Industry-based Skills Standards for Building Operators—A Business Case

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ABSTRACT

Although there is growing evidence that a skilled workforce and high performance building processes are fundamental to a profitable corporate energy management strategy, current training frameworks lack performance specifications that identify the knowledge, skills, and abilities that operations and maintenance (O&M) personnel need to implement energy management goals. This article examines industry-defined skill standards for building operators (O&M personnel), recently identified in a joint collaboration between the Northwest Energy Efficiency Council, Midwest Energy Efficiency Alliance, Northwest Energy Alliance, and City University of New York's Building Performance Lab supported by the Department of Energy. The Developing a Curriculum (DACUM) method was used to identify job tasks processes. The skill standards present the core skills required for building personnel to operate a high-performing facility in today's commercial built environment, focused on improving facility energy usage and maintaining efficient systems. Validation of skill standards was achieved through a national survey of industry professionals. The resulting framework may be used by facility directors to assess the competencies of building operators, identify skill gaps, select appropriate training options, and prepare job descriptions. Building operators may use skill standards to assess career paths within and between industries and gauge personal training needs. The demand for skilled building operators and engineers is evident in the recent Federal Buildings Personnel Training Act of 2010, requiring all federal building personnel to be trained in energy efficient operations, and there is demand for training in the marketplace due to the associated energy savings and positive impact on an organization's bottom line. Clearly defined core competencies and standards will ensure that educational mechanisms deliver high-quality and professionally relevant training for this workforce.

INTRODUCTION

The question of how to reduce energy costs and operate energy consuming devices efficiently in institutional, commercial, and industrial facilities has been on our collective mind for over 36 years. As evidenced in numerous case studies, a successful energy management strategy—one that yields measurable results—hinges on a skilled workforce and high performance management processes. This is not a new paradigm. A strong procedural model for facility management processes was well documented in Peter Herzog's 1997 book, *Energy Efficient Operation of Commercial Buildings*. National building commissioning guidelines echo Herzog's call to "involve the people who influence operation," and they underscore the need to focus on a structured and ongoing management process rather than discrete engineering projects. Strategic Energy Management Planning (SEMP), a guideline for healthcare institutions, emphasizes that "integrated design" is also the key. In other words, all stakeholders work in concert—construction managers, designers, engineers, operators, medical staff, and commissioning agents. The new ISO 50001 Standard for Energy Management raises the bar even higher, insisting that energy consumption must be measured across an organization's supply chain, drilling down to management processes that impact energy usage.

THE ENERGY MANAGEMENT STAKEHOLDERS

Historically, energy audits have assessed equipment and delivered a list of energy-saving alternatives. Today, more organizations are focusing on operating efficiency because cost savings can be achieved quicker and more economically than with major retrofits. Moreover, organizations are beginning to look at managing energy as a way of doing business, as opposed to only making improvements on a project-by-project basis. Organizations are actively managing energy service and cost, including utility service accountability. They are involving the "true operators" of energy-using equipment, however numerous and varied, in an effort to make the equipment they operate work efficiently. These stakeholders broadly include the building trades (O&M personnel)—facility manager, operating engineer, boiler operator, HVAC-R technician, controls operator, general maintenance worker, repair worker—as well as the occupants

of energy-intensive facilities such as data centers, production lines, labs, hospitals, and offices. Achieving operating efficiency of energy-using systems and equipment assumes an understanding of the operator's competency on the basis of education, training, skills, and experience. As a baseline, energy managers, and now even commissioning agents and auditors, need to be familiar with O&M best practices, the roles and responsibilities of O&M personnel, and the assessment of their readiness to execute the energy management or building commissioning plan.

Who is this ubiquitous workforce, representing different building system trades and crafts with composite skills that encompass the complete built environment? The Northwest Energy Efficiency Council in collaboration with Midwest Energy Efficiency Alliance, Northwest Energy Efficiency Alliance, and City University of New York's Building Performance Lab conducted an occupational study using the Developing a Curriculum (DACUM) method. The result was a list of tasks and activities that building personnel perform in today's commercial built environment, focused on improving facility energy usage and maintaining efficient systems over time. Some 203 building operators, researchers, and industry leaders reviewed the duties, tasks, knowledge, skills, abilities, and tools of the operator. Each task and activity was rated, based on its importance to the job and the years of experience needed to perform the task with expertise. The study yielded useful benchmarking data (skills standards), skills analysis tools[1], and training strategies that informed a curriculum development project sponsored by the U.S. Department of Energy.

