



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.

TABLE OF CONTENTS

Oregon Association of Professional Energy Managers' Summer Forum 2011! 1
Facebook Opens a High Efficiency Data Center in Prineville, Oregon 1
President's Corner 2
Future Forum Announcements 2
Call for Nominations for Energy Manager of the Year 3
The Seed of Resource Conservation Management in the Northwest 4
Reflections On Earth Day - 40 Years Later 4
Energy and Resource Efficiency Programs at Oregon's Colleges and Universities 5
In case you missed it - APEM 2011 Spring Forum Recap 6

FACEBOOK OPENS A HIGH EFFICIENCY DATA CENTER IN PRINEVILLE, OREGON

and they are giving away the specifications online at: www.opencompute.org

In March of 2011, Facebook opened a highly efficient data center in Prineville, Oregon with a claimed PUE (Power Utilization Effectiveness) of 1.07 which means that 97% of the electricity used at the site is used by the computer servers (see Spring 2011 Oregon APEM newsletter for more in-depth discussion of PUE). Most of Facebook's other data centers operate with a PUE around 1.5. Facebook is also taking the unprecedented step of sharing the specifications for this high efficiency data center with the world - online. The founders of Facebook relied upon open-source software from Linux when they started up their company, and they are now passing on the open-source nature of Linux by giving away their specifications at www.opencompute.org. This data center achieves its high efficiency by utilizing - and expanding upon - ASHRAE's recent temperature guidelines for data centers. In 2008 ASHRAE updated their TC 9.9 Thermal Guidelines for Data Processing Environments and they have expanded the recommended temperature ranges that data centers can operate in. ASHRAE based their recommendations upon industry-wide systems, and now they permit entering air temperature (air that enters into the rack of computers) in a data center to be as high as 80.6 °F. See table below for new ASHRAE recommendations.

ASHRAE Revised Temperature Recommendations for Data Centers

Table with 3 columns: Variable, 2004 Version, 2008 Version. Rows include Low End Temperature, High End Temperature, Low End Moisture, and High End Moisture.

Article continued on page 7



Oregon Association of Professional Energy Managers

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OREGON ASSOCIATION OF PROFESSIONAL ENERGY MANAGERS' SUMMER FORUM 2011!

"RCMs, Energy Managers, Sustainability Coordinators... Who Needs 'Em? (You Do!)"

What: RCMs, EMs, SEMP's, Sustainability Coordinators, and the like, can do for your bottom line

When: Friday, June 3rd 7:30am - 1 pm

Where: Vancouver, WA - Clark PUD

See details on page 3

PRESIDENT'S CORNER

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I am starting to wonder about the Obama administration's energy policies. I know his heart is in the right place, but every time Obama revises his energy policy to endorse another source of energy it seems we

have another disaster. Remember the endorsement of offshore drilling revealed in late March 2010, and then by April 20th we had the Deepwater Horizon disaster. This year in January he commits money to the "new nuclear renaissance" and by mid-March, as if the earthquake and tidal wave weren't enough, Japan is having to deal with the worst Nuclear disaster and radiation levels that haven't been seen since Chernobyl. Now that he came out in his speech on March 30th this year for hydraulic fracturing (hydro-fracking) to extract shale-gas, should I be worried?

Seriously, we can't afford to discount the value of any clean power; natural gas and nuclear are often considered clean power. But we also need to evaluate the risks and true costs of these power sources. It will be years before we know the full toll from the Fukushima Dai-ichi radiation releases. I truly hope that by the time you are reading this column we will no longer be reading daily reports of increased radiation levels and releases. Its been over a year since the Deepwater Horizon exploded and we still don't know the extent of

the environmental damage. How are we going to find out the true environmental costs and risks for a new process like hydro-fracking; when EPCRA 2005 Section 322 specifically exempted it from regulation by the Environmental Protection Agency?

