



SUMMER/FALL 2013

## Changing Behavior in Energy Efficiency: A Different Take

The major component of BOC training is using energy more efficiently, with an emphasis on no-cost/low-cost solutions. One of the most obvious no-cost solutions is to modify user behavior by asking people to become more conscious of their usage and to point out when they are being wasteful. Communicating this can be simple, but telling people how much they can save doesn't always translate into them actually doing it.

Many readers may be familiar with the TED (Technology, Entertainment, Design) Talks, which began in 1984 in Monterey, California and have since expanded to similar formats worldwide. In June of this year, Alex Laskey gave a presentation discussing how behavioral science can help "nudge" people into doing the right thing, something they want to do anyway.

In Laskey's view, "If something is inconvenient, even if we believe in it, moral suasion, financial incentives, don't do much to move us – but social pressure, that's powerful stuff."

### The Case for the Significance of Using Less Energy

In his talk, Laskey points out that "for every unit of energy we use, we lose nine." The flip side is that for every unit saved, we save nine. To illustrate, he uses a jar of coal

against its nine-times counterpart: a wheelbarrow. The coal in the jar is all that a CFL bulb requires in a year, but extra costs in the production and delivery chain require the amount in the wheelbarrow.

While Laskey also points out that materials scientists are making great progress in new technologies, in general most of these are not ready for prime time. Conserving

receiving this message achieved a "marked decrease in energy consumption simply by being told what their neighbors were doing." Social pressure – power stuff indeed.

### Reacting to the Study

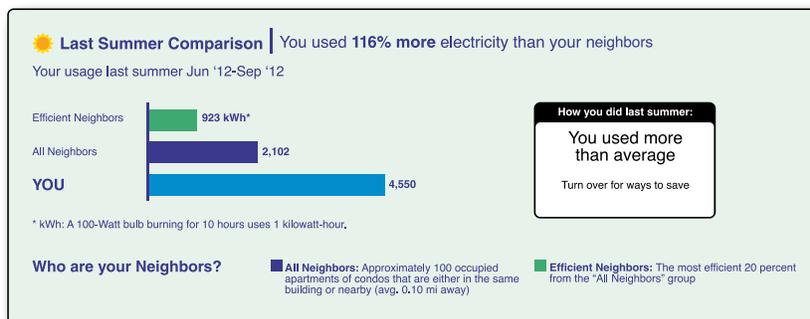
Laskey has partnered with over 80 utility companies (including many BOC sponsors) in six countries to offer "personalized home energy reports." Some of you may have even received one. They compare your energy consumption to that of your neighbors as a whole and then against the energy hot shots among the group.

Laskey estimates that the five-year results in various test areas have saved two terawatt hours, which he translates to using 34 wheelbarrows of coal every minute of every hour of every day for a year. He also gives an estimate of household energy waste in the United States at about 20 percent which, on a yearly basis, translates to about \$40 billion.

Some of this waste, as BOC grads know, is phantom waste. Consider the office microwave, left on 24/7 but only used, at best, an average of ten minutes a day. The clock on the microwave uses more power than the microwave-use itself, so a device running 24/7 is only being used 4.2 percent of the time. One example among many.

### Expanding on Behavioral Science for Efficiency

Marketers are intuitive behavioral scientists, which is probably not news. But marketing applications have always been predominantly in the advertising sector. MacArthur winner Sendhil Mullainathan, another TED speaker, who also works with Laskey on this



Above is an illustration of what a National Grid customer would receive detailing their energy use versus that of all their neighbors, as well as against the most efficient ones.

energy is immediate. He cites a behavioral study done ten years earlier in San Marcos, CA where grad students tagged neighborhood houses with three different messages: Save Money; Save the Planet; Be a Good Citizen, each tag explaining the concept. The change in behavior? None. As Laskey says, "It's like the grad students had never been there."

They included a fourth message though, which basically said: Your Neighbors Are Doing Better. Bingo. The households

### IN THIS ISSUE

Changing Behavior in Energy Efficiency: A Different Take.....	1 & 6
Cleanest and Greenest: Energy Conservation!.....	2 & 7
BOC Grads Making a Difference.....	3-6
BOC Around the Country and Conferences & Symposiums .....	7 & 8
Tech Highlight.....	9
BOC Training, Announcements & Certification Renewal Credit .....	10 & 11
Contact BOC & Sponsors.....	12

(Continued on page 6) **CHANGING BEHAVIOR.**

# Cleanest and Greenest? Energy Conservation!

A Perspective from Alan R. Mulak, PE



Alan R. Mulak, PE

Recently, I've been reading several excellent articles about the future of electric supply. It is apparent that there are many different opinions as to how we, as a nation, should proceed. It is also obvious

that statistics and facts can be combined to make a strong case for (or against) any and all choices. That's the way it is. Everyone interprets facts and statistics to suit their own beliefs, and then disregards those that may run counter to the point being made.

Here is an important point that everyone agrees upon: We all need to be thinking about energy. Not just politicians and scientists – all of us. We are an energy-intensive nation and are becoming more so with each passing day. With the growth of electronics in all sectors, electric usage is on the rise. Think about how many devices you have that require electricity. I'll bet it is a lot more than it was ten years ago.

So how do we meet this electric load growth? Since WWII, we have all witnessed power plants being built to meet the growing demand. Those days are over. Power plants are hideously expensive and, in some cases, dangerously dirty. Future power generation has to be clean, green, and affordable. Sound impossible? Not so. Wind, solar, and geothermal are developing and may be ready for prime time within a decade. Nuclear (in my opinion) can be safe and cost effective. Just ask any nuclear sailor in the US Navy. Natural gas is the best of the carbon-based fuels but, like oil, is a finite resource. Oil should no longer be used to produce power. It simply has too many "strings attached." And coal is abundant, but dirty. If I'm in charge, there will be no more coal plants built and those currently online will be phased out ASAP. Sorry coal miners, but that's the way it is. Before building anything, we must stop wasting what we have. In other words, energy conservation. The new Energy Secretary, Ernest Moniz, sums it up as follows: "The cleanest electricity is no electricity at all."

