



THE BOC Bulletin

SUMMER/FALL 2007

A Newsletter for BOC Graduates, Enrollees and their Employers

Creative Cooperation for More Efficient, Cleaner Energy

Jim Gorman, Facilities Manager for Roche Molecular Diagnostics (RMD) in Pleasanton, California has been committed to energy conservation and sustainability ever since the early stages of the 1999-2000 California energy crisis. He and his staff have identified and implemented numerous energy conservation projects at the 180,000 sq. ft. Pleasanton facility, which is comprised of office, lab and warehousing space.



A view of the PV panels installed at the Pleasanton, CA facility.

Key success factors involved fine tuning of the building automation system (BAS) to ensure equipment only operated when needed and that set points were optimized for efficient operation. By optimizing the BAS and lighting controls, huge energy consumption savings were realized quickly, with very little financial investment. Results included a total energy consumption reduction of 66% (1998 vs. 2001). While some of the energy savings were related to temporary reductions in site operations in 2000, most were related to changes made to the BAS and a few small capital projects.

Early capital energy conservation projects provided a very large energy-savings return with little financial investment. Two energy

projects included retrofitting an 800-ton centrifugal chiller with an AFD/VFD, and the replacement of an oversized air compressor/air dryer with a much smaller, "right sized" compressor/dryer combination. These modest changes to large energy-consuming equipment provided significant energy reductions, high internal rates of return (IRR), and extremely short periods for returns on investment (ROI).

The next step in the sustainable energy program after implementation of the energy conservation measures was to look at renewable energy options.

In early 2002, photovoltaic (PV) panels were researched to see if they were a financially viable solution. Unfortunately, the project analysis showed this to be a poor business model, with a negative NPV (net present value), and a simple payback period of over eleven years.

"You should start by implementing energy conservation measures before jumping into renewable energy," according to Gordon. "Optimize the building operation using existing tools

*(Continued on page 8.) See **Creative Cooperation**.*

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Reminder: 2007 BOC Grads

By March 2008, you will need Continuing Ed credit to renew your Level certification. Level I renewal requires 5 hours annually and Level II requires 10 hours. See page 10 in this newsletter for details.

Tightfisted Ways to Cut HVAC Costs

No budget for new equipment? Don't give up. A little money and a fresh look at what's already in place can bring big savings

by Lindsay Audin

Energy costs for HVAC systems can be reduced through many small efforts requiring little or no capital investment. Reputable building management firms have claimed up to 24 percent savings from the latter, making such actions worth a close look.

Some of these measures might be called low-cost - that is, they pay for themselves in a year or less through avoided energy expenses. Other steps qualify as no-cost because they require only staff time.

Where can facility executives find such low-cost/no-cost savings? Four areas are worth looking into:

- **Controlling outside air more effectively**
- **Fully exploiting existing capabilities**
- **Minimizing simultaneous heating and cooling**
- **Using more efficient replacement components**

What may be cost-effective at one facility, however, may not be at another. Even if an option has no out-of-pocket expense, savings may vary because of local climate, current energy pricing, type and age of equipment, use of an energy management system, and staff availability, knowledge and experience.

Get the Most Out of Outside Air

Depending on local climate and the amount of air being recirculated in a building, conditioning outside air may account for a significant portion of cooling load. Spaces that can hold many people at one time (e.g., theater, auditorium) and those that cannot recirculate air due to tasks being performed (e.g., labs, hair salons) spend a lot to heat, cool, humidify or dehumidify outside air before bringing it into a building. In such cases, existing VAV control should be maximized. At some times, it may be possible to reduce air flow to a lower minimum level without violating fresh air requirements. Flow measurements and a check of the building code could yield major savings at practically no cost.

Even where most air is recirculated, however, judicious use of outside air can help cut HVAC bills. An economizer cycle uses outdoor air instead of return air to cool a space when the outside air is significantly cooler and dryer than return air. Depending on outdoor humidity, using more outside air in the 60-65 F range may provide some "free" cooling. When outside temperature is sufficiently low (below about 52-57 F), chillers may be shut off and 100 percent outside air used to perform all necessary cooling. Doing so may involve only changes to EMS programming or alterations to outside air damper linkage settings.

With a bit more sophisticated programming, and possibly the addition of a humidity sensor, even higher temperature outside air may be used, especially in dry climates. By comparing return air wet-bulb (instead of just dry-bulb) temperature to that of outside air, the differential enthalpy value is taken into account (enthalpy measures the total heat content of air, including that held by its moisture). Dry air in the high 60s F may hold much less total

heat than moist return air, for example. From the point of view of a cooling coil, maximum use of such outside air makes its job easier.

To maintain an odor-free facility, close outside air dampers as far as possible. Outside air intakes should also be closed at the end of the working day. In spaces that are chronically occupied after 5 p.m., add a window air conditioner that can exhaust air, or a local exhaust fan, so that large air handlers may be shut down at the end of the typical workday. Look for units with built-in timers that shut units off when occupancy is highly unlikely.

As outside air dampers age, they may not close fully or seal tightly in the closed position. Adding edge seals (flexible plastic strips designed to improve sealing) may be an inexpensive way to cut damper leakage, especially in cooler northern climates.

Avoid over-conditioning outside air. In one case, seasonal settings for humidity were reversed in an EMS, forcing wet summer air to be dried to about 35 percent humidity and humidifying dry winter air to 65 percent. The building was comfortable, but chillers had to labor to remove the extra moisture, reheat coils worked overtime to keep anyone from getting a cold shoulder, and electric humidifiers raised winter power bills to a new high. Unless special health requirements are involved (for instance, in a hospital), try humidity settings that are lower in winter and higher in summer. In a one-day test, shut off winter humidification. You may be surprised to find that nobody notices it.

Outside air may be used to pre-cool at night by pulling heat from the considerable mass of a building's floors and interior structure. Cooling such materials with night air reduces chiller load during the first few hours of the next day. Research is needed before pursuing this option, however. Where night electric rates are roughly the same as daytime rates, or evening air is humid, the net effect may be to raise, instead of lowering, energy bills. Even assuming night dry-bulb temperature is low, the cost to run fans for 8 hours



You can complete your reading of this article on the Web at
www.facilitiesnet.com/bom/article.asp?id=5391&keywords=hvac,%20energy%20efficiency

About the Author

Lindsay Audin is president of EnergyWiz, an energy consulting firm based in Croton, N.Y. He is a contributing editor for Building Operating Management.

