



SUMMER/FALL 2014

## Renewables: Ready for Prime Time in the U.S.

According to a recent article at **Renewable EnergyWorld.com**, Bloomberg New Energy Finance (BNEF) forecasts that worldwide investment spending on new power plants through 2030 will be about \$7.7 trillion, and of this, two-thirds is likely to be invested in renewable energy projects. This projected investment of \$5.1 trillion in renewables through 2030 is skewed toward Asia and other developing areas. These areas will be able to leapfrog the fossil fuel options of more developed countries, particularly in rural areas where there is no established energy infrastructure. In fact, just this past July, the off-the-grid village of Dharnai, India became the first in the country to be powered entirely by an autonomous solar electricity micro-grid system.

Preliminary data for 2013 from the U.S. Energy Information Administration (EIA) says that "renewable sources of energy accounted for 10 percent of total U.S. energy consumption and 13 percent of electricity generation." But this is not a huge number when you consider that there are some countries that produce 100 percent of their energy from renewable sources. Iceland and Norway, for example, have been at that level since 1980, mostly with hydropower and some geothermal sources. Paraguay (hydropower) actually exports about 90 percent of what it produces. Different circumstances and needs, of course, but they are self-sufficient on the energy front.

### U.S. Usage by the Numbers

By simple definition, fossil fuels (oil, coal, natural gas) are finite; renewables are not. The U.S. Energy Information Administration (EIA) estimates that primary energy

consumption (this does not include electricity, since that is produced with primary sources and is thus a secondary power source) in 2013 broke down as follows:

<b>Petroleum</b> .....	<b>36%</b>
<b>Natural Gas</b> .....	<b>27%</b>
<b>Coal</b> .....	<b>19%</b>
<b>Renewables</b> .....	<b>10%</b>
<b>Nuclear Electric</b> .....	<b>8%</b>

Total usage in the U.S. for 2013 was 97.5 quadrillion Btu's, of which 38.4 was dedicated to producing electric power. The EIA report also breaks down usage by sector (residential & commercial, 10.7; industrial, 21.5; transportation, 26.9, in addition to the electric power's 38.4), but notes that "nearly all electricity is used in buildings and by industry. This means that the total amounts of energy used by residential and commercial building, industry, and transportation are actually higher...when electricity is included."

With renewables at only 10 percent of primary energy sources, there is a lot of room for growth. The United States has been a fossil fuel or "petro" state for over a century, so things cannot turn around overnight with the fossil fuels infrastructure being firmly in place. But the ever-increasing awareness of climate change and its repercussions have finally brought a sense of urgency to decreasing energy usage. Using energy more efficiently, as our readers know, is a central focus of BOC training. Addressing efficient usage of the current energy infrastructure is one way in which the transition to renewables can be accomplished, using less energy and therefore, decreasing reliance on fossil fuels.

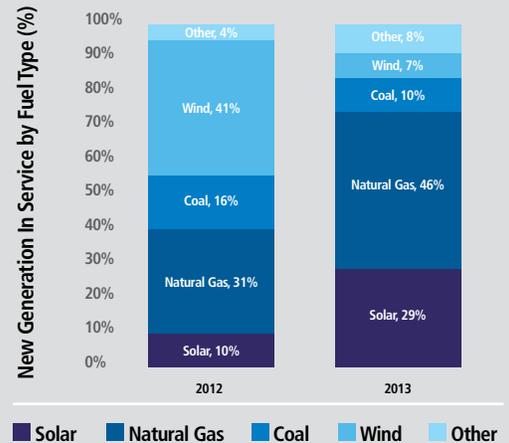
### Renewables and the Outlook in the U.S.

The EIA estimates that energy sourced from renewables for electricity and heat will increase over the short term by 2.9 percent in 2014 and by 4 percent in 2015. In their Annual Energy Outlook 2014, longer growth is estimated at 69 percent from 2012 to 2040. As methods of producing renewables improve, this estimate could increase.

So what are the various options for renewable energy and what are the various outlooks for these options?

The graph below shows the breakdown of new energy sources coming online between 2012 and 2013.

### New U.S. Electricity Generation Capacity, 2012 vs. 2013



GTM Research/SEIA: U.S. Solar Market Insight®

Solar and natural gas had large increases at the cost of wind and coal. Costs became (and are continuing to become) more competitive for solar and, importantly, energy storage also became more viable and cost-effective. U.S. production of natural gas is at all-time high levels with new extractions (some obviously more controversial than others) increasing output.

(Continued on page 2 see **RENEWABLES.**)

### IN THIS ISSUE

Renewables: Ready for Prime Time in the U.S. ....	1-2
Getting to Net-Zero Energy & Tech Horizons.....	3
BOC Grads Making a Difference.....	4-6
BOC Around the Country and Conferences & Symposia .....	7
Tech Highlight.....	8-9
BOC Training, Announcements & Certification Renewal Credit .....	10 & 11
Contact BOC & Sponsors .....	12

**RENEWABLES** (Continued from page 1)

## Solar

According to *U.S. Solar Market Insight*, “more solar has been installed in the U.S. in the last 18 months than in the 30 years prior.” Solar is becoming much more competitive on cost basis and thus is becoming much more attractive to residential, non-residential, and significantly, utilities. Installations in all sectors spiked last year, especially in the fourth quarter. Some of this was due to federal tax incentives but oversupply of solar panels has brought costs down as well. Also, as above, with energy storage improvements, utilities have started to see solar as a viable alternative.

## Geothermal

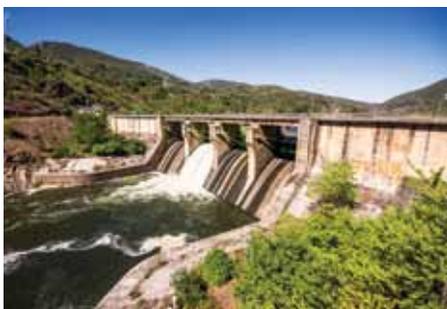
Geothermal installations use piping drilled into the ground to access the internal heat, creating electric power as well as heating and cooling options. Smaller installations, such as residential and single building, can access enough of the Earth’s heat nearer the surface to make these installations viable, but most geothermal plants in the U.S. are located out west and in Hawaii, where the larger geothermal reservoirs are closer to the surface areas near major plate boundaries.

