OREGON ASSOCIATION OF PROFESSIONAL ENERGY MANAGERS

P.O.Box 6764, Portland OR 97228-6764 www.oregonapem.org

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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TABLE OF CONTENTS

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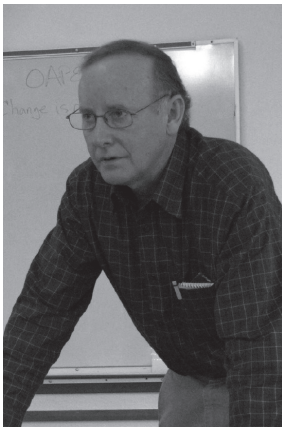
PRESIDENT'S CORNER



We are off to a very good start at Oregon APEM, with the just concluded Spring Forum on the 2030 Challenge, Reaching Net Zero. Watch our web site for Powerpoint postings if you missed it. There also is an article about it in this newsletter and an article about the upcoming Summer Forum that you won't want to miss.

I want to encourage you to stay connected with Oregon APEM this year with all the changes and challenges we see in our society and the changes coming with Oregon APEM. Behind every problem lies an opportunity.

We have two developing student chapters, one at OIT and one at Lane CC that are getting strong student interest. They are both looking for support in the way of speakers for their meetings, advisory help and for networking to connect them to the Energy Industry. These students, after they graduate will be prime candidates for job openings with companies that need experienced and motivated employees as part of their "green" workforce.

Oregon APEM is also a great resource for anyone hoping to make job connections with the energy efficiency and renewables industry and improve their career options. Let Oregon APEM help keep you informed on where the energy jobs are and what you need to know to make the most of those jobs.

An example of how to make the most out of a job can be made with the exciting field of renewable energy. This field is generating a lot of interest. But if we don't do the basics first to make our buildings and homes efficient, it will be much more expensive to reach our sustainable goals. It's like trying to sail (wind power) in a boat that has holes in the hull. Fix the leaks first (make your building efficient) then go for a sail with no worries. And right now there are tremendous incentives through various utility and government programs to help make your buildings more efficient at low cost to you. Contact your local utility or again stay connected through Oregon APEM to stay in the know.

Hope to see you in June,

David Christie

President, Oregon APEM

SPRING FORUM: THE 2030 CHALLENGE REACHING NET-ZERO

Dave Christie Getting the Forum Started.

Oregon APEM's Spring Forum on April 2nd, 2009 took a step beyond the usual fare; instead of emphasizing today's tools, cutting edge technology, and best practices for energy management Oregon APEM took a look into the future of energy management. The Spring Forum brought together some of the rising stars and superstars of our industry to help us understand how global warming effects our industry.

The forum was held at the Gerding Theater in Portland, an amazing building with quite some historical significance. The theater started its life in 1891 as the Portland Armory. After outliving its usefulness as an armory, going through several re-births and mid-life crises, the old Armory has been rejuvenated as a world class theater and achieved a LEED Platinum rating. As stated on Portland Center Stage's website, "The facility is the first historic rehabilitation on the National Historic Register, and the first performing arts venue, to achieve a LEED (Leadership in Energy & Environmental Design) Platinum rating."

After taking a few minutes to admire the venue, enjoy some good coffee, pastries, and the chance to catch up on the news and network with fellow energy managers; David Christie, Oregon APEM President stepped up to the microphone and got the Forum started. The presentations started out with Kelly Hoell of Good Company leading us through the chemistry of greenhouse gases, carbon equivalents and global warming; and then introducing the topic of the 2030 Challenge. Initially we had only allotted 20 minutes for this introduction to the topic; but Kelly told us it would take more time to properly cover the topic. And we are glad we made the extra time. It was a great presentation, she made a difficult topic easy to grasp.

The topic just kept building with each presentation. Next up was Terry Egnor of MicroGrid and a consultant for Better Bricks. Terry brought carbon accounting home to energy management by asking us, "Can you say kili-Btu?" Making the case that carbon can't be reduced and net-zero cannot be reached without energy conservation, he emphasized the need for existing buildings to also be meeting the 2030 Challenge targets. After a short networking break we heard from Mitch Dec, a mechanical engineer and energy modeler for Glumac. Mitch provided information and detailed discussion on the potential of the many new and emerging technologies that are available and may be required to reach net-zero. Jim Benya of Benya Lighting shared his knowledge on seriously sustainable lighting. Jim made the case that net-zero can't be reached without major reductions in electrical lighting loads. He discussed many of the new lighting technologies including LEDs; but made the case that aggressive use of daylight harvesting is the only way to reduce electrical loads to the point that renewable and alternative energy sources can meet the demand and lead us to net-zero.