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The Commercial Kitchen: Overlooked Energy Savings in Your Most Ignored Room

by Richard Young

Every big building has at least one and yet the commercial kitchen, from an energy standpoint, is the most ignored room in the building. Since food service operations are usually managed by an outside company, such as Marriot or Sodexo, and most appliance repairs are handled by a service company, most building engineers have the feeling that the kitchen is not their responsibility. But sub-metered kitchens are extremely rare, which means that the food service operator has no incentive to control energy use – effectively passing that responsibility back to the building engineer. If the food service operator is billed for energy, it is often on a square-foot basis that is equivalent to the rest of the building. This is a great deal for the food service company but not so good for the building owner since the kitchen can use as much as five times more energy per square foot than basic office, lodging or retail space. In other words, the kitchen is one of the most energy intensive spaces in your building and you ignore it at your own peril.

Fortunately there are resources and strategies available to building engineers that can help get a handle on what's cookin', energy wise, in their commercial kitchens. The biggest step, if possible, is to sub-meter the utilities (gas, electric and water) and find out just how much of these expensive commodities the kitchens are actually guzzling. This also provides a baseline against which you can measure (and prove) energy savings.



How much energy do you think this kitchen uses?

On the operations side, one of the easiest things you can do to save energy in the kitchen is to retro-commission any energy-management systems, including everything from broken occupancy sensors and twist timers to lighting panels, defrost time clocks and the building EMS. It is not unusual to find kitchen exhaust hoods that run 24 hours a day because the energy system was on override.

On the list of new, clever energy-management tools – and one of the systems best suited to institutional kitchens – is “demand controlled” kitchen ventilation. By using sensors and variable frequency drives to modulate

the kitchen exhaust fan-speed based on how much cooking is going on, this system can produce total energy savings (fan and tempered air) in the range around 50%!

For more information on this technology as well as a treasure trove of other energy management strategies for the commercial kitchen, visit PG&E's Food Service Technology Center (FSTC) online at www.fishnick.com. The FSTC also offers commercial-kitchen specific classes on everything from lighting and refrigeration to appliances, kitchen ventilation and hot water systems. These classes qualify for BOC education credits and are offered throughout California in partnership with SCE, SoCal Gas and SDG&E.

Richard Young is a senior engineer and the director of education at the Food Service Technology Center (FSTC) in San Ramon, CA.

FREE
BOC
Webcast

Learn more about the program by participating in a free BOC Informational Web cast. All you need is a desktop browser and a telephone. The presentation describes Level I and Level II course topics, schedules and certification requirement in detail. Listen in and find out who benefits by attending BOC training and how graduates are improving their facilities.

The next Web cast date is:

Thursday, Sept. 13, 2007

8:30AM - 9:30AM (PST)

11:30AM - 12:30PM (EST)

A future 2007 Web cast will be scheduled for October 25, 2007.

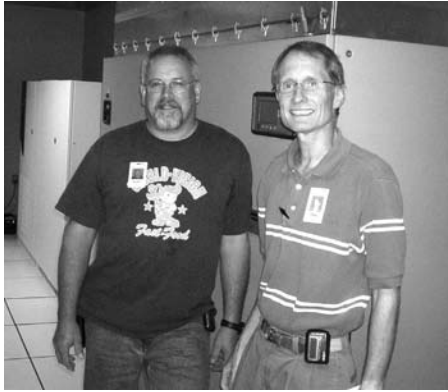
To sign up go to:

www.theBOC.info



BOC Grads Making a Difference!

BOC graduates Terry Stickney and Shane Conrad of World Vision in Federal Way, Washington had a problem. The number of World Vision's data center servers had grown from four to well over 120 and was (and is) continuing to grow, drastically increasing the heat load in the data center. Tasked with cooling the area on a budget, there were several creative options they put into place.



Shane Conrad and Terry Stickney.

Hot/cold aisles were established so that all servers exhausted into common hot aisles and received intake air from common cold aisles. Special panels were fabricated for a couple servers with powerful exhaust to ensure that no hot exhaust would escape into the

cold aisles. By adjusting perf floor tile placements, they balanced the room air flow. Using an infrared thermometer to locate areas of greatest heat concentration above the servers allowed them to optimize placement of the exhaust egg crates above the servers. Duct work was installed to extend their Liebert AC unit intakes to the drop ceiling, creating a plenum ceiling. This was a step toward focusing on cooling just the cold aisle instead of the whole room. These changes freed up an estimated 8-10 tons of cooling, adding approximately 20% more capacity to World Vision's data center, and helping to recover some of the redundancy cooling that had been given up to cool the ever-increasing high density server heat loads.

Since these original changes, the air-cooled condenser intakes of the portable Movincool backup AC units have been ducted, providing the necessary 9000 CFM of air necessary to cool the condensers from outside the data center. This allows use during emergencies without producing negative pressure in the data center which would draw in unconditioned air from the outside and would hold the doors open.

Currently, Stickney and Conrad are monitoring rack temperatures, especially at tops of the server racks where high density servers often run out of cool air. They are in the process of experimenting with ducting cool air to the tops of these racks, which has decreased the temperatures there by 3-5 degrees with the same amount of energy expended.

As the heat load continues to grow, the facilities staff at World Vision constantly explores ways to increase efficiency. Money not spent on additional cooling equipment translates into additional money for the children and communities World Vision assists, as a Christian humanitarian organization dedicated to working with children, families, and their communities worldwide to reach their full potential by tackling the causes of poverty and injustice.

As BOC Level II graduate Terry Stickney puts it, "BOC provided a great overview of what is available to work with, and allowed me to hear some different perspectives from instructors and fellow students in similar trades. That has been a great asset in my work here at World Vision."

The Avery Research Center in Pasadena, CA had a major problem with their 18-year old chiller. A freon leak in the water loop had caused irreparable damage to the compressor and it meant that, at a minimum, the chiller system needed to be replaced. The center's **facilities manager, BOC graduate Roger Recupero**, worked to pull together the replacement/repair options.



Roger Recupero.

An obvious initial option was to simply replace the old chiller with a similar model, which would have meant continuing to operate with the same inefficiencies inherent in an older system. Considering the work done in the laboratories, the chemicals present and the need for a controlled environment 24/7, it made more sense to look for improved technology that would give equal or, hopefully, better performance at reduced energy requirements. After reviewing and updating the original system specs and current needs, an RFP was drafted and forwarded to five contractors in the field.

Opinions came back and it was apparent that the system was going to have to be entirely replaced, both chiller and cooling tower. Proposals were submitted, reviewed and refined. Everything was ordered with a target installation of several months later in November, a cooler, more convenient time of year, since one compressor was still available to maintain the processes.

Of course the best laid plans can go awry and usually do. The compressor died in August and the project had to be completed immediately. Since all the equipment had already been ordered and delivered, everything was in place and ready to go. Total installation and commissioning was completed in September of last year.