## Biomass

Biomass energy is that which comes from burning renewable materials, such as wood, some type of garbage, certain crops raised as biomass fuel, to name a few sources.

## Hydropower

In 2013, Hydropower represented over 50 percent of all renewables power generation and is one of the oldest sources of energy, using paddle wheels centuries ago to grind grain. It is basically harnessing water flow.



Subcategories of hydropower are tidal power, wave power, and ocean thermal energy conversion. These technologies are much newer and less explored at this point, although it is interesting to note that the first community-owned tidal power plant just began operating in Scotland in late July of this year.

## Wind

Wind is actually created by the heat from the sun. The sun heats both the land and the water but at different rates. As the air is heated (more quickly) over the land, it rises and the cooler air over the water moves in to replace it, thus creating the wind. This process reverses at night, when the land then cools off more quickly.



Texas embraced wind power early on and, as of 2013, was the number one wind power producing state in the country, with a production capacity of 12,355 MW, over double that of number two, California. Also at the end of 2013, Texas had over 7,000 MW of wind farm projects awaiting completion. Several of the state’s locations lend themselves to wind power installations and are areas where wind farms can be built on a large scale, a big advantage to address the not-in-my-back-yard (NIMBY) factor.

## Issues

There have been environmental objections to some of the renewable options. People complain that wind towers are loud and harm or kill birds that fly into their propellers. There is also the NIMBY mentality that needs to be addressed. Solar installations can also harm the bird population, with birds sometimes mistaking the glistening panes for water and diving into them.

Enhanced geothermal also has its critics, who claim that drilling too far into the Earth’s depths essentially creates the same problem that fracking does in the natural gas extraction process and could cause earthquakes. These are all issues that are being and will continue to be examined and addressed.

## The Road Ahead

There are a lot of renewable options that, as the technologies and designs become more advanced, become both more economically and logistically viable. The trick is to stay on top of the technologies and to know what is appropriate for your area’s circumstances.

Renewable energy options have gone well beyond the smaller, residential sphere and

applications are now available to serve the energy needs of commercial and institutional buildings. (Please see page 3 for a successful application of both solar and geothermal technologies at Camp Pendleton in California.)

This past May, the New York State Department of Public Services issued a report entitled “Reforming the Energy Vision” where they examine sweeping but realistic ways to change the structure of the way utilities deliver services. The goal is to get the state to 100 percent renewables over a several decade time period. An article at [TheSolutionsProject.org](http://TheSolutionsProject.org) on the proposal acknowledges that it is a long road but that, “the science and economics suggest the plan will produce massive economic benefits for New Yorkers.”

The Solutions Project site also has a “50 States/50 Plans/100% Renewable Energy Benefits” mission that proposes what it sees as the most logical breakdown of renewables for each state to target to achieve 100 percent renewable status. It’s an interesting project that encourages everyone to get involved by presenting renewable plans for each state – and thus, their own back yards.

## Attitudes Shift, Action Needed

Even former investors in fossil fuels have had a change in attitude. In a press release for the recently-established (October 2013) *Risky Business Project*, co-chair and billionaire Tom Steyer, a former investment manager whose funds had multiple fossil fuels holdings, had this to say: “Climate change is nature’s way of charging us compound interest for doing the wrong thing.”

In essence, we need to pay down the loan and mitigate the damage by getting the interest payments down. In the U.S., energy efficiency measures, like those promoted by BOC training, will not only help to transition to renewables, but will be essential to reducing climate changing emissions so needed to halt the now-unfashionable term: global warming.

*For information on the various renewables and efficiency incentives available both at the federal level and in your area, please visit the Database of State Incentives for Renewables and Efficiency at [www.dsireusa.com](http://www.dsireusa.com).*

*An excellent source for up-to-date information on the newest developments in renewable energies is the online magazine [www.renewableenergyworld.com](http://www.renewableenergyworld.com).*

# Getting to Net-Zero Energy

Marine Corp Base Camp Pendleton in San Diego County, California has been involved in some amazing energy efficiency projects over the years and has also hosted a BOC Level I course for their public works operators. One project that was recently completed fits right in to the discussion of renewables: ground-up construction of a four-story recruit barracks campus facility that provides 95 percent of its electric load with both concentrated (CPV) and traditional (PV) photovoltaic systems.

The complex also has a geothermal HVAC system, which provides heating and cooling year-round from multiple ground loop wells. A microsystem that will store the energy produced on-site is scheduled to be completed in the fall, making the facility completely self-sufficient, even in the event of a total area outage.

Look for more details in the winter/spring 2015 issue of the *BOC Bulletin*, when we will highlight a number of the forward-looking efficiency and renewables projects at Camp Pendleton.



Pictured is the concentrated photovoltaic array that helps power the new recruit barracks complex.

## TECH HORIZONS

*This section focuses on new technologies that, while not yet commercially available, are on their way to becoming practical applications – technologies to watch.*

### Smart Pipe

Recently highlighted by MSN's Money web site as one of the "6 inventions that could change the world," smart pipes use nano-sensors placed at strategic points in a water system to determine problem areas for leakage.

With recent news indicating that there are now seven US states under severe drought conditions, with one-third of California reaching "exceptional" drought status conditions (the highest-intensity status used by the U. S. Drought Monitor) as of mid-June 2014, the case for promoting water usage efficiency is becoming more urgent.

According to an article at the Illinois State Water Survey site (listed below), a study was done in 2005 stating that six billion gallons of treated water is lost every day mostly due to faulty infrastructure – an amount, they calculate, that would be enough to supply California. With smart pipe's nano-sensors in place, systems could be monitored for flow rate, water quality, leaks, and more,

all of which could be done wirelessly at a central location, with applications in both private and public sectors.

