



WINTER FORUM ANNOUNCEMENT:

Looking Forward & Looking Back - Review Of Where We've Been And Where We Are Going With Efficiency And Energy Management

Date: Please join us on Friday, December 10th
8:30am – 2:00pm

Location: McMenamins Edgefield
2126 SW Halsey Street
Troutdale, OR 97060

- Regional Conservation Progress Review 2005-2009 – How has the Northwest done compared to Regional goals?
- ISO 50001 – New international Energy Management standard, scheduled to be released 2011 – What is the new standard and what does it mean for energy managers?
- Utility Incentive Programs – What we can expect in 2011. Some introductions to BPA's preference power tiered rates that will be changing October 2011.
- Energy Manager of the Year – Winner Presentations
- OAPEM annual business meeting

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OREGON APEM WEBSITE UPDATE

Oregon APEM has been updating our website for the past month to provide our members with more current information in a timely manner. We will continue to make changes to our website, so look forward to more changes in the near future.

Visit: www.oregonapem.org

BOARD ELECTIONS NOW!

By the time this Newsletter is published we will have sent out Voting Ballots for vacant board positions. Please review the nominated members and submit your Vote for your Oregon APEM Board.

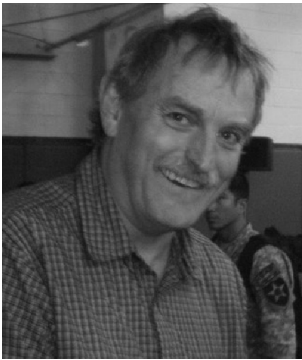
THE NEW EDITION OF THE ADVANCED LIGHTING GUIDELINES IS NOW AVAILABLE ONLINE!

ALG Online offers a one-stop resource for a variety of lighting information from the industry's leading thinkers. This new web-based edition of the Advanced Lighting Guidelines features:

- Up-to-date information on energy-efficient lighting design
- The latest in lighting technology
- Comprehensive resources for lighting educators and students, making it a great resource to study for the Nation Council on Qualifications for the Lighting Professions (NCQLP) Lighting Certification exam

To check out this new web-based tool and subscribe, visit www.algonline.org.

PRESIDENT'S CORNER



As I'm writing this column in late October, our utility providers are busy in negotiations with the Oregon Public Utilities Commission (PUC) finalizing our rate structures for the next year. After seeing two years of stagnant and falling fuel costs and utility rates; our economy is slowly staggering back to life. Be prepared to see a more

normal market of regulated increases in our utility rates.

Recall the crisis days of late 2008 when we saw oil climb to over \$140 a barrel and then drop to under \$40 almost overnight, NW Natural went from projecting 40% rate increases in the summer of 2008 to an almost 20% rate reduction in 2009. This volatile market combined with international recognition of the need to reduce global carbon dioxide levels, a growing interest in green building and sustainability, and the natural tendency to conserve when the economy goes south, has brought us many new converts to the field of energy management.

Many of the recent converts to the energy field comes from business, facilities, and property management backgrounds. Much effort has been made to court these newcomers, look at all the seminars over the last few years on "Making the Business Case for Sustainability". The success of these efforts has resulted in a new set of buzzwords like "the triple bottom line" and "carbon footprint". At the same time we are seeing an influx of recent graduates from all the new and expanded energy and renewable energy programs at colleges and technical schools in Oregon (and Washington). Many Architecture schools are now including sustainability in their curriculum. This all adds up to an unprecedented level of interest in our field.

We need to welcome these newcomers. Those of us with years in the industry need to mentor and help them to maneuver through the many pitfalls that they will surely encounter. If we are to have any hope of meeting the goals of the 2030 Challenge we will need to keep the property managers, facility managers, business people, and Architects actively involved in energy management for the long haul.

That brings me to the point of this rant; I see many of the newcomers only using dollars as the metric for determining the success of their energy management program. This has worked during a period of falling and stagnant rates. Over the last several years even the slightest decrease in energy use was almost guaranteed to produce dollar savings. (Sometimes just slowing the increase in energy use provided monetary savings and was sold as a decrease in energy use.)

One of the paradoxes of energy management is that reducing energy use doesn't always reduce cost; conversely dollars can be saved and carbon reduced without reducing site energy use. Energy use, dollars, and carbon are all inherently linked; but it is a moving target they are not directly proportional, and the "law of supply and demand" is only loosely enforced.