Because the new cooling tower is matched to the new chiller, there is much more efficient usage of water and chemicals for treating the water. Recupero says that the projected energy savings are about 260,000 kilowatt hours per year, translating to \$36,000 saved annually. The center has also realized a reduction in water usage in excess of 1000 HCF, saving around \$3000 in the 10 months the new system has been operational. Another bonus is that with the new equipment, maintenance costs are lower as well. Avery also received a rebate from the City of Pasadena based upon projected savings estimates.

Recupero reports that there are many energy-saving projects in the pipeline, including the replacement of the existing 80-ton package units that currently service office areas of the research center.

(Continued on page 5.) See **BOC GRADS**.

BOC GRADS. (Continued from page 4.)

Jeff Miller, BOC graduate and commercial maintenance technician for Harsch Investment Properties in Portland, Oregon, has been busy working in the home office building on a replacing old, inefficient magnetic ballasts (R2P32TP type) with new, electronic lamp ballasts (ICN-3P32-SC 3 type). Replacements are made on an as-needed basis. The old magnetic ballasts fire only two lamps to the three an electronic ballast can accommodate. The old ballasts also tend to flicker once they are starting to go, making the lighting quality distracting.

Not only are the newer ballasts significantly less expensive (\$22.63 versus \$36.85 each), they also use approximately 40% less electricity. Flickering is also eliminated. Miller has made a dozen or so replacements thus far, but the six-story building has approximately 200 lamps per floor, so savings will be substantial

as the switch-outs are made. For even more savings, the lights are on timers to ensure that they are switched off during non-peak hours.

In another recent energy-efficiency project at the home office building, Portland's Reitmeier Mechanical assisted in a swap out of an old, oversized 75-gallon steam boiler for a new 25-gallon hot water boiler, a more appropriate match for the hot water heating system and the building needs. New variable frequency drive equipment was also installed on each floor, along with new VAV (variable air volume) controllers.

Many of these projects are either recently completed or ongoing and so final savings numbers are not yet available, but the trend is significant and the savings are indeed considerable. Between the lighting replacements and the work on the heating system, Miller anticipates they will cut energy bills by at least a third.

NEEC Takes on BOC Administration in the Northeast

The Northeast Energy Efficiency Partnerships, Inc. (NEEP) announced a recent decision to end its service administering the Building Operator Certification (BOC) program in the Northeast region. NEEP will complete its existing obligations for BOC courses currently in progress, and will transfer administration to the North-west Energy Efficiency Council (NEEC), the national administrator of BOC.

NEEP Executive Director Susan Coakley stated that, "The BOC course is a tremendous resource for an under-served audience – building operators – providing valuable hands-on information to improve building energy performance through best practices in building operation and maintenance."

NEEC is working with Alan Mulak, and utility and state sponsors in the Northeast to offer BOC courses in 2007-08. Please welcome the new team providing BOC services in New England, New York and New Jersey.

Alan Mulak has served as the founding BOC program manager in the Northeast. A licensed professional engineer, Alan has 36 years of experience in the energy field, working first as a test engineer on nuclear submarines, and then on power plant construction, overhaul and maintenance. Prior to his association with NEEP and BOC, he also worked on a variety of energy management and conservation projects for utilities, private owners/investors and public municipalities.



Alan Mulak



Carlos Montanez

BOC instructor **Carlos Montanez** is associate director of maintenance & utilities at Phillips Andover Academy and is also the chief engineer for the school's central heating and electric power plant. With over 30 years of power generation, utility distribution and mechanical systems experience, Carlos plans and coordinates all the utility and building project engineering for the academy and is responsible for all energy-related matters.

Carlos has an MS degree in facility management, a BS in marine engineering, a Chief Engineers license in the U.S. Merchant Marine, and is a First Class Stationary Engineer, a Certified Energy Manager, a Certified Plant Engineer, and holds several other licenses and certifications.

William A. Turner, MS, PE, and BOC instructor, received his MS in engineering from Northeastern University. He served for ten years on the research staff of Harvard University School of Public Health. Since 1985, Mr. Turner has focused on "Building Science" issues including air quality, moisture, geothermal energy efficiency, sustainable building shell design and building commissioning. His experiences include unplanned airflow, microbial source amplification, VOCs, soil gas, particle staining, air and water leakage, construction containment, healthy building design and forensic evaluations. He has published and lectured extensively, advising the US EPA, the American Lung Association, and Habitat for Humanity.



William A. Turner

Owner of Canterbury Engineering Associates, LLC, BOC instructor **Richard Vaillencourt** has degrees in both mechanical and electrical engineering, combined with over twenty-five years of practical experience as a designer and project manager in electrical construction, as an industrial plant engineer, and as an industrial corporate energy manager. Richard has presented several papers at the World Energy Engineering Congress over the years and has authored a book, *Simple Solutions to Energy Calculations*, which is in its fourth edition. Richard has also been published in *Energy Engineering*, *Strategic Planning for Energy and the Environment*, and *Energy User News*.



Richard Vaillencourt

If you have ideas for where you would like to see BOC courses in your community, please give Alan Mulak a call or email at 978-486-4484 or AMulak@comcast.net.

Congratulations!

