

Western's monthly energy efficiency and renewable energy newsletter dedicated to customer activities and sharing information on energy services.

Tri-State embraces next generation lighting

Editor's note: We at Energy Services are aware that lighting technology is changing rapidly, particularly in the area of light-emitting diodes (LED). There is still much to be learned about best practices, economics and appropriate applications. This article is intended to encourage discussion about the pros and cons of different types of energy-efficient lighting systems. For another point of view, see In my opinion: Look at all options, issues when upgrading lighting.

Lead by example is a good way to get people to try something new, so Tri-State Generation and Transmission Association is upgrading the lighting at its headquarters with light-emitting diodes (LEDs), indoors and out.

The board of directors of the Westminster, Colo.-based G&T recently approved funding for LED demonstration projects for cities in their members' territories. "If we want our members to adopt LEDs,

they have to be able to examine the fixtures, see the lighting quality for themselves and talk to facility managers who have experience with the technology," said Mike McCoy, senior engineer for key accounts at Tri-State. "This demonstration will give them a place where they can do that."

Fewer lights

The project began with two conference rooms—a smaller facility, and Tri-State's main conference room. McCoy explained, "We wanted to get the retrofit done for the January meeting of the board of directors."

The conference rooms were lit with a combination of downlights that consumed 75 watts each and 2x2 fluorescents that used either 23 watts or 40 watts depending on the tubes. The small conference room had four 2x2 fluorescents and eight downlights, while the big room had eight 2x2s and 19 downlights. Replacing all the lights with 12-watt LEDs reduced the two rooms' energy consumption by more than



By replacing all the conventional lights with 12-watt LEDs, Tri-State reduced energy consumption in its two conference rooms by more than half when all the lights were in use. (Photo by Tri-State Generation and Transmission Association)

half when all the lights were in use.

Some people worried that the LEDs wouldn't be bright enough. "So we brought them into the room and turned on the lights," McCoy recalled. "It was so bright, we were able to take down two 2x2s and 3 downlights. That cut the energy use by about two-thirds. We may be able to take down more lights."

The fixtures chosen for the indoor retrofit are also dimmable down to 5 percent. McCoy noted, however, "That's such a small load, the dimmer thinks nothing is connected."

Low maintenance

Outdoors, the conversion of 34 400-watt metal halide parking lot

What's inside

In my opinion: lighting..... 3

Corn cob test burn 5

Power line 6

Web site of the month 7

*See NEXT GENERATION LIGHTING
page 2*

Next generation lighting *from page 1*

lights to 153-watt LED fixtures is underway, and should be completed by April. The project places Tri-State in the ranks of Anchorage, Ak., Ann Arbor, Mich., and other municipalities that are discovering savings in more efficient street lighting.

A lighting engineer from vendor Cree LED Lighting worked with McCoy to measure the parking lot lighting and evaluate Tri-State's maintenance records. "A vendor should have computer modeling software to help customers look at the whole picture before making a decision," said McCoy.

The big picture should take into account LED lighting levels and low annual maintenance—considerations that go a long way to offset high first costs. Not only will the lights in Tri-State's parking lot use less energy, fewer lights may provide the same light level so fewer will need to be on at a time. The instant on-off capability of

LEDs means that the lights could be placed on motion sensors, or turned on only when needed between 10 p.m. and 4 a.m. "If security needs to see what's going on in an area, they turn on the LED and get full light level right away," McCoy said. "By the time a metal halide reached full intensity, an intruder would be miles away."

He anticipates saving a large portion of the \$800 Tri-State spends annually to maintain its lot lighting for a total payback of about four years. Labor savings play a large part in street and traffic lighting projects that boast paybacks of as little as two to three years. "City lights are usually on for about twice the amount of time as our parking lot lights," McCoy noted.

Taking an even longer view, he pointed out that LEDs depreciate rather than burn out, so older lights could be moved to light an area that doesn't need as high a light level. "But it will take about 25 years for our parking lot lights to depreciate by 30 percent, so someone else will be making that decision."

Slow road to adoption

Despite LEDs' long life, gross efficiency estimated at almost double that of CFLs and construction of non-toxic, recyclable material, cities and facilities have not rushed to install them. The technology is still very expensive and not suited to all applications. McCoy, a former lighting engineer, admits that if cost is the greatest consideration, the latest generation of fluorescent lighting is the way to go. "But do your homework—some LED applications, like refrigeration lighting, are already competitive and others will be soon," he said.