With four passionate and knowledgeable presenters before lunch, it was a very full morning. Catering for the event was provided by Artemis, known for use of fresh, local and sustainable products in the preparation of their award winning meals.

After lunch, and it was an effort to pull everybody away from that spread, did I mention that the vegetarian lasagna was to die for? Nick Collins of PAE provided a case study of the Columbian Office building, the first local building to meet the 2030 Challenge targets. Nick provided slides and descriptions of the systems that gave 50% better than code energy savings and made the project eligible for the federal EPACT tax deductions. These systems included high performance building envelope, an open well ground source heat pump chiller system and a radiant heating and cooling slab in the large open pavilion.

To top off this event Portland Center Stage offered site tours of the Theater pointing out the innovations and reuse of materials that helped it to achieve LEED Platinum. Portland Center Stage also provided a pair of tickets for our speaker gifts to each of the five presenters. Thanks to Portland Center Stage and the passion of our presenters it was an excellent forum. If you missed it, or just want to refresh your memory, watch the Oregon APEM website for posting of each presenter's Powerpoint slides. (But if you missed the lasagna…)

MAKING DOLLARS OUT OF SENSE

Oregon APEM scheduled this year's summer forum on Thursday, June 18, 2009 from 5:00-8:30 p.m. at Willamette Valley Vineyards in Salem. Yes, that's right – PM. We hope to see you and your spouse for an evening at the winery. Registration will open at 4:00 for anyone who's interested in wine tasting and a tour of the winery.

The topic of this forum centers around innovative ideas for low cost/no cost energy projects – including incentives and case studies – both in commercial buildings and residential homes. The forum features an impressive group of speakers, including:

- Nathan Good to talk about residential opportunities
- Dennis Wilde to talk about innovative, commercial opportunities
- Representatives from The Oregon Way, Energy Trust of Oregon, and Department of Energy to talk about federal and state incentive opportunities
- Representatives from McKinstry to talk about a successful case study that pulled it all together

We hope to see you at the forum. We'll eat a delicious dinner, enjoy some wine, watch the sunset, and learn about new and innovative ways to help the bottom line.

Register for the Summer Forum at the following link: www.regonline.com/Oregon_APEM_2009_Summer_Forum

ENERGY TRUST LAUNCHES PATH TO NET ZERO PILOT FOR NON-RESIDENTIAL BUILDINGS

Energy Trust of Oregon, Inc., is launching a "Path to Net Zero" pilot for owners who construct buildings with exceptional energy performance and strive for net zero on-site energy use. Eligible new construction and major renovation projects will receive enhanced design and technical assistance, as well as premium cash incentives.

"Net zero buildings are a significant milestone in the evolution of modern building design because of the critical environmental benefits that they provide," said Spencer Moersfelder, business sector manager, Energy Trust. "Energy Trust launched the Path to Net Zero pilot to provide the technical assistance and financial support for project teams to move aggressively toward designing and building to a net zero standard."

To be eligible for the pilot, projects must commit to achieving energy efficiency savings of at least 50 percent beyond Oregon code, with combined energy efficiency and renewable energy savings of at least 60 percent beyond Oregon code. Projects must also be in schematic design phase or earlier.

Energy Trust's incentive offering for eligible Path to Net Zero pilot projects will include:

- $10,000 for early design assistance, paid toward an integrated design charrette held with the entire project team
- Up to $50,000 for technical assistance, paid toward energy studies, building simulation modeling and other necessary technical analyses
- Premium installation incentives, calculated based upon the project's estimated energy savings and amounting to at least two times the current New Buildings program rate
- Performance verification incentives, paid toward monitoring and verification of building energy performance post-occupancy

Successful Path to Net Zero projects can also receive significant Energy Trust incentives upon completion. The four components of the incentive offering will be rolled out throughout 2009, beginning with the availability of the early design assistance incentive on May 1, 2009. Project owners and design teams who are striving toward net zero energy and interested in being involved in a pilot project, can contact Becky Walker at 503.467.0898. Path to Net Zero has limited funding and projects will be qualified and enrolled on a first-come, first-served basis.