The resulting framework may be used by facility managers to prepare job descriptions and recruit credentialed operators, assess the skills of incumbents, identify skill gaps, and select appropriate training that leads to a credential aligned with the skills standards. People in the industry often mistake a "certificate of completion" for a *professional certification* or *credential*. A certificate of completion simply indicates completion of training classes or a course series, whereas a professional certification or credential requires operators to demonstrate acquired knowledge, skills, and abilities via application or an exam, thus validating mastery and competency. Some training providers voluntarily submit to rigorous standards such as IACET 1-2007 or ASTM E2659, both of which reference the

1. http://www.theboc.info/pdf/ENERGY—CONSERVATION—SKILLS INVENTORY_FORM_distr.pdf

American National Standards Institute (ANSI) standard for administering continuing education and certification programs. Additionally, training programs for building operators should be able to provide students and employers with third-party evaluations or impact studies that verify the efficacy and impact of training on energy performance improvements and O&M practices in the workplace.

Building operators may use skill standards to take an inventory of the skills needed to operate buildings efficiently, track and identify gaps in their skills, and promote and utilize their skills effectively. Over 56 years of research in the areas of workplace learning and performance improvement has demonstrated that adults need to know the reason for learning something. That begins by "knowing what they don't know." Adults need to be able to practice solving real-world problems, demonstrate their level of experience and expertise, and test themselves, especially in cases where errors occur even when a task is performed correctly. As such, adults need to be involved in planning and evaluating the training they receive because they are accountable for performing their job well. Adults need to understand the value of the training and its immediate relevance to their job—especially if training addresses change within the organization, such as O&M processes and/or the building systems technology.

The skills standards help education entities like the Building Operator Certification Program develop appropriate training programs that hone needed skills and are responsive to the changing needs of the workforce. There are a number of impact evaluations that have assessed both electric and gas savings from a range of retrofit and O&M activities attributed to operator training. One study quantified savings per participant ranging from 42,936 kWh to 130,746 kWh[2]. Another one estimated 119,000 kWh of annual savings per operator[3]. Other studies report energy savings of 6-19% of total annual energy costs[4]. Energy savings point to other benefits of training, such as increased safety, reliability, productivity, and positive impact on the financial bottom line.

The independent post-training studies above also reveal that operators who receive O&M training are more confident, more likely to implement energy efficiency measures, and better stewards of the building.

2. (Navigant Consulting, Inc.)

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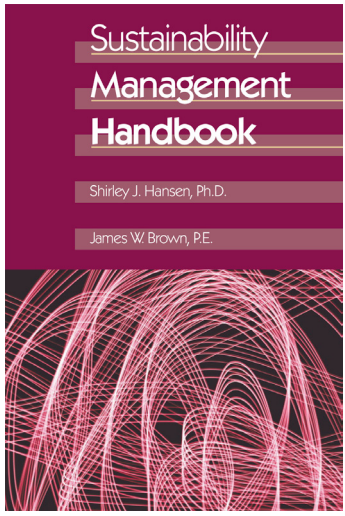

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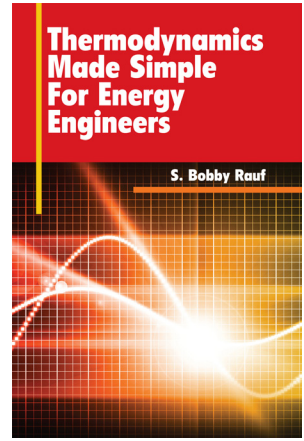

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Learning also fosters valuable interactions with instructors and peers; professional relationships flourish where there are opportunities to learn from one another. Cirrus Aircraft in Duluth, Minnesota operates 270, 000 square feet of production and office space. After completing the Building Operator Certification course, the facilities manager and mechanical technician applied methods they were taught for assessing the "health" of buildings and calculating expected energy savings. They completed several low-cost efficiency upgrades, which improved the energy efficiency of production processes and reduced demand charges by 20%—a savings of $10,000 per year on a $5,000 investment.