Cree Lighting demonstrates its LED fixtures at a trade show. In the top photo, the display is lit with CFLs. The bottom is the same display lit with LEDs in the company's LR6 downlight fixtures. The pictures are unretouched. (Photos by Cree Lighting)

McCoy added that demonstrations like Tri-State's are a necessary step toward wider commercialization. "LEDs work differently than the other lighting technologies currently available. We need to test them in real world settings to learn their capabilities and limitations, to figure out the best uses for them," he said.

Another challenge to retrofit projects is finding good quality fixtures, essential to the light's performance and to the success of the installation. Energy Star now rates commercial LED lighting, but compared to other products, the list of LED partners is limited, both in number and applications.

McCoy chose another strategy for keeping up with the rapidly-changing technology. "I spent time getting to know vendor

*See NEXT GENERATION LIGHTING
page 4*

Energy Services Bulletin

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In my opinion: **Look at all options, issues when upgrading lighting**

For another point of view, see Tri-State embraces next generation lighting.

The opinions expressed here are those of Ryan Holl and are not an endorsement by Western or the U.S. Department of Energy. Holl, who works in market development for Orion Energy Systems in Manitowoc, Wis., was a speaker at the DSM technology workshops Western co-sponsored in 2008.

As a result of increasing electricity costs, a troubled economy and a push by the Federal government to improve energy efficiency, municipalities throughout North America are taking steps to reduce energy consumption and costs. Street and parking lot lights represent a significant expenditure for municipalities, in terms of both operating and maintenance costs, but also offer an enormous opportunity for energy and cost savings.

Recent advances in light emitting diode (LED) and fluorescent technologies have resulted in new options for outdoor lighting. These technologies provide municipalities with impressive advantages when compared to traditional lighting options developed in the 1960s. Advantages include improvements in energy efficiency, longer operating lives and a brighter, whiter light source.

Economics

Municipalities must consider three major issues when considering the economic viability of upgrading their outdoor lighting



A parking lot lighting project in Manitowoc, Wis., replaced the four lamps in the foreground with fluorescent units that operate at 234 watts. Compare the upgraded lights to the HID legacy lamps in the background that operate at 1160 watts. (Photo by Orion Energy Systems)

systems, including 1) the initial acquisition cost, 2) the efficiency of the system and 3) the operating hours of the lamps or diodes.

LED technology is still in its infancy and therefore costs significantly more than already proven technologies. The initial costs of LED fixtures range from \$500 to more than \$1,000 each, while the cost of comparable fluorescent fixtures ranges from \$250 to \$400 a piece. Typically, an LED outdoor fixture provides 60 to 65 lumens per watt compared to 80 to 85 lumens per watt for fluorescent technology. These efficiencies can lead to energy cost savings of \$25 to \$50 per fixture per year depending on the utility rate.

Both LED and fluorescent lighting have longer life spans than traditional high-intensity discharge

lights. The estimated lifespan of LEDs is 50,000 hours or longer, 40,000 hours for fluorescents and 15,000 to 30,000 hours for high-intensity discharge lights.

The longer operating lives of LEDs and fluorescent lighting create maintenance savings, which will increase the economic viability of the project. Thermal efficiency is critical to the long-term performance of LED and fluorescent technology. Poorly designed luminaires can degrade and destroy the longevity, light output and lead to outright failure.

Compare first

The first step in evaluating outdoor lighting technology is knowing what questions to ask. Questions to be considered include:

See IN MY OPINION page 4

In my opinion

from page 3

Are photometric reports available? What is the warranty? Is operating temperature data available? What are the initial costs? Will the manufacturer or vendor stand behind hours of operation claims? To help, the U.S. Department of Energy provides a wealth of information about LED lighting through its Solid State Lighting Program.

After collecting initial data, testing and running a pilot program is a cost-effective way

of evaluating efficient lighting technology. Invite manufacturers and vendors of LED, fluorescent and induction lighting to install fixtures for 90 days to evaluate their performance. The city of Pittsburgh, Pa., is considering a street and parking lot lighting upgrade, and recently issued a request for information that asks the right questions of potential contractors.

A pilot program is vital to a successful project. Recently, city officials in Grand Rapids, Mich., refused to commit to LED streetlights because the pilot

program didn't produce the level of illumination required and officials questioned the actual energy savings of the project.

