August 2012

Energy Services BULLETIN

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

United Power taps landfill for homegrown base-load energy

Overcoming the intrinsic limitations of a particular energy generation technology may sometimes require only that a utility keep an open mind and recognize opportunity when it comes knocking. That's how Brighton, Colo.-based United Power acquired 3 Megawatts (MW) of base-load power to count toward the utility's renewable requirement.

The Erie Landfill Gas to Energy Project became only the second landfill gas-to-energy (LGE) powerplant in Colorado when it started up last October. "Although such systems are fairly common in other parts of the country, LGE projects in the Rocky Mountain region have a history of falling apart," said Jerry Marizza, United Power's new energy program coordinator. "Because of our low humidity, it takes longer for trash to decompose to the point of releasing methane," he explained. "In Colorado, a landfill has to be three times larger than one in a more humid climate to produce the same amount of methane."

New Energy Program Coordinator Jerry Marizza shows off United Power's latest power purchase, a landfill-gas-to-energy system that generates 3.2 MW of base-load power. (Photo by United Power)

Finding a landfill in the semi-arid state big enough to make an LGE project economically feasible is a challenge. According to Brian Karp of Front Range Landfill, the company managing the Erie landfills, a site needs to be at least 400 acres. The Denver Arapahoe Disposal Site developed three years ago by investor-owned Xcel Energy and Waste Management covers about 700 acres. The three different landfills comprising the Erie facility total close to 600 acres, 13 miles west of United Power and 25 miles north of Denver.

Many pros

In spite of the difficulties of making an LGE project work in Colorado, utilities have plenty of reason to try. The state renewable portfolio standard (RPS) counts landfill gas as a renewable resource. The RPS requires cooperatives with more than 40,000 meters, like United Power, to get 10 percent of their annual retail sales from renewable energy by 2020, with 3 percent being the target for 2012. The Erie facility represents 2 percent of United Power's annual

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What's inside

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electricity needs; however, the state law assigns a multiplier of 1.25 to LGE projects. "So this power plant counts as 2.5 percent of our sales," said Marizza. "Our wholesaler Tri-State [Generation and Transmission Association] covers the rest."

LGE plants have less environmental impact than conventional generation. The Erie project is estimated to prevent the equivalent of about 30,000-metric tons of carbon dioxide from reaching the atmosphere each year. Perhaps even more important, the facility will turn this potent greenhouse gas emission, methane into a valuable, usable product like electricity. "The landfill would be releasing methane whether we captured it or not, so any time you can do something with that stuff, it's a huge positive," Marizza noted.

From an operational point of view, LGE systems have the advantage of producing power 24/7. "It's consistent and controllable, and the fuel price is stable," said Marizza. "The power purchase agreement locked in the price for the next 10 years, so it meets our requirement for reliable and affordable power."

There are other economic benefits as well—the city of Erie received permitting fees for plant construction, and the facility will have three to four full-time employees.

And, yes, cons

There are drawbacks, of course, or LGE systems would be popping up all over the place. In addition to the track record of LGE projects in Colorado, United Power had another reason to proceed with caution.

As a distribution co-op, United Power does not own generation, but rather takes it from its supplier Tri-State and delivers it to customers. To put a generation plant right in middle of its distribution system required the utility to rethink its way of routing. "It wasn't an overwhelming obstacle, but we needed to set up protections to maintain system integrity," said Marizza.

Also, it took a while for the deal to come together, thanks to the fluctuating price of another fuel, natural gas. When the price of natural gas was around $10 per MMBtu in early 2008, the developer, Landfill Energy Systems, was more interested in converting the methane to natural gas to sell. "Then the economy crashed, and natural gas dropped to $2 per MBtu. That's when they got serious about negotiating to generate electricity," recalled Marizza.

The negotiations were not especially complicated, given United Power's position as a distributor. "The price we get from Tri-State is our benchmark, so if we can get a similar or better price, we can go for it," Marizza said.

Renewable energy certificates (RECs) were instrumental in reaching an acceptable price. United Power purchases the RECs from the project and passes them through to Tri-State. At the end of the year, the wholesaler calculates the credits as part of its member system's renewable energy portfolio.

Look for experience

With the power purchase agreement in place, the project moved ahead quickly. Construction began in spring 2011, and the plant was generating its first kilowatts by October. Marizza attributes the prompt completion to the developer's experience. "Landfill Energy Systems knew exactly what they were doing. The company has built and managed hundreds of these systems," he pointed out. "That track record gave us the confidence that they could make an LGE system work here."

He added that finding a partner that has experience with LGE generation in all kinds of settings is as important to the success of a project in the West as finding a large-enough resource. "Those are the two things I would tell utilities considering landfill-gas-to-energy," Marizza advised. "That, and these systems are a great way to add renewable resources to your portfolio in Colorado."

Learn more about using landfill gas as an energy resource from the Environmental Protection Agency's Landfill Methane Outreach Program.