To find out more, check out this link: <http://www.isws.illinois.edu/gws/sensor/smartpipe/>

### Solar Roads

In a June 2, 2014 article at TheWeek.com, author John Aziz offers a piece on the economic case that can be made for solar roads, an idea developed and implemented by owner Scott Brusaw's company, Solar Roadways. A small prototype under a contract with the Federal Highways Agency has been installed and is already generating electricity.

The concept certainly has its critics but the potential results, if taken to the extreme by replacing all the country's roads, sidewalks, etc. with solar applications, would mean that they "could generate three times the energy the U.S. uses in a year, while reducing greenhouse gas emissions by 75 percent."



Scott and Julie Brusaw standing on an installation of "solar road".

Pie-in-the-sky? Perhaps. But you could also envision practical applications of the technology in parking lots or in driveways for residential electricity production. It's a complex technology with numerous factors to consider.

Find out more about this nascent technology by going to [www.TheWeek.com](http://www.TheWeek.com) and searching on "solar roads" – or better yet, go to the source itself and check out [www.SolarRoadways.com](http://www.SolarRoadways.com). The FAQ section is particularly informative.

# BOC Grads Making a Difference

## Creative Workarounds for Achieving Energy Savings



**Richard Laws**  
Physical Plant Supervisor

**Richard Laws** supervises the physical plant department at United Radio in East Syracuse, New York. Laws came to United Radio four years ago after ten years spent running his own property maintenance company. Self-taught in the many aspects of

property maintenance, he got an EPA 608 certification, and is a certified HVAC/R preventative maintenance technician as well.

Around the time he joined the company, local utility National Grid was holding a BOC Level I series, Laws decided to participate, completing his training in November 2011. "The training gave me a new system of thinking about how to approach building management," notes Laws. One BOC tenet he took to heart was the idea of creative thinking about problem-solving and looking at no-cost/low-cost possibilities.

United Radio's New York facility had its challenges. The manufacturing and repair company deals with automotive, communications, and consumer electronics, with a building dedicated to each division. Operations are very energy-intensive. The three buildings together are about 275,000 square feet.

One of his more satisfying ongoing projects is the 50,000 square foot automotive building. Operating an average of 18-20 hours a day, the equipment generates so much heat that it requires continuous cooling. An HVAC specialist, this was right up his alley. "With our location in central New York, I wanted to take advantage of all the free cooling I could get," says Laws.

The building had a total of 10 rooftop units that were anywhere from 18-24 years old. "While in disrepair, they were still good units that just needed some attention," Laws states. Many of the units were either disconnected or by-passed so, in effect, useless. The project to repair the units began. He had the good fortune to be able to enlist the help of Senior Director of Development Jim Fellows (who had recently been inducted to the National Electronics Hall of Fame) to understand the electronics behind the HVAC system. The two met (and still meet)

weekly for a "class" where Fellows imparts his extensive knowledge of electronics to Laws and they work on projects designed to test and monitor equipment.

Laws would bring components of the existing economizer system to Fellows so that they could troubleshoot problems. They built a portable tester for the economizer components, which gave them flexibility and time. "With Jim's knowledge, we are able to rebuild the components ourselves most of the time," Laws explains.

The ability to quickly troubleshoot and repair means that equipment is consistently monitored – Laws checks the system three times a week – so problems are discovered before they become major repairs. Laws estimates that they are about 98 percent self-sufficient in maintaining the system.

"I also use small duct work to pull the hot air at the suspended ceilings in heavy production areas to move the warm air produced there to cooler outer perimeters, such as offices, where heat is needed most of the year," explains Laws. "This helps in having less air to cool, and also adds to overall comfort." Using inside air to heat cooler office areas and outside air to cool hot production areas, they have altered the building envelope and now get nine-to-ten months of free cooling, as well as redirected heating.

*"The training gave me a new system of thinking about how to approach efficient building management."*

– Richard Laws

Laws also worked on a project with Fellows at the complex's corporate building. They built a tester to put on the control boards of the building's 45 water-source heat pumps, running them through the various cycles to determine potential failures. "The tester gives me the capability to run and test other components in

the heat pumps," says Laws. "I am able to repair pumps before they become major problems, with a fairly fast turnaround and very little downtime."

Other projects have included lighting retrofits in all three buildings to T8 fluorescents, installation of motion sensors and programmable thermostats, and converting all parking lot lighting from high-pressure sodium and mercury vapor lights to LEDs, yielding savings and better lighting. "We received a 50% incentive on the lighting project through National Grid. The balance was paid through our monthly bills. This project took less than one year to pay for itself," notes Laws.

Laws also participates in a "Lunch and Learn" program where on three of the Wednesdays in

each building from November through April, employees get together for lunch and hear about the different energy efficiency measures he is trying to put in place, "so that we as a company can benefit and reduce our carbon footprint." He also includes tips for residential energy consumption, getting buy-in to create better energy-use habits at work and at home.

The economizer project began in April of 2013. Total energy use for all three buildings was 1,948,028 kWh in 2012 and 1,789,600 kWh in 2013 – an 8.1 percent drop. A comparison of the first five months of 2013 and 2014 yields 7.4 percent decline. "Our energy consumption for 2014 is on track to decline further, especially as we continue to repurpose the huge amount of heat produced in our line of work," says Laws. These reductions were achieved with a 30 percent increase in testing equipment through this time period.

Laws' new "system of thinking" is getting some great results and, at the same time, giving him the challenges he clearly relishes

## It's Not Just About Energy Efficiency



**Debra Hernandez**  
Production Supervisor

BOC grad **Debra Hernandez** was hired as a production supervisor at Seneca Food Corporation's Ripon, Wisconsin location almost five years ago. She had a background in the food industry, but not in facilities management. Still, her plant manager, Scott Fortier (also a BOC

grad) believed she was a quick learner and had the people and organizational skills to be a good maintenance supervisor. He encouraged her to take BOC and she completed Level I certification in June 2011.