Been there and done that? Not so fast. I have been conducting energy audits for more than two decades and can tell you the opportunity for energy conservation is alive and well. Consider the following partial list:

## 1. Lights

New technology is advancing so quickly, building operators have to run to keep up! LED products are hitting the market with a wide variety of shapes and sizes. Just a few years ago, the only LED lights were in exit signs and flashlights. Now, they light parking lots, grocery store coolers, and automobile headlamps. LEDs use a fraction of what we used to use and last many times longer. Consider this: Each incandescent bulb replaced by an LED saves electric energy, labor (LEDs outlast other light sources by a wide margin), and air conditioning load (LEDs are cool to the touch – not so with other light sources). Downside? They are expensive, but more about the money end of energy conservation later.

## 2. Lighting Controls

Once upon a time, we called these "motion detectors," and they were a bit troublesome. Not so anymore. Modern sensors have dual sensing devices that eliminate the need for a designated arm-waver to trigger the device. They also can be tied to exhaust fans, heating systems, and other occupant comfort devices. In short, they make it possible for a building to match energy usage with occupancy – the goal of all building operators! New controls also address those previously "uncontrollable" areas such as stairwells and hallways. If you believe the energy consumed in these areas is insignificant, drive through any city at 3 AM. Those buildings lit up? Much of it is stairwell and hallway lighting. And one final note on lighting sensors: Beware of wall switch devices. Instead, mount them on the ceiling. Why? Wall switches are often not the best location to "see" room occupants and can also be more easily tampered with.

## 3. HVAC (Heating, Ventilating, and Air Conditioning) Systems

HVAC systems are evolving rapidly. So much so that many building owners, designers, A&E firms, etc., are unaware of all the choices. Because energy is far more expensive in Germany and Japan, much of this new technology comes from these countries. For example, the most common building heating device, the boiler, is now smaller, vastly more efficient, no longer covered with asbestos, and capable

of being controlled (instead of the old boilers that were either "on" or "off") to meet the variances in outside temperature. The days of boilers being the size of an oil delivery truck are over. Other choices for heating are new heat pumps, mostly from Japan. They are incredibly efficient, small enough to fit into tight spaces, amazingly quiet, and really work! The heat pumps of the 1970s were terrible and couldn't produce heat when it got cold outside (go figure!) but these new units operate efficiently all the way to zero. And being a heat pump, they also provide cooling as well. Perhaps the best feature of these new and improved devices is the ability to provide individual space controls. If you like it warm

and the folks down the hall like it cooler, you can both be satisfied. Wow! Yes, these new HVAC systems cost more than our traditional "box-on-the-roof" or "manly-sized" boilers, but importantly, this new technology exceeds the Energy Code. The old types of units, not so much. So where are you going to come up with the money to buy these? Stay tuned.

## 4. Motors and Drives

Do you drive a car? Your auto has a motor and a drive. The motor lives under the hood and the drive is the gas pedal. If your motor is properly sized for the type of driving you do, you'll get decent gas mileage. If you have an 8-cylinder beast and spend lots of time in stop-and-go traffic, you'll be paying big time at the gas pumps. Rule of thumb for motors: Proper size equals optimum performance. And what about a drive? (These are also called variable speed drives or VSDs.) Well, if you didn't have a gas pedal on your car, how would you control your speed? With the brake pedal? Not very fuel efficient! The gas pedal allows you to go slow and thus use just a little fuel, or go fast and use lots of fuel. This is the same as a drive on your motors. Great energy savings. Great flow controls. Great idea.

(Continued on page 7) **CLEANER AND GREENER.**

*"The days of boilers being the size of an oil delivery truck are over. Other choices for heating are new heat pumps, mostly from Japan. They are incredibly efficient, small enough to fit into tight spaces, amazingly quiet, and oh, by the way, really work!"*

– Alan Mulak

# BOC Grads Making a Difference

## Continuing to Achieve Energy-Use Excellence

In the summer/fall 2006 issue of the *BOC Bulletin*, a highlight was the renovation of the former Qwest Communications building to the current Bellevue City Hall in Washington. **City Facility Manager Earl Meldahl** and his (now 100 percent BOC certified) staff implemented energy-saving measures such as high efficiency boiler and chiller installations, enhanced wall insulation, and the conversion of HVAC in the building's concourse to an under-floor system.

Their efforts did not go unacknowledged and in 2008, the Bellevue City Hall was recognized with an ENERGY STAR certification, signifying its place among the top 25 percent of energy-efficient buildings in the country with a rating of 89.

But that was 2008. Meldahl and his staff, which includes two superintendents (HVAC and electrical specialists) and eight field operators, have continued to improve efficiency in the building and, in June of this year, again received the ENERGY STAR certification, but this time with a 98 rating. This places Bellevue City Hall among the

top 2 percent in the country in terms of energy efficiency performance. It is one of three city halls in Washington with this distinction and one of only 19 currently nationwide.

The city's O&M staff's responsibility extends beyond city hall to include other municipal buildings, such as the Bellevue Service Center, the courthouse, and ten fire department sites. Such wide range of coverage for the department necessitates that some of the duties are performed by outside contractors, coordinated and overseen by staff.