When was the last time you heard anybody talking about or read anything about progress towards meeting the 2030 Challenge goals of being Carbon neutral? If we are going to get there its going to take a lot more than just conversation. Our number one supplier of oil is now Canada; providing oil extracted from shale sands- a process with huge environmental risks and a huge carbon footprint. The flights over Libya are costing \$10,000 per hour. How much of that is for fuel- what is the carbon footprint? Carbon neutral is going to take serious conservation. Its going to take smart application of technology, and its going to take alternative power and clean power. Unless we really get serious on conservation and alternative power, I worry that we aren't going to be able to afford to be picky about our sources of clean power.

Join us on June 2nd for the APEM Forum for a discussion (conversation about conservation) on Resource Conservation Management: Overcoming the Resistance and the path to a successful energy management program.

Don Holland

President, Oregon APEM

FUTURE OREGON APEM FORUM ANNOUNCEMENTS

Fall 2011

The APEM fall forum will focus on boilers and central plant operations. Topics covered will include boiler types, piping and operating techniques used to increase efficiency during the heating season. We will present the latest boiler retrofit technologies, case studies and strategies used to reduce energy consumption and facility utility cost. Come to find out about current programs within the Northwest for engineers, building operators and central plant technicians to further their knowledge of these facilities. Watch for an e-mail blast later this year or check the web site, www.oregonapem.org.

Winter 2011

Is your building's energy use a mystery? Why are the utility bills so high? How can you prove any expected savings from an energy conservation project that you implement? Plan on attending the Oregon APEM Winter Forum to help solve these mysteries and learn the tricks of the trade to help you measure and verify the real energy savings. Watch for an email blast later this year or check the web site, www.oregonapem.org.

How wonderful it is that no one need wait a single moment before starting to improve the world.

- Anne Frank

OREGON ASSOCIATION OF PROFESSIONAL ENERGY MANAGERS' SUMMER FORUM 2011!

How many times have you heard about a brand-new building, or even a retrofit, designed with sustainability and energy efficiency in mind, only to find the building uses much more energy than by design? Why is that?

Often its because the design frequently depends on specific behavior and knowledge of the building occupants and operators. Unfortunately, occupants are rarely informed of their role in helping a building run efficiently and operators are more focused on addressing and resolving complaints. Its not uncommon for a building operator to invoke a repair that indeed makes the complaint go away but fails to consider the efficiency involved in the activity.

One of the most effective ways to optimize design efficiencies is to enlist the assistance of someone whose sole focus is to make sure operational strategies are aligned with efficiency goals on an ongoing basis. One of the best ways to accomplish this is to hire a person or firm that has extensive and sufficient training in this area, such as a Resource Conservation Manager (RCM), Sustainability Coordinator, Energy Manager, etc. While these terms are often used interchangeably, each offers a unique approach to building operations and should be considered in that light. This forum will focus primarily on the role of the RCM. Once thought of as an adjunct to facility operations, focused on closing doors and turning off lights, Resource Conservation Management has become much more than that.

In building on our 2011 theme of "Overcoming Resistance to Energy Efficiency," our Summer Forum will focus on these roles and the significant value they can bring to the bottom line with relatively little investment on the part of the building owner or operator. **Roger Ebbage** with the **Northwest Energy Education Institute and Lane Community College**, will characterize his educational program and the value graduates of such a program can bring to a variety of arenas such as building design and operation, utility programs, ESCOs, and energy management programs, to name a few.

Since November of 2008, **Evergreen Public Schools** (Vancouver, Washington) has saved over \$3.5 million dollars in energy costs. Their annual energy expenditures went from just over \$4 million, and trending upward, to less than \$3 million, and still trending downward. Much of the savings can be attributed to an efficiency focus brought to the district upon their hiring an RCM. **Dave Cone** will offer a case study of his work with the district, and describe how the culture of the district, both staff and operations, has be altered to embrace efficiency, which accounts for a large portion of the savings.

Many utilities have embraced RCM as a strategy to support their customers. **Sheryl Anayas** with **Puget Sound Energy** (PSE) has a presentation that illustrates why a utility such as hers, financially supports Resource Conservation Management as a valuable means to significantly reduce energy consumption among it customers.