Level I training was the perfect solution for Hernandez's situation and, she notes, "kind of lit a fire in me. I came back and wanted to use what I'd learned. I looked around the facility and saw so many places where we could use that knowledge to improve our energy usage."

Hernandez and her staff, whom she says are "the best maintenance crew on the planet," have worked on several projects, such as lighting upgrades (the traditional "low-hanging fruit" for efficiency) and steam trap improvements. The entire production area was updated from old 400-watt metal halide fixtures to 118

energy-efficient T5 fluorescents, saving the company \$10,870 annually. With incentives from local utility Alliant Energy defraying the costs by almost 20 percent, the payback for the project was 4.7 years in energy costs alone.

But one project stands out for her. An 1,800 square-foot area of one of the location's four facilities housed a palletizer, which automatically puts product(s) on pallets for shipping. The large, complex equipment was lit with 35-year-old metal halides, which not only used more energy than other options available, but were almost inaccessible by anything but a boom lift. Bulb changes were an expense in terms of time, money, and most of all, safety for the electrician performing the work.

"Our research determined that 100,000-hour Huron Induction lights would eliminate the need for frequent maintenance," says Hernandez. This would save on energy costs but more importantly, would alleviate need for frequent and onerous replacement. Hernandez estimates that the lights are on an average of 12 hours a day for the whole year. This is total usage time of 4,368 hours. Even if the lights last for half the estimated output, it would be over a decade before they required change-outs.

So why does this particular project stand out for Hernandez? "I think of this project as my baby. It got my foot in the door of making a difference here." Without the technical background in facilities maintenance, Hernandez believes that BOC training gave her the tools to address an issue, evaluate various solutions and, crucially, to persuade the financial decision-makers.

Estimated simple payback for the project was close to eight years, with an ROI of 6.7 percent, so it was not as easy a sell as some of the quick payback change-outs can be. But there were other considerations. In addition to being difficult to access and maintain, the halide lighting was inadequate for the area, where workers were tasked with inspecting shipments and needed better lighting.

Hernandez credits her local utility's representative, Mary Brott of Alliant Energy, with helping to move the project along. "Mary is an excellent rep and a source for efficiency incentives available for this and other projects," she notes. The utility's liaison with Focus on Energy, Brott helped to get financial incentives for the lighting project from FoE. Brott notes, "It's a wonderful success story for Seneca, thanks to Deb's focused efforts. She has so much enthusiasm for energy efficiency, and is clearly respected at the company."

You cannot always go by simple payback or ROI. Projects have savings other than just energy costs, though at well over \$1,000 per year in that

one 1,800 square-foot area, the saving is significant. Freeing up the man-hours needed to do frequent bulb replacement saves on labor costs. Better lighting means easier, safer, and more productive working conditions. Less mercury having to be recycled – an environmental saving. Energy efficiency isn't just numbers.

So Hernandez used her BOC training, her new tools, to solve a lingering problem. What else did the training give her? "BOC was probably the best continuing education experience I've had. After the classes, I felt much more comfortable jumping into the hands-on aspects of making our buildings more efficient, more green," she says. "It helps that I have such an experienced crew. They continue to teach me as well because we do these projects as a team. It just makes my job great."

## For Non-Profits, Good Savings Numbers Get Needed Funding

A 40-year veteran of the FM industry, BOC grad **Lou Rogowski** is the facility director for The Connection, a non-profit community and social services organization with fifty locations throughout the state of Connecticut. Based in the New Haven location at 48 Howe Street, Rogowski has been with the non-profit for over seven years supervising all locations. His previous job was as FD with the Derby Connecticut Public School District. Prior to that, his experience was in the corporate sector.

Rogowski notes that, "The big difference between corporate and non-profit is basically bottom-line versus how-can-you-serve. The equalizer here is that everyone is concerned about saving energy these days." His background gives him the tools to bring bottom-line results that allow non-profits to better serve their community.

Non-profits rely on state and local funding, donations, and grants, so emphasis is on creating projects and proposals that prove efficient use of funds. Rogowski notes that it is the only way to pay for some of the more exotic projects that, in the long run – or even the short run – will pay dividends. "We provide the energy-savings numbers so the grant writers can make a solid case."

The Connection has been very successful in its pursuit of funding for efficiency projects, recently rewarded \$880,250 from the state's Non-profit Grant Program, the third highest amount rewarded. Funds will be directed both to energy efficient and structural changes at 48 Howe Street location, as well as installation

of stand-by generators for Connection House in Middletown and Pendleton House in New Haven.

In June, the latest of The Connection's energy efficiency projects fired up at the 48 Howe Street location: installation of two 10 kW cogeneration plants, and a 200 kW stand-by generator. Funding of \$372,000 for the project came from the state's Department of Mental Health and Addiction Services.



Lou Rogowski (on right), Facilities Director, with David Kyle, Facilities Manager, who will be attending BOC in the fall.

The 48 Howe Street location, a 90,000 square foot facility, is an old YMCA building listed on the National Register of Historical Sites that was constructed in 1929. Acquired by The Connection in 1997, it was in disrepair. The needed renovation has been ongoing, with an eye to obtaining LEED certification for the landmark building.

**"No matter how smart or experienced you are, sometimes if you simplify your approach, it makes it easier to go after the basics I'm constantly going for."**  
 – Lou Rogowski,

Rogowski estimates that the cogen installations will save between 15-20 percent annually on electricity costs, but the even bigger benefit stems from another aspect of the process. The cogen's engine runs on natural gas and produces electricity, water is used to cool the engines and that, in turn, is

reclaimed by a heat exchanger for occupant hot water use. The building houses between 200-250 clients non-stop, seven days a week, and has tremendous hot water needs.

The existing system had two 744,000 BTU hot water boilers. It was thought that these would be in backup mode but, "It's been three weeks and they haven't come on once," says Rogowski, sounding pleasantly surprised. The use of natural gas to run the cogen system basically offsets what would have been used to power the water boilers. But there's more. Utility incentives make the cogen rate for natural gas much lower than that for regular use.

