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WINTER/SPRING 2015

Managing Energy Efficiency Mandates

The Energy Independence and Security Act of 2007 (EISA) set energy efficiency goals for all federal agencies, with the baseline year of 2003 and a start year of 2006 going through 2015 – a ten-year horizon. It was an aggressive but doable list of goals. At Marine Corps Base Camp Pendleton in San Diego, California, the facilities maintenance department (FMD) committed completely to these goals and is on target to meet those now near-term targets in fiscal year 2015, which means by the end of September.



Atop a parking garage near one of the living quarters is one of the many photovoltaic arrays at MCB Camp Pendleton.

Mandate: a 3 percent per year average reduction in electricity demand.

Mandate: an average water-use reduction rate of 2 percent per year over the same period (this was actually done by executive orders from both presidents Bush and Obama, in conjunction with EISA's goals).

Mandate: a reduction of 3 percent per year in greenhouse gas (GHG) emissions for the period, reducing scope one, two, and three emissions.

Mandate: from the Secretary of the Navy's office, a goal to have renewable energy sources at 50 percent by 2020.

Camp Pendleton, the major West Coast base of the US Marine Corps was built in 1942 and is about 200 square miles in area, 17 of those along the coastline, and is one of the last major areas along the southern

California coastline to remain relatively undeveloped. The camp has year-round training of service men and women, for marines as well as other branches of the military and thus encompasses a variety of operational and environmental challenges.

Camp Pendleton's FMD staff took advantage of 42 U.S.C. (US Code) 8256, which encourages federal agencies to enter into utility energy service contracts (UESCs) as "an effective means to implement energy-efficiency, renewable-energy, and water-efficiency projects," according to the Energy.gov description. In such contracts, utilities "will provide the analysis, design, and installation and when necessary, arrange financing." It further states that UESCs can be entered into with no initial capital outlay, but can also employ strategic use of funding.

Combining Investment with Training

With the government mandates put in place, FMD at the camp partnered with a utility planner to form an Energy Team to develop a strategic energy plan to achieve the proscribed goals. Now as the ten-year plan is winding down, let's look at some of the ways they have achieved these goals.

Leading the Camp Pendleton Energy Office is Energy Manager Jeff Allen, who

is the military liaison with the lead energy consultants for projects, Charles Howell and Kerry Hamamura. The camp has several hundred varied facilities – living quarters, administration buildings, training areas, etc. – so developing a plan was crucial to targeting potential areas of efficiency.

One of the key elements initially was educating base occupants to have an awareness of saving energy, according to Howell. The Department of Defense has a "scoring" system to determine how bases are performing relative to each other. They do not use the scoring system to penalize bases, but do acknowledge and incentivize good performance – more of a carrot than a stick approach, and also something that can give rise to healthy competition, as well as a no-cost/low-cost solution for savings.

The measure used is kWh/square foot, or energy intensity, and even within the base, that measure is used to show different area managers their facility's energy use relative to the rest of the base facilities. It is also detailed enough to show them what within their own facility is a relative energy hog.

With the economic downturn of 2008 and the subsequent ARRA (American Recovery and Reinvestment Act) stimulus package, funding became more readily available. Projects

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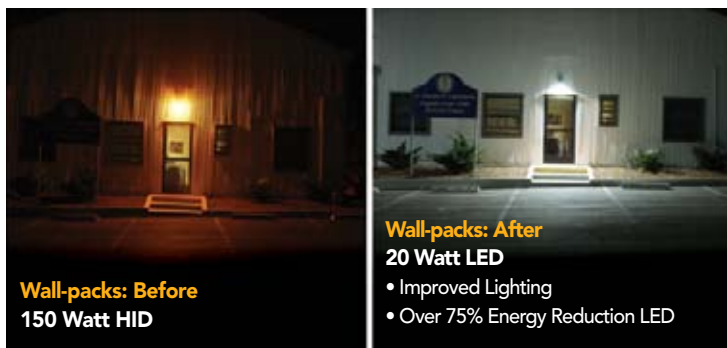
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came far and fast in lighting, HVAC, water conservation, smart metering, pump or motor replacements – all chipping away at energy and water use. Costs were also defrayed by taking advantage of energy efficiency rebates and incentives provided by local utility San Diego Gas & Electric's business programs (EEBR and EEBI).

They also delved into renewable energy sources, as highlighted in the last issue of the BOC Bulletin, which noted the ground-up construction of a four-story living quarters facility. The complex uses concentrate (CPV) and traditional (PV) photovoltaic systems, as well as a geothermal HVAC system and an energy storage system. Construction finished this past fall and the facility it is almost completely energy self-sustaining.

Recognizing the varied ages of the buildings, from WWII-era to about 4 million square feet built just within the last couple of years, they realized they needed to invest in training as well. Both BOC Level I and Level II series have been held at the camp and over two dozen facilities management and maintenance people have completed both trainings.

Newer buildings are required to be LEED Silver Certified at a minimum but Camp Pendleton has several that are Gold (25) and even Platinum (18) Certified. But, as Howell notes, they don't run themselves and have to be constantly monitored by trained FMD staff. "The combination of the new construction and the fine-tuning of equipment in existing buildings gives us the leverage to achieve our energy intensity goals."



A Few Project Details

Lighting is certainly where you seem to get the most bang for your buck from an efficiency standpoint – the "low-hanging fruit" highlighted in BOC training. Lighting technology keeps improving so not only are the options more efficient, the color renderings, long a main complaint of build-

Projects in Progress	Est. Annual Savings	Simple Payback	SIR (Savings to Investment Ratio)
Boiler Retrofits 15 Facilities	\$423,450	9.67	1.67
Weather Stripping & Door Closures 112 Facilities	\$78,350	8.1	2.4
Installation of Window Film 81 Facilities	\$163,100	9.04	1.63

Lighting Projects Completed	Projected Annual Savings	Savings in Percentage
Replace 150-watt HID Exterior Wall Packs with 20-watt LED	\$56,135	75%
Replace Exterior HID Security Lights with LEDs	\$273,102	60%
Retrofit 32-watt T8s with 25-watt T8	\$137,133	22%
Replacement of 6 Air Compressors	\$37,249	64%
Replace 2x2 U-Tube Fluorescents with 2x2 LED	\$122,801	40%

ing occupants, are much more pleasing, and costs have lowered.

With ARRA funds awarded in 2012 for 2013/2014 projects, several light change-outs were implemented with excellent savings results (See Table 1 above.) and dramatic improvements in the quality of the light (See below.).

The next few months promise the completion of boiler retrofits, weather stripping and door closures, and installation of window

film – all with solid paybacks. (See Table 2 above.)