Energy Trust of Oregon, Inc., is a nonprofit organization dedicated to changing how Oregonians use energy by promoting energy efficiency and clean renewable energy for Oregon customers of Portland General Electric, Pacific Power, NW Natural and Cascade Natural Gas. For more information, visit the Energy Trust Web site, www.energytrust.org, or call 1.866.368.7878.

"National Sustainable Building Advisor Program is offering a Portland class. It is a 9-month certificate training course and exam specifically designed for working professionals eager to apply sustainable concepts to the buildings they design, develop, and construct. To sign-up go to http://www.nasbap.org."

HOW DO YOU SPELL STIMULUS? ARRA: JUMPSTARTING THE ENERGY ECONOMY

The American Recovery and Reinvestment Act (ARRA) is providing $94 billion stimulus dollars for direct and indirect spending on energy efficiency projects and developing clean energy. This stimulus money will be provided as tax incentives, grants and loan guarantees to encourage conservation, renewable energy, and to help jumpstart the energy economy. Over 40 million of those dollars are slated for Oregon.

The energy-related stimulus funding for public agencies in Oregon is being managed by the Oregon Department of Energy (ODOE). A web-interface has been created to allow cities and counties to submit plans for energy efficiency improvements and ODOE has already begun reviewing projects.

To ensure the maximum impact the stimulus funds must be leveraged by combining with other funding sources. ETO and utility incentives, Business Energy Tax Credits (BETC), and the State Energy Loan Program (SELP) are all great tools to explore for leveraging funds. Note, if you are planning on using BETC funds, stimulus funds provided as tax incentives do not effect the "Eligible Cost" calculation for BETC; but stimulus cash grants reduce the "Eligible Cost" on a dollar for dollar basis. Energy Savings Performance Contracting (ESPC) can also be a strategic tool for leveraging the stimulus funding.

Although business has certainly slowed down for many industries, energy management is still good business. It may be what makes the differences between those companies that survive and those that don't. (Have you ever seen a job posting for Energy Managers at General Motors?) Energy management will be at the heart of transforming our economy. We are seeing, or are about to see a huge spike in demand for energy engineers, energy auditors, RCMs (Resource Conservation Managers), and ESCOs (Energy Saving Companies).

"Energy conservation is the new patriotism." So get your surfboards out folks and get yourself positioned to work that big wave, its coming our way!

SOLID STATE LIGHTING: LEDS, ARE THEY READY FOR PRIME TIME?

The Edison lamp (incandescent lighting) came into it's own at the beginning of the 20th century, for the first time in history man could produce light without an open flame. Because of the need for ways to compare, rate, and measure this "new" electric lighting the Illuminating Engineering Society (IES) was formed in 1906. The changes that we are witnessing here in the early years of the 21st century are almost as revolutionary as the changes that took place just over a hundred years ago. These changes have made the T8 v. T5 arguments seem so last century; now LEDs (light emitting diodes), also referred to as Solid State Lighting (SSL) are all the rage. We are living through radical changes in the lighting industry.

Light Emitting Diodes, LED, OLED, junction temperatures, drivers, binning, heat sinks, it's a whole new language. We are regularly seeing press releases and advertisements claiming greater than 100 lumens per Watt from white LEDs, showing LEDs as viable replacements for just about every type of light source including linear fluorescents. An internet search found claims of 100,000 hour life, warm white light, efficacies as high as 300 lumens per Watt, and that LEDs produce no heat. Where's the truth? How do we find out if LEDs are living up to their potential or can these claims just exist in a lawless environment like the wild, wild west? Do we have a way to compare LEDs to fluorescent and incandescent lighting?

Help is on the way! It is no longer the wild, wild west because US Marsall Matt Dillon is riding into town wearing an Energy Star for his badge and leading a posse that has names like CALiPER, LM79, & LM80.

The IES has evolved into the Illuminating Engineering Society of North America (IESNA). Different century but they are stepping up again to help define the new solid state lighting. Recognizing the confusion and frustration experienced by lighting designers IESNA has introduced two new standards, LM79 and LM80, to help define this new light source. LM79 defines test conditions so that all LEDs will be tested under similar conditions, and LM80 provides testing procedures for determining the useful life of the light. Lamp output and efficiency for LEDs are difficult to separate from fixture (or luminaire) efficacy. Because of this difficulty of measurement, the variability of light output from individual LEDs, and the effect that heat has on their light output, LM79 measures light output from the complete fixture (luminaire efficacy) under set conditions. The testing methods defined by LM79 standards include measurements for chromaticity, correlated color temperature, and lumen output. These measurements allow us to compare the LED performance to more familiar lighting sources.