The US Energy Information Administration is predicting increases for the heating season and coming year (at the national level) of over 6% for fuel oil and gasoline, over 3% for natural gas, and almost 1-1/2% for electricity. By the time this is published we will most likely know what our local utility providers have in store for us. My guess is that we will be seeing small rate increases across the board. That means we are going to have to re-familiarize ourselves with terms and calculations like "cost avoidance", "fuel shifting", and get used to evaluating the impact of "site v. source" energy use. As we make this transition, let's not forget that some in our field may have never had to deal with this and may need help to maintain the early successes of their programs.

Don Holland

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FALL FORUM RECAP

“CRUISE INTO THE ENERGY FUTURE WITH ELECTRIC VEHICLES”

Topics included:

- EV 101: Electric vehicle and charging stations types
- State and Federal Incentives, tax credits and code restrictions for electric vehicles and charging stations
- EV Project overview
- Charging station installation lesson's learned



Standing from Left to Right: Peter Brandon (City of Hillsboro), Dave Johnson (OIT), and Sam Walker (Clark PUD)



Rick Durst and Art James (ODOT)

The Oregon APEM 2010 Fall Forum, “Cruise into the Energy Future with Electric Vehicles,” was held at the World Trade Center’s Portland Conference Center, in downtown Portland (a special thanks to Portland General Electric for being such wonderful hosts). Throughout the day there were many interesting and thought provoking speakers, as well as the opportunity to see and interact with some of the latest charging station equipment manufactures and experience first hand several electric vehicles from Portland General Electric’s fleet that were on display in the plaza area.

Rick Durst began the day by providing an overview of the basic types of electric vehicle’s and charging stations that will be arriving in our state shortly. He explained the acronyms (EV, BEV, PHEV, etc.) and difference between Level I, II, and DC fast chargers, and guided the general discussion about electric vehicle power requirements and infrastructure needs.

Art James from the Oregon Department of Transportation continued the discussion by explaining the available tax credits, incentives and code restrictions that are associated with the coming electric vehicle revolution.

David Mayfield of ECOtality, discussed the “EV Project”, a current Department of Energy grant to deploy roughly 2,000 charging stations in Oregon over the next year and how local businesses and governments can be involved in purchasing electric vehicles or charging stations. Dave explained the project’s goals, scope and timeline in Oregon.

Peter Brandom, Sustainability Manager for the City of Hillsboro, talked about the challenges involved in getting EV chargers installed in a community. Peter has worked directly with charging station manufactures, local utilities, and the state to install or plan the installation of several charging stations in the Hillsboro area. Peter offered great insight into this process, along with the complications and options available in the charging station market.

Rich Durst lead a very enlightening activity showing the normal driving patterns of forum participants. This great activity highlighted the average daily commute, and the average mileage to favorite destinations of our forum audience from several different geographic regions. This unscientific, although highly entertaining, activity helped bring home the point that the majority of Americans could perform their normal driving activities with an electric vehicle.

BUILDING OPERATOR ENERGY EFFICIENCY IDEAS

For building operators, the bottom line often is the cost of energy. Energy efficiency investments pay for themselves. There are numerous opportunities that generally involve maintenance and operation rather than more long-term capital investments that can save energy and dollars. Here is a sampling of suggestions for reducing energy use that building operators can do.

General

Track your energy use. Analyze your energy bills for the past year, looking for patterns. This information will help you see the results of energy-saving efforts and alert you to developing problems that could be costly. Encourage employees to be energy conscious. Consider offering a small reward or other incentives for employees who save the most energy.

Lighting

- Eliminate unneeded lights. Many offices are over-lighted. You may be able to turn off up to half of overhead lights without a problem. Don't run desk lights and task lights in addition to overhead lights.
- Replace incandescent task lights (desk lamps) with compact fluorescent lamps. Compact fluorescent lamps use one fourth as much energy and last ten times longer.
- Change out incandescent exit lights with 3 -7 watt LED exit lights. These lights last up to 25 years, reducing maintenance costs.
- Motion sensors, timers, and other simple lighting controls can turn lights on and off according to occupancy and time of day.
- Make sure photocells (light sensors that turn on electric lights after dark) are clean.
- Increase use of available daylighting. It is not only the healthiest but also the cheapest source of lighting.
- If a janitorial service comes in after hours, request that they only use lights in areas they are cleaning. Have them turn all lights off when they are finished for the night.