Whether it is lighting or any other energy-efficient system, no one technology is right for every application. Make sure to evaluate all lighting systems available to get the most energy and cost savings from your lighting project. ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/mar/mar092.htm

Next generation lighting

from page 2

representatives so they invited me to local presentations to see new units," he said.

Through his contacts, McCoy learned of the LR6, a new LED fixture manufactured by LED Lighting Fixtures, Inc. (LLF). The downlight combines 42 LEDs per fixture in a proprietary mix of colors to deliver more light per watt and better color rendering than most CFLs. LLF used Cree LEDs to demonstrate its product at the International GreenBuild Conference in 2007, where it was named one of the green products of the year. "Cree

was so impressed, it bought LLF," recalled McCoy.

Opportunity for members

McCoy and the Tri-State board were also impressed—enough to install the units at the headquarters building and to approve funding for a demonstration program. The G&T is encouraging cities served by its member co-ops to replace conventional street lighting with LEDs by offering to pay one-third of the installation cost. The co-op and the city would supply the balance of the funding. The cities of Ouray, Telluride and Durango, Colo., have expressed interest in LED street lights, and Tri-State is accepting proposals from

members for retrofit projects.

Lighting is considered the "low-hanging fruit" of energy efficiency, and Tri-State's two-year-old CFL program has helped to put 125,000 compact fluorescent lights in consumers' homes. McCoy sees the new LED program as the next logical step. "Eventually, LEDs will replace fluorescents. The technology potentially has so much more to offer than current lighting systems," he said. "Tri-State is demonstrating LEDs now so that our members will be ready to help their communities and customers take advantage of the most efficient lighting available." ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/mar/mar091.htm

Cobs plus coal could help Willmar meet renewables goals

Long before ethanol plants began to spring up across the Midwest, corn was widely used as a biofuel in farming communities—a tradition Willmar Municipal Utilities may revive on a utility scale.

The utility's 60-year-old, municipal powerplant received a permit from the Minnesota Pollution Control Agency (MPCA) in February to test burn a new "recipe" for producing energy: corn cobs and coal. If the pilot project is successful, corn cobs could become part of Willmar's power portfolio—and a new source of income for local farmers. "Burning cobs may be able to help us meet our renewable energy goals and support the local economy at the same time," says Willmar General Manager Bruce Gomm.

New renewables mix

Minnesota's renewable portfolio standard mandates that all state utilities meet at least 25 percent of their energy needs with renewable resources by 2025. A \$10 million wind project Willmar is developing may contribute as much as 3 percent toward that goal. The utility set the foundation for two 2-MW turbines last fall, and expects delivery of the DeWind D 8.2 units in May.

The percentage of Willmar's power mix that corn cobs would represent is based on the total fuel that goes into the powerplant's boiler. "If the mix is 20 percent cobs to 80 percent coal at a 10-MW plant, we are getting two megawatts from renewable resources," Gomm explained. Burning 450 tons of cobs in the 20-to-80 ratio will take about two weeks to a month. Gomm anticipates that the power plant will need to start up and shut down a few times for fine-tuning. "We are

testing with the equipment that's in place, so the system is not fully designed around this kind of fuel," he acknowledged. "There will probably be a few bugs to work out."

In addition to determining if cobs and coal burn efficiently in combination, the test will provide data to the MPCA for issuing a permit to allow Willmar to permanently burn the cob/coal mix. Permitting biomass projects poses a challenge to the agency because of the variability in materials. Several sets of rules and regulations may apply to a given project. "The MPCA is working very closely with us to develop testing procedures for this kind of burn," said Gomm. "Favorable results would be good news for growers and the state," he added.

Boost to local sources

That's because farmers in Kandiyohi County alone planted 150,000 acres of corn last year, according to Minnesota Municipal Utilities Association. Willmar Utilities would need to purchase 20,000 to 40,000 acres annually to supply its municipal powerplant. At a rate of \$30 to \$60 per ton, it is no wonder that the community is so supportive of the test burn, or that several growers volunteered for the harvest.



Willmar piled the cobs for the test burn on a runway at the city's old municipal Airport. Corn cobs do not require any special storage facilities. (Photo by Steve Downer, Minnesota Municipal Utility Association)

Ultimately, it was easier for one farmer to supply all the cobs for the test, but Gomm noted that he received calls from people across the country. The corn came from 650 acres farmed by a local couple, Ryan and Lonnie Fosso. "Our plan would be to contract directly with the farmers to buy the cobs," Gomm said. "That way, the money stays in the county."