In addition to the ongoing efforts of the maintenance staff, in 2010, Meldahl took advantage of local utility Puget Sound Energy's Resource Conservation Manager (RCM) Program, which provided (and still provides) funding and support to qualifying utility customers in all types of facilities. "PSE was and is a great partner and actively supported our hiring process to find just the right person to fill the position. As a result we hired Emma Johnson and I couldn't be happier," says Meldahl.

Ben Rupert, Johnson's main PSE point of contact for the RCM program concurs.

"Emma's willingness to roll up her sleeves, ask thoughtful questions, and focus on results have helped make the City of Bellevue's RCM program a huge success. As the city's RCM, she has helped the city save over \$350,000 in cumulative energy costs in the first three years of Bellevue's program, which is no small feat."

While the facilities services division certainly had many energy-savings measures in place already, the role of the RCM is to expand and organize both behavioral and procedural practices with the goal of energy – and thus cost – savings. With Johnson's help, they began to include energy-efficiency projects in their major maintenance plans for city

hall (the largest facility under management), and other facilities under their auspices.

Bellevue's facilities staff have always excelled at preventive maintenance but since the commencement of the RCM program, staff members have been proactively seeking out new ways to save, such as instituting more aggressive night setbacks, installing additional lighting controls, refining set-points, and upgrading their building automation system. "The new version of the building automation system (BAS), with its demand control ventilation capabilities, is calculated to save us about \$54,000 a year," says Meldahl.

So Bellevue City Hall continues to increase savings, dropping from an Energy Use Intensity (EUI) of 85 in 2008 to an EUI of 60 in 2012. The adjusted annual use energy use has been reduced by 34.1 percent for the period. "Our energy bills at city hall are now over \$163,000 less per year than in 2008," says Meldahl.

Another key feature of the success at city hall is communication and education. In addition to having a maintenance staff that is 100 percent BOC certified, they take advantage of continuing education opportunities to stay up on the latest technologies and techniques. The maintenance staff and its supporting administration members also give building occupants ongoing reminders on how to conserve energy, as well as keeping them informed of scheduled conservation projects and their anticipated savings.

It is this continued vigilance in the pursuit of operational and energy efficiency that keeps the City of Bellevue's maintenance staff at the top. Meldahl knows that there is always something more they can do.

## A Mystery Solved – at No Cost Department of Citywide Services (DCAS)

BOC grad **Danny Donovan** is a **senior stationary engineer** with the Department of Citywide Services (DCAS) in New York City, and attended level I in 2009 at one of the sessions DCAS had sponsored for its facilities personnel. He has been in facilities management for 22 years, eleven of that with the city. Stationed at the Brooklyn Municipal Building and its associated facility, Borough Hall, Donovan was overseeing a staff nine, some



L-R Back Row: Emma Johnson, Resource Conservation Manager; Dave Schaut, Facilities Operations Specialist/HVAC; Mike Leonard, Structural Maintenance Specialist; Jim Wesley, Structural Maintenance Specialist; Kim Luetzgen, Facilities Operations Specialist/Electrical; Paul Bartelmes, Facilities Security Superintendent; James Johnston, Facilities Operations Specialist.

L-R Front Row: Michelle Herman, Project Coordinator; Teresa Starbuck, Sr. Office Assistant; Julie Reznick, Program Coordinator; Earl Meldahl, Facility Manager; Tracy McMahan, Facilities Operations Superintendent; Tyler Nelson, Structural Maintenance Specialist; Jim Schneider, Facilities Operations Specialist; Steve McBride, Structural Maintenance Specialist.

## BOC GRADS (Continued from page 3)

of whom have also been through BOC, and a controls technician. They were faced with a major cooling issue.



**Danny Donovan**  
Senior Stationary Engineer

The two buildings operated almost completely independent systems, the one exception being a piping system that supplied chilled water to Borough Hall from the municipal building for cooling in the summer months.

The problem? When cooling was required from the system, it wasn't cool. Window units had been installed in Borough Hall to compensate for the lack of cooling.

"There were two issues we had to deal with," explained Donovan. First, the chilled water loop was not supplying the correct temperature (even though the chiller was supplying 45 degrees to the loop), and second, the need to operate two condenser water pumps with one chiller. "We tackled the condenser water loop first and discovered that the contractors had never removed the startup strainers. These were almost collapsed from debris." Once these were removed the condenser water flow issue was resolved. Now to tackle the next problem.

The chiller system is a de-coupler loop chilled water plant, which has constant speed primary pumps, and variable speed secondary and tertiary pumps. The tertiary loop was the one that supplied Borough Hall and, for some reason, controls were not responding properly to the temperature set points, setting up a low delta T syndrome, where a second chiller would be brought on line as the chilled water temperatures in each loop was getting warmer yet the primary loop was maintaining the 45 degrees set point.

Unable to solve the problem by checking visible and testable equipment, they needed to check the chilled water flow through the various piping segments. With an ultra-sonic flow meter, they investigated the operation of these loops. "Now that we knew our flow rates through the evaporators with the various pump configurations, we needed to see what the requirements would be for each of the three separate loops supplying the air handlers, fan coil units, and Borough Hall," explains Donovan.

It became a calculation and balancing game with the various components of the system. "We noticed that on start-up, the chiller would ramp up to the demand setting of 95 percent, dropping to 60 percent once all chilled water loops were satisfied. Noting that, we felt that some serious demand savings were available if we cut the demand set point back to, say, 70 percent and just brought the chiller online earlier," says Donovan. It was an extremely effective strategy, with demand dropping significantly against past performance, affecting overall electricity costs, with the extra kW used more than offset by the demand savings.

"The knowledge attained through the BOC training gave us the tools and confidence to tackle this complex issue. The entire staff at 210 Joralemon Street was excellent and more than eager to resolve any and all issues," Donovan states. "The problem also gave an appetite for BOC training to staff who participated in the project but had not yet attended the course."