(Continued on page 6 see **BOC GRADS**.)

## BOC GRADS (Continued from page 5)

The result is a game changer in that the original energy-savings estimate was cautiously conservative. In a facility where utilities run at an estimated \$200,000 annually, 20 percent (a figure Rogowski still believes will be conservative) is significant.

During his tenure in the school system, Rogowski developed a fruitful working relationship with local utility United Illuminating (UI), whose Energy Conservation Fund Director, Roy Haller, suggested that the BOC program might be of interest. Hesitant at the time commitment and, then thirty years in the business, not so sure it would be relevant, he agreed to attend. UI picked up the cost of the training as part of an energy efficiency program it had through its Energy Conservation Fund. The series was sponsored by the State of Connecticut, a long-time supporter of BOC. "It was a good working tool, giving a focus and direction," he states. "No matter how smart or experienced you are, sometimes if you simplify your approach, it's easier to go after the basics I'm constantly going for."

While he has not had the time to attend Level II, Rogowski has recommended the program to his right-hand man, David Kyle, with whom he has worked since joining the company. Kyle, a 25-year veteran of the industry, will take the training later this year at a series sponsored by area utility National Grid.

They are up for more challenges. "We have a capital plan in place now looking for \$30 million! We won't get that kind of money but as grant funding becomes available, with a plan in hand, you can prioritize your projects and streamline what you ask for. We're prepared for that," explains Rogowski. Last year, a BAS system was installed at Howe Street. His staff can monitor and control the entire building from a laptop – either on-site or off. Getting all fifty sites, gradually, up on that system is a great goal for him, saving money and energy, as well as the time of facilities personnel who would no longer have to be dispatched on site for minor adjustments.

The Connection ([www.TheConnectionInc.org](http://www.TheConnectionInc.org)) has been serving Connecticut's communities for over 40 years with three principal service areas: Behavioral Health, Community Justice, and Family Support Services. It provides invaluable programming helping many of the most vulnerable members of society and is firmly committed to continuing this ambitious plan of implementing 21st century energy conservation measures. Rogowski and his staff are very happy with the part they play in this mission.

## Concentrate on Usage and \$ Savings Will Come



**Brian Eko**  
Director of Facilities

BOC grad **Brian Eko** received a degree in construction management from Washington State University and then spent the next several years going around the country as a construction project manager building airports, dams, and hydroelectric plants among other development projects. In the mid-90s, Eko went back to work in Washington, settling where he grew up.

At that time, Eko heard of the BOC training and decided it was a good continuing education opportunity and a good credential to add to his resume. Just under six years ago, he took on the position of director of facilities, maintenance and technology at the Centralia School District in Washington, where both his skills and the BOC training came in handy.

Centralia is a smaller community in southwest Washington. The school district has five elementary schools, one middle school, one high school, and five ancillary facilities for related school functions. They encompass about 500,000 square feet of building area over 73 acres and serve well over 3,000 students. "The newest building I have was built in 1969 and the last bond issue for schools was in 1988, so there was – and is – a lot to be done and a lot of potential for savings," says Eko.

The school district had been fairly cautious when funding improvement projects so Eko focused on one project as a proving ground to show that real savings could be had with some investment, together with potential external resources. He targeted one of the middle schools, illustrating to the district that, with some grant funding from local federal agency Bonneville Power Administration (BPA) and the balance from the district, he could switch out all the old lighting with T8 and T5 fluorescents, and also install occupancy sensors. This would be a \$60,000 project that would pay labor costs with the energy savings within six months and pay for materials above and beyond anything not rebated by BPA within a year.

"Since completion of that project five or so years ago, we've basically been making money on it," notes Eko. Shortly after completion, the state voted funding for the Office of Superintendent of Public Instruction (OSPI) to promote energy efficiency projects in schools. "I went to the district and told them, we have to go after this money."

Working with an energy service company (ESCO), as required by the terms of the OSPI grants, in 2009 Eko put together several projects totaling \$1.4 million. \$400,000 of this was given in a grant and the balance was paid for with a state loan, the terms of which were set up to pay off the project with the projected energy savings costs. "The ESCO can't guarantee the actual cost savings because prices change, but the energy savings can be calculated and overall, it comes close on costs," notes Eko.

Old boilers were replaced throughout the district's schools, BAS heating controls were installed in several of the schools, and the rest of the schools were retrofitted with T8 & T5 lighting and occupancy sensors. They also did extensive replacement of water fixtures with more efficient models – faucets, toilets, sinks, etc.

In 2011, when OSPI extended the grant availability to all buildings within a school district, Eko targeted the rest of the district's facilities, worked up a project proposal for \$1.2 million, not only doing the same types of updates to ancillary buildings as had been done on the schools, but also reconditioning an indoor pool facility that had been built in 1979. Once again, \$400,000 was grant money and the rest financed.

And the energy savings? From FY 2009 through 2013, natural gas usage declined by 21 percent throughout the school district's facilities. The electricity savings at the schools was about 3 percent decline from FY 2009 through 2012, but this decrease is impressive because computer loads have increased, as has building hour usage with new after-school activities. One of the greatest impacts has been on water, with over a 38 percent decline in usage over that 2009 to 2013 fiscal year period. "This is really significant for us. Water rates in the district are the highest in the state due to sewer fees because of a new treatment plant. We were very happy with these numbers," says Eko.

"In my situation where a lot of the equipment is much older, I always factor in maintenance costs, replacement costs, how many man-hours will be saved with more efficient options – hours that can be better spent on other projects," says Eko. "It's also just the right thing to do in terms of efficient energy use."

So Eko continues to chip away at project after project, improvement after improvement, aware of overall cost savings, but much more intent on working towards usage savings, which will usually yield cost savings, but certainly is the right thing to do. It can also be aided with some savvy knowledge of the options, both in the latest equipment and technology available, and in funding resources.