Harvesting cobs requires a specially-designed collector inventor Vernon Flamme calls the Cob Caddy. Flamme was brought into the project by consultant Jon Folkedahl of Willmar who originally proposed the idea of burning cobs to the utility. The Vermeer Corporation recently bought the patent for the collector and renamed it the Cob Harvester. "We hope that we can start out small, and as the market for corn cob grows, farmers will invest in the harvest equipment," Folkedahl said in an interview with the West Central Tribune.

Selling cobs is a better proposition for growers than turning them back into the

See COBS PLUS COAL page 8



TOPICS from the POWER LINE

Targeting outdoor display lighting to reduce energy use

Question:

How much energy is consumed by outdoor display lighting in Washington state? Are any state or utility programs targeting this end-use for peak demand reduction?

Answer:

One of the challenges in obtaining such data is that people who know the most about outdoor lighting—planners and designers—aren't usually focused on macro energy use. A second challenge is that most information sources don't differentiate non-essential outdoor display lighting from the category of outdoor lighting that includes street, security and public safety lighting such as parking lots.

Few pros, many cons

Debra Tachibana with the Evaluation Unit of the Energy Management Services Division at Seattle City Light noted that outside lighting represents about 36 average megawatts of the utility's load. That amounts to 3 to 4 percent of the utility's total connected load for lighting buildings, sidewalks, parking lots/garages, roadways, work-yards, architecture/landscape and signage. A fraction of 1 percent of this load would be for display lighting, and there would likely be resistance from retailers whose livelihood depends on exposure. The great majority of this lighting is for security and public safety; so, for liability reasons, building owners would likely resist

attempts to curtail this load.

The unit manager concluded that, "Curtailed outdoor lighting would be extremely challenging. Due to concerns with safety and security, the level of compliance would be very low while economic liability could be quite high."

Also, there is a surprising amount of effort involved in reducing this type of municipal energy use. For example, to shut off every other streetlight, as Tacoma tried once, requires someone to actually climb up each lighting fixture, turn it off and post a sign on it informing the public that it's off on purpose and not broken.

More state measures

The following are examples of efforts in other states to pursue outdoor lighting curtailments:

1. California Governor Gray Davis signed the Reduction of Outdoor Lighting Act in as a measure to address the state's energy crisis in 2001. Outdoor Lighting Zones are also covered in the 2005 Building Efficiency Standards.
2. During that time, the California Independent System Operator (Cal-ISO) called upon citizens to reduce power demand to avoid a stage-two power emergency. They did not specifically address display lighting.
3. The International Dark-Sky Association has a number of references and links to mu-

nicipalities that have instituted restrictions on lighting, but these focus on reducing light pollution and improving energy efficiency rather than on peak demand reduction.

4. Utility Options is a database of actual programs operated by utilities. You can search the database for lighting programs.

Although your question specifically targeted outdoor display lighting, you may want to consider other measures that are easier to implement and enforce, and have more impact and less potential political fallout.

On a related note, the California Energy Commission asked Jim Benya, a well-known lighting designer, to come up with recommendations to reduce power shortages, his first thought was to recommend occupancy sensors and photosensors in offices. However, further analysis determined that at the time there weren't enough available licensed electrical contractors in the state to install them. He therefore altered his recommendation to encourage the use of CFL task-lighting and desk-top occupancy sensors to turn off the task-lighting and computer monitor when occupants were away from their desks for a pre-determined length of time. For offices with windows, the circuit powering overhead lighting would be turned off. These measures avoid the lack-of-availability problem and expense of hiring electrical contractors. ⚡

Want to know more?
Visit www.wapa.gov/es/pubs/2009/mar/mar094.htm

Web site of the month:

Online IRP compliance training

www.wapa.gov/es/irp/complytraining.htm

The integrated resource plans (IRPs) Western customers develop to meet their consumers' electricity needs are as diverse as, well, our customers. On the other hand, the rules about the kind of information IRPs must contain, who must approve them and when to submit them are very specific—and a little overwhelming.

A step-by-step training program walking utility staff through the IRP submission process might make life easier, so Energy Services created one. Better yet, we put it online where our customers can go through it at their leisure and reference it whenever they need.