Solid state lighting has made tremendous leaps forward in the last several years. Recognizing this and taking an active interest the US Department of Energy (DOE) began independently testing commercially available white LED fixtures in 2006. The program is called Commercially Available LED Evaluation and Reporting or CALiPER. The CALiPER testing and reports were instrumental in making the lighting community aware of the overstatement of performance and lack of availability of reliable data on LED products. Their reports have shown that LEDs have more potential for directional lighting than for non-directional lighting; but has generally found them to be lacking when designed for direct replacement of an existing efficient light type. The CALiPER reports have also brought to light the problems that LEDs have with heat management. As light output increases the heat output also increases and unless this is managed through effective heat sinks the LEDs efficiency decreases.

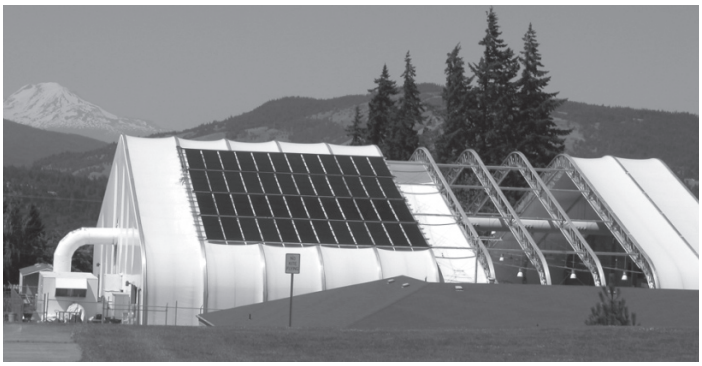
The lack of reliable data or a method to compare with more conventional light sources kept DOE and EPA from rating solid state lighting until now. White LEDs didn't even make it out of the lab until the late 1990s, but the advent of LM79 has allowed the Energy Star program to come up with standards for an LED Energy Star rating. Now with LM79 they can be tested and compared for efficiency with more conventional lighting sources. The Energy Star rating is based on the application and fixture type. If an LED fixture provides the same amount or more lumens per Watt than the typical compact fluorescent (CFL) fixture for the same application, then the LED fixture earns the Energy Star. The Energy Star rating is available for the lighting applications where solid state lighting has begun to gain some acceptance. The applications include portable task lights, under cabinet lights, recessed downlights, outdoor step, path and porch lights.

With all the testing and additional information can we draw any conclusions? LEDs can't be beat for colored lighting applications; but they still have trouble consistently delivering good quality white light. The high performance T8 fluorescents rival white LEDs in life and vastly exceed them in light output and luminaire efficacy. The LEDs are catching up with CFLs. But I would say that Energy Star has set the bar very low for LED lighting, if these solid state lights only need to meet the average efficiency of the typical CFL. There are several good LED downlights being manufactured; but as Jim Benya asked at the Spring Forum "is the attic really where you want to put something that requires 2.2 pounds of aluminum as a heat sink?" Some of the most promising new applications are in outdoor lighting, refrigeration, pools and water features where the heat output isn't a big issue and the large heat sink isn't needed. At this point in time LEDs are still a niche product; but they have inserted a wedge in that niche and are working on cracking the whole lighting market open. LEDs have definitely moved beyond cute, they aren't just for exit lights anymore; but for most lighting applications they are still a very expensive lighting solution.

MEASURED SAVINGS FOR SOLAR & BOILER PROJECTS

The Hood River Aquatic Center recently lowered their gas bill by 27%. They accomplished this by installing (48) solar thermal collectors on the roof to heat pool water, and installing a new high efficiency condensing boiler.