As a training camp, barracks obviously make up a good deal of the camp's buildings. Water conservation measures undertaken in early 2014 at 248 facilities saw an annual savings of over

\$1.23 million, with the replacement of more efficient fixtures for toilets, urinals, low-flow showerheads, and flow controls on existing fixtures.

The camp even sports 30 electric vehicle (EV) charging stations, which support both military electric vehicles and personal EVs of

the camp's occupants. The list goes on, and will continue to go on.

What's Ahead?

While this ten-year cycle of mandated goals comes to a close for Camp Pendleton at fiscal year 2015, that doesn't mean that there aren't new targets beyond the already established target of 50 percent renewable energy by 2020. They never wind down. They just move on to the next project. The Base Energy Team has completed 20 UESC projects and is now working on the next phase (21), with projects submitted to the Marine Corps Installation Command (MCICOM) for future funding.

One project they are looking into for renewable energy is a 15-megawatt photovoltaic installation. As noted at the beginning of this story, the base is about 200 square miles and much of that is undeveloped so that there are many environmental considerations to be weighed. As one of the minimally developed parcels of land in the area, there are many endangered species that settled there for "safe haven" as development along other coastal areas boomed.

So, as with all other efficiency projects, the Camp Pendleton Energy Office will continue to make strides, analyzing projects, considering results, and managing the facilities and land to the highest standards they can.

BOC Grads Making a Difference

An Unexpected Turn into Facilities Management



Tracey Rohr
Facility Manager

BOC grad **Tracey Rohr** came to her position as facilities manager at the Menominee Casino Resort in Keshena, Wisconsin in a round-about way. She had been working there with dual roles, as poker dealer and supervisor/administra-

tive assistant in the casino. After a few years, Rohr left the job to pursue her bachelor's degree. Six months later, in 2007, she found that while she wanted to continue her studies, she needed a job. There was an opening for an AA in the facilities department and the position would not only allow her to get some needed income but also gave her the time to continue her education.

During her initial tenure in the position, while not "hands on" in the FM sense, she learned a lot. "I had the coolest boss ever," she says. "He knew the building complex inside and out but wasn't as strong on the admin side, so we traded lessons: computer lessons for lessons on 'how things worked' – motors, heating and cooling systems and the like."

Rohr readily admits she had no knowledge of building systems until then. "To be honest, I didn't even know the equipment on the roof was for heating and cooling!" But she is a quick learner and had a good teacher. When he left, his replacement abruptly quit after a short time, leaving quite a vacuum. She had finished her BS degree in business administration and was continuing on for an MBA. Having shown supervisory skills previously and with the four years of office experience in the FM department, in September 2011 the company offered her a six-month interim position as facilities manager for the casino resort. She is still there.

Rohr had been observing the department at a time that coincided with her BS and MBA education and had lots of ideas for improvements. She applied much needed work streamlining and developed processes, writing a handbook with rules and policies and, in general, organizing her team. "They wanted me in a management role because while I can't really get in there and fix things, I can lead a team," she notes. "We have a fantastic staff of

"We have a fantastic staff of 13 maintenance technicians that includes an electrician, HVAC tech, and a carpenter so we can do a lot in-house."
– Tracey Rohr

13 maintenance technicians that includes an electrician, HVAC tech, and a carpenter so we can do a lot in-house."

Then she started tackling various energy efficiency measures. She worked with local utility, Alliant's representative, Mary Brott, to monitor utility costs and look for areas of improvement. Brott, as Alliant's liaison to Wisconsin's Focus on Energy (FoE), helped Rohr seek out incentive and rebate opportunities offered by FoE. She also recommended BOC training to Rohr, and successfully lobbied Alliant to assist her with tuition for the program. Rohr completed her training just over a year ago and credits the training with making her aware of the big picture and the interdependencies of systems. "Because of the BOC classes, I know how to ask the right questions."

Over the last year or so, the team has implemented several energy projects:

- **lighting change-outs from T-12s to T-8s, and incandescents and fluorescents to LED**
- **temperature controls**
- **a complete Preventive Maintenance schedule**
- **and finishing up water saving measures, including replacement of toilets, faucets, and shower heads.**

The average ROI for the lighting changes is 1.6 years with an annual kWh saving of 56,845. The most recent lighting project included an approximate 35 percent rebate from FoE. Average ROI for the water measures is 1.2 years, with a gallon per month savings of 270,547, a 26 percent savings on water and sewer utilities when complete.

Another BOC advantage Rohr found was peer networking. Portions of the Midwest had a huge propane shortage last year due to a damaged pipeline and LPG prices skyrocketed. She reached out to people she had met in class to learn where they were sourcing their propane, and how they were handling the shortage – for example, what types of building settings they were using, what temperature levels. And they made it through the shortage, re-upping the delivery contract with price safeguards in place.

Rohr's quest for energy efficiency is ongoing. She has numerous projects in the pipeline, one of which is working with Brott on another FoE-incentivized project to replace the evapo-

rator coils in the casino's primary restaurant along with adding kitchen hood ventilation controls, and ECM (electronically commuted fan) motors. Any future replacement purchases will be Energy Star® for the refrigerators, freezers, and coolers throughout the complex, a facility that includes a 103-room hotel, convention center, casino and games rooms, a huge swimming pool, restaurants, and a gift shop. It's quite the variety of demands, especially since Rohr is also the building & grounds committee chair, the safety committee chair, and head of the housekeeping department.

Rohr continues to put more on her plate: "I have also begun to look into guest room energy management for the hotel and am very interested in benchmarking and completing a bi-yearly energy audit to ensure that we are utilizing best practices in energy management."

"This wasn't really my plan," Rohr says now. But as Brott notes, "I'm lucky to have such a dynamic woman working facilities in my territory! Tracey's MBA and the BOC technical training have equipped her with a unique combination of skills that is really an advantage to someone in her position. To that, she adds an enthusiasm for saving energy and money."

So sometimes plans take a turn. Those unexpected turns can be very fulfilling, to which Rohr's fervor for her relatively new position can attest.

Making Strides with Measured Steps



Luc Gelinas
Manager of Energy/
Operations

Luc Gelinas, manager of engineering/operations at The Hanover Insurance Group at its Worcester, Massachusetts location, has worked in facilities maintenance for 35 years, 25 of those with The Hanover. He completed his BOC Level I training in 2013 and, despite his years

of experience, believes the training gave him a fresh outlook. "BOC opens the eyes of facilities managers to new approaches," he notes. He also says that the training "sparks a lot of interaction among facilities people," echoing common themes of BOC grads' impressions of the training: a fresh approach and the cultivation of a professional network.