For submitting report

The training will help to clarify IRP requirements for customers, explained said Energy Services Manager Ron Horstman. "The course is designed to answer questions that even experienced planners may have about how to submit an IRP," he said. "Customers can also use it to train new employees who will be involved in the process."

Energy Services representatives—present and future—will find the online training a useful resource, as well. "We will use it inside Western to make sure that everyone who evaluates an IRP is applying the same standards," Horstman added. "That's why we call it 'train-the-trainer'."

One thing the course does not do is tell customers how to conduct resource planning, Horstman points out. "It is up to our customers to

look at all of their options and make the best decisions for their unique circumstances," he said. "Once they have done that, the online training helps them to answer all the questions Western has about their planning process. It also tells them when their IRPs and annual reports are due, and what to expect if they don't meet the requirements."

Full training, quick reference

The online training has nine sections covering the different aspects of submitting an IRP or annual report:

- Overview
- Selecting the right report for your utility
- Approval criteria
- Rules for submitting an IRP
- IRP and alternative plan checklists
- Annual updates
- Periodic customer review
- Reporting deadlines
- Penalties for non-compliance

Users who are new to resource planning can start with the overview for a concise explanation of the IRP, why the process is valuable to utilities, a brief description of Federal requirements and links to alternative plans. A History link at the bottom of the page provides more details about the background and evolution of the planning requirements for those who are interested.

Customers who have done IRPs before may use the program to look up specific requirements. In each chapter, the requirements are linked

to corresponding regulations in the Energy Planning and Management Program (10 CFR 905). Checklist items are followed by the regulation's section number for the user's convenience. The report checklists are now available in two forms—as Web pages and in a downloadable pdf version at the bottom of the checklist page.

Customer input needed

Properly done, integrated resource planning is more than a Federal requirement—it is a guide to sound, long-term decision-making. Online IRP compliance training is the latest tool to help our customers get the most out of this process.

Energy Services plans to introduce more Web-based IRP resources later this year, but we need our customers' help. Let us know if the compliance training program helps when you are preparing your next IRP. Tell us if a point is unclear or if you couldn't find the answer to your question. Even if you don't have an IRP or annual report due right away, you can still test the pages and share your ideas for making the program more user-friendly.

In the end, all Web sites are an interactive work in progress, and this is your chance to shape a new Energy Services tool. Contact the Energy Services Web master with your suggestions. And, as always, your Energy Services representative is available to answer your questions, because no Web site can take the place of good old-fashioned, one-on-one customer service. ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/mar/mar095.htm

Cobs plus coal

from page 5

soil, Gomm observed. Unlike stover, cobs have low nitrogen content, but take nitrogen from the soil to break down. "Basically, that makes them nitrogen neutral," he said.

Excellent potential

On the other hand, there are several factors that make cobs a good biofuel source. The slow-decomposing cobs have an energy value of 75 to 80 percent of Powder River Basin coal Willmar burns at its powerplant. The CO₂ released by burning has been recycled from the air, and the sulfur and ash content of the emissions is low. Perhaps most important, Gomm pointed

out, is that cobs are abundant in Minnesota. "The best way for a biomass project to be economical is for the fuel to be a fuel of opportunity," he said. Storage, frequently a logistical obstacle to biomass projects, has not posed a problem to Willmar so far, even though the cobs cannot be mixed with coal. "The difference in density causes the cobs to migrate to the top and the edges of the bin," Gomm explained. "It creates handling problems."

So the cobs were trucked to an old municipal airport, and piled on a runway. Sitting in the open air, the cobs only become drier and more flammable over time. "It's doubtful that we would build a dedicated storage facility," said Gomm.

With so many advantages, it is not surprising that other facilities in the area are harvesting corn cobs. The Fosso farm also supplied cobs to the Chippewa Valley Ethanol Company, which plans to gasify the fuel at its plant in nearby Benson. The University of Minnesota-Morris may also use cobs as part of the fuel mix firing its new biomass gasification plant, launched in October 2008.

Gomm is not worried about the competition for feedstock, however. "We are hoping that the higher demand will cause more interest in harvesting cobs and therefore create a more stable market," he said. "There is more than enough supply in this part of the state to support all of these potential markets." ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/mar/mar093.htm

Demand-side Management Technology Workshop: Motors and Variable-frequency Drives

April 6, 2009
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8 a.m. – 4:30 p.m.

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<http://www.johnsonconsults.com/calendar/register.asp?CalendarID=11>

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