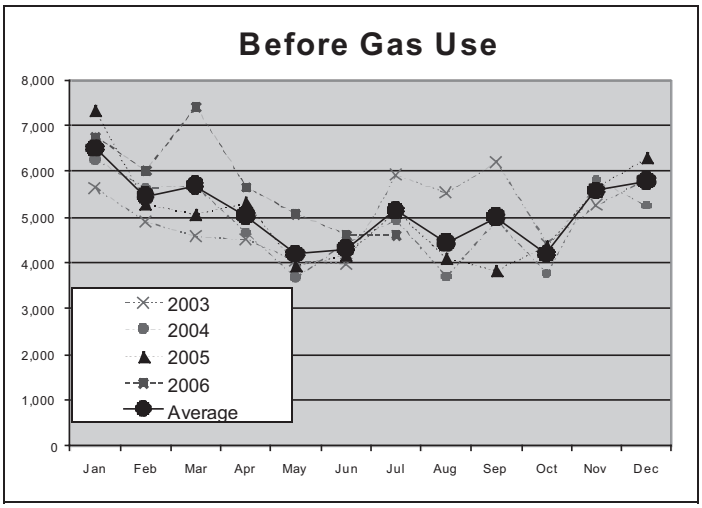
The 23,000 square foot municipal pool was built in 1993. The main pool covers 5,000 square feet and is heated to 85 F. The facility is open to the public 340 days a year, from early morning to late evening. The walls and roof are made of an inner and outer layer of plastic. The center roof and wall sections are removed in the summer.



Solar Collectors & Open Pool Roof.
Photograph by Brent Gunderson of Gen-Con, Inc.

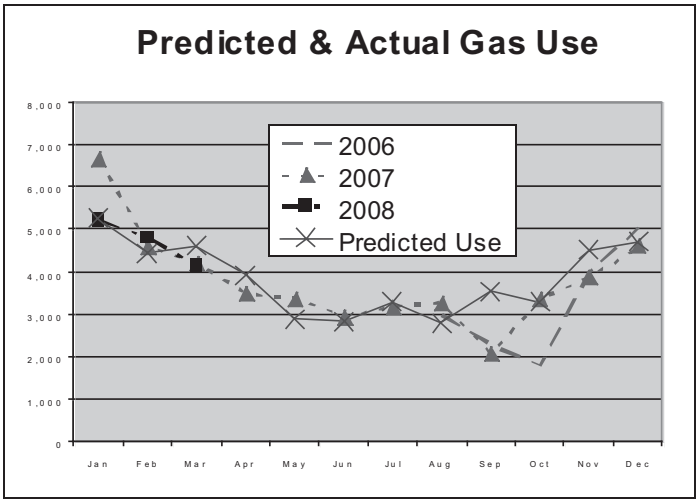
A drain-back style solar heating system was installed to heat the main pool water. Pool water is pumped directly through (48) unglazed plastic solar collectors (2,300 square feet) when there is sufficient solar energy available. This relatively low-cost type of solar system is the most economically advantageous renewable energy project available for any facility owner in Oregon. This system generates hot water from mid-April though mid-October which coincides with Oregon's sunniest weather.

A 13-year old low pressure steam boiler was replaced with a new high efficiency condensing hot water boiler. This also required new pumps, piping, and plate & frame heat exchangers. A new web-enabled DDC system was installed to control the boiler system, heat exchangers, and monitor the solar system.



The gas use was averaged over 3½ years before the upgrades were installed. The only gas appliances on this gas meter is the boiler and the domestic water heater, there is a separate gas meter supplying the gas-fired space heating equipment.

The gas use prior to the upgrade varied from year to year by less than 5%. The larger month-to-month variations are attributed to temporary changes in the use of the pool blankets and manual adjustments to the pool and space heating systems. The increased gas use during the winter months is attributed to lower indoor humidity which increases pool water evaporation and heating energy. The increase in gas use in the summer months is attributed to the opening of the roof panels – subjecting the pool to more wind during the day and colder air at night, both of which increase pool water evaporation and heating energy.