Of course RCM strategies that work for one sector of building owners and operators may not work for others. Programs implemented in a school, for example, operated and occupied by the building owner's employees, may not be as effective in an apartment or office building where occupants are simply renting or leasing a space and there's a disconnect between the owner and the occupant. These facilities may even be operated by an entity totally unaffiliated with the occupants or owners, offering a unique challenge to efficient operations. To this end **Priya Premchandran, SERA Architects** will review and propose a variety of activities that can be employed in these situations.

As always there will be ample networking opportunities. Please join us!

See page 1 of this newsletter for the date and location of this informative Forum.

CALL FOR NOMINATIONS FOR ENERGY MANAGER OF THE YEAR

Have you been impressed by the work of a person, company or organization in the field of energy management over the last year? Is there a co-worker, educator, or industry leader that you feel deserves the acknowledgement of their peers in Oregon APEM?

Oregon APEM is now accepting nominations for Energy Manager of the Year. Any individual, company, school, or association that has done outstanding work to save kilowatt hours, raise awareness, or promote the industry is eligible to be nominated for this award.

Recent past winners include:

- Charlie Brown, for his groundbreaking work on a modular classroom building that is 100% daylighted in Oregon climate.
- Roger Ebbage and the energy educators at Lane Community College's Energy Management Program.

Please take the time to honor fellow warriors in the fight against wasteful energy use by filling out one for the nomination forms found at www.oregonapem.org and submitting it by October 15, 2011.

THE SEED OF RESOURCE CONSERVATION MANAGEMENT IN THE NORTHWEST

Resource conservation management services are based on a program operated in seven Oregon school districts from 1992 to 1995. In October of 1995, the program participants received a national award from the US Department of Energy as the best Energy Efficiency and Renewable Energy Program in the nation.

Energy Smarts—Resource Conservation Management Pilot

The Resource Conservation Management (RCM) concept grew out of a series of meetings between Energy Smarts Partners—Portland General Electric, Northwest Natural Gas, BPA, Oregon Dept. of Energy and Dept. of Education. They had identified several barriers that prevented school districts from developing and implementing comprehensive energy management plans. These barriers included:

- School boards and administrators underestimate the cost of poor maintenance, inefficient equipment and undefined building operating schedules
- A perception that energy conservation and management is highly technical, requires large sums of money and engineering expertise and is outside the experience of school district staff
- School district officials are not convinced that energy management saves money

The decision was made to extend the program to all resources—energy, water, and solid waste management. An employee of each school district was reassigned as the Resource Conservation Manager (RCMgr) providing the program with instant credibility. The project sponsors guaranteed that the RCMgr’s salary would be paid from the savings gained from improved resource efficiency. In addition the sponsoring utilities provided project coordination and technical support for the RCMgr, while school districts provided space and staff support and committed to implementing the recommendations.

The program savings primarily came from behavioral changes of the occupants as well as modifications in operating procedures of the school plant and equipment. Discovery of opportunities was based upon school district-wide resource accounting system and monitoring procedures established by the RCMgr.

As an employee of the school district, the RCMgr was located on-site. Monthly meetings of the project coordinator and all the RCMgrs helped facilitate a total quality management approach. The RCMgr was responsible for the four elements of the project:

- School district and facility resource conservation plans
- Resource accounting system
- Resource survey and tracking
- Involving teachers and students in school conservation activities

The seven school districts involved had a total of 8.5 million square feet and annual resource costs of \$5.8 million.

Cost and Savings Information:

Total costs for the RCM program include both administrative/overhead costs and the RCM salaries. Administrative costs of \$319,500 were paid by project sponsors and included initial start-up costs for computers, labor, training and on-going project coordination costs. RCMgr salary costs were \$394,700, paid directly by the school districts. Total costs of the 2-year pilot program were \$714,200.

Average savings per school district in the second year were 15.3% (range = 10.6%-25%), well in excess of the 10% target. This was determined using the resource accounting software. The following data reflect actual program activity from June 1993-June 1995.