## EPA Recognizes NEEC with 2014 Energy Star Award for Excellence in Energy Star® Promotion

The U.S. Environmental Protection Agency (EPA) has named the Northwest Energy Efficiency Council (NEEC) as a 2014 ENERGY STAR Award for Excellence in ENERGY STAR Promotion winner for its outstanding contributions to reducing greenhouse gas emissions through significant consumer education efforts promoting superior energy-efficient products. NEEC's accomplishments were recognized at an awards ceremony in Washington, D.C. on April 29, 2014.

An ENERGY STAR partner and active supporter since 2002, NEEC is honored for its work in promoting ENERGY STAR programs and products that meet ENERGY STAR specifications for energy efficiency, especially through its BOC® program which, in addition to its training of facilities staff in best practices for energy efficiency, includes benchmarking building performance through ENERGY STAR's Portfolio Manager software tool and in specifying the purchase of ENERGY STAR products and equipment.

NEEC also operates the Help Desk for the City of Seattle's successful energy benchmark and disclosure policy which uses ENERGY STAR software. The City of Seattle has achieved the highest rate of compliance of any city in the U.S. with a similar disclosure requirement.

"With the Northwest Energy Efficiency Council's help, Americans are saving energy and money while protecting the environment and fighting climate change," said EPA Deputy Administrator Bob Perciasepe. "Their innovative efforts to promote ENERGY STAR products are helping consumers make smarter choices about the products they buy."



Doug Francis, NEEC Board Member, accepting the Energy Star award.

## NEEC Reaccredited as an Authorized Provider of IACET CEUs

In June, the International Association for Continuing Education and Training (IACET) awarded reaccreditation status to the Northwest Energy Efficiency Council (NEEC), administrator of the BOC program. IACET Authorized Providers are the only organizations approved to offer IACET Continuing Education Units (CEUs). The accreditation period extends for five years, and includes all programs offered or created during that time.

"We are pleased to continue our relationship with the Northwest Energy Efficiency Council as an Authorized Provider," stated Kristopher J. Newbauer, President of IACET and Director of Learning & Organization Development at Rotary International in Evanston, IL. Newbauer added, "NEEC joins nearly 650 organizations around the globe that have had their programs vetted by third-party experts in continuing education to ensure the highest possible standards are met."

In order to achieve Authorized Provider accreditation, NEEC completed a rigorous application process, including a review by an IACET site visitor, and successfully demonstrated adherence to the ANSI/IACET 1-2013 Standard addressing the design, development, administration, and evaluation of its programs. NEEC has pledged its continued compliance with the Standard, and is now authorized to use the IACET name and Authorized Provider logo on promotional course material. In addition, NEEC is now linked to the IACET web site and is recognized as offering the highest quality continuing education and training programs.

## BOC Wins 2014 IACET Exemplar Award

In addition to being reaccredited as a continuing education provider, NEEC is honored to have been selected as the International Association for Continuing Education and Training (IACET) 2014 Exemplar Training Organization, in recognition of the BOC program. This national award is presented to one training organization annually by IACET, whose mission is to advance the global workforce by providing the standard framework for quality learning and development through accreditation.

On behalf of NEEC, BOC National Project Director, Cynthia Putnam, will accept the award at an IACET awards reception event in Irvine, California on September 18th.

Please see more detailed information on IACET at the reaccreditation announcement above.

## National Conferences & Symposiums 2014

### IFMA World Workplace 2014

New Orleans, Louisiana  
September 17-19, 2014

**MORE INFO:** [www.ifma.org/events/](http://www.ifma.org/events/)

### I2SL (formerly Labs21) 2014 Conference

Orlando, Florida  
September 22-24, 2014

**MORE INFO:** [www.i2sl.org](http://www.i2sl.org)

### World Energy Engineering Conference 2014

Washington, DC  
October 1-3, 2014

**MORE INFO:** [www.aeecenter.org/Shows/](http://www.aeecenter.org/Shows/)

### Building Operating Management's NFMT Vegas 2014

Las Vegas, Nevada  
October 7-8, 2014

**MORE INFO:** [www.nfmt.com/vegas/](http://www.nfmt.com/vegas/)

### GreenBuild International Conference & Expo

New Orleans, Louisiana  
October 22-24, 2014

**MORE INFO:** [www.greenbuildexpo.org](http://www.greenbuildexpo.org)

### Midwest Energy Solutions (MES) Conference

Chicago, Illinois  
January 28-30, 2015

**MORE INFO:** [www.meeaconference.org](http://www.meeaconference.org)

### NFMT (National Facilities Management & Technology) Conference/Expo Baltimore

Baltimore, Maryland  
March 10-12, 2015

**MORE INFO:** [www.nfmt.com/baltimore/](http://www.nfmt.com/baltimore/)

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.



# Vaunting VRF: An Energy Slashing System Is on the Rise

Get familiar with an HVAC technology that is dominant overseas

By Christopher Curtland

Variable refrigerant flow (VRF) HVAC systems may soon become a very important import in the U.S. It has about 24% of the global commercial air conditioning market and over 35% market share in China, India, the European Union, and Eastern Europe. But as of 2012 in the U.S., VRF represents only 3%, according to a GSA report citing manufacturer LG.

About one-third of commercial building energy usage in the U.S. is used for heating, cooling, and ventilation, according to the GSA. Owners and FMs would be wise to consider any technology that can slash that piece of the pie.

While VRF has been dominant worldwide for over 20 years, the U.S. has been slow to accept it for several reasons. Products have primarily been manufactured by Asian companies, which at one point had limited presence in the U.S. There is also little critical evaluation of actual field energy performance.

But VRF sales in the U.S. are growing and multiple manufacturers offer these systems, including Carrier, Daikin, LG, Mitsubishi, and Sanyo.