BOC Level I & II Students Certified in January – August 2007

Level I Certified Students

Alvarez, Jr., Vidal, Cushman & Wakefield at Adobe
Amrine, Gregory, Snohomish School District 201
Anderson, Eric, Whitehead Institute
Axline, Patrick, Providence Everett Medical Center
Babers, Oscar, CSU Northridge, Phys Plant Mgmt
Bachman, Roy, Estee Lauder
Baker, Arthur, Town of Monroe
Barr, Joyce, Brooklin School
Batten, David, Dept. of Corrections
Beeman, Molly, Everett Community College
Bell, Billy, The Irvine Company
Bell, Craig, Cal State University Los Angeles
Beltran, Jose, Viejas Casino
Bennett, Robert, WSDOT
Berger, Bill, Cal State University San Marcos
Bernardo, Mark, CSU Stanislaus
Berzinas, Anthony, California Highway Patrol, Fac Sect
Bidot, Pedro, Olympia School District
Blunt, David B., Corning Incorporated
Boldis, Imre, CSU Northridge, Phys Plant Mgmt
Bourque, Eric, Tyngsborough Housing Authority
Bredeson, Thomas, City of Bellingham
Brown, Christopher, Bristol Myers
Brown, Clint, Integrated Real Estate Services
Buchanan Hening, Maureen, California Lutheran Univ.
Burr, Willie, UC Davis Fac Operations and Maint
Calo, Paul E., Berwick Academy
Campbell, Stephen, San Diego Gas & Electric
Cardenas, David, UC - LLNL
Carlson, Craig, Norwalk Community College
Carpenter, Brian, Jones Lang LaSalle
Cavaliere, Angelo, Dept. of Motor Vehicles
Chaboya, Robert, LA County Sheriff Dept. (FSB)
Chacon, Gary, CSU Northridge, Phys Plant Mgmt
Chapman, Eric, Exotic Metals Forming Company
Clough, Skip, South Berwick Sewer District
Cohen, Marilee, Three Rivers Community College
Colello, Jr., Joseph, Town of Hamden, Attn Mayor's Office
Coltharp, Cameron, Telecare Corporation
Conner, Eric, Office of Legislative Management
Contris, Mark, State of WA, Dept of GA
Corcoran, Arthur, Headway Technologies
Corsa, Christopher, Town of Marlborough
Costanzo, Nick, Dept. of Corrections
Cuevas, Hector, CSU Northridge, Phys Plant Mgmt
Culver, William, Raytheon
Curtis, Craig, Cal State University San Marcos
Cyr, Philip, Town of Rocky Hill
Daffer, Gerald, UCSD
D'Arinzo, Pasquale, Town of Darien
Davidson, Jeffery, Jefferson County
Davila, Gary, Pleasanton Unified School District
Davis, Bruce, Town of Stafford, Dept. of Public Works
Davis, Lawrence, United States Postal Service
Davis, Randen, Sonoco Products Co.
De La Rosa, Marco, Rich Maynard Management Co.
Deis, Greg, County of San Diego
Deuning, Edwin, Nutrilite
Deveney, John, Gill-Montague Regional School District
Diaz, Mike, Suffolk County Community College
Diaz, Rigoberto, CSU Northridge, Phys Plant Mgmt
Divjak, Robert, Naugatuck Valley Community College

Dolan, Beth, Seattle Public Schools
Dooley, Dennis, SAIF Corporation
Dorak, Matt, Smithtown Central School District
Downs, David, MSAD 30
Dukhovny, Lazar, Applera Corporation--Applied Biosys
Dunkin, Jerry, The Irvine Company
Dwyer, Phil, PM Property Management
Erven, Jerry, City of Gresham
Fenech, Tim, Theravance Inc
Fitzgerald, Thomas, Essex Elementary School
Flores, Aaron,
Foley, Tom, CSU Northridge, Phys Plant Mgmt
Fortier, Richard, MPV Commission
Fowlkes, Jr., Willie, Murrieta Valley USD
Fox, David, CSU East Bay
Fuller, David, Raytheon, Facilities Maintenance
Gaeta, Jr., Manuel, Assoc Students, Inc Cal Poly Pomona
Gauthier, Scott, Quinsigamond Community College
George, Steve, Precision H2O
Giampa, Mark, Whitehead Institute
Gier, Bruce, Portland Development Commission
Gomez, Robert, CSU Northridge, Phys Plant Mgmt
Gormley, Michael, The Winchendon School
Grace, John, Gill-Montague Regional School District
Granillo, Ernie, CSU Northridge, Phys Plant Mgmt
Granillo, Tim, San Mateo County Comm College Dist
Greene, Allen, San Diego Facility Solutions
Greene, Rod, Olympia School District
Greisen, Patrick, Dept of GA/Buildings & Grounds
Grice, Gardner, First Unitarian Church
Grossman, Richard, Dept. of Children and Families
Habershaw, James, Home Energy Solutions
Hagerty, Tony, Lincoln Unified School District
Hama, Vinnie, Stanford Univ - Student Housing
Hanratty, Anthony, Suffolk County Community College
Hansen, Chris, Providence Centralia Hospital
Hao, Jian Xing, Fairmount Olympic Hotel
Hardcastle, Jeffrey, Sutter Tracy Community Hospital
Harrell, Chris, Smithtown Central School District
Hawkins, John, St. Joseph's Medical Center
Haves, Stephen,
Hernandez, Anthony, Winbond Electronics Corp of America
Hescock, Paddy, State of WA Dept of Corrections
Hill, Robert, Pratt & Whitney
Hinojosa, Martin, Jones Lang LaSalle
Holbrook, Steve, Cal State University San Marcos
Holland, Terry, Olympia School District
Hottle, Kevin, CSULB
Hubeny, Linda, Dept. of Administrative Services
Huckins, Curt, Fallbrook Union HS District
Hughes, Valerie, CSU Northridge, Phys Plant Mgmt
Imus, Edward, Providence Everett Medical Center
Inokuchi, Richard, SMCCCD/Skyline College
Isaacson, Robert, Snohomish School District 201
James, David, LA County DHS
Jauch, Shannon, Las Virgenes Unified School Dist
Johnson, Michael, City of Snohomish
Johnston, Christopher, Commision on Fire Prevention & Control
Jones, Anthony, Dept of GA/Buildings & Grounds
Jordan, Jennifer, San Diego Facility Solutions
Jurgens, Mark, UCSD
Kardys, Robert, Town of Ldtyard Highway Dept

Kelly, Gene, Polaroid Corporation
Kelly, Waverly, California Lutheran University
Kerouac, Mike, County of San Diego
Killops, Tim, The University Corporation
Knavel, Bill, WSDOT
Knittle, Kirk, The Evergreen State College
Kofoed, Sharon, NAS Whidbey, Dept of Defense - PWM
Korell, Roger, Providence Place
Korell, Roger, Providence Place
Krogh, Rhawn, Western Oregon University
Krueger, Richard, ContinentalAFA
Krueger, Richard, ContinentalAFA
Ladosky, Gerald, US Navy, Code N46VO2
LaFave, Larry, City of Edmonds
Lanthier, Wayne, 939 Coast Management Association
Larramendy, Jim, Prometheus Real Estate Group
Larsen, Dennis, Vancouver School District
Last, Michael, Agriculture Experiment Station
Law, Robert, CSU Stanislaus
Le, Than, Whitehead Institute
Lerma, Jose, The Irvine Company
Lewis, John, Sutter Tracy Community Hospital
Lilly, Allison, Dept of Information Services
Logsdon, James, CSU Northridge, Phys Plant Mgmt
Loomis, Mark, CSU Northridge, Phys Plant Mgmt
Louie, James, SMCCCD/Skyline College
Maderazo, Robert, San Diego Gas & Electric
Maeyama II, Yoshio George, St. Joseph's Medical Center
Magnano, Joseph, Granby Public Schools
Marchi, Joe, JAE Oregon
Martin, Christopher, Northrop Grumman Corp
Martin, Perry, CSU Northridge, Phys Plant Mgmt
Martinez, Manuel, City of Beverly Hills
Mayer, Belinda, Chevron Bus and Real Estate Svcs
McCoskey, Roy, Pasco School District
McDuff, John, Valentine Tool & Stamping
McKnight, James, Golden Gate Bridge Highway & Transportation District
McQuade, Gerard, Cal State San Marcos
Mider, James, 939 Coast Management Association
Miles, Curtis, Boston Scientific
Millard, Terry, Vancouver School District #37
Miller, John, University of Washington, Bothell
Miller, Paul, City of Portland, Fire Bureau
Miller, Ronald, Suffolk County Community College
Miranda, Gerald, UC Davis Fac Operations and Maint
Misel, David, Rejuvenation, Inc.
Mishler, Dennis, Providence Hospital
Mix, Raymond, Sunrise Adult Living
Moberly, Jon, Vought Aircraft Industries, Inc.
Moran, Eddie, EMC Corp
Moscatiello, Benjamin, Longwood Schools
Moscatiello, Frank, Three Village Schools
Mullen, Timothy, United States Mint
Muller, Joseph, Asnuntuck Community College
Murphy, Bill, CSU Northridge, Phys Plant Mgmt
Murray, Lee, Stanford Univ - Student Housing
Murrell, Michael, Snohomish County Facilities Maint
Nelson, Gary, Town of Bloomfield
Nickoley, Chuck, Raytheon, Facilities Maintenance
Norman, Michael, Worcester District / Superior Court
Nowakowski, Edward, Dept. of Veteran's Affairs
O'Neil, Michael, North American Health Care, Inc.