Donovan is now senior stationary engineer at the Bronx Hall of Justice. Unlike Brooklyn Municipal and Borough Hall – built in the 1920s and 1870s, respectively – his new post finds him at a mostly glass building built less than a decade ago. It's all a part of learning a building's personality. More challenges, more puzzles to solve – just different ones.

### Spreading the Word on Energy Options

*Blue Mountain Hospital*

**Steve Hill** has been the **director of facilities services** at Blue Mountain Hospital in John Day, Oregon for almost two decades. Before then, his training was in boilers, electrical power generation, industrial maintenance, building electrical maintenance, and general contracting, so his experience in the field has been considerable.

Hill first heard about BOC through his work as a board member of the Oregon Society of Healthcare Engineers and thought he'd give it a try as a good fit to tie together his experience. And he was right. "I feel that BOC has been very helpful to me in providing technical resources and skilled contact people for any facility or design issue that may arise," he observes. He completed his BOC II course in June 2013.

While Hill's efficiency projects are ongoing, one project in particular has been a real win-win situation for both his facility and the local community.

The hospital, a 57,000 square foot facility with a 25-bed capacity, was subject to rising fuel oil costs, its source of building heat and hot water supply. This rise, as well as the environmental consequences of the fuel (its crude-oil fired boilers were installed in the 1950s, prior to EPA emission mandates), prompted Hill and hospital CEO Bob Houser to enlist the aid of a consultant to help them sort through options.

Doing due diligence, Houser, Hill, and their consultant spoke with two other local facilities that had installed biomass systems and were very satisfied with the results. These included another hospital and the regional airport. The proximity of the wood pellet supplier they ultimately used, Malheur Lumber – just a few miles away from Blue Mountain Hospital – meant that supply could be replenished on an as-needed basis. The company sourced its wood for pellets from forestry residuals and trees from national forests cleared during land stewardship. And having a local supplier meant supporting the local economy.



**Steve Hill**  
Director of Facilities Services

So the choice of a biomass system installation seemed a good one for Blue Mountain.

But there were hurdles, cost being one of them. Taking into account all components needed (pellet silo, pellet boiler, and containment pad), plus installation and system integration costs, overall project costs were estimated at \$450,000.

Through the American Recovery and Reinvestment Act, \$339,923 – over 75 percent – of the project costs were funded via state and federal channels. Energy Policy Analyst Lee Willeman, Hill's state contact for the project, notes that, "The grant was intended for projects that save energy and invest in the local community. What was a good business choice for Blue Mountain Hospital has provided economic stimulus to the entire John Day community."

Hill agrees, noting that, "The Recovery Act grant really helped the hospital board make the decision to go ahead with this project." The remainder was funded through a bank loan. Due to better than expected savings, the payback was 1.5 years.

The installation was completed in April of 2011. And the results? After a few initial glitches and tweaks, such as getting the correct composition of pellets so that the ash content is minimal and avoids “clinkers,” Hill says the results have been as good if not better than expected.

Annual heating cost savings were estimated at \$84,000 but an actual 2012 survey of what was spent on pellets versus what would have been spent on oil resulted in net savings of over \$150,000. The hospital consumes about 240 tons of the pellets per year. This demand is reflected seasonally and is twice in colder months when both heat and hot water are needed, rather than just hot water. With a silo storage capacity of 50 tons and a local supplier, replenishing is pretty much a non-issue. There is still an oil-option backup but currently over 90 percent of the heat and hot water generated is done so via the new system.

People ask Hill about all the ash and boiler cleaning, but he notes that, “Only about five gallons of ash is produced every six months. The pellet mill has rigid standards for ash content.” Boiler tubes are brushed and vacuumed about every six weeks, which only takes about two hours.

One of the pre-EPA emissions standards boilers has been removed, and the two remaining back up oil boilers were refitted with modern burners and modern controls. The carbon footprint has improved considerably, and the hospital was able to utilize carbon tax credits in the financial process. Maintenance is also about one-third of what it used to be and is estimated at about \$1,200 yearly. Calculations for a ten-year annualized rate of return are 13.7 percent and for a 25-year internal rate of return are at an impressive 25.4 percent.

“I want to make sure that the message goes out that anyone burning diesel or #2 fuel oil should take a look at pellets from a cost and operational savings point of view and a reduced maintenance and reduced carbon footprint point of view in addition to the reduction in the reliance on fossil fuels,” concludes Hill.

One thing many BOC grads often say is that it is important to “know” your building and its own personality. This also extends to understanding your facility’s best options in terms of its location. Granted, this kind of localized situation does not exist everywhere, but in the case of Blue Mountain Hospital, it has certainly been a logical and successful option.

## A Passion for Conservation

*Kirtland Community College, Michigan*



**Evelyn Schenk**  
*Director of Facilities*

abstract from Evelyn Schenk, director of facilities at Kirtland Community College in Northern Michigan. She was very pleased with the outcome.

“Evelyn did such a great job on the presentation and was a wonderful champion for BOC – without even trying,” says Granfield. She and Evelyn Schenk presented at the International High-Performance Building Conference in June and Schenk will again present at the October MAPP conference in Grand Rapids.

Schenk is not new to facilities management, having been in the department for 11 years of her 13 at the college. Three years ago, she took on her current position as director of facilities. One of the first items she noticed was that 52 percent of the department’s budget was in energy costs.

“We have no control over costs, but we do have control over how much we are using. That’s what I wanted to focus on,” says Schenk. At one point she was talking with her utility representative at Consumers Energy (a BOC sponsor), who suggested that BOC might be a great program for her to learn some efficiency measures.