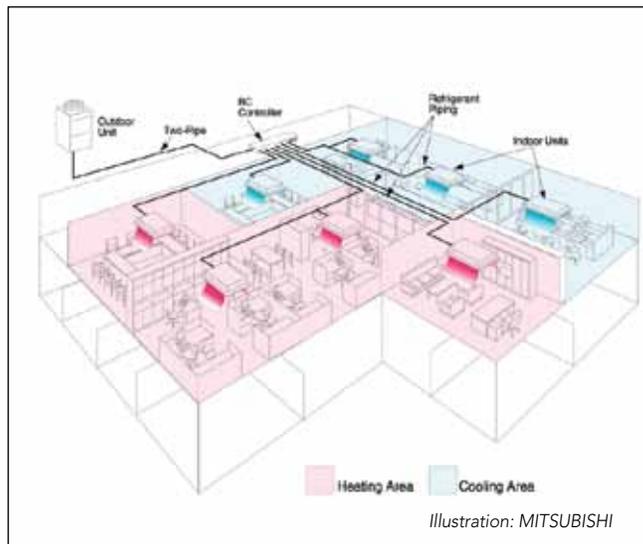
If you still have questions about how it works, what motivates its implementation, and where its potential is maximized, let the following guide help you with your next HVAC decision. VRF is valuable for either whole buildings or individual spaces and floors

## FATHOM FUNCTIONALITY

VRF systems are comprised of two major parts: a compressor unit and multiple indoor fan coil units. The compressor, typically located on the roof, cools and heats refrigerant connected through piping to the building.

These systems are capable of simultaneously cooling some zones and heating others. They can recover heat from spaces being cooled for use in spaces being heated and vice versa.

"Energy consumption is cut by offering on-demand cooling and heating for individual zones. Power is reduced because



**How VRF Works.** SYSTEMS provide heating and cooling simultaneously through refrigerant piping as opposed to ductwork. It can recover heat from spaces being cooled for use in spaces being heated and vice versa

the system operates only at the levels needed to maintain a constant, comfortable indoor environment," explains Mike Smith, senior marketing manager for manufacturer Mitsubishi. "The condenser fan rarely has to run at full speed, offering quiet performance."

The fan coil units can be mounted directly in the space or configured in the ceiling, walls, or at floor level. They also can be hidden above the ceiling or located near, but not in, the conditioned space.

Because of its zoning customization abilities, VRF systems offer integrated controls with the units, which typically don't require a separate building automation system. Many also include self-diagnostics and monitoring points.

These features allow VRF systems to achieve 30% or higher HVAC energy cost savings relative to minimally code-compliant conventional systems, according to a report from Pacific Northwest National Laboratory (PNNL).

## MEASURE MOTIVATIONS

There are several drivers for implementation aside from strides in efficiency. Energy wasn't the key motivation for a VRF installation in a Manhattan office, designed by engineering

firm Environmental Systems Design (ESD). The project utilized VRF for a single 8,000-square-foot floor on a 35-story building of 1920s construction.

"At that site, we were able to shrink the mechanical room by about half, which is huge with the cost of real estate in New York," explains Louis Franceschini, senior associate at ESD. "Physical dimensions have a surprising impact."

Lightweight VRF rooftop units typically don't require a crane during installation, and the systems have limited space requirements, particularly for air distribution inside the building, which utilizes half-inch piping as opposed to 12-inch or larger ductwork.

"The systems are designed to blend into their environments," Smith says. "You can accommodate the aesthetics of a space instead of sacrificing interior design due to the limitations of conventional ducted systems."

According to PNNL, the best opportunities for VRF systems include buildings with any of these target characteristics:

- Inefficient fan systems
- Lack of cooling or inadequate cooling capacity
- Leaky and/or poorly designed or installed ductwork
- Inefficient HVAC systems and high energy costs
- Older and historical sites with limited room to install or change systems
- Already targeted for HVAC upgrades, replacements, or energy improvements
- New building projects that can take advantage of opportunities to reduce floor-to-floor height or increase usable floor space by removing mechanical equipment inside.

There is a growing availability of utility incentives, which also provide considerable motivation. Early participants include

Southern California Edison, Efficiency Vermont, the Energy Trust of Oregon, and Pacific Gas and Electric.

Buildings with small, separated areas can take full advantage of the zonal control capability. These include offices, schools, lodging, multi-family, healthcare, and retail shopping centers and malls with small stores.

## ASSESS APPLICATIONS

Generally speaking, the best candidates for VRF technology will be either older, inefficient buildings due for retrofit, or facilities that have multiple spaces with independent occupancy, varying comfort requirements, and enclosed rooms.

VRF offered a solution for a unique problem at a Chicago office, says Maureen Kozel, senior associate with ESD. An electronic trading firm occupied 13,000 square feet on the 27th floor of the 35-story high-rise built in 1971.

"There was a much higher computer heat load than a typical office, and the firm had just acquired another company, so they increased their headcount and wanted to change the layout," Kozel explains. "They needed to provide supplemental cooling without altering the walls or the ceilings. By running small pipes to ductless cassettes that just popped into ceiling tiles, VRF was the noninvasive answer."

At the Manhattan office project, VRF allowed floor-to-floor heights to remain the same in areas where there were only 6 inches between the beam and ceiling. "Any efficiency gain on top of the space savings is icing on the cake," Franceschini says.

Rush Health Systems implemented a VRF system for the maternity ward on the 45,555-square-foot third floor of the Rush Foundation Hospital in Meridian, MS.

"There was nothing but problems – people being too hot or cold. I had a 34-year-old, 500-ton chiller running at 98% capacity," says Fred Rogers, vice president and chief resource officer at the hospital.

The site uses VRF for the third floor in conjunction with the old chiller, which still serves the rest of the hospital. The system improved efficiency by taking the entire third floor's load off the overworked chiller.

"We've saved about \$36,000 per year in energy reduction just from that one job on

the one floor," Rogers says, adding that he has already installed smaller units throughout the rest of the campus. Two critical-access, 25-bed hospitals were recently built and 75-80% of the new facilities are served by VRF, he estimates.

## REACHING ROI

Initial costs of a VRF installation vary from \$16.50 to \$33 per square foot, PNNL notes. Systems should last at least 15 years, so any payback period inside that time frame is ideal, the report adds. But aside from simple payback, there are several factors that contribute to a successful installation.