Opprecht, Susan, The Evergreen State College
Orchard, Paul, Providence/Hood River Memorial Hosp
Palamaris, Brandi, SBM Site Services, LLC
Paranal Jr., Constancio, West Inn & Suites
Peaslee, Travis, City of Saco
Perez, Jr., Jorge, IAC/Interactive Corp
Peterson, Karin, Commission on Culture and Tourism
Pizarro, Joy, San Diego Gas & Electric
Plummer, Roger, MSAD 71
Poulin, Donald, Dept. of Public Works
Precie, Samuel, Belo Corp—The Press Enterprise Co.
Quach, Thien, City of Los Altos
Rangel, Albert, United States Mint
Ranos, Corazon, Fairmont Olympic Hotel
Ratcliffe, Keith, State of WA-GA/Buildings & Grounds
Redmond, Donald, WSDOT
Reiman, James, Manchester Community College
Ren, Alan, United States Mint
Reyes, John, The Irvine Company
Richardson, Larry, San Mateo County Transit District
Riley, Marigrace, Dept. of Public Works
Roberson, Raymond, The Press Enterprise Co.
Robertson, David, The Irvine Company
Robinson, Keith, Headway Technologies, Inc.
Rodriguez, David, Cal State San Marcos
Rojas, Marcos, LA County Sheriff Dept. (FSB)
Rosales, Enrique, Maynard Rich Management
Rossley, Kevin, Lincoln Sudbury Regional School District
Russell, Larry, Cal State San Marcos
Russo, Alan, Town of New Milford
Salazar, Ramiro, Trojan Battery Co.
Salonga, Francis, Applied Biosystems
Santella, Kevin, The Fay School
Santoanni, Thomas, Naval Base Ventura County
Sauceda, Marty, Dublin San Ramon Services District
Sawyer, Charles (Tom), Lake Oswego School District
Scherer, Jo, City of Seattle Fleets & Svcs
Schultz III, Frank, CSU Northridge, Phys Plant Mgmt
Scott, Paul, SBM Site Services
Scranton, Dennis, University of CT Health Center
Severance, Kirk, Town of Granby
Seward, Anthony, Dept of GA/Buildings & Grounds
Shackelford, David, Snohomish School District 201
Shattuck, William, Dublin San Ramon Services District
Sheehy, William, City of Seattle, Fleets & Fac Dept
Sherman, John, Saco Parks and Recreation
Silvestri, Peter, Town of Sprague
Simonton, Ross, Wildhorse Resort Casino
Smachetti, Daniel, Dept. of Transportation
Snider, Gregory, Renton Technical College
Snuggs, Victor, Community Hospital of Long Beach
Souza, Anthony, Cushman & Wakefield
Speaks, John, Genl Atomics Aeronautical Syst, Inc
Spiessl, Richard, US Navy, NAVFAC SW
Stables, Susan, NAVFAC NW, PWD Whidbey
Startzman, Don, City of Edmonds
Stidd, Todd, Dept of GA/Buildings & Grounds
Sutphin, Charles, Volkswagen of America
Swan, Alyce, MSAD 71
Swaney, Clay, Dept of Genl Admin
Sweet, Robin, Port of Bremerton
Tejada, Mauricio, Cal State Los Angeles
Terrazas, Sergio, CSU Northridge, Phys Plant Mgmt
Teschera, Arthur, Headway Technologies, Inc.
Thompson, Kenneth, Northrop Grumman
Thornton, Lisa, Stanford Univ - Student Housing
Thornton, Russel, Vancouver School District #37
Tippett, Ronald, Raytheon, Facilities Maintenance
Todd, Robin, WA State Dept of Information Svcs
Tonucci, Stephen, Manchester Board of Education

Truly, Jeff, University of Washington, Bothell
Trussell, Larry, SAIF Corp
Tuakoi, David, Openwave Systems, Inc.
Van Houton, Richard, Western Conn. State University
Villa, Jorge, Nutrilite
Wagner, Matthew, Genl Atomics Aeronautical Syst, Inc
Wait, Patti, Vancouver School District #37
Wallace, Donald, Smithtown Central School District
Wallace, George, City of Bristol Public Works
Watson, Thom, Everett Community College
Webb, James, Transwestern Commercial Services
Webber, Michael, Tamastslitk Cultural Institute
Weeding, Larry, Viejas Casino
Weir, Jonathon, Vancouver Schools
White, Debbi, Puget Sound Energy
Wolfe, Otis, Snohomish School District
Woo, Johnson, City of Burlingame
Woodmansee, John, State Dept. of education
Worland, Clint, IAP World Services, Inc.
Young, Carolan, East Valley School District #361
Zamora, Fernando, CSU Northridge, Phys Plant Mgmt