Never having been a “hands-on” person in the facilities department, Schenk felt it would be more productive to go with one of her staff and was accompanied by lead maintenance technician, Ron Sharpe. The benefits were immediate. “The BOC class gave me great insight as far as applying O&M practices for improving the performance of our buildings and making better decisions for reducing operational costs. I had to get involved and trace out piping systems, HVAC components, lighting systems, electrical distribution, etc. There were a lot of hands-

on projects. I had never done any of that,” she explains. Schenk believes the training gave her the ability to make more informed decisions, as well as a better understanding of the issues faced by her staff.

Kirtland has three campuses with an approximate building square footage total of 260,000. Her staff consists of four maintenance technicians, and one maintenance lead technician. Her department also oversees the grounds, custodial, and shipping & receiving departments.

Schenk and her staff put together a methodical plan to address efficiency. “I’m really blessed with a skilled group of maintenance technicians who had already been doing a lot of this work, but we now have better, more focused direction and discussions on how to control our energy consumption and save money.”

Together they put a plan in place that involved no-cost/low-cost solutions, complementing that with the search for any utility rebates for which their projects would be applicable: interior and exterior re-lamping and upgrades, converting an antiquated fuel oil-fired boiler to a propane model, installing occupancy sensors, digital controls, scheduling HVAC equipment, etc.

The result was that, in two years time, they achieved an annual savings of \$35,000 in energy costs, decreased kilowatt usage by 14 percent, and, in addition to this, received over \$37,000 in utility rebates. Because of the department’s collaborative effort in energy conservation and focus on reducing operational costs, Schenk says that the college’s board of directors have been “very supportive” of her team’s projects financially, which has been a huge contribution towards promoting a commitment to energy conservation campus wide.

Displaying a real passion for the concept that responsible stewardship of the campus will only help the community and future users of Kirtland, Schenk continues to champion energy efficiency projects and investigate new energy alternative options as they become financially viable.

So, while not literally “hands-on” in most cases, Schenk is certainly “hands-on” when it comes to her passion: energy conservation.

## Meeting Georgia's Energy Challenge – Campus by Campus

West Georgia Technical College (WGTC)

In 2008, Georgia Governor Nathan Deal issued the Georgia Energy Challenge to all state agencies to reduce energy consumption by 15 percent by 2020. At West Georgia Technical College (WGTC), they have risen to the governor's challenge and made great strides in energy reduction.

WGTC has five main campuses and three remote sites and **Mike Jiles**, a BOC grad, is the **director of facilities** for the college. "Every campus has their own maintenance team and all of the maintenance supervisors take the BOC course," says Jiles. "The savings that we have seen can be greatly attributed to the training."

Jiles explains that, "Currently, of the four active main campuses, three have met the energy challenge by reducing their energy consumption by 20.5 percent, 22.6 percent, and 32.3 percent. We have more work to do to accomplish our goals, but I believe we would not be as successful as we have been had we not taken the BOC training."

**Chuck Lawhorne** is the **maintenance supervisor** for the WGTC Douglasville campus and has been since 2010, when he first enrolled in the BOC training program. He completed Level II in 2012. "After starting the course, I was able to recognize more areas that needed to be addressed," says Lawhorne, who has both a military background and 20 years in facilities maintenance.

Lawhorne implemented a more comprehensive preventative maintenance program, and an energy management plan. With a strong background in HVAC, Lawhorne started scheduling the system settings to be more in line with occupancy, saving an hour in the cooling season mornings by starting at 5 a.m., and then saving another at the end of the day by shifting from 10 p.m. to 9.

"We have retrofitted T-12s to T-8s and have installed sensors in classrooms and office spaces where occupancy can vary," states Lawhorne. "We are also going from 500 to 250 watt fixtures in our parking lot lighting, which will be a 50 percent savings on annual usage in the parking lots alone."

He and his staff perform weekly inspections of the whole campus to root out potential trouble spots. Lawhorne notes that the

power usage since 2010 is down by about 12 percent. Overall he has achieved the 15 percent goal established by the Georgia Energy Challenge with 22.6 percent savings. "The BOC program has helped open my eyes as to how to address problems in a more structured way on my campus and the college as a whole," he notes. "It would benefit anyone in the maintenance field. I'd like to see a Level III."

Over on the LaGrange campus, **Gary Lockhart, maintenance supervisor** since 2011, completed his BOC training in June 2012. Lockhart, too, specializes in HVAC and has 25 years of experience in facilities management. He had his challenges.

"Our main building is a 28 year-old, 250,000 square foot manufacturing facility converted into a college building," says Lockhart. "I came in on a weekend and discovered over 600 lights on in our empty building." He notes that some of these could have and should have been turned off, but that some didn't even have reachable switches. "The BOC class made me aware of the importance and the cost of lighting in a facility such as ours," he notes. Installation of sensors has been key to alleviating this issue, as have lighting retrofits (T-12s to T-8s) and other lighting conversions.

The campus recently received \$1.5 million from the state to address the HVAC system in the main building, which has 25 large air handlers that, due to computer controls that no longer worked, had to be manually turned on and off.

Lockhart's campus, too, has met the Georgia Energy Challenge with an overall reduction of 32.3 percent since the start of the challenge. Comparing 2012 to 2011, electricity usage is down by 11.75 percent, water and sewage by 30.6 percent, and gas usage by 35.7 percent, for a cost savings of almost \$90,000.

"We had already started some of the improvements, but the BOC classes gave me additional ideas of how and where to save. Most importantly, I learned a better approach to help get funding," observes Lockhart. "The classes gave me a lot more confidence that we were on the right track."

WGTC is certainly meeting the Georgia Energy Challenge – and going beyond it!

## CHANGING BEHAVIOR

(Continued from page 1)

issue, advocates combining psychology, marketing, art, and scientific method to promote effective change in behavior.