Heating and Cooling

- Schedule HVAC tune-ups once or twice a year. Clean coils, check and correct refrigerant charge, clean and lubricate the fan motor, check for proper airflow, adjust the pulley settings and fan belts, replace air handling unit filters, and do routine checks to ensure proper performance.
- When the building is unoccupied, make sure outside air dampers are closed. This includes morning warm-up periods.

- During occupied hours, make sure the amount of outside air matches load. Adding CO2 monitors, coupled with outside air controls, will only allow as much outside air as is necessary to enter the building in the heating season.
- Raise cooling settings and lower heating settings on programmable thermostats for both occupied and unoccupied hours.
- Seal ducts that run through unconditioned spaces. Leaking ductwork can lose 20 percent or more of the conditioned air in a supply duct run.
- When scheduling group activities and meetings after hours, use rooms and areas that can be heated and cooled individually, so you don't have to heat or cool a whole floor.

Equipment

- When purchasing computers, computer monitors, photocopiers, fax machines, and other equipment choose those with "Energy Star" power management features.
- Install "energy misers" on indoor vending machines. These are motion detectors that turn off display lights and slow the cooling compressor when customers aren't around.
- Set domestic water heater thermostats at 120 degrees. To avoid health risks associated with Legionnaire's Disease, never go below 115 degrees on potable water systems.
- Stage turn-on of continuous motor loads with 1/2 hour intervals between loads. This prevents spikes in demand use and associated charges due to higher-than normal start-up power.

Recycling

- Substitute reusable products for disposable products, whenever possible. If you must use disposable products, make sure that they contain post-consumer recycled content.
- Reuse items such as paper clips, rubber bands, and paper with print on only one side.
- Recycle all waste office paper, aluminum cans, and plastic bottles in containers provided for that purpose.

Publication by Washington State University Cooperative Extension Energy Program and the Northwest Energy Efficiency Alliance – WSUCEEP02_149 December 2002

HEATING BOILER BASICS

By Don Holland

Boilers are a mystery to many energy managers. They are like relics from the distant past, a long forgotten component of the industrial revolution or the steam locomotive. The boiler plant in northern climates is the single largest fuel user in most commercial buildings. Commercial heating boilers have a range of input from about 500,000 Btu to greater than 5 million Btu, and the heating plant may consist of multiple boilers. Boilers use combustible and explosive fuels. We have all read about the horror, carnage and fires that have been caused by an exploding boiler. Because of this, boilers have to meet specialized codes, meet pressure vessel requirements, be inspected on a regular basis to meet insurance requirements, and should only be worked on by knowledgeable technicians.

Heating boilers have to meet different performance requirements than an industrial process boiler. Industrial processes have a predictable and often constant load profile. The boilers may even run 24/7 until there is a plant or process shutdown. Heating boilers regularly have to contend with seasonal variations in heating load profile, cold starts and the unpredictability of weather and building schedules.

As energy managers we all want to see our boilers running at their maximum efficiency with the burner firing at a rate that just meets the building's heating load. We also want to see building's heating setpoint dropped to something in range of 55°F at night and during extended unoccupied periods. This results in the boiler cold starting in the morning and having to fire at or near capacity for the first hour or more of operation to bring the building up to the occupied temperature setpoint. Most conventional boilers are not designed to perform well under these types of operating conditions. There are piping and operational methods that can minimize the negative impacts on the boiler and improve operating efficiencies. But before we delve into that we need to cover some boiler basics and define some of the confusing terminology.

Boiler Types

Boiler discussions can get confusing very quickly with the technicians and engineers discussing the benefits of high mass v. low mass boilers, steam or hydronic, fire tube v. water tube, package, Scotch marine, cast iron sectional, and condensing boilers. Then they start talking about boiler horsepower, square feet EDR, whether a dual fuel burner is needed and they haven't even got around to discussing modulation, turndown ratio or the efficiency us energy managers want to talk about. Help me Mister Wizard, Help!!

Steam v. Hydronic: Hydronics is the use of water as a heat transfer medium. It can include steam; but in heating boilers it is typically used to refer specifically to hot water boilers.