Nortech Systems in Bemidji, Minnesota operates 60,000 square feet of space for medical equipment production and offices. Their facility manager credits the Building Operator Certification training for the discipline to set up a preventive maintenance schedule. He learned about the "real world" experiences of other people undertaking similar projects—what works, what doesn't, new technologies and services, and vendor relationships. That helped him make better decisions about purchasing new equipment. Between 2006 and 2010, he observed a 19% reduction in the facility's average monthly kWh electricity consumption, which he attributes to optimized operations and maintenance practices, an added storage tank valve bank, HVAC controls repair, lighting retrofits, and computer monitor upgrades.

The demand for skilled building operators and engineers is evident in the recent Federal Buildings Personnel Training Act (FBPTA) of 2010, requiring all federal building personnel to be trained in energy efficient operations. FBPTA recognizes that skill standards provide a framework for assessing the qualifications of personnel charged with properly maintaining the portfolio of building assets of the General Services Administration (GSA) and safeguarding its value.

OPERATIONAL AND SYSTEMIC CHALLENGES

A profitable energy management strategy is one that is well integrated into the overall management structure, with established commitment to continual performance improvements and support from the top. Herein lie great challenges that must be addressed so as not to undermine performance goals. Overarching challenges include declining budgets, limited staffing, low professional clout, and a sense of

powerlessness among building operators towards improving building performance, especially in instances of high tech buildings that don't perform as designed. The information being made available about actual versus expected energy use in buildings equipped for high performance has been disappointing. At least one study showed that more energy was being used per square foot in a new high performance building than in the old building it replaced. Knowledge transfer is a major challenge between designers and operators—between intended design and the actual constraints that occupancy and building operations place on design. In buildings where there have been major capital improvements, there is often a discrepancy between the design, build, and operations phases. For example, substantial change to the building and energy systems may clash with the existing systems or original design intentions.

Also high on the list of challenges is fragmentation of building stakeholders. The disparate responsibilities between owners, occupants, and facility managers hinder investment and promote inefficient operation of systems. O&M personnel are sometimes given conflicting assignments. Often, they are simultaneously trying to satisfy occupant comfort, building policies, and management directives. Hinge, in his *ACEEE Summer Study on Energy Efficiency in Buildings*, points out that these "potentially conflicting goals of indoor environmental quality, occupant comfort, system redundancy, and energy savings need to be explained, wrestled with, and reconciled." Successful facility operations in manufacturing companies such as Cook Composites, and Polymers and Freescale Semiconductor, distinguish themselves by fostering continuous knowledge-sharing and learning about energy management. This includes capturing knowledge about their building performance, disseminating it widely among building stakeholders, and demonstrating this knowledge in their processes and products.

GAUGING ENERGY MANAGEMENT READINESS

The manufacturing sector has long adhered to ISO standards for its management and manufacturing processes, which makes this sector a prime candidate to test the new ISO 50001 framework. The U.S. Council for Energy-Efficient Manufacturing (CEEM) has positioned itself as a certifying body, verifying energy performance improvements and management practices through its Superior Energy Performance (SEP) program

scheduled for launch in 2012. A feature of the SEP program is standards that set requirements on how to conduct an energy efficiency assessment of different system types, with a view to redefine the market for system assessment services "previously described as energy assessments, energy audits, energy surveys, and energy studies."[5] These standards promise to assist both users and certified sellers of these services whose skills will be vetted. ANSI-accredited Certified Practitioner candidates will receive training and will be subject to a rigorous qualification exam and, once certified, continuing education requirements. Certified Practitioners will assist facilities in conducting energy system-specific assessments and establishing procedures for continuously improving energy efficiency of that system. Additionally, the assessment report will be required to identify in sufficient detail the opportunities for improving the facility's overall performance, as well as recommendations for resource utilization; reducing per unit production cost; and improving environmental performance relevant to the assessed system(s).