Gelinas recognizes that the technology in building systems is rapidly changing and so

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BOC GRADS (Continued from page 3)

weighs the benefits of improvements with the likely trajectory of developments. "As with all the technological advancements, especially in lighting systems, I am hesitant to move too quickly, as LED lighting systems continue to improve. As these advancements lower material costs and ROI and improve color rendition, it may well be worth waiting six months to prove itself out," he argues.

The Hanover facility in Worcester is a four-building complex of over 750,000 square feet with about 2,000 employees, 26 of those FM staff. The challenges are varied because the buildings range from being built in 1956 to 1989. While a lot of energy efficiency work has already been done, witnessed by the fact that the complex has been EnergyStar-certified for the past six years, it is an ongoing process.

Another important aspect of FM to Gelinias is customer satisfaction and buy-in and he is adamant that, "you need to do a good job on the front end of selling the concept of the changes you want to implement." He also feels it is important to "pilot" his projects in smaller areas of the facility to get feedback.

For example, they switched over to T-8 lighting about seven years ago. Now that these lighting systems, lamps, and ballasts are starting to need replacement, Gelinias has already engaged his utility energy rep at National Grid to see what options and incentives will be available to them.

"We are currently testing a dimmable lighting system that requires retrofitting our existing 2 x 4 foot troffer type fixtures that incorporate a special electronic ballast, control module and sensors for a truly custom dimmable solution," he says. While impressed with the level of granularity and control over individual fixtures the system has to adjust for different occupant preferences, he's not entirely convinced this is the way to go since, as powerful as it is, it's still fluorescent versus LED. But that is part of the process.

They test in limited areas to see people's reaction to the new products – is the light too harsh, too dim, too white? – and make decisions based on occupant reaction. He notes that piloting smaller areas for satisfaction

makes a lot more sense than making a blanket decision about the whole complex based on savings numbers alone, when there could be other options available.

The district is served by two utilities – NSTAR for natural gas, and National Grid for electricity. Gelinias also worked closely with his utility representatives to garner rebates for energy

projects. This past year, he completed the following five projects with NSTAR:

1. Performed a comprehensive survey of all steam traps: "We identified several failed steam traps that would have otherwise wasted energy and money by replacing and/or rebuilding all the steam traps in the system with less than a year's payback," he states. Hanover received a \$10,577 incentive from NSTAR to complete the replacement/rebuild of all steam traps.
2. Rebuilt vacuum pumps on the condensate return and trap systems: Annual savings have been calculated at \$25,000 in electrical consumption and heating fuel costs.
3. Completed the installation of a new insulated boiler feed water tank in the central heating and cooling plant, rebuilt vacuum pumps (vacuum assisted condensate return system), new feed water pumps with VSD control. The estimated water savings for the feed water tank project are calculated at approximately 1,000 gallons a day (during the heating season with usage based on nine months/four weeks a month/six days a week), which means a conservation of about 216,000 gallons of water annually.
4. Completed a compressed air leak survey of each mechanical room using the same technology used for the steam trap survey: Identified and corrected pneumatic air leaks on supply lines and actuators. Annual savings in electricity have been calculated at approximately \$4,000.
5. Received an \$8,300 incentive from NSTAR for the selection and installation of a highly efficient condensing gas fired boiler for their fitness center. This system serves the domestic hot water for both men's and ladies' locker and shower facilities with an estimated \$1,669 per year savings in natural gas. They could have completed a one-for-one replacement of the

existing boiler, but to Gelinias it made sense to opt for the high efficiency choice. Having taken the BOC made him interested in looking at more options. Since usage varies at the center, they didn't need the system to be up and running all the time and the new, two-stage boiler provides the highest efficiency. Calculated

ROI on this necessary replacement is at about 12 years. Without choosing the condensing two-stage water heating system option, the ROI would have been more like 18 years.

And things won't slow down in 2015. In addition to working with his National Grid rep on potential lighting improvements, Gelinias and his staff will also be working on three HVAC

projects where he estimates the savings will be over \$22,000 annually based on current rates.

While constantly looking for ways to both save energy and improve occupancy comfort, Gelinias likes to do his homework first. He works with staff, utility representatives, and building occupants to arrive at solutions amenable to all, intent on taking two steps forward, but wanting to avoid any half-steps back.

Preventive Maintenance: Take Time to Make Time



Barry Carver
Maintenance Manager

BOC grad, **Barry Carver** became the primary maintenance person for the Washington-Nile Local School District in West Portsmouth, Ohio, when the position opened up in 1993, after spending eight years as an HVAC installer and sheet

metal mechanic. He credits his HVAC background with giving him a broad knowledge of building operations because the variety of installations required a good familiarity with other building systems, such as electrical and plumbing. He notes that, "In HVAC, you kind of have to do it all."

In 2006, the district was looking for ways to save on energy costs and hired energy consulting company Four Seasons Environmental to assess its schools. Carver and the consultants went through every room in each facility and mapped out all the equipment related to maintenance tasking, and then entered the manufacturers' specs into a database to organize a preventive maintenance schedule.

Carver further customized the schedule based on equipment location to save time, which is huge considering he is the only person doing full-time maintenance, and also moved tasks around to accommodate seasonal changes. "Now I get a PM task list in my mailbox printed monthly and I start on the list as time allows, along with emergency repairs and tasks as they may come up," he says.

Carver also credits his earlier HVAC training with making him a proponent of the preventive maintenance the database represented, since much of that earlier work included scheduled service of the installed systems. Working with the school's administration to look into maintenance training programs, the energy consulting firm also recommended that he take BOC classes, which he did in 2007. The training fit in perfectly with his work philosophy, preferring to be proactive rather than reactive. Despite his already-solid experience in the field, Carver says the training encouraged him to look at

"BOC opens the eyes of facilities managers to new approaches ... the training sparks a lot of interaction among facilities people."

– Luc Gelinias

things from different perspectives – thinking outside the box and looking at the “whole facility” view.

This was helpful when it came to a major series of projects implemented more recently.

In late 2013, the district applied for and received funding from Ohio’s Energy Conservation Program, which allows funds to be borrowed to make efficiency improvements, using the cost savings to pay back the funds, without having to put it to a voter ballot.

The Washington-Nile Local School District has three schools serving 1,540 students in the elementary, middle, and high schools. Two of the older schools had failing boilers and outdated lighting. All ran on propane gas.