The first decision that needs to be made is whether it is going to be a steam or a hot water (hydronic) system. Even though conventional hot water boilers and low pressure steam boilers by most boiler manufacturers are identical other than the boilers internal controls, steam and hot water boilers cannot easily be exchanged. Steam systems are controlled off of pressure

(temperature and pressure are linked, look at your steam tables) and hot water boilers are controlled off of temperature.

The ASME pressure vessel code limits low pressure steam boilers to 15psi, steam heating boilers are considered low pressure steam systems. There are very few new steam systems being installed, most engineers consider low pressure steam a lost art (some may even consider it a dark art). But if a boiler is being replaced on an existing steam system it most likely needs to remain a steam system. The big advantage of steam is that the huge amount of energy contained per pound mass of steam allows smaller heating coils. The disadvantages include difficulty of control, maintenance of steam traps, condensate return and feedwater systems, and lack of knowledgeable practitioners.

Hot water boiler systems can use either conventional boilers or high efficiency condensing boilers. Conventional hot water boilers typically operate with supply water temperature between 140°F to 180°F, but can be run at higher temperatures.

High Mass v. Low Mass: Modern boilers contain less volume and have less room for expansion, this makes proper sizing of the boiler and burner critical. The old boilers installed in the 1950s and before are huge with a rounded top almost resembling a steam locomotive; the new boilers are box shaped. The new low mass boiler of the same Btu capacity will fit in a smaller footprint and be much shorter. Water expands when heated and expands greatly when the phase change creating steam occurs. During the expansion and phase change the mass of the water remains constant; because of this boilers that hold a smaller volume of water for the same heating output are referred to as low mass boilers.

The standard rule of thumb used when a new boiler isn't available at the exact heating capacity of the boiler being replaced is to always choose the larger size so that you are guaranteed adequate heating capacity. This can get you into trouble with steam systems; the lower volume, higher Btu boiler may result in an unstable system. If replacing a steam heating boiler, it is very important to find an experienced engineer with a good track record on steam boiler replacements.

Fire Tube v. Water Tube: Boilers are basically a shell and tube, water to gas heat exchanger with the burner providing the heated gas. If the flame (heated gas) passes through tubes surrounded by the water it is referred to as a fire tube boiler. When the water is in the tubes and heated gas is in the shell it is referred to as a water tube boiler. Heating boilers, both hot water and low pressure steam are almost exclusively fire tube boilers. Water tube boilers are typically used for large industrial high pressure steam boilers.

Packaged boilers: A packaged boiler refers to a boiler that is shipped fully assembled and installed as a unit. Often package boilers need to be installed prior to putting the roof on a building. Originally package boilers were developed for ships and one of the first and more popular styles was referred to as a Scotch Marine Boiler. Most packaged boilers are welded steel. Cleaver Brooks is a major manufacturer of packaged boilers.

HEATING BOILER BASICS (CONTINUED)

Cast iron Sectional Boilers: Cast iron sectional boilers are manufactured in sections. Each section is small enough to fit through a door. The sections can be wheeled in on a hand truck and then the boiler can be assembled in the space. Capacity is increased by adding sections. Cast iron sectional boilers are subject to problems with thermal shock when return water temperatures drop below 140° F. Both packaged boilers and cast iron sectional boilers typically run between 140° to 180° F. These types of boilers achieve their maximum burner efficiencies of between 83% and 85% at high fire. Weil-McClain and Smith are major manufacturers of cast iron sectional boilers.

Condensing Boilers: The air and the fuel entering a boiler both contain large amounts of moisture. It requires a large input of energy to vaporize this moisture. In a conventional boiler the vaporized moisture and the energy required to vaporize it go up the stack as waste. Condensing boilers remove enough energy from the stack gas that the moisture condenses in the stack. Any boiler when run with return water temperatures below 130° F will begin condensing. Most conventional boilers have the burner at the bottom of the boiler. If run in the condensing range (with low enough return water temperatures to condense the stack gas) acidic condensate will drip down the exhaust stack and eventually onto the burner and begin to erode the burner. Some condensing boilers have the burner located at the top so that this will not happen – but all condensing boilers require drains be installed on the exhaust stack to divert the condensed water safely down a drain. Condensing boilers often have efficiencies of greater than 95% when return water temperatures are below 100° F. The efficiency drops with higher return water temperatures. At 160° F condensing boilers drop to about 85%; this matches the very top end of efficiency achieved by a conventional boiler – so care should be taken when using condensing boilers to make sure that they do operate in the efficient condensing mode at least 60% of the time. Systems designed for condensing boilers have larger coils and typically call for maximum supply water temperatures below 160° F on a Design Day. Condensing boilers should always be operated with aggressive reset strategies to keep the return water temperature as low as possible, which keeps the efficiency as high as possible. Condensing boilers can operate at much lower supply water temperatures, offer greatly improved comfort during mild weather conditions, along with the large increases in efficiency.