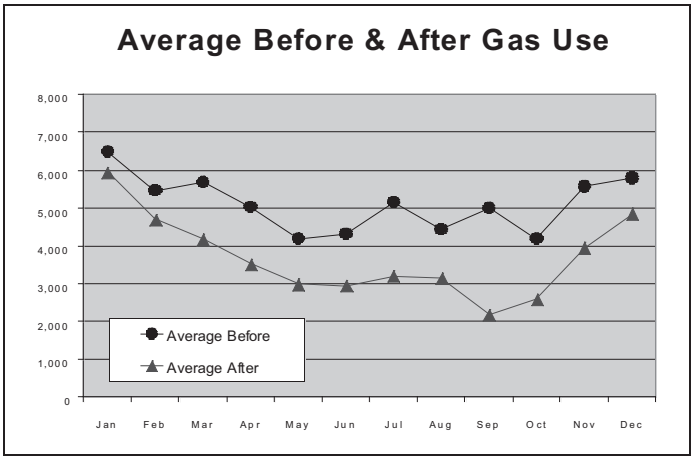


An energy audit that led the owner to install these projects calculated the boiler savings as follows:

Gas Savings = Existing Gas x (1 – 75% / 92%)

The solar savings were calculated with the RETScreen software (www.retscreen.net) using Portland, OR weather data. The first (19) months of gas bills since the construction was completed have been averaged to determine a "post-upgrade" average gas use.

The high gas use in Jan. 2007 is attributed to the failure of the space heating system in the natatorium at this time, which caused the pools to heat the entire space.



The additional savings in September & October are attributed to additional savings from the solar system due to the annual draining and re-filling the pool – and heating all 280,000 gallons with the solar collectors.

Submitted by: Rich Davis of Abacus Resource Management. Feel Free to contact Rich Davis at 503-350-3423 for more information.

BOARD MEMBER BIO

Christie Sphoon has been with the Oregon Department of Energy for nine years. She is currently an Energy Specialist in the Building Technologies Section working primarily with the Schools Team. The Schools Team helps Oregon's K-12 schools install energy efficiency measures within their educational facilities. Christie is also a recipient of the Energy Management Certification through Lane Community College.

Christie has been active in support of Resource Conservation Management in Oregon and has submitted the following article.

RESOURCE CONSERVATION MANAGEMENT (RCM)

Resource Conservation Management (RCM) has been part of the Oregon energy efficiency landscape since the 1980's. It grew out of pioneering work done at seven Oregon K-12 schools under the Energy Smarts Partnership. This Partnership was led and staffed by BPA, Northwest Natural Gas, PGE, and the Oregon Departments of Energy and Education.[1]

Since that time, RCM has grown tremendously in the Northwest, led by the state of Washington and the market transforming work done by Puget Sound Energy. This stands in contrast to the state of Oregon. Despite pioneering the RCM concept, Oregon's RCM efforts have been largely relegated to individual organizations with limited, direct institutional support. These organizations include, but are not limited to:

- Salem-Keizer SD
- Portland SD
- Beaverton SD
- State of Oregon's Department of Administrative Services
- Portland Metro
- Oregon Convention Center

As evidence of RCM's environmental and cost effectiveness mounts so to does the interest in program adoption and embarking on RCM as a career-path. Below is a short-list of RCM or related-type academic programs available to interested individuals:

- Columbia Gorge Community College
- Lane Community College
- Oregon Institute of Technology
- Portland Community College
- Portland State University

Because a well-coordinated RCM program works with the "human element" to better manage systems to reduce energy and water demand – and thus the waste generated at facilities – they are a great complement to of energy efficiency investments. What level of support should the state of Oregon make to RCM to increase market adoption? Should RCM stand on its own? As professional energy managers, where do we stand on this issue? Our next APEM Forum in June will delve into this topic in greater detail, highlight success stories and lessons learned from across the state.

And if you are interested in learning more, please see the list of available materials and resources below:

RCM Guidebook
Developed by Washington State Department of General Administration and Oregon Department of Energy
http://www.oregon.gov/ENERGY/CONS/RCM/rcmGuide.shtml

Lane Community College
Energy Management Two-Year Program with RCM Track
(Not Released Yet, Coming Soon!)
http://www.lanecc.edu/science/energyMgmt/index.html

Northwest Energy Education Institute
Building Operators Certification
A professional development program designed for Building Operators
http://www.nweei.org/boc.html

List Serv
Available with Oregon Department of Energy on RCM information
http://www.oregon.gov/ENERGY/CONS/RCM/rcmhm.shtml

Washington State University
RCM monthly newsletter "listserve"
(Contact Karen Messmer too find out more)

RCM News
Public Agency Employees in the Northwest may sign up for e-mail listserv to receive monthly issue of RCM News, as well as occasional announcements and information.
Send a blank email to: MessmerK@energy.wsu.edu