The administration had been looking at a conversion from propane to natural gas and had located a gas line about two miles from the district. Their project, begun in late 2013, also included the replacement of the two older boilers, lighting changeovers from metal halide to CFLs, and the installation of vending misers and motion detectors.

Local utility Pike Natural Gas agreed to run the needed natural gas line through the district (making it possible for local homeowners to hook up as well if they wanted to) and install the schools’ hook-ups. Once the lines were in place, a local company was set to do the necessary boiler work at the schools. “Barry was a key part in getting the school hook-ups implemented and the boiler conversions and replacements, taking a very active role in overseeing that the work was done right,” notes School District Superintendent Jeff Stricklett.

District Treasurer Sherry Patterson said that the savings from the installations alone saved an estimated \$80,000 in energy costs and that in a year-on-year comparison of fuel costs, the conversion to natural gas use at all three schools saved an estimated \$60,000, about 30%, just in fuel costs. They also had some help from local electric utility American Electric Power (AEP), which came up with almost \$50,000 in lighting rebates. Per the HB 264 guidelines, Patterson hopes to have the savings pay off the funding within ten years.

In January 2013, the district also worked with Ketchum & Walton of Cincinnati to change air handler filter systems from box filters and pre-filters to a pocket-type filter, which reduces energy used by the fan motors and maintains filter efficiency.

While preventive maintenance items are scheduled in advance, there are always things that come up. The school district also has a Maintenance Track program that allows staff and faculty to submit work orders for various

needs. Carver encourages all staff to enter maintenance requests in the tracker because it creates a record. But he also has his own backup. “For over twenty years, I’ve carried a notebook around with me to jot down notes on what tasks might come up, whether it’s anything from kitchen equipment failure or a chiller condenser fan failure. I still have those notebooks at home – it’s a stack about two feet high at this point – and I occasionally refer back to them,” Carver happily declares. “I’m kind of old school in some ways and like to do things right and thoroughly.”

Between his preventive maintenance scheduling plan, the Maintenance Track submissions, and his “to-do” notebooks, Carver seems to have his facilities covered pretty thoroughly. He likes to stay ahead.

A Teacher Turns Energy Manager



Chris Bryson
Energy Manager

In 1997, **Chris Bryson** had been teaching seventh and eighth grade science in the Bibb County School District in Georgia for seven years. The district had contracted with a third party energy management advisory company to get a handle on their usage and make appropriate improvements. One of the company’s suggestions was that they hire a full-time energy manager. Rather than hire someone from building operations, the company stipulated that it should be someone who had classroom experience, reasoning that since the position would be a liaison between operations and the faculty, staff, and students, it would be best to have someone familiar with how the facilities worked from the user perspective.

Bryson thought it would be an interesting change of pace for a couple of years and now, 17 years later, he’s still working to improve the efficiency of the Bibb County School District, which serves 39 schools with an estimated 25,000 students and 3,500 employees, 40 of those in facilities maintenance. It is a full service FM department, with electricians, plumbers, painters, HVAC techs. “We try to contract out as little as possible,” says Bryson.

Early on in his role as the energy manager in the late 1990’s and early 2000’s, Bryson was focusing more on working with the staff at each location to change their day-to-day behaviors. The goal was (and still is) to support

the instructional process in as efficient a way as possible from the standpoint of utility usage. There was also a push to increase the number of facilities that were under some sort of building management system. Approximately one-third of the facilities had a very basic DDC control system in place, but Bryson and the district worked over the next decade to push this to over 90 percent.

In 2012, Bryson learned from a colleague in the Construction and Capital Improvement Office that grant money was available for a BOC program that was being offered by Gwinnett Technical College and the Georgia Environmental Finance Authority. When he completed his training, the district had again contracted with an energy management company, this time to do an updated assessment and plan for the schools.

Working with the company, the facilities team spent the first six months creating the baseline profile for the three years prior to compare usage after the various recommended upgrades.

The main upgrade, for which Bryson was the project manager, was to be lighting retrofits throughout the schools. From March 2012 through August 2013, the staff worked non-school hours to remove over 100,000 T-8 lamps, rewire as needed, and replaced them with some 82,000 LED lights. “The new LED lamps provide as much light as the T-8’s, but at much lower wattages,” notes Bryson. “Typically, four 32-watt lamps and the ballast were removed and replaced with three 15-watt LED lamps in a standard 2x4 ceiling fixture.”

They also replaced metal halide lighting in the schools’ gymnasiums with induction fluorescent lighting. Here, the wattage could also be cut by over half, with a typical 250-watt halide lamp reduced to 120 or a 400-watt one to 200 - or even 160-watts.

“The new LED lamps provide as much light as the T-8’s, but at much lower wattages. Typically, four 32-watt lamps and the ballast were removed and replaced with three 15-watt LED lamps in a standard 2x4 ceiling fixture.”

– Chris Bryson

Annual savings of about \$600,000 or more due to wattage reduction was estimated, although usage during the period climbed, as did rates, so a comparison isn’t really apples to apples. Upon completion, a comparison of August 2013 with the baseline of August 2011 revealed that consumption was reduced by 334,803 kWh, or 8.6 percent. The

school district also received lighting rebates from Georgia Power totaling \$262,734, approximately 44 percent of the materials costs.

The district’s contract with the lighting vendor includes a 1 percent overstock and a ten-year replacement guaranty, so not only do they

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BOC GRADS (Continued from page 5)

have immediate replacements on hand for any faulty lamps, they also get replacements for free. While they don't anticipate many failures, it's good to have the back up and it also means that they won't be purchasing any lights for the next decade.

Paid for by the school district's general budget, as well as being financed, the lighting project has an estimated payback of eight to nine years. The savings generated through the upgrade should meet or exceed the financing costs annually, so there is little impact to the district's overall budget during this period of time.

The extensive school district always has ongoing projects: replacing older schools with new ones, renovations, and consolidating smaller, less efficient schools into more operationally efficient ones.

Bryson notes that, "The operations department staff has been brought into decisions on these projects far more than we used to be. The Construction and Capital Improvement Office has really helped us a lot and we have a voice in the five-year plan for the district. The lessons learned in the BOC courses can be a great aid in evaluating and designing features for these new projects."

With his longstanding interest in the energy manager's position and his enthusiasm for the positive changes he can help make in the school district's operations efficiency, it sounds as if the classroom will have to wait a little longer before Bryson returns.

Moving Forward in Building Efficiency



BOC grad **Daniel Hansen** grew up in equipment maintenance. In high school, he started working with his father, a refrigeration technician, at the same time taking classes toward an associate's degree in air conditioning and refrigeration at Utah Valley University. Upon

Daniel Hansen
Director of Plant Operations and Maintenance

completing the degree, he started a full-time job doing preventive maintenance on UVU's HVAC system, gradually developing more skills, as he earned a bachelor's degree in information technology. Currently, he is working on a degree in mechanical engineering and a master's in management leadership.