"Depending on the style of the building, VRF zoning systems tend to have fewer components than conventional HVAC systems, reducing equipment costs and complexity as well as installation time," Smith explains.

According to PNNL, the major energy savings potential comes from the following aspects:

- Variable speed compressors provide high part-load cooling and heating efficiency.
- Reduced fan energy results from low static pressure and elimination of ductwork for space cooling and heating reduces fan energy.
- Refrigerant, rather than water or air, requires less energy to move the heat transfer fluid.
- Some units are capable of heating and cooling at the same time to different zones without reheat and providing heat recovery between zones in heating and cooling at the same time.

VRF systems require occasional maintenance of the fan coil unit, which entails filter changes, cleaning of condensate removal systems, and the replacement of fan motors and coils.

"I'll knock on my desk because to this point I've had no maintenance issues," explains Rogers, adding that he has only needed to clean coils and change filters. "They've just hummed along."

Since the installation, Rogers has observed many intangible benefits aside from the \$36,000 annual energy savings.

"Now people can do what they want," he says. "Since the installation, I haven't had

anyone call me to complain that they're too hot or cold."

Occupant satisfaction brings value by attracting and retaining people at your facility.

"Early adopters looking for an edge against older designs will just reap that many more benefits in the future," says Kevin McNamara, vice president of commercial air conditioning for manufacturer LG. "VRF can really help owners, operators, and occupants have a much better building experience."

Author **Chris Curtland** is assistant editor of *Buildings.com*. This article originally appeared in that online publication on December 30, 2013 and is reprinted with permission. The online version also contains four case studies on successful implementations of VRF HVAC solutions in contrasting settings and can be accessed by going to [www.buildings.com](http://www.buildings.com) and searching on "Vaunting VRF".

You can earn one hour of credit towards your BOC maintenance by taking a quiz based on the material in this article. **Go to [www.theBOC.info](http://www.theBOC.info) to take the quiz.**

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## Check out BOC's Technical Webinar Series!



The BOC web site ([www.theBOC.info](http://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 remaining 2014 live sessions.

The final LIVE webinars offered in 2014 will be held from 11 AM to noon Pacific Standard Time. These sessions cover:

- **Optimizing Energy Management through Big Data and Analytics** (Wednesday, September 24)
- **Strategies to Help Reduce Peak Use** (Thursday, October 23)

## 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 are scheduled for **August 13th** and **September 10th** and more will be scheduled in 2015 (see the BOC website for new dates). Please note that pre-recorded webcasts can be downloaded from the BOC website 24/7.

To sign up go to: [www.theBOC.info](http://www.theBOC.info)

## Stay Ahead: Prep for BOC Maintenance Now!

To maintain BOC certification, graduates must accumulate maintenance points each year following a full calendar year after their certification. Level I maintenance requires 5 points each year and Level II requires 10. 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 7 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 can expect to receive their applications via email and US mail the week of January 5, 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). The deadline for application submission is March 31, 2015.

Last year, we simplified the application process (both hard copy forms and on-line versions) for the yearly maintenance cycle. We set up a HELP Desk with knowledgeable staff to address questions and assist with the maintenance application. We also simplified the Maintaining Certification pages of the BOC website for easier navigation and information gathering. Please note that if your BOC Level II certification is current, your Level I certification will automatically remain current as well. You need only apply to maintain Level II certification. The maintenance points remain the same at ten points per year.

### 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 a HOB0® data logger is October 1st.

Congratulations to Duane Gibson of the Cleveland Metropolitan School District, the winner of our April drawing!

### ENTER TO WIN HERE:

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

### Another Benefit for BOC Certified Operators

BOC graduates who maintain their certification receive a 20% discount on the BOC webinars series. Watch for details of new offerings at the BOC website ([www.theBOC.info](http://www.theBOC.info))

## Call for Feedback and Projects!

Our publication aims to highlight new technologies, relate success stories of graduates and get the word out about new ideas in the facilities management industry. We are open to suggestions: *What would you like to read about?*

All readers are encouraged to submit their thoughts on content they would like to see, technologies that spark their interest on which they'd like more information, or their own personnel successes as energy-efficient facilities personnel.

Please submit your ideas to email address: [news@theBOC.info](mailto:news@theBOC.info). You can also submit your own successful project story at the BOC web site ([www.theBOC.info](http://www.theBOC.info)) under the "For Graduates" section. Many of these projects are reviewed for potential stories.

**We'd love to hear from you!**



## Find A BOC Training In Your Area

When such a high value is being placed on energy efficiency, knowing how to run your building at its optimal performance is an essential skill set for building operators. Join with the growing number of facilities professionals that are recognizing 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](http://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 12,000 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 New Mexico, the District of Columbia to Hawaii, and represent companies in education, government, manufacturing, health care and beyond – 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 renewal. Check out the Education, Professional Development and Events Calendars at these sites.

### APPA:

The Association of Physical Plant Administrators  
[www.appa.org](http://www.appa.org)

### BOC:

Building Operator Certification  
Live and recorded seminars  
[www.theBOC.info/m-live-webinars.html](http://www.theBOC.info/m-live-webinars.html)

### BOMA:

Building Owners & Managers Association  
[www.boma.org/education/](http://www.boma.org/education/)

### BOMI:

Building Owners & Managers Institute  
[www.bomi.org](http://www.bomi.org)

### ENERGY STAR®:

Live web conferences, pre-recorded trainings, self-guided presentations  
[www.energystar.gov/index.cfm?c=business\\_bus\\_internet\\_presentations](http://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](http://www.eere.energy.gov/education)

### GreenBuild:

US Green Building Council  
[www.usgbc.org](http://www.usgbc.org)

### HVACR Education:

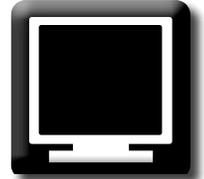
On-Line Learning for the HVACR Industry  
[www.hvacrededucation.net/](http://www.hvacrededucation.net/)

### IFMA:

International Facility Management Association  
[www.ifma.org](http://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 Retuning, 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](http://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.

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