Measured Savings from Resource Conservation Management Pilot Program

	Units saved	\$ Saved
Electricity	11.7 million kWhs	\$584,820
Electric Demand	not available	\$52,530
Natural Gas	821,200 therms	\$460,125
Garbage	2.1 million cu. ft. eliminated	\$158,075
Water	35.7 million gallons	\$47,750
Total for 2 years		\$1,303,300

A more telling number is the second year savings of \$888,000—nearly 70% of the total savings. This would imply there are more savings generated once the program has been established for a while.

REFLECTIONS ON EARTH DAY – 40 YEARS LATER

Much has changed since 1970. While we’ve made progress in some aspects, we still have a long way to go.

- Energy use: energy use per person in the U.S. has hardly changed since 1970 despite substantial increases in energy efficiency of homes and appliances. U.S. energy per person is twice that of France and Germany.

Source: Number 17, NYC and Ian Yarett, April 26, 2010

ENERGY AND RESOURCE EFFICIENCY PROGRAMS AT OREGON'S COLLEGES AND UNIVERSITIES

The 2010-2011 school year saw the introduction of several new college-level programs in the state of Oregon focused on energy and resource efficiency. Added together with already existing programs, colleges and universities in Oregon are now offering a wide variety of programs in many locations across the state.

Community colleges have been developing specialized programs in response to workforce demands in the region; these programs provide students with the opportunity to gain specific technical knowledge with an emphasis on hands-on training. Oregon's four-year universities provide engineering degrees as well as Master's and Doctorate programs for students pursuing higher levels of education.

New Programs

Starting Winter Term 2011, Clatsop Community College began offering the Sustainable Energy Technician AAS; this program was developed to align with the new Oregon Green Technology Certificate which will soon be offered in nine community colleges in rural locations across Oregon. This certificate program was developed with a State Energy Sector Partnership Grant and includes 35-45 credits of core content intended to train the student for an entry level position in industries that are associated with or support green jobs

Other recently introduced programs include Lane Community College's Resource Conservation Management Program as well as Clackamas Community College's Energy and Resource

Management program. Starting in Fall 2011, Oregon State University's College of Engineering will be offering an exciting new Energy Engineering Management degree through its OSU Cascades Campus.

More information about these programs will be available soon on Oregon APEM's website, at www.oregonapem.org.

Note: Only programs specifically focused on Energy Efficiency, Renewable Energy, and Resource Efficiency are listed below. There are many other programs that have some energy and resource related content but are not strictly centered on these subjects. Examples of programs not included below are: environmental studies and environmental science, public policy and management, and natural resource science.

	School	Location	Program Name
2-Year Degrees	Clackamas Community College	Oregon City	• Energy and Resource Management
	Clatsop Community College	Astoria	• Sustainable Energy Technician
	Columbia Gorge Community College	The Dalles	• Renewable Energy Technology • Wind Energy Technician
	Lane Community College	Eugene	• Energy Management Technician • Renewable Energy Technician • Resource Conservation Management • Coming Fall 2012: Controls Technician
	Portland Community College	Portland	• Renewable Energy Systems (OIT Renewable Energy Engineering Transfer degree)
4-Year Degrees	Oregon Institute of Technology	Klamath Falls Portland	• Renewable Energy Engineering
	OSU Cascades - at Central Oregon Community College	Bend	• Coming Fall 2011: Energy Engineering Management
Master's or Doctorate	Marylhurst University	Marylhurst	• MBA in Sustainable Business Renewable Energy Program • MBA in Sustainable Business Green Development Program
	University of Oregon College of Law	Eugene	• Energy Law and Policy

IN CASE YOU MISSED IT – APEM 2011 SPRING FORUM RECAP

“Energy Conservation Opportunities in Data Centers”



Our Spring Forum presented technical information on energy conservation strategies for existing data centers, a look at the future of data centers, two case studies of newly built high efficiency data centers, and an update from the ETO (Energy Trust of Oregon) on incentives for data centers. We also took a tour of the Oregon State Data Center where we not only toured the mechanical rooms but also walked onto the data center floor to see how hot their hot aisles are, and how cool their cold aisles are. All of the presentations are available online, at www.oregonapem.org.