He likes to learn, likes results, and likes saving energy. As a result, Hansen is now director of plant operations and maintenance at

Salt Lake Community College (SLCC), which has about 14,000 students over seven campuses of various sizes covering about 2.5 million square feet total.

Hansen heard about BOC when the college was asked to host a training series a couple of years ago by the Intermountain Building Operators Association (IBOA). For hosting, IBOA gave the college one free spot in the classes so he decided to take it. "I already had a really good understanding of building systems, but BOC exposes people to thinking more outside the box in terms of energy efficiency," says Hansen. "It's a good vehicle for getting people to understand BAS systems." He has since had five of his staff go through the training and plans to check out Level II.

The energy management department is also, logically, part of plant and operations and they have taken on a number of energy-saving projects recently. With incentives from local utility Rocky Mountain Power (RMP), five of the campuses received exterior lighting retrofits.

Bret Carlson, senior energy efficiency project manager for RMP, has worked with the department. "It has been a pleasure working with Salt Lake Community College's energy team and watching them build a culture of efficiency across their campuses. They are a forward-thinking organization that realizes the many benefits of energy efficiency." Carlson also notes that by utilizing each of the offerings within the wattsmart Business program, the college has been able to take advantage of incentives, long-term energy savings, and reduced maintenance costs, all of which allow them to remain a leader in their industry.

In the parking lots, they replaced 369 old high-pressure sodium fixtures with 268 new LEDs, for an estimated annual savings of 600,000 kWh, or \$25,000 at current rates. Retrofits of walkways and wall packs fixtures at the five campuses should yield approximately 390,000 kWh in energy savings, or \$16,000 annually at current rates.

For campus interiors, they replaced 366 fluorescent lamps and 100 lighting fixtures to LED lighting as well, with a projected saving of 225,000 kWh annually, and also installed efficiency modulators on 50 vending machine, saving an additional 6,000 kWh per year.

"We used a combination of two different options for incentives, option A prescriptive would give us \$100/fixture and \$10/lamp, and option B, a bill credit, would give us up to 80 percent of applicable costs applied as a discount to your power bill over seven to ten years," Hansen explains. The combined savings annually is at over \$50,000 per year,

with rebates from RMP of over \$400,000 between the two options, some of it immediate and some over the coming years, per option B.

Another big project is at the central plant on their redwood campus where there was next-to-no automation. "We are now staging the chillers and pumps according to their load and speed for optimum performance," says Hansen. "All the pumps, towers, and chillers now have VFDs." He further explains that they will stage them based on outside air, building demand from BTU meters, historical data, and weather data, and run them in the most efficient points of operation. "The pumps will run based on differential pressure and the towers will ramp based on temperature set point. Most set points will be reset and variable."

Hansen estimates total cost for the project to be about \$400,000. RMP supplied a rebate of over \$45,000 and the expected annual energy savings of 303,440 kWh, or about \$21,600.

Ever interested in new ideas and technologies, Hansen and his team are in the process of implementing a building analytics tool alongside his BAS. He believes such tools will be huge in the coming year because of their more proactive building management abilities. "A BAS can tell you if a fan isn't running when it's supposed to be, but it can't tell you that the hot valve and the chill valve are both open at the same time," he explains. The tool can override the BAS if it finds something amiss in the building's system, and then sends an email to let the building operator know what it has done.

This is still in its initial setup but Hansen is eager to use it to full potential. "It's a lot of fun. I really enjoy what I'm doing!" he notes. Learning and saving energy – he makes it fun.

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BOC Now a Preferred Program for GSA Employees

The Northwest Energy Efficiency Council (NEEC) has been awarded a Facilities Maintenance and Management – Schedule 03FAC contract by the U.S. General Services Administration (GSA), the procurement arm of the federal government.

GSA establishes long-term government wide contracts with commercial firms to provide access to millions of commercial products and services at volume discount pricing. NEEC's inclusion as a GSA Schedule 03FAC vendor enables all government agencies to obtain the BOC training at approved pricing and with license terms from a trusted vendor.

The awarded five-year contract is the culmination of a rigorous process in which the GSA carefully evaluates companies to determine their proficiency and suitability for providing products and/or services to the Federal government. The assessment covers an array of an organization's capabilities, including organizational structure, performance history, customer satisfaction, and other criteria.

"NEEC is very pleased to make our services available through the GSA," said Stan Price, Executive Director of NEEC. "By streamlining and standardizing the procurement process, our GSA Schedule 03FAC contract helps NEEC and prospective government clients focus on what matters most, training personnel on energy efficient building operations to reduce energy consumption and utility bills for all agencies."

Federal, State, and local agencies can obtain information on the GSA Advantage web site at: www.gsaadvantage.gov (search for Contract Number: GS-21F-093BA) or by contacting NEEC and the BOC program directly at 1-877-850-4793.

NEEC would also like to acknowledge the Northwest Energy Efficiency Alliance (NEEA)

for supporting this initiative through financing made available through Northwest utilities. NEEA is a longtime supporter of NEEC's training programs and is an important energy efficiency advocate in the Northwest.

NEEC Presents at BECC Conference

The BOC program's Manager of Training Olga Gazman presented at the Behavior, Energy & Climate Change (BECC) Conference held in Washington, D.C. in early December 2014 on the subject of, "Unlocking Behavior-Based Energy Savings through Employer Engagement," a talk that examined the significance of employer attitudes about continuing education for their maintenance staff in the area of energy efficiency.

The BECC Conference examines "the behavior and decision-making of individuals and organizations and on using that knowledge to accelerate (the) transition to an energy-efficient and low-carbon future." Gazman's talk focused on a study that measured the rate at which BOC-certified operators maintained their credential though professional development and the role O&M management played in encouraging or discouraging their employees in doing so. Certificants up for maintenance renewal indicated that support from supervisors was a significant factor to them for keeping up certification and that continuing education or energy-efficiency projects required for maintenance had excellent savings results.

According to Gazman, "This study contributes to the understanding of how employer engagement can influence employee behavior and offers a model for evaluation of behavior-based measures. What we learned here can help inform best practices for training and certification of personnel programs and professional development policies within the organization."