Level II Certified Students

Agapito, Alejandro, Dixon Unified School District
Alderman, Brian, ConnectCare
Allen, Tyler, UC, San Diego Facilities Mgmt
Allred, Myong, Pierce County Facilities Maint
Almeida, Michael, Equity Offices
Anderson, Anthony, Jefferson County Bldgs & Grounds
Andrews, Alec, Equity Offices
Bachman, Roy, Estee Lauder
Baxter, Arthur, Equity Offices
Bazoniski, Perry, Equity Offices
Bechtold, Jeff, CSU Fullerton
Beeman, Douglas, Transwestern Commercial Services
Bell, Craig, Cal State University Los Angeles
Bellavance, William, Equity Offices
Bertram, Martin, Tacoma PUD
Berzinas, Anthony, California Highway Patrol, Fac Sect
Boran, William, Equity Offices
Brown, Ted, Puget Sound Energy
Carlson, David, SMUD
Carpenter, Larry, Equity Offices
Charest, Robert, Greater Lawrence Technical School
Chevez, Jose, Equity Offices
Chismer, Robert, Equity Offices
Christensen, Kerry, Pacific Lutheran Univ/Fac Mgmt
Correia, Jack, Cal State Univ Fullerton
Crocker, Clifford, Air Force Village West
Currier, Kevin, Equity Offices
Deary, Robert, BAE Systems
Delfierro, Redentor, County of San Diego
Donaldson, David, King County Library System
Donovan, Kim, MSAD 71
Doyle, John Patrick, Equity Offices
Draper, Earl, Equity Offices
Dumas, Alonzo, Fairmont Olympic Hotel
Dyer, Joe, City of Whittier
Ellis, Glen, Bonny Eagle Middle School
Everett, James, MSD 20, Fort Fairfield
Ferebee, Curtis, SMUD
Flint, David, City of Palm Desert
Frawley, Mike, Town of Westport
Fulford, John, Equity Offices
Furtado, Marcelino, Equity Offices
George, Bart, Equity Offices
Gorman, Robert, SUHRCO Management, Inc.
Grendell, Mike, Penobscot Job Corp Center

Grice, Gardner, First Unitarian Church
Gyll, Brad, Santa Barbara City College
Hagen, Mark, Dept of GA/Buildings & Grounds
Hamel, Sr., Phil, Rose Hills Company
Herlihy, Richard, Equity Offices
Hernandez, Alfredo, City of Whittier
Hodges, Edward, Northrop Grumman
Housler, Dan, City of Edmonds/PWD
Hudson, Matthew, Equity Offices
Hull, James, Trammell Crow Co.
Jauch, Shannon, Las Virgenes Unified School Dist
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Keene, Chris, The Jackson Lab
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Krueger, Richard, ContinentalAFA
Ladley, Lee, East County Family YMCA
Lahey, William, Equity Offices
Lemieux, Gerry, CL&P
Lemieux, Paul, SMUD
Levanas, Bruno, The Irvine Company
Lewis, Mark, Rose Hills Company
Mailman, Thomas A., Community Living Association
Majd, Al, Hilton Anaheim
Manis, Jeff, Cal State Univ Long Beach
Manzella, Raymond P., Pitney Bowes
Mariazeta, Roberto, SMUD
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McCann, James, Palomar Community College
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Michalik, Richard, UTC Power
Michaud, Fred, Caribou School Department
Miller, William, City of Milwaukie
Mize, Kenny, Cal State Fullerton
Montenegro, Patricio, Equity Offices
Moreno, Henry, Rose Hills Memorial Park
Morris, Annie, WSDOT
Morrison, Tristan, Equity Offices
Neilssien, Bill, The Irvine Company
Norris, Darrell, The Irvine Company
Paulsen, Mike, Banta
Pawl, Christopher, Equity Offices
Plummer, Erskine, Equity Offices
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Rice, John, Efficiency Maine
Rindfleisch, Scott, Raytheon, Facilities Maintenance
Robertson, David, The Irvine Company
Roche, Ernesto, Equity Offices
Roman, William, Town of Redding
Ross, Bob, San Diego Convention Center Corp
Rossignol, David, Penobscot Job Corp Center
Sanchez, Jesse, The Irvine Company
Schauf, Rodney, Westin Hotel Seattle
Scheier, Patrick, Jones Lang LaSalle
Sewell, Steven, SMUD
Snell, Randall, Dept of GA/Buildings & Grounds
Stangier, Hans, Linn County Sheriff
Tarascio, Michael, Pitney Bowes
Tenaglia, Paul, Equity Offices
Therault, Adam, Equity Offices
Threadgill, Mike, City of San Diego
Tippett, Ronald, Raytheon, Facilities Maintenance
Umana, Adonis, Northrop Grumman
Virissimo, Jose, The Grand Colonial La Jolla
Wallake, Joe, San Diego Rescue Mission
Wright Jr., Lamarr, Port of Bremerton

CREATIVE COOPERATION (Continued from page 1.)

like building automation systems or local controls, identify high energy ROI projects (low hanging fruit) that provide the biggest bang for the buck, and then look at the renewable option."

In late 2002, other energy systems were investigated to try and find a more efficient, lower cost energy solution for meeting the energy needs of the site. A 375 kW combined heat and power (CHP) cogen unit was selected and installed. The analysis at the time revealed CHP to have the best combination of energy efficiency and return on investment. CHP systems are dramatically more efficient than most fossil fuel based generators supplying electricity to the grid. With up to an 80% overall efficiency rating, CHP can out perform grid systems by 50% or more. If the efficiency of delivered electricity from the grid was closer to the CHP rating of 80%, reserves of natural gas would effectively be doubled, and the environmental impact cut in half.

After implementation of the CHP system in late 2003, they took another look at renewable energy, wanting to find a solution that would provide environmental benefits and still meet the investment criteria of the company. The solution identified was a Solar Power Purchase Agreement (PPA).

A solar services provider put together the PPA that included every aspect of the project from financing to a completely designed and installed system. The unique aspect of this type of project is that it requires no capital investment from a company or resources to install and operate the system, other than some basic coordination efforts. The systems are owned by a group of investors that have targeted environmentally beneficial projects and are willing to realize stable but modest returns on their investments. A state rebate paid for about one third of the project costs and federal tax incentives were also part of the PPA, both of which are claimed by the investors (system owners). Ongoing operation and maintenance of the systems is performed by a third party, so the internal facilities team can focus on core business requirements.

Of course there are obligations necessary to making a PPA work. Roche had to provide the space for installation of the photovoltaic (PV) panels and inverters, and agree to purchase 100% of the electricity generated by the system over an initial 10-year term. The electricity produced by the system is purchased at a discount compared to the electrical utility price, providing both a financial and environmental win. At the end of the ten-year term, there are several options including extending the agreement, outright purchase of the systems, or having the systems removed should more attractive options exist at that time.

Because PV systems burn no fuel and have no moving parts, they are clean and silent, producing no atmospheric emissions or greenhouse gases that have detrimental effects on the planet. The combined systems will provide enough clean, renewable electricity to supply 116 households for one year.

The concept of the PPA was shared with RMD's sister site in Branchburg, New Jersey, and a combined project approach was developed to increase the overall project size from the initial 200 kilowatt system in Pleasanton to the final combined size of over one megawatt. The larger project allowed RMD to negotiate better terms and further reduce the carbon footprint of the organization. Solar power panels are now being installed on the roofs of three buildings located in California and New Jersey, and the systems are on schedule for completion by the end of August.