Mullainathan notes that the personalized home energy reports various utilities are using produced a 2-3 percent reduction in energy use (a figure used in his talk, which was in 2010). Determining what campaigns actually work means adding the scientific method to psychology, marketing, and art, and quantifying results.

## Can You Apply This to Your Facility?

While facilities are not yet a target of the various companies involved in quantifying energy use against peer groups in this specific, local fashion, lessons have been gleaned and modified to apply in facility situations. Building systems are much more efficient and site-specific. Sub-metering areas to create "neighborhoods" is a real option for at-work social pressure behavior modification.

Last year, PECl conducted a two-week competition among the three floors of its Portland, Oregon office. Using real-time energy monitoring software that participants could access, the goal was to see which floor could achieve the greatest reduction in plug load. In an already energy-conscious environment, they reduced plug load by 14 percent.

In her article on GreenBiz.com detailing the study, Amber Buhl writes that, "What surprised us on multiple floors was the emergence of spontaneous leaders." These were the people trying to generate enthusiasm for the competition, getting people to do what they knew was right – "nudging" them to better behavior. It's a critical role to take and one that needs to be sustained. In many facilities, a resource conservation manager fills this need.

How are you communicating with your facility's inhabitants? Can you change this? Are incentives working or is the "that department's doing better" approach a possibility? Thinking outside the box to determine what might work in your situation is yet another role of the facilities manager, a role which is becoming increasingly complex.

*To check out Alex Laskey's and Sendhil Mullainathan's TED talks, as well as many other fascinating videos on a variety of topics, go to [www.TED.com](http://www.TED.com) and search on their names.*

## CLEANEST AND GREENEST

(Continued from page 2)

### 5. Hot Water

If you are reading this at work, I'll bet about half of you have hot water heaters at home that are keeping about 75 gallons of water hot. But no one is home. Sound familiar? We heat way too much water and this certainly applies to business and industry as well. When electricity, oil, and gas were cheap, this was not a problem. Not so anymore. Proper sizing of water heaters and storage tanks saves big dollars over the life of the equipment. Also, on-demand water heaters are a home run. They only use energy when someone wants some hot water, not when no one is at home.

### 6. Kitchens

People who work in commercial kitchens know something about making omelets and milk shakes but surprisingly little about energy conservation. That's why, at any given time during the day, just about every appliance, heat lamp, and cooking surface is energized and spinning the meter. Not only does "just turn it off" work well but also, the new commercial kitchen appliances are far more efficient than their predecessors. Then, there are a variety of controls (there's that word again) that can limit energy consumption in walk-in coolers and freezers, exhaust hood ventilation, and a variety of other energy intensive equipment found in most commercial kitchens.

As stated earlier, this is just a partial list of opportunities. If you have read this far, you are probably wondering how to pay for all this stuff. Now you have to do some homework. The first step is to look at: <http://www.dsire-usa.org/>. This resource lists funding sources for green technologies, energy efficiency programs, incentives, rebates, tax credits, etc. Then you should call your local electric and gas utility and ask them about their programs.

These two investigations may net your facility some serious dollars. Not enough? Maybe. However, if equipment is failing and replacement is imminent, the extra dollars may be enough to cover the incremental difference between "run of the mill" and "wow" equipment.

Energy Conservation is not the final answer but it's a great start. And in choosing this route, you'll be choosing the cleanest and greenest.

*In addition to being a long-time BOC instructor, energy consultant, and man of strong opinions, author Alan Mulak also claims to be a mediocre ice hockey goalie, reasonable fly fisherman, and abysmal Trivial Pursuit player.*

## NEEC and NSSC Team up to Bring BOC® to the Mid-Atlantic Region

NEEC is pleased to announce an exciting new education partnership with the National Sustainable Structures Center (NSSC) at Pennsylvania College of Technology, which will bring the national Building Operator Certification (BOC®) to building operators in the U.S. Mid-Atlantic region, specifically Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia and District of Columbia. NEEC and Penn College entered into a license agreement for the national program in March of 2013. Under the agreement, NSSC at Penn College will serve as the licensed administrator of BOC training for the six states and the District of Columbia with access to the resources of the national program -- curriculum, training materials and instructor pool -- to provide programming in their territory.

NSSC is dedicated to providing building science and energy conservation training in both the commercial and residential fields so offering BOC is a natural fit. NEEC and NSSC share the common goal of providing high quality educational programming for skill enhancement in the energy efficient operation and maintenance profession. Under the partnership, students at the center will be eligible for training and credentialing opportunities through NEEC's nationally recognized BOC program. The Building Operator Certification (BOC®) training is a leader in energy efficiency education for commercial building operations and maintenance personnel.

"The BOC training is a perfect fit for building operators who want to tune their energy awareness and management skills," says John "Jack" Wilson, NSSC's BOC program manager. "The certification is designed to cover all trades that interact with the structure. The combination of classroom training and project assignments completed at their facility really drives home how the employee can start to take control of the overall energy consumption of a structure."

Stan Price, executive director of NEEC said, "We are very excited about this partnership between Pennsylvania College of Technology and the Building Operator Certification program. Penn College is an educational leader and innovator and a perfect match for a training and credentialing program

that increases the knowledge, skills and abilities of facility professionals for resource efficient building management. We look forward to working with Penn College's National Sustainable Structures Center and the success of the BOC effort in the Mid-Atlantic region."

Pennsylvania College of Technology is a special mission affiliate of Penn State University, committed to applied technology education. The National Sustainable Structures Center ([www.pct.edu/nssc](http://www.pct.edu/nssc)) operates under Workforce Development & Continuing Education at

Penn College, which offers noncredit training and workforce development to industry and the general public.