National Conferences & Symposiums 2015

National School Plant Management Association Annual Conference

Myrtle Beach, South Carolina • February 22-25, 2015
MORE INFO: www.nspma.org

NFMT (National Facilities Management & Technology) Conference/Expo

Baltimore, Maryland • March 10-12, 2015
MORE INFO: www.nfmt.com

IFMA Facility Fusion 2015 Conference & Expo (Canada)

Vancouver, British Columbia • March 10-11, 2015

IFMA Facility Fusion 2015 Conference & Expo (United States)

Orlando, Florida • April 21-23, 2015
MORE INFO: www.ifma.org

International Summit on Health Facility Planning, Design & Construction

San Antonio, Texas • March 15-18, 2015
MORE INFO: www.ashe.org/PDC/

Association of Energy Engineers (AEE) Conferences & Technology Expos

Globalcon 2015

Philadelphia, Pennsylvania • March 17-18, 2015

West Coast Energy Management Congress (EMC)

Long Beach, California • June 3-4, 2015

World Energy Engineering Congress (WEEC)

Orlando, Florida • September 30-October 2, 2015
MORE INFO: www.aeecenter.org/Shows/

BOMA 2015 International's Medical Office Buildings & Healthcare Facilities Conference

Cleveland, Ohio • April 29-May 1, 2015
MORE INFO: www.boma.org

NFMT (National Facilities Management & Technology) High Performance Buildings

Fort Worth, Texas • June 2-3, 2015
MORE INFO: www.nfmt.com

American Public Power Association (APPA) National Conference & Public Power Expo

Minneapolis, Minnesota • June 5-10, 2015
MORE INFO: www.publicpower.org/NationalConference

BOMA 2015 International Every Building Conference & Expo

Los Angeles, California • June 28-30, 2015
MORE INFO: www.boma.org

American Society for Healthcare Engineering (ASHE) 52nd Annual Conference

Boston, Massachusetts • July 12-15, 2015
MORE INFO: www.ashe.org/annual

Trade shows, conferences, and symposiums are a great way of keeping up with trends in the industry. Attendance is also another way to earn certification maintenance points, with one given per event attended.

Grand Opening of the BOC's Online Shop!

Come check out our new online BOC Shop! We've got T-shirts, polos, mugs, and hats that highlight your well-earned BOC credential – as well as the most current BOC handbooks to keep you up-to-date with the latest in the field! Visit shop.theboc.info for available products or contact brittany@putnamprice.com for more information.



In previous issues of the BOC Bulletin, we have highlighted informational articles from the BetterBricks website dealing with performing night walks for your building (summer/fall 2011) and the "Top Four Strategies for Energy Savings" (summer/fall 2009). BetterBricks is always updating its site information and now they have a six-part video series on night walks, as well as an addition to the four strategies for energy savings: building envelope. The BOC quiz that you can take for credit towards your yearly certification maintenance will be based on the building envelope information below, as well as the six-part video series – each of which is no more than one or two informative minutes. Links to both the videos and more great information from the BetterBricks site is at the end of this piece, which was taken from the new "Top Five Strategies for Energy Savings."

Developing a Building System Operations Map

Uncovering problems requires a thorough understanding of how a building is used, operated, and maintained. One way to obtain that understanding is to develop a Building System Operations Map.

A Building Systems Operations Map documents the current conditions, focusing on the envelope, scheduling, and on targeting HVAC systems and equipment (see below) where common opportunities are found in similar buildings and systems. The map clearly identifies areas for immediate improvement (e.g., changing thermostat setpoints or equipment schedules) and provides the basis for additional evaluation. When completed, the map should document the current uses in the building and how well the operation of the energy systems matches the actual use.

The map should identify major energy-using systems and occupancy types by area. Developing the map requires reviewing the building envelope, utility bills, as-built drawings, and sequences of operations; interviewing building operations and maintenance staff; and cursorily reviewing systems and equipment with a focus on targeting particular HVAC systems and equipment for potential energy savings.

Outline of a typical Building System Operations Map:

For **building envelopes**, identify:

- Perimeter doors with poor seals or no seals, poor closures
- Duct penetrations (supply, exhaust, and relief) with no motorized dampers, or failed dampers
- Pressurization fans in high-rises with backdraft dampers or leaky motorized dampers
- Architectural details that lack proper or failed sealants

For central **boilers, chillers, and cooling towers**, identify:



Screen capture from 'An Elevator Shaft Shouldn't be a Wind Tunnel'. One of six BetterBricks' Night Walks videos.

- Operating schedules and sequences of operation
- Large pumps and circulation loops served
- Fan systems served (terminal units and air handlers)
- Major energy systems served (e.g., water heating, sterilizers)
- General maintenance practices and equipment condition

For each major **fan system**, identify:

- The operating schedule and setpoints
- Occupancy schedule of the area(s) supplied, noting any areas with special extended operating hours
- Any capability of terminal units or baseboards to run independently of main fan
- Sequence of operations for terminal units/baseboard
- Sequence of operations for air handler with a focus on control of outside-air damper, mixed-air temperature, and supply-air temperature

- General maintenance practices and equipment condition

For each major **occupancy**, identify:

- Occupancy schedule
- Lighting schedule and control method
- Equipment schedule and control method

Document **on-going problems** and what building operators are doing to compensate:

- Undersized equipment
- Oversized equipment
- Spaces that can't maintain temperature settings
- Building pressurization problems
- Major HVAC equipment with higher failure rate than typical

Targeting the Envelope

The building envelope is the largest single component of any HVAC system. It has to be able to contain the air being conditioned by the HVAC system in order for the HVAC system to operate at its highest potential efficiency.

Envelope Integrity

The cheapest energy is that which you do not use. Allowing conditioned air to escape the envelope in an uncontrolled manner guarantees high energy bills and tenant comfort issues.

Visitors will complain when envelope leakage causes the lobbies to become excessively negative, bringing cold drafts deep into the building and up the elevators. In extreme cases, the elevator doors can be hard to close against the pressure differential across the doors. Buildings without revolving doors or motorized ADA doors can experience problems with tenants even being able to get into the building!

Leaky exterior doors or roof hatches at the roof produce stack effect in the stairwells, which can prevent doors on lower floors from completely closing after being used. This allows for leakage from the specific floor, plus creates a security concern.

Elevator machinery rooms that are naturally ventilated with louvers and exhaust fans are prime locations for losing air. Typically the worst case is at night when there is no one around to observe how the dampers are reacting to differential temperatures. Stack effect can easily lift backdraft dampers. Adding motorized dampers, or even better, adding mechanical refrigeration can allow the space to be sealed hermetically, preventing air losses. If the facility has water-source heat pumps, adding a unit will allow the rejected heat from the machinery to be brought back into the building HVAC system for heating in other parts of the building.