John Pappas of Mazetti Nash Lipscomb Birch presented detailed information about energy conservation strategies in existing data centers. John has been a mechanical designer for over thirty years, and he was recently hired by the ETO to educate design engineers in Oregon about how to design high efficiency data centers. He presented detailed results of CFD (computational fluid dynamics) modeling that shows how air is often short-circuited inside data centers that result in inefficient cooling systems. Cooling systems are designed to operate with a 20 °F to 25 °F delta (difference between the leaving temperature and the return temperature) but due to short-circuiting of the air they often operate with only a 10 °F delta. Typically some cold supply air passes through the front side of a computer rack where it picks up heat and then exits through the back side of the rack – often this warm air then circles back around to the front and re-enters a different spot on the rack – leading to “hot spots” in the rack, which are then typically remedied by lowering the supply air temperature or adding more cooling and fans. Another problem with poor airflow is that the cold air enters the room and then leaves the room without passing through a computer rack, thus it does not provide any effective cooling. One way to remedy this is to block the air from short-circuiting and force all the cool air through the rack just one time, and then collect the warm air and send it back to the air conditioning unit without mixing it with cold air. John showed us one method of accomplishing this by using the ceiling plenum as a return air plenum, and adding ductwork to the CRACs (computer room air conditioners) so that they only receive air from the ceiling plenum – this method can be applied to existing data centers to minimize short-circuiting of the air and improve airflow distributions. Another energy-saving strategy is to use outside air for cooling – when a data center is laid

out with isolated hot and cold aisles the supply air only needs to be as low as 70 or 75 °F to provide adequate cooling, and this 70 to 75 °F air can be provided over 90% of the year in the Willamette Valley with outside air economizers. Adding direct and or indirect evaporative cooling to the economizer can provide cooling about 95% of the year, resulting in the need to run compressors for cooling only 5% of the year. John spoke of a company he recently designed a system for in California where the economizer, direct and indirect cooling provides adequate cooling for all but 36 hours of a typical year, and the owner decided they can live without mechanical cooling for those 36 hours a year, resulting in savings first cost of installing a mechanical cooling system. John also spoke about the State of Oregon Data Center, which his firm designed six years ago, which uses airside economizers to provide cooling for about 70% of the year (whenever the outside air is below 60 °F) without mechanical cooling.

Steve Knipple of EasyStreet Online Solutions provided a case study of the Hillsboro data center they opened in 2011. Their data center floor is laid out with racks that incorporate hot aisle containment chimneys and they do not use a raised floor. The cool supply air enters the room and enters the racks around 70 °F, much higher than most data centers that are designed with 55 °F supply air. The 70 °F air enters the racks and is exhausted through the chimneys – which eliminate any short circuiting and guarantees that all the air entering the racks is around 70 °F. They monitor the exhaust temperatures to ensure that they stay below 115 °F, which is the temperature recommended by the manufacturers of the computer systems inside the racks. The rooftop air handlers supply the 70 °F supply air using direct and indirect evaporative cooling to produce cooling without the need for mechanical cooling over 90% of the year. The building collects rainwater and stores it for use in the evaporative cooling systems. This facility also uses virtualized systems – virtualized systems typically combine 30 to 40 traditional servers onto one “virtualized” server through the use of sophisticated software.

Brandon Adams of McKinstry presented a case study of a data center they recently expanded in downtown Seattle. This existing facility was electrically constrained so that they could not add mechanical cooling for the increased data center. This led them to innovate and design the expansion to be cooled without the use of any mechanical cooling. This design worked so well that they removed the mechanical cooling from the existing data center. The cooling for the entire data center is now provided through the use of airside economizers, and direct and indirect evaporative cooling systems.

A networking activity was held during a break to give the audience and speakers a chance to get to know one another. Will Miller of PGE won the prize for meeting the most members during this activity.

Continued on page 7

Continued from previous page

Jonny Holz spoke on behalf of the ETO to educate the audience about energy incentives that are available from the ETO specifically for data centers. The ETO offers a \$350 incentive for each server that is virtualized, as long as the owner virtualizes a minimum of ten servers at a time. The ETO also offers incentives for owners to install PC software that turns monitors off and puts desktop computers to sleep when they are idle. Both the State Data Center and EasyStreet Online solutions applied for and received incentives from the ETO when building and retrofitting their data centers.