*"The certification is designed to cover all trades that interact with the structure. The combination of classroom training and project assignments completed at their facility really drives home how the employee can start to take control of the overall energy consumption of a structure."*

— John Wilson

nationalgrid

BOC Level I course beginning  
September 17 in Worcester, MA.

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Classes will be held at College of the Holy Cross.



To register for this course and for the schedules, please visit [www.theboc.info/ne/ne-schedule.html#worcester](http://www.theboc.info/ne/ne-schedule.html#worcester)

## MEEA Presents at the International High Performance Building Conference 2013



The Midwest Energy Efficiency Alliance presented two topics at the International High Performance Building Conference held in Lansing, MI this past June. "This conference is unique in that high performance building academics, researchers, and practitioners will come together to discuss cutting edge technology and its impacts on the design-engineering-construction process as well as the implications for education in these topics. Conference attendees will have many networking opportunities and chances to share in the transfer of best practices and the latest technologies and techniques among industry professionals and academics." (IHPBC website: [ihpbc2013.org](http://ihpbc2013.org))

MEEA's Kerry Granfield and Mark Allen, principal at DNV KEMA, discussed the topic of Walking Your Building for Low-Cost, Energy Efficient Operational Improvements. Later in the conference, Granfield and Evelyn Schenk, of Kirtland Community College, present Achieving Cost-Effective Energy Savings Through Building Operator Training, which outlines a case study from Kirtland Community College.

*Evelyn Schenk is profiled in this issue. Please see page 5 for her story.*

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## Bethel School District RCM Program Yields Savings and Awards

The Bethel School District (BSD) in Washington state recently received two ENERGY STAR awards from the EPA for its work in reducing energy use: The Leader Top Performer Award and The Leader Award for Leadership in Reducing Greenhouse Gas Emissions.

The first award is given for an energy score of 76 or better. BSD achieved a score of 83, joining just 18 other school districts nationwide to earn this distinction. By reducing their greenhouse gas emissions by more than 20 percent, BSD joined an even more exclusive group to become one of 14 passing this hurdle just this year.



*Bethel School District's Michael Knaack (left) and EPA's Robert Drake display Bethel's two recent Energy Star Awards.*

The district began their Resource Conservation Management program in 2005, hiring Michael Knaack as energy manager. Since that time, they have avoided \$4.7 million in energy costs.

Knaack is also a BOC grad, as are five others on the BSD facilities management team. He believes that the training has given him the ability to "ask more intelligent questions of the actual experts in the school district. It's one more tool in my tool belt needed to create a comprehensive energy conservation program."

*Kudos to the Bethel School District!*



## National Conferences & Symposiums 2013-2014

### NFMT (National Facilities Management & Technology Conference/Exposition) Las Vegas

Las Vegas, Nevada  
September 17-18, 2013

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

### Labs 21 2013 Conference

Minneapolis, Minnesota  
September 24-26, 2013

**MORE INFO:** [www.labs21century.gov/](http://www.labs21century.gov/)

### World Energy Engineering Conference

Washington Convention Center  
Washington, DC

September 25-27, 2013

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

### IFMA World Workplace 2013

Philadelphia, Pennsylvania  
October 2-4, 2013

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

### GreenBuild International Conference & Expo

Pennsylvania Convention Center  
Philadelphia, Pennsylvania  
November 20-22, 2013

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

Over a hundred educational sessions are offered and are also eligible as Continuing Education Units (CEUs). This year's Opening Plenary Keynote Speaker is former Secretary of State Hillary Rodham Clinton

### Midwest Energy Solutions (MES) Conference

Fairmont Hotel  
Chicago, Illinois  
January 14-16, 2014

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

This annual conference will also host a BOC Stakeholders meeting coinciding with MES to share best practices, tackle challenges, and brainstorm innovations.

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

The Baltimore Convention Center  
Baltimore, Maryland  
March 12-14, 2014

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

# Measuring Carbon Dioxide Inside Buildings – Why is it Important?

The quality of air inside a building depends on the concentrations of contaminants – such as gases and particles – and how much fresh air is brought into the building through its ventilation system to dilute and remove these pollutants. It is essential to monitor indoor air quality (IAQ) to provide for occupant health, productivity and comfort.



levels not exceed the local outdoor concentration by more than about 650 ppm. Good practice indicates that the ASHRAE Standard 62.1 target CO2 level in indoor air is about 1,030 ppm, as follows:

380 ppm CO2 typically found in OSA + 650 ppm CO2 (ASHRAE target maximum level) = 1,030 ppm CO2 (ASHRAE maximum recommended indoor level of CO2)

## This article:

- Explains how carbon dioxide (CO2) levels in a building can be used to monitor IAQ and the ventilation rate.
- Provides guidance about accurately measuring CO2 levels.

See the companion factsheet “Good Ventilation is Essential for a Healthy and Efficient Building,”\* to learn about how much fresh air should be brought into a building to keep the environment healthy and comfortable without using excessive energy.

## Using CO2 levels as an indicator of IAQ

The complex mixture of gases and particles in indoor spaces is difficult to measure.

However, CO2 levels, which are easy to measure, can be used in place of other measurements to indicate IAQ. CO2 is produced when people breathe. Each exhaled breath by an average adult contains 35,000 to 50,000 parts per million (ppm) of CO2 –

100 times higher than is typically found in the outside air (OSA).

The CO2 concentration in an occupied indoor space indicates if the building’s air exchange balance is appropriate – that is, if the optimal amount of OSA is being mixed with air that has been circulating in the building.

## Using a CO2 meter

A CO2 meter lets you easily and inexpensively measure CO2 levels in specific areas of your building. But, because the outdoor CO2 concentration is included in the amount of CO2 indoors, you must measure outdoor CO2 levels when assessing indoor concentrations. Outdoor CO2 levels are typically around 380 to 500 ppm.