Life safety pressurization fans are also a source of problems for several reasons. Low leakage motorized dampers should be installed at every unit, regardless of location in the building. A time delay needs to be programmed, or control can be through an end-limit switch in the damper actuator, which prevents the fan from starting before the damper is wide open. Dampers should be checked quarterly to ensure they stayed closed and that there are no failed operators or slipped linkages. Life safety dampers are designed to fail open.

For buildings with associated garages, look for air transfer between the garage and building. Sometimes the garage exhaust fan system can actually pull conditioned air from the building. Make sure vestibules and doors are tightly fitting with full seals. Conversely, a building under negative pressure in the main lobby due to stack effect can pull garage air

into the building, bringing carbon monoxide and carbon particulates along.

Every CFM you prevent from escaping the building in an uncontrolled manner reduces the amount of air you need to condition, regardless of whether it came in through the front door or through the air handlers.

The online version can be accessed by going to <http://www.betterbricks.com/building-operations/tools/common-opportunities-top-five>.

The six-part Night Walks series can be viewed at <http://www.betterbricks.com/building-operations/building-night-walk-video-series>.

You can earn one maintenance point towards maintenance of your BOC certification by taking a quiz based on the material in this article and the associated videos. Go to www.theBOC.info to take the quiz.

REPLACING T8 LAMPS?

Switch to Low Wattage T8s!

- Extra Long Life
- Lower up-front cost compared to LED fixtures
- Compatible with existing electronic ballasts
- Lower operating costs if switching from 32W T8s

Annual Energy Cost Savings
100 Two-Lamp Fixtures Using Low-Wattage Instead of 32W T8s

Usage Type	28-Watt T8 Cost	25-Watt T8 Cost	Savings
Office - 2800 hour/yr	\$134	\$218	\$84
Retail - 4368 hour/yr	\$210	\$341	\$131

BETTERBRICKS
The Green Building Institute

This section highlights new or updated technologies that, while might not yet be commercially available or as yet viable for your facility, are on their way to becoming practical applications – technologies to watch.

BIG DATA ANALYTICS

An online article published this past November at FMLink.com addresses the enormous amount of building data that is now captured and how it can be harnessed to analyze more effective ways of operating facilities.

Unlocking the Role of Big Data in Facilities Management, written by Frost & Sullivan for FMLink, presents the case for the value of these new, sophisticated systems:

“Big Data can generate numerous opportunities in terms of complete energy solutions, business value, and optimum customer service satisfaction in any facility. Facility managers must leverage the entire plethora of collected data to make this possible. Hence, the idea is to create a structured way to collect, process, and analyze a set of data to better performance and increase functional capabilities of the facility.”

To read about the increasing potential of ever-evolving big data analytics, simply go to www.FMLink.com and search for “Big Data Analytics” or from the home page, go to Features in the left menu bar and click on “Analyst Insights” where the articles will be listed by title. FMLinks.com has many other articles of interest and resources for those in facilities management. Check some of those out as well!

Check out BOC's Technical Webinar Series!



The BOC web site (www.theBOC.info) offers both live and recorded webinars, available for viewing at your convenience. Complete a quiz at the conclusion of the

session and you can earn 1.5 points towards maintaining your BOC certification. Visit the BOC site to check out current options of recorded webinars, as well as the schedule for 2015 live sessions.

New sessions for 2015 will cover:

- **Communicating with Your Boss** (Tuesday, February 10)
- **Communicating with the Boss' Boss** (Thursday, March 12)
- **Communicating Energy Performance in Your Organization** (Wednesday, April 22)
- **Communicating with Building Occupants** (Wednesday, May 20)

Diagnostic Tools Series:

- **Tool Kit Stories from BOC Graduates** (Thursday, September 17)
- **What's Your Favorite Diagnostic Tool?** (Thursday, October 22)

New to BOC?

Register for a FREE Informational BOC Webcast:

BOC Informational Webcasts are for newcomers to the program. Learn about Level I and Level II course topics, schedules and certification requirements in detail. Listen in and find out who benefits by attending BOC training and how graduates are improving their facilities.

Informational webcasts last approximately one hour, starting at :

- 8:30AM - 9:30AM (PST)**
- 9:30AM - 10:30AM (MST)**
- 10:30AM - 11:30AM (CST)**
- 11:30AM - 12:30PM (EST)**

The next live broadcasts for 2015 are scheduled for **February 4th, March 11th, August 12th, and September 16th**. Please note that pre-recorded webcasts can be downloaded from the BOC website 24/7

To sign up go to: www.theBOC.info

It's Maintenance Time!

To maintain BOC certification, graduates must accumulate points each year following a full calendar year after their certification. Level I maintenance requires five points each year and Level II requires ten. Points may be earned as follows:

- Continued employment in building operations **2 points/year**
- Continuing education in building operations..... **1 point per hour of classroom time**
- Energy efficiency projects completed at your facility **Up to 11 points/year**
- Membership in a building operations association **1 point/year**
- Offices held in membership associations..... **2 points/year**
- Awards received for efficient building operations **2 points/award**
- BOC newsletter tech article quiz (see page 8 for details) **1 point/passed quiz**
- Completion of an energy consumption benchmark for the previous twelve-month period using **Energy Star®** Portfolio Manager or alternative energy accounting tool **3 points/year**
- Enrollment in a BOC webinar and completion of its quiz (See webinar announcement on this page) **1.5 points/passed quiz**

BOC graduates whose certification expires March 31, 2015 should have received their applications via email and US mail the week of January 5th 2015. To complete the application, certificants will report maintenance points (Level I maintenance requires five points and Level II requires ten) and submit the maintenance application fee (\$65 for either Level I or II).

Use our HELP Desk (1-877-850-4793), whose knowledgeable staff can address questions and assist with the maintenance application. **The deadline for application submission is March 31, 2015.**

Are you a Current Credential Holder?

WIN FREE STUFF! – Twice a year, current credential-holders may enter a drawing to win merchandise such as diagnostic tools and reference manuals. Our next drawing for merchandise from our new BOC Store is April 15, 2015.

Congratulations to our last winner, Miami County Maintenance Supervisor Dennis O'Dell of Paola, Kansas, the winner of a HOBO® data logger our October drawing!