Because PV systems burn no fuel and have no moving parts, they are clean and silent, producing no atmospheric emissions or greenhouse gases that have detrimental effects on the planet. The combined systems will provide enough clean, renewable electricity to supply 116 households for one year. The avoided emissions are equal to

removing 196 cars from the road for a year, or the protection of 7.44 acres of forest from deforestation. Thanks to the PPA option, RMD was able to overcome the substantial financial hurdles that stood in the way of installing PV and take a green step in the right direction to leave a very small carbon footprint on the planet.

Jim Gorman completed BOC Level I training in December 2003 and went on to complete Level II in March 2005. His company and department are so committed to energy conservation that every member of his facilities management team has completed Level I training, at a minimum, including the department's administrative assistant.

QUICK

TIP

BOC instructor Richard Jackson-Gistelli reminds us that it is important to get to know your utility representative and to use him or her as a valuable resource to get pertinent energy statistics, such as billing history and access to real time usage and demand data. Your rep can also keep you abreast of various financial incentives for lighting, HVAC, motors, and other energy efficiency projects as well as best-practices rate structures for your facility.

As he puts it, "It's the best source for all energy consumption and energy savings info. I am a utility rep so I tend to promote this because helping our customers is our job."

Continuing Education Opportunities For Certification Renewal Credit

Below you will find listings of various organizations that offer continuing education courses that are applicable to annual BOC certification renewal. Check out the Education and Events Calendars at these sites or call for information regarding upcoming training opportunities.

BetterBricks Professional Training Program

Website: www.BetterBricks.com

Contact: 206-343-3960

Workshops, brown bag presentations and roundtables for design and engineering professionals in the Northwest. Call to request a free Brown Bag presentation for your company in the Northwest.

BOMI – Building Owners & Managers Institute

Class Information: www.bomi-edu.org

BOMA – Greater Los Angeles

Class Information: www.bomagla.org

CASBO – California Association of School Business Officials

Class Information: www.casbo.org

California Society for Healthcare Engineering

Class Information: www.cshe.org

California Energy Efficiency Training Resources

Energy Resource Center - Downey, CA

Website: www.socalgas.com/business/resource_center/erc_home.shtml

Pacific Energy Center - San Francisco2, CA

Website: www.pge.com/education_training/classes/energy_efficiency/

Energy Training Center - Stockton, CA

Website: www.pge.com/education_training/

Customer Technology Application Center - Edison, CA

Website: www.sce.com/RebatesandSavings/EnergyCenters/workshops.htm

San Diego Regional Energy Office

Website: www.sdenergy.org/ContentPage.asp?ContentID=50&SectionID=46

Efficiency Maine

Website: www.energymaine.com/education_programs.htm

Energy Services

Website: www.energyexperts.org/calendar/

FEMP – Federal Energy Management Program Workshops & Conferences

Website: www.eere.energy.gov/sro/

For WA, OR & CA, you can also try: www.eere.energy.gov/states/ and click on your state.

FSTC - Food Service Technology Center

Website: www.fishnick.com/education/seminars/list.php

Energy Resource Center (ERC)

Website: www.socalgas.com/business/resource_center/erc_home.shtml

HVACR Education: On-Line Learning for the HVACR Industry

Website: www.hvacreducation.net/

IFMA International Facility Management Association

Website: www.ifma.org

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

Long Island Power Authority

Website: www.lipower.org/community/education/

Massachusetts Division of Capital Asset Management

Website: www.mass.gov/cam/statewide/sw-camistrain.html

NYSERDA - New New York State Energy Research & Development Authority

Website: www.nyserdera.org/events.asp

NEEI - Northwest Energy Education Institute

Website: www.nweei.org

Contact: Erik Westerholm at 541-463-3154 or

E-mail: westerholme@lanecc.edu

Northwest Lighting Design Lab & Portland Daylighting Lab

Class Information: www.lightingdesignlab.com/calendar/index.html

Contact: 206-325-9711 x0 or 800-354-3864 x0

Sacramento Municipal Utility District

Class Information: www.smud.com/education-safety/index.html

The UC/CSU/IOU Partnership (University of California, California State University, Investor-Owned Utility Energy Efficiency Partnership)

Website: www.uccsu.northwoodsoft.com/

University of Washington Engineering Professional Programs

Contact: 866-791-1275

E-mail: west@enr.washington.edu

Website: www.engr.washington.edu/epp

WAMOA – Washington Association of Maintenance & Operations Administrators

Website: www.wamoa.org

Washington State Society for Health Care Engineering

Website: www.wsshe.org

WSU Energy Program – Continuing Education Calendar

Website: www.energyideas.org

BOC Certification Renewal

To retain BOC certification, graduates must accumulate continuing education (CE) hours each year, following a full calendar year after their graduation. Level I certification renewal requires 5 CE hours each year, and Level II renewal requires 10 CE hours each year. The hours may be earned in any of the following ways:

BOC Certification Renewal Activities	CE Hours Equivalency
--------------------------------------	----------------------

- | | |
|--|--------------------------------|
| • Continued employment in building operations..... | 2 hours/year |
| • Continuing education in building operations..... | Actual hours of classroom time |
| • Energy efficiency projects completed at your facility..... | Up to 11 hours per year |
| • Membership in a building operations membership association..... | 1 hour/year |
| • Offices held in membership associations..... | 2 hours/year |
| • Awards received for efficient building operations..... | 2 hours/award |
| • BOC Newsletter quiz (see below)..... | 1 hour/passed quiz |
| • Completion of an energy consumption benchmark for the previous 12 month period using ENERGY STAR® Portfolio Manager or alternative energy accounting tool..... | 3 hrs/year equivalency |

You will be notified by mail when your certification is up for renewal (your renewal date appears on your wallet card). Once you have received a renewal notice, complete the short application, provide a list of your certification renewal activities from the past year and return the information to NEEC. For 2008, the renewal fee is \$45 for each of Level I and Level II, or \$75 for a "combo" renewal of both Level I and Level II.

Easy Certification Renewal Credit

Another easy way to get some continuing education credits for your yearly certification renewal requirement is right here in the BOC Bulletin. Just read the featured technical articles (pages 1-4 and continued online), then take the short quiz provided on page 11 of the newsletter. Send or fax it back to us for one CEU credit hour per quiz passed, along with your recertification application.

Conferences & Symposiums

National and Regional – Fall 2007

NATIONAL

Labs 21 2006 Conference

Charleston Area Convention Center Complex • Charleston, SC
October 2-4, 2007

Co-sponsored by the U.S. Department of Energy, the U.S. Environmental Protection Agency and the International Institute for Sustainable Laboratories

More info: www.labs21century.gov/conf

The three-day international conference has dozens of technical sessions highlighting new and innovative products designed to usher in the next generation of laboratories.