Most CO2 meters are accurate enough to indicate if ventilation in offices and schools is adequate. Some of these instruments measure only CO2; others simultaneously measure temperature, relative humidity and other gases, such as carbon monoxide. A

new generation of CO2 monitors can measure volatile organic compound concentrations and infer CO2 concentrations from these measurements.

Instruments that record data internally or are coupled to an external data logger (as opposed to only giving instant readouts)

provide valuable data for identifying trends, trouble-shooting and verifying solutions.

## How much CO2 is too much?

Current ventilation guidelines, such as those from the American Society of Heating Refrigerating, and Air Conditioning Engineers (ASHRAE), recommend that indoor CO2

It is important to adhere to these guidelines. The performance of individuals in schools and offices with elevated CO2 concentrations can be affected because occupants may become lethargic and drowsy. Additionally, as CO2 builds up, so do other indoor air contaminants, which increases occupants’ exposures to irritating, distracting and potentially unhealthy gases and particulates.

## Interpreting indoor CO2 measurements

Interpreting CO2 data is often a more significant source of error than instrument accuracy. Meaningful assumptions about ventilation rates based on CO2 values require that the building or zone be occupied long enough to allow the CO2 levels to reach a balance with the ventilation rate. This balance is known variously as equilibrium, unity or steady-state.

\* See resources, informational sidebars, and footnotes at the full version of this article, the link of which can be found in the online version of the BOC Bulletin at [www.theBOC.info](http://www.theBOC.info) under News and Resources. You can earn one hour of credit towards your BOC renewal by taking a quiz based on the material, which can also be found at the BOC website.

This article was written for public distribution by the Washington State University Energy Program in January 2013. This and other articles on energy topics can be found at [www.energy.wsu.edu](http://www.energy.wsu.edu).



## Check out BOC's Technical Webinar Series!



The BOC web site ([www.theBOC.info](http://www.theBOC.info)) offers webinars, both live and prerecorded (available for viewing at your convenience). Register and receive a link, with log-in and

password information. Successful completion of each webinar and its accompanying quiz earns you 1.5 continuing education hours towards maintaining your BOC certification.

The remaining LIVE webinar offered in 2013 will be held from 11 AM to noon Pacific Standard Time.

### Wednesday, September 18th *Measuring and Controlling Plug Loads*

Information on fees and registration is available at the BOC web site as above. A link to the webinar details can be accessed on the home page.

## New to BOC?



### Listen to 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 7** and **September 18** and more will be scheduled throughout the year (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)

## BOC Certification Maintenance – New Process!

*We have updated our process for continued BOC credentialing, effective January 1, 2014. The changes?*

### 1) New Name

The change from a "renewal" process to a "maintenance" one highlights the importance of BOC grads continuing to expand their knowledge in the field by maintaining a level of active participation.

### 2) New Credit System

To more accurately reflect our system, "continuing education hours" are now "maintenance points." This change eliminates the confusion between our term "continuing education hours" and the standard academic credit of "CEU (Continuing Education Units)." Generally one maintenance point equals an hour, but some activities may be worth a set amount of points. See our updated activity info below.

### 3) New Procedure for BOC Level II Graduates

NEEC is revising the maintenance requirements for Level II. Effective January 1, 2014, 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.

### 4) New Expiration Dates

For those BOC graduates whose certification will expire on March 31, 2014, the maintenance process will begin in the first week of the year. During that first week of January 2014, NEEC will send maintenance application notices via email and US mail to all eligible graduates. The deadline to maintain your certification for 2014 is March 31, 2014. Once you have received a maintenance notice, complete the application form and return it to your program administrator as instructed. Maintenance fees are \$65 for each level.

### 5) Increased Benefits for Current Graduates

We polled graduates about additional benefits we could implement that would encourage them to maintain their credential. Stay tuned to learn more about new benefits of certification!

### 6) Simplified Application Processes and Instructions

We will be striving to simplify the application process (both hard copy forms and on-line versions) for the January 2014 maintenance cycle. We will also be striving to simplify the Maintaining Certification pages of the BOC website for easier navigation and information gathering. You will see changes to those pages throughout the next year.

### 7) New Prices

Fees are being increased from \$55 per level to \$65 per level. Since Level II graduates will no longer need to renew Level I certifications, there will no longer be a combo fee for the renewal of both levels. Therefore, the cost for Level II graduates is reduced from \$85 to \$65.

### BOC Certification Maintenance Activities and Points Earned

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

- Continued employment in building operations ..... **2 points/year**
- Continuing education in building operations..... **1 point per hour of classroom time**
- Energy efficiency projects completed at your facility..... **Up to 11 points/year**
- Membership in a building operations association ..... **1 point/year**
- Offices held in membership associations..... **2 points/year**
- Awards received for efficient building operations..... **2 points/award**
- BOC newsletter tech article quiz (see page 9 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**
- Enroll in a BOC webinar and complete its quiz (See webinar announcement on this page)..... **1.5 points/passed quiz**

## 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

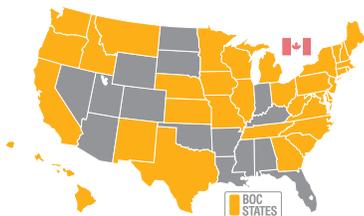
The Level I series comprises 74 hours of training and project work in building systems maintenance. In fall of 2012, updated curriculum was developed and made available in select locations. This curriculum is now widely available in 2013.

### 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 California, Montana to Texas – and even Hawaii!



## BOC Graduate Numbers Continue to Grow!

There are currently over 10,000 BOC graduates throughout the country and 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 32 states, 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)

### 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/)

### PNNL:

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

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

### 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.

### 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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