This hands-on approach is radically more involved than the way energy audits are typically conducted—rarely if ever addressing O&M processes and production cost. Alan Mulak, PE, with over 36 years of experience in the field of energy conservation and engineering, points out that although there are guidelines and some standards for ASHRAE Level 1, 2, 3 energy audits, in actual practice they are generally ignored, despite the fact that building operators are key players in surfacing known or suspected issues and trends in their facility's performance:

> There is a lack of qualified energy auditors and they operate as best they can, but most certainly, not to any standard. This rather haphazard approach yields inconsistent results. Such is life in the energy-auditing world. Further, results from O&M (or lack of same) are difficult to quantify. Many auditors are not familiar with O&M nor do they understand the value of O&M. Let me explain my approach, which closely aligns with ASHRAE goals and standards. For both Level I and Level II Energy Audits I always make reference to the FEMP O&M Best Practices Manual and recommend Building Operator Certification Training. This pair of recommendations is particularly valuable to customers who are short of cash (like public

5. (U.S. Council for Energy-Efficient Manufacturing)

schools) because big results can be achieved from a relatively small investment. In summary, O&M investigation and improvement will almost always produce cost effective results in a timely fashion. Unfortunately, this entire topic is generally ignored by most energy audits and auditors.

Building commissioning as a service and profession has benefitted from adherence to guidelines. The hand-off stage has evolved to include a training analysis for O&M personnel to determine their readiness to independently proceed with operating and maintaining retrofit projects. Guidelines charge commissioning agents with devising a training plan and providing or identifying credentialed training programs to certify facility personnel in building operations and maintenance. Agents also develop persistence strategies to help O&M personnel succeed in the long term. Again, these activities assume that an agent has familiarity with O&M best practices and the roles and responsibilities of personnel, as well as the ability to gauge their readiness to execute on the energy management or building commissioning plan.

Building operations is a dynamic, evolving profession, and the role of building operator is changing. Michael Bobker, of CUNY's Building Performance Lab, points out that there are significant changes with regard to new skills, behaviors, and knowledge. The profession faces new challenges and opportunities, created by technological advances in data-based performance monitoring; optimization of control sequences; and systems-level management centered on quantification, data acquisition, and trend analysis. Organizational culture is also driving new challenges and opportunities through team-based process improvements such as strategic facility assessments, energy audits, and retrocommissioning.

At a 2010 ASHRAE meeting, Danks presented a case involving a plant owner who was ordered to reduce emissions. An environmental engineering firm scoped the project, which would retrofit an existing boiler rated at about 50,000 lbs. /hr. at 400 psi with a programmable logic controller (PLC) to achieve and maintain a tight range of flame stability. A facilities contractor oversaw installation, as well as daily operations and maintenance, with a crew that had varied skills and experience. The project called for project-specific training for contracted personnel, which basically involved starting the boiler. Within one year there were three explosions, causing extensive property and systems damage. Danks outlines the lessons learned from the investigation, stressing the need to

set operators up to be good stewards of building assets. In this case, the project training failed to bridge the gap in operator skills to the highly technical boiler controls retrofit. There was no verification of learning, nor were there any O&M processes changed to help operators adapt to the PLC's hand-off operation.

CONCLUSION

Project-focused operations, stakeholder fragmentation, lack of well-defined skill standards for in-house and contracted personnel, and a poor organizational climate for learning can adversely impact energy management goals. This article has focused on a key stakeholder, the O&M workforce. It is a profession common to all facility types, and one that significantly influences the operation of energy-using equipment common to all HVAC and lighting systems.

We have examined the skills framework for gauging O&M workforce readiness, accountability, and commitment to an energy management plan. Facilities management has to adapt quickly and intelligently to energy efficiency and performance improvements and mitigate their impact on O&M staff and procedures, as well as foster a culture of learning. As a first step, skills of building operators should be assessed, using skills standards to determine knowledge gaps. Employers, students, commissioning agents, and others charged with identifying opportunities for improving the facility's overall performance should have these standards and gaps in mind when evaluating a training organization. It is essential to verify the quality of instruction and examine the learning outcomes. Outcomes should be usable and transparent, documenting student know-how and ability to perform the work with the high level of competency demanded by organizations committed to improving energy performance and safeguarding the value of building assets.