Jon Haas of Intel presented information on the future of the equipment that is inside the data centers. The computer systems are getting more and more powerful, and they are getting smaller and smaller, the result of this is that the equipment inside a rack uses more and more power, resulting in higher watts per square foot density. John also educated us about the Green Grid, which is an international organization dedicated to improving the energy efficiency of data centers.

John Santana of the Pringle Creek Community gave a presentation of the energy dashboard system that monitors the energy use and the energy production of the solar PV array. During our rainy spring day forum the solar panels were generating about 4 kW of electricity, while on a sunny summer day they will generate about 21 kW.

James Meyer of Opsis Architects gave a presentation on the Pringle Creek Community Center and Community. This is a planned community designed to house over 100 individual homes when they are fully built out. All the homes will be owned by the individuals living there, and they are required to be built to meet LEED standards. The homes will have small yards and share large green spaces. There is a creek running through the community, two large greenhouses, and plenty of trees. The community utilizes pervious paving to allow groundwater to seep right through without collecting and causing erosion. The existing buildings utilize a

ground source heat pump system to provide heating and cooling. The community center utilizes natural ventilation, high efficiency lights, and has 96 photovoltaic solar collectors mounted on the roof.

Bryan Nealy and **Ben Tate** of the State of Oregon gave a presentation of the strategies that the State has been incorporating into their data center to save energy, and a tour of their facility after a gourmet lunch catered by Wild Pear. The State has been virtualizing their computer servers to run the same amount of systems on fewer and fewer servers. They participate in PGE's (Portland General Electric) Dispatchable Generation program whereby PGE takes care of the maintenance of their generators in exchange for being allowed to turn them on when PGE needs extra power in the service area. Ben and Bryan took us on a tour of the data center floor. The computer racks are lined up in hot and cold aisles, but they are not physically isolated so there is still some short-circuiting of air around the server racks. They previously installed blanking plates on the unused slots of the racks, which did reduce the short-circuiting of air and lowered the average cold air aisle temperature by 4½ °F. They use an underfloor supply air distribution system and they were operating with outside air economizers on the day of our visit to provide 63 °F supply air to the entire floor. Their two centrifugal chillers were off, and we toured the mechanical rooms housing them and could see for ourselves that they were off. In fact, their mechanical chillers are only needed to operate when the outside air is above 65 °F, which is only about 15% of the year in a typical weather year. They are now looking to the ETO to provide an energy audit of their facility to identify additional strategies that they can incorporate to save more energy, and they are very interested in a cold aisle containment system. Due to the short-circuiting of the air in their computer cabinets they turn on a chiller when the return air temperature reaches the mid 70's °F or higher.

FACEBOOK OPENS A HIGH EFFICIENCY DATA CENTER IN PRINEVILLE, OREGON

Continued from page 1

While ASHRAE allows 80.6 they go on to explain that 77 °F may be more appropriate, and most computer server internal fans start to increase their speed (and energy use) as the inlet temperature rises above 77 °F to maintain cooling across the servers. According to the specifications for the Facebook data center the hot aisle temperature is maintained at or below 85 °F. They are exceeding the ASHRAE recommendations inside the data center because they are confident that the energy efficient servers that they are utilizing can safely withstand even higher temperatures. Their specifications also state that they utilize a full airside economizer up to 80 °F outside air temperatures! Above 80 °F outdoor temperature they start to employ a direct evaporative

cooling system. The system is built with no mechanical cooling, which drastically reduced the cost of the installation. They built the data center using a design outdoor temperature of 110 °F. The system also uses variable speed drives on fanwalls, LED lighting with occupancy sensors throughout the data center, eliminates 480v to 208v transformers, reuses hot air from the data center to heat the non-data center areas of the building in the winter, and eliminated the need for a central uninterruptible power supply (UPS). Thank you Facebook, for sharing your design with the world and encouraging us to duplicate your efforts if not exceed them. We salute you!



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