ENTER TO WIN HERE:

<https://www.surveymonkey.com/s/BOCFreeStuff>

More Benefits for BOC Certified Operators

BOC graduates who maintain their certification receive the following additional benefit:

Webinar Discounts – a 20% discount on the BOC webinars series. Watch for details of new offerings at the BOC website (www.theBOC.info)

New Online BOC Course Launches in 2015

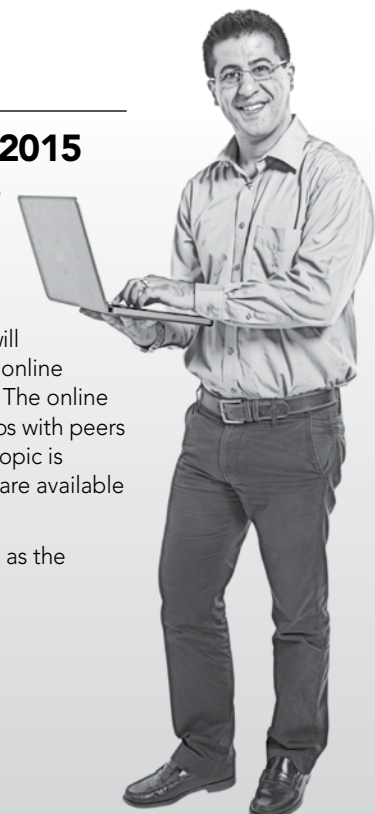
BOC is pleased to offer our first online blended learning course beginning in spring 2015. In response to growing demand, this course offers the convenience of one less day away from the facility, reduced travel time, and completion of the online modules at your own pace to meet the deadlines. The course is a blend of classroom and online learning. Seven class dates will be held in the traditional classroom setting, with one class held online in a live webinar in combination with multimedia presentations. The online class is instructor-led, and supported by online discussion groups with peers and the instructor, projects, and instructor feedback. The class topic is **BOC 1003 – Efficient Lighting Fundamentals**. Online lessons are available 24/7 for completion by their due dates.

Requirements for the blended learning course remain the same as the traditional course:

- **Attendance at all classes**
- **Completion of all project assignments**
- **Passing grade of 70 percent or better on all exams**

Course schedule and location:

<http://www.theBOC.info/wa/wa-schedule.html#seattle-15>



Find a BOC Training in your area

When such a high value is placed on energy efficiency, knowing how to run your building at its optimal performance is an essential skill set for building operators. Join the growing number of facilities professionals that recognize the value of BOC certification, both for their facilities and for their own career paths.

BOC Level I Certification

The Level I series comprises 74 hours of training and project work in building systems maintenance. There are six core courses, complemented by one supplemental class, which is selected by area program administrators to enhance the BOC training experience specific to their region of the country.

BOC Level II Certification

Level II has 61 hours of training and project work in equipment troubleshooting and maintenance. Courses include four core classes and two supplemental classes. The four core classes include: Preventive Maintenance & Troubleshooting Principles, Advanced Electrical Diagnostics, HVAC Troubleshooting & Maintenance, HVAC Controls and Optimization. See the website for supplemental class topics.

To find and register for a Level I or Level II training in your area, please visit the BOC website at www.theBOC.info.

Training is available from Maine to Hawaii, Montana to Texas – and now even Ontario!

BOC Graduate Numbers Continue to Grow!

There are currently over 14,000 BOC graduates throughout the country and now in Canada. That number will continue to grow because the need for educated facilities operations & maintenance personnel is stronger than ever.

Starting out in the Pacific Northwest region in the late nineties, BOC training has expanded and is now offered in over two-thirds of states in the US, as well as in Ontario, Canada. That number continues to grow as well. Graduates hail from Washington to Utah, the District of Columbia to Hawaii, and represent companies in education, government, manufacturing, healthcare and more – just about every sector you can name.

Continuing Education Opportunities for Certification Renewal Credit

Below you will find listings for the web sites of various national organizations that offer continuing education courses that are applicable to annual BOC certification maintenance. Check out the Education, Professional Development and Events Calendars at these sites.

APPA:

The Association of Physical Plant Administrators
www.appa.org

BOC:

Building Operator Certification
Live and recorded seminars
www.theBOC.info/m-live-webinars.html

BOMA:

Building Owners & Managers Association
www.boma.org/education/

BOMI:

Building Owners & Managers Institute
www.bomi.org

Energy Star®:

Live web conferences, pre-recorded trainings, self-guided presentations
www.energystar.gov/index.cfm?c=business.bus_internet_presentations

Energy University :

<http://www2.schneider-electric.com/sites/corporate/en/products-services/training/energy-university/energy-university.page>

a FREE, online, educational resource, offering more than 200 vendor-neutral courses on energy efficiency and data center topics to help you identify, implement, and monitor efficiency improvements within your organization.

FEMP:

Federal Energy Management Program Workshops & Conferences
www.eere.energy.gov/education

GreenBuild:

US Green Building Council
www.usgbc.org

HVACR Education:

On-Line Learning for the HVACR Industry
www.hvacrededucation.net/

IFMA:

International Facility Management Association
www.ifma.org

The International Facility Management Association has several regional chapters, all of which can be accessed from the association's main web site address as above. Be sure to check out the site for the variety of learning options available, both online and via seminar.

PNNL:

Pacific Northwest National Laboratory
<http://retuningtraining.labworks.org/training/lms/>

This interactive online class, Building Re-tuning, enables you to learn the initial steps involved in re-tuning a building controlled with a building automation system (BAS). Interactive exercises are included to provide you "hands-on" practice of the re-tuning process within a virtual building. Training takes about six hours to complete but does not have to be done in one sitting, and entitles you to six hours of CE credit.

Utility Energy Training Centers:

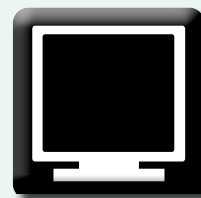
www.dsireusa.org

Your local utilities may offer energy education events and their sites are sources for training opportunities as well. Regional industry associations also offer a number of options for further education. The link brings you to a database of state incentives for renewables and efficiencies.

BOC:

You can also follow us on Facebook or visit our blog at the BOC website:

www.theBOC.info/blog





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FACEBOOK
www.facebook.com/thebocprogram

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Partners in the BOC program include: Canadian Institute for Training, Energy Training Foundation (South Africa), Focus on Energy, Gwinnett Technical College, Intermountain Building Operators Association, Midwest Energy Efficiency Alliance, National Sustainable Structures Center at Pennsylvania College of Technology, New York State Energy Research & Development Authority, North Carolina Community College System, Northwest Water & Energy Education Institute, Northwest Energy Efficiency Council, Pellissippi State College, Sacramento Municipal Utility District, Santa Fe Community College, South Carolina Community College System BOC Consortium, South-Central Partnership for Energy Efficiency as a Resource, University of Hawaii – Maui College, and University of Hawaii – Manoa.

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