[1] "Survey and Assessment of RCM Programs" Final Report – Submitted to Washington State Department of General Administration, July 16, 2002. Prepared by WSU Cooperative Extension Energy Program

COMPACT FLUORESCENT RECYCLING

The Home Depot® is launching a free, national in-store, consumer compact fluorescent light (CFL) bulb recycling program at all 1,973 The Home Depot locations. This free service is the first program so widely available by a retailer in the United States and offers customers additional options for making environmentally conscious decisions from purchase to disposal. At each The Home Depot store, customers can simply bring in any expired, unbroken CFL bulbs, and give them to the store associate behind the returns desk. The bulbs will then be managed responsibly by an environmental management company who will coordinate CFL packaging, transportation and recycling to maximize safety and ensure environmental compliance. The CFL recycling program is an extension of The Home Depot's Eco Options program. Eco Options, launched in April 2007, is a classification that allows customers to easily identify products that have less of an impact on the environment. Switching from traditional light bulbs to CFLs is an easy change consumers can make to reduce energy use at home. According to the EPA's ENERGY STAR® program, if every American switched out one incandescent bulb to a CFL, it would prevent more than 600 million in annual energy costs and prevent greenhouse gases equivalent to the emissions from 800,000 cars. As the largest retailer of light bulbs in the country, The Home Depot sold over 75 million CFL's in 2007, which saved Americans approximately $4.8 billion in energy costs and 51.8 billon pounds in CO2 greenhouse gases over the life of the bulbs. For more information on the CFL Recycling Program or Eco Options, please visit www.homedepot.com/ecooptions.

CFLS, MERCURY, AND EMBEDDED ENERGY

Want the straight information on the embedded energy and mercury content of compact fluorescent lamps?

Go to Energy Star
http://www.energystar.gov/cfls
Click on Recycling and Mercury, then under Learn More download the Fact Sheet.

ENERGY MANAGEMENT: THE NEXT GENERATION

Lane Community College in partnership with the Northwest Energy Education Institute (NEEI) offers a comprehensive two year degree program in Energy Management. The program started in 1980 and experienced a very slow growth curve over a number of years. This is no longer the case as we have seen a steady and almost exponential growth in the last few years. In 2007 the program had a maximum of 30 seats for student enrollment. 2008 saw a doubling of that number to 60. In fall of 2009 the program will be open to 90 full time students and the waiting list for 2010 is already beginning to fill. Just as the Energy Management program has seen a growth in enrollment overall, there is also a new trend in the levels of education students have prior to entering this program. These range from High School graduate to PhDs. These trends say something for the popularity of our industry and LCCs Energy Management Program.

LCCs Energy Management program to date has offered two directions of study, Energy Management Technician and Renewable Energy Technician. In 2009 we will see the introduction of a third branch of study, "Resource Conservation Management". This will be an exciting new addition. Students from all three divisions study in classes ranging from basic physics to very detailed classes in their branch of choice. The classes teach and prepare students at very high industry standard levels, as well as a broad knowledge base within their chosen path. Along with the studies students are encouraged early on to become part of the industry by joining associations such as APEM and ASHRAE and also to complete internships with industry related companies and agencies.

LCC and NEEI have come together to turn out a degree program which is very valuable to both the students and the industry. Graduates exit this program both knowledgeable and hirable.

My experience in this course so far has been exciting and very informative. I am at the end of my first year, heading towards the Energy Management Technician path, and look forward to the coming year. My personal background includes working in lumber mills, residential construction, home and car audio and security and finally as a computer technician. Today, as I look back at the unfolding of my varied career choices I see a path that leads me directly to our industry. I look forward to combining all of my acquired skills from both work experience and my new education to possess a full set of tools in this industry. From what I can see at this point, the future holds many opportunities in our field and I am very excited to be involved.

Dirk Patton

ANOTHER FIRST FOR LCC

Lane Community College on May 15th successfully completed the first forum by an Oregon APEM student chapter. The forum, Remaking Campus (and Urban) Buildings: Insight into Sustainable Urban Re-development was co-sponsored by NEEI (Northwest Energy Education Institute) and Oregon APEM. Rich Franko of Mithun Architects in Seattle and Mike Hatten of Solarc in Eugene provided an excellent Powerpoint presentation and discussion. It was a great talk with a turnout of about 30 people. People were VERY into the presentation and there was excellent participation in the discussion period. Overall it was successful, informative, and enlightening.

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