building operation and maintenance.
- Define carbon emission and discuss ways emission is measured and controlled.
- Describe national rating systems, strategies, and energy benchmarking tools for sustainable building design, construction, and operation.
- Evaluate the sustainability of a facility and identify opportunities and challenges in making the building's operations more sustainable.
- Evaluate the sustainability of a facility's grounds and identify opportunities and challenges of making the building site and landscape more sustainable.
- Calculate the baseline water consumption for a building and design a fixture schedule to achieve Federal water conservation standards.
- Recall energy cost control strategies and describe a range of O&M practices for improving building energy and resource conservation.
- Evaluate ways a facility can reduce energy consumption, identify challenges, and propose solutions.
- Define Indoor Environmental Quality (IEQ), evaluate chemicals and products against sustainability standards, and discuss strategies for improving the IEQ of a building.

## **Course Structure**

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Series duration is 12 weeks of live, instructor-led class. Individual classes will occur once a week, and each class lasts approximately six hours. Four of the weeks are focused on applying concepts learned in class through hands-on exercises.

***Note: The instructor reserves the right to modify content at anytime with timely notification to enrolled participants.***

## **Grading System and Procedures**

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A training certificate of completion will be issued to learners that complete an application, meet the attendance requirements, and receive a score of 70% or higher on each of the open-book exams. Students are permitted to miss no more than one week of class. Participation in class discussions and group exercises is highly encouraged.

## **Need for accommodations**

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If a student has need for specific accommodations to complete the course, please contact our training center at 570-327-4768 or [cleanenergy@pct.edu](mailto:cleanenergy@pct.edu).

## **Course Policies and Procedures**

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### **Location:**

TBD based on client preference

### **Clean Energy Center Office Hours:**

8 a.m. to 4:30 p.m. daily

**Phone:** 570-327-4768

**E-mail:** [cleanenergy@pct.edu](mailto:cleanenergy@pct.edu)