IFMA World Workplace 2007 Conference & Expo

New Orleans, LA
October 24-26, 2007

More info: www.worldworkplace.org

CALIFORNIA

Northern California Plant Engineering & Facilities Maintenance Show (NCPE)

Santa Clara Convention Center • Santa Clara, CA
September 26-27, 2007

More info: www.biztradeshows.com/trade-events/ncpe.html

West Coast Facility Engineering Show (formerly the Inland Empire Facility Engineering Show)

Los Angeles Fairplex • Pomona, CA
October 17-18, 2007

More info: www.iefonline.com

WASHINGTON

WSSHE Annual Conference

Yakima Convention Center • Yakima, WA
September 19-21, 2007

More info: www.wsshe.org

WAMOA's Annual Fall Conference

Doubletree Hotel – City Center • Spokane, WA
October 3-6, 2007

Sponsor: Washington Association of Maintenance & Operations Administrators

More info: www.wamoa.org/Conference.html

This annual three-day conference, now in its 25th year, provides workshops, speakers, and roundtable discussions, along with trade show presentations and networking opportunities for industry professionals.

NORTHEAST

N. New Jersey Facilities Expo

New Jersey Convention & Expo Center • Edison, NJ
October 24-25, 2007

More info: www.facilitiesexpo.com

Tightfisted Ways to Cut HVAC Costs

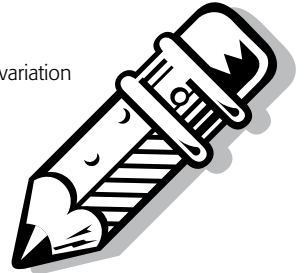
REVIEW QUIZ

Here is an easy way to earn **earn one continuing education hour** towards annual BOC recertification. Read the article *Tightfisted Ways to Cut HVAC Costs* that begins on page 2 and take this short quiz on the material. Mail or fax your answers to our offices, with your certification renewal application, as directed at the end of the quiz. With a passing grade, we will apply one credit hour to your record.

Check your answer(s):

- 1) At what outside temperature range can 100% outside air be used to perform all necessary cooling (i.e. chillers can be shut off)?
 - a. 48 - 52°F
 - b. 52 - 57°F
 - c. 57 - 63°F
 - d. 63 - 67°F
- 2) Dry air is "cooler" than moist air.
 - a. TRUE
 - b. FALSE
- 3) For best energy-efficiency results, humidity settings should be:
 - a. lower in the winter and higher in the summer.
 - b. higher in the winter and lower in the summer.
 - c. the same year-round.
 - d. set in a range no wider than 10%.
- 4) Night cooling generally works best where off-peak electric rates equal daytime rates and night air is relatively cool and dry.
 - a. TRUE
 - b. FALSE
- 5) As outside air dampers age, they _____
 - a. need to be replaced on a regular basis.
 - b. may not close or seal properly
 - c. can be repaired inexpensively with flexible plastic strips.
 - d. b & c.
- 6) Lighting efficiency upgrades have no effect on HVAC costs.
 - a. TRUE
 - b. FALSE
- 7) Four-pipe fan coil units use built-in heating coils next to cooling coils to:
 - a. dry air to an acceptable room-appropriate level.
 - b. treat air as it is discharged to the outside.
 - c. mix air to correct temp before discharging into a room.
 - d. make it easier to clean the system

- 8) Duty cycling and using two- or variable-speed motors are equally effective as cost- efficiency measures to control heating or cooling of a space.
 - a. TRUE
 - b. FALSE
- 9) A wider range of temperature control variation is most appropriate for:
 - a. lobbies and hallways.
 - b. storage spaces
 - c. a & b
 - d. a, b & c
- 10) Fill material in cooling towers is used to allow water to cool faster and more efficiently.
 - a. TRUE
 - b. FALSE



END OF QUIZ

We include a quiz like this in each of our bi-annual newsletters. To submit your completed quiz for re-certification credit (1 credit per quiz passed), please complete the following and either fax it to 206-292-4125, or mail it to: **BOC Quiz, NEEC Office, 157 Yesler Way, Suite 409, Seattle, WA 98104.** Please remember to send it with your certification renewal application.

Your Name: _____

Title: _____

Employer: _____

Address: _____

City: _____

State: _____ Zip: _____

Phone: _____

Fax: _____

Email: _____



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206-292-4793 ext. 2



BOC Fax:

206-292-4125



Email:

BOCinfo@theBOC.info



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San Diego Gas & Electric • Seattle City Light
Snohomish County PUD • Southern California Edison • Southern California Gas • Tacoma Power • U.S. Dept. of Energy, Federal Energy Management Program • Washington State General Administration

Editor and Contributing Writer: Christine Doonan
Graphic Design: Thom Harris Design

2007-08 COURSE SCHEDULE *

BOC Level I Certification

The Level I series comprises eighty hours of training and project work in building systems maintenance. Courses include: Building Systems Overview, HVAC Systems and Controls, Facility Electrical Systems, Indoor Air Quality, Environmental Health & Safety Regulations, Efficient Lighting Fundamental and Energy Conservation Techniques. See websites for cost and updated dates and locations.

BOC Level II Certification

Level II has seventy 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 websites for supplemental class topics, dates and locations.

California - Level I www.theBOC.info/ca
Sacramento10/16/07 - 4/08/08
Ontario.....10/11/07 - 4/10/08
San Diego (sold out).....10/10/07 - 4/09/08
San Jose.....11/28/07 - 5/14/08
San Francisco11/29/07 - 5/14/08

California - Level I www.theBOC.info/ca
Port Hueneme.....9/6/07 - 2/26/08
Downey.....9/5/07 - 2/27/08
San Francisco10/2/07 - 3/4/08

Oregon - Level I www.nweei.org
Portland.....9/27/07 - 03/11/08

Oregon - Level II www.nweei.org
Portland.....(TBD) 4/08 - 9/08

Washington - Level I www.theBOC.info/wa
North Seattle.....10/04/07 - 4/3/08
Longview10/16/07 - 4/5/08

Washington - Level II www.theBOC.info/wa
Everett.....9/12/07 - 2/14/08

Northeast - Level I www.theBOC.info/ne
Canton, MA (sold out)9/6/07 - 9/29/07
Melville, NY10/24/07 - 10/13/07
Beverly, MA.....10/26/07 - 10/14/07
Portland, ME.....10/23/07 - 2/5/08

Northeast - Level II www.theBOC.info/ne
Waterville, ME10/3/07 - 12/19/07

* As of publication date; see BOC website for up-to-date schedule information (www.theBOC.info)