Operational and systemic challenges that limit O&M personnel's capacity to operate a high-performing facility are signals for greater commitment to improved performance and more support from the top. Here, standards afford a workable management model for fostering energy efficiency/high performance and driving down associated costs, using proven methodologies for measuring and validating improvements. Similarly, adoption of industry-based standards for O&M skills and best practices promote the success of an organization's energy management

program, help sustain high performance over time, and ensure educational mechanisms that deliver high-quality and professionally-relevant training for O&M practitioners.

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References

Abramson, Barry. "Quantifying the Energy Benefits of HVAC Maintenance Training and Preventative Maintenance." Energy Engineering (1999): 46-60.

Barrett, Peter. Facilities Management: Towards Best Practice. Malden, MA: Blackwell Publishing Company, 2003.

Barry, James. "Elevating the Role of the Multifamily Building Operator: How Operators Can Save Energy, Minimize Waste, and Improve the Bottom Line." ACEEE Summer Study on Energy Efficiency in Buildings. 2010. 10-25.

Bobker, Michael. "Training for Performance Management of Conventional & Solar Energy Systems." IREC Clean Energy Workforce Development Conference. Saratoga, 2011.

Bordass, W. "Energy Performance of Non-Domestic Buildings: Closing the Credibility Gap." Proceedings of the Improving Energy Efficiency of Commercial Buildings Conference. Frankfurt, Germany, 2004.

California Commissioning Collaborative. "California Commissioning Guide: Existing Buildings." 2006.

Ernest-Jones, Terry. "Know how: managing knowledge for competitive advantage." The Economist Intelligence Unit JUNE 2005: 1-2.

Herzog, Peter. Energy Efficient Operation of Commercial Buildings. New York: McGraw-Hill, 1997.
Hinge, Adam. "Moving Toward Transparency and Disclosure in the Energy Performance of Green Buildings." AEEE Summer Study on Energy Efficiency in Buildings. 2006.
IFMA. ROI On Education and Training. Study. Houston, 2009.
Madan, Rachel. "The Human Side of Energy Efficiency: The Value of Training." Steam Digest 2002: 43-44.
Navigant Consulting, Inc. Evaluation Of Minnesota Building Operator Certification Training. Chicago: Midwest Energy Efficiency Alliance, 2011. http://www.theboc.info/pdf/Eval-MEEA-MN-BOC-Training-Evaluation_%20FINAL.pdf
—. Long-Term Monitoring and Tracking Report on 2010 Activities. Boulder: Northwest Energy Efficiency Alliance, 2011.
Nonaka, I. "The Knowledge Creating Company." Harvard Business Review (1991): NOV/DEC.
Northwest Energy Efficiency Council. "Energy Conservation Skills Inventory." n.d. Building Operator Certification. 29 August 2011 http://www.theboc.info/pdf/ENERGY-CONSERVATION-SKILLS-INVENTORY_FORM_distr.pdf.
Richard A. Danks, NASA Glenn Research Center. "Closing the Gap: High Performance Buildings Require High Performance Technicians." ASHRAE Annual Meeting. Albuquerque, NM, JUNE 2010.
U.S. Council for Energy-Efficient Manufacturing. System Assessment Standards. 15 June 2011. 25 August 2011. http://www.superiorenergyperformance.net/system_assessment_standards.html.
U.S. Department of Energy EERE. "Cook Composites and Polymers Company Achieves Superior Energy Performance Gold Certification." JUNE 2011. Superior Energy Performance. 25 August 2011. http://www.superiorenergyperformance.net/pdfs/ccp_sepcasestudy_itp3.pdf.
—. "Freescale Semiconductor Successfully Implements an Energy Management System." JUNE 2011. Superior Energy Performance. 25 August 2011. http://www.superiorenergyperformance.net/pdfs/freescale_case_study.pdf.
United States Office of Personnel Management. "Fact Sheet on Certification and Certificate Programs." 13 August 2008. Chief Human Capital Officers Council. 25 August 2011 http://www.chcoc.gov/Transmittals/Attachments/trans1489.pdf
Washington State Board of Community and Technical Colleges . "Developing, Integrating and Assessing Skills Standards Guidebook Volume 1." 1999.

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