Boiler Capacity and Efficiency

Boiler capacity can be measured either as fuel input to the burner, burner output, or as boiler heat output. The most difficult to get accurate information and numbers for is actual boiler heat output.

- *Combustion Efficiency* - Burner output divided by input. Also can be measured by the amount of unburned fuel and excess air in the exhaust stream
- *Thermal Efficiency* - the heat exchangers effectiveness at transferring heat from the combustion process to the water or steam in the boiler

- *Fuel to Fluid Efficiency* - the overall efficiency of the boiler including burner efficiency, thermal efficiency of the heat exchanger, radiation and convection losses – boiler output divided by burner input.

Burners are tested and given an AFUE combustion efficiency rating. However heat exchangers (recall the boiler is just a shell and tube heat exchange) are rated for effectiveness not efficiency. The Institute of Boiler and Radiator Manufacturers provides I=B=R ratings for boilers. There are two ratings Gross I=B=R and Net I=B=R. Both ratings are in Btu. Gross I=B=R is essentially the net burner output, the heat input to the boiler; Net I=B=R is a measure calculated to determine heat output from the boiler taking into account the thermal efficiency of the boiler. Other measures of boiler output are Boiler Horsepower and Square Feet EDR. Both of these are based on steam, however boiler horsepower is often used for hot water boilers. Boiler horsepower was originally developed as measure of output from a steam engine. One boiler horsepower is equal to about 33,479 Btu per hour of output from the boiler. Square feet EDR is a measure of Equivalent Direct Radiation from a steam radiator. One square foot EDR is equal to 240 Btu per hour.

Seasonal efficiency is a measure of the efficiency of the boiler throughout the heating season. It takes into account the effect of cycling on a boiler's efficiency. Burners are least efficient during start up and shutdown. Not only is there the unfired gas and loss of efficiency during starting there are losses due to the purge cycle. Each time a burner shuts off the boiler goes through a purge cycle to remove unfired gas from the system. This is a very important safety measure, but it also reduces the efficiency of the system. During the purge cycle room temperature air passes through the boiler, steals some stored heat and sends it straight up the stack as wasted energy. There are a number of articles and methods for calculating this including ASHRAE standard 115P. If a boiler is oversized it will cycle more often and reduce the system seasonal efficiency. Even when a boiler is properly sized for the Heating Design Day, it will effectively be oversized 95% of the heating season. Modulating burners with a high turndown ratio (high fire rate divided by low fire rate) can allow the boiler to run much longer at low fire without shutting down, thereby increasing the seasonal efficiency. Installing multiple boilers and sequencing their operation so that boiler capacity is more closely matched to the load throughout the heating season can also improve seasonal efficiency. Condensing boiler typically have very high seasonal efficiency even when they aren't sized to run in the condensing range on a Heating Design Day.

The EERE website has a section called Energy Tips-Steam. The following link will take you to one of their articles on burner efficiency: www1.eere.energy.gov/industry/bestpractices/pdfs/steam24_burners.pdf. The article is labeled as steam tips and is aimed at large industrial systems the example is for a huge (500,000 MMBtu) industrial boiler. However, the burner efficiency and tune-up tips apply equally well to smaller heating boilers whether they are steam or hot water systems.



**2011 OREGON APEM FORUMS
SUGGESTIONS FORM**

What energy issues would you like to see addressed at an Oregon APEM Forum?

Is there an energy topic that you would be interested in presenting to our membership?

Please tell us of a speaker that you would like to hear from:

Please submit form by **December 31, 2010** to: orapem@gmail.com
(Put "Oregon APEM 2011 Forum Suggestions" in the subject line.)
or mail to Christie Sphoon, Oregon Department of Energy, 625 Marion Street NE, Salem, OR 97301

Mission Statement: To advance the understanding and practice of sound energy and resource management principles, and to provide a network among business, government, and utilities for information, education, and leadership.



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