Energy Services Bulletin

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For links to more resources, visit http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb1.aspx

Innovative system produces green heat for Avon recreation center

Proving that sustainable energy opportunities can be found in the most unlikely places, the mountain town of Avon, Colo., is capturing heat from treated wastewater to warm its municipal pools and heat public buildings.

The Avon Community Heat Recovery Facility, as the system is called, began operating in January 2011. "The heat recovery system reduces our energy consumption from traditional sources, uses renewable wind energy as the motive force and reduces greenhouse gas emissions," said Public Works Director Jennifer Strehler.

The town of Avon participates in Holy Cross Energy's voluntary green power program, paying a substantial monthly premium for enough Colorado–based wind energy to offset the Avon Recreation Center's average monthly electric consumption for pool heating. Member Services Manager Stephen Casey said, "This type of project is a great example of using innovation and technology to turn a waste stream into a resource. Furthermore, we are pleased that the Town continues its purchase of wind energy that ensures the process is even more sustainable."

Strategy to curb emissions

The idea of using treated wastewater as a heat energy source did not originally appear in Avon's Climate Action Plan, created in 2007. The plan focuses on reducing greenhouse gas (GHG) emissions from Avon's municipal operations to 30 percent below 2006 levels by 2020, and 80 percent by 2050. In a mountain town where recreation is the leading industry, heating is a significant source of GHG emissions. Replacing fossil fuel in heating systems with a low-emission resource could go a long way toward helping the town meet its ambitious environmental goals.

The town council began its search for a readily accessible, long-term heat source that might be used for building and snowmelt heating needs. To Strehler, a chemical engineer with a background in wastewater treatment and co-gen systems, the answer was clear. "There was a nearby heat source being wasted, and we knew how to put it to good use," she said.

Stakeholders come together

Although city officials were supportive, a wastewater heat recovery project could only work with the cooperation of the Eagle River Water & Sanitation District. "I don't think they originally expected the idea to be technologically feasible," Strehler recalled. "But they were intrigued and agreed to be co-applicants for a grant we submitted to the state of Colorado."

Staff at the Colorado Department of Local Affairs and at the Governor's Energy Office were impressed enough with the innovative proposal to help the town secure a $1.5 million "New Energy Community Grant." The sanitation district contributed $422,400 in cash, plus an 11,000 square-foot land lease at the treatment facility site to accommodate project construction, operations and maintenance. Project designer CDM-Smith provided $50,000 in in-kind services, and the town of Avon invested $2.6 million from its Capital Improvements Program.

Choose first project wisely

With the partners on board, the next challenge was to find the right application for the system. The initial plan was to use the heat pump-based system to melt snow and ice on Avon's busy transit plaza to improve public safety while eliminating the need for manual snow removal with gas-powered engines. That phase of the project was put on hold until adjacent private development of a hotel in the town center could be completed "We didn't want to have to tear up those streets twice," said Strehler.

This innovative heating system captures the heat from treated wastewater to warm four pools at the Avon Recreation Center. In the future, the system could be expanded to create a district heating enterprise. (Photo by United Power)

Another obvious potential use for the recovered heat was to replace the natural gas boilers heating the public swimming pools at the town's recreation center. Meeting this demand would be a cost-effective use of a year-round heat pump installation. The four pools were a constant heating load, and the natural gas boilers supplying the heat annually emitted an estimated 640 tons carbon dioxide (CO2). Computer modeling of the pools' energy needs, day and night through the year, confirmed that pool heating would be a good fit for the heat recovery system. The system also provides space heating for several public buildings.

The project took seven months to build, including two new equipment buildings to house the large heat pump, water pumps, heat exchangers, control valves, piping and computer automation. An insulated pipe loop, buried in a trench deep in the town center, carries the heat energy from the treatment facility to the recreation center and buildings.

Cost-effective, expandable

The system the town of Avon installed is similar to geothermal, ground-source heating and sewer geothermal. All of these technologies

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Training wheels–a personal adventure of electric transportation

by Patrick Olin, Western Power System Dispatch Trainer

Editor's note: As part of his graduate research in sustainable business and renewable energy, Patrick Olin compares gas-powered vehicles to an electric vehicle.

For years I have been looking into the process of converting a gas-powered vehicle to an electric vehicle, but never purchased the parts and equipment to make the conversion. The time, skills and space such a project required seemed overwhelming.

Inspired by my recent course-work, I began researching electric vehicles that were already in production. It didn't take long to decide that the $20,000 to $30,000 price tag was a bit too much for a new vehicle that might or might not meet my needs, so, I returned this project to the back burner.

While researching electric cars, however, I stumbled onto a website for electric motorcycles. Although I hadn't ridden a motorcycle in years and my endorsement had long ago expired, I got an exciting idea. An electric motorcycle costs considerably less than an electric car, and it fit my commuting needs.

Shopping for the right model initially proved difficult, since there are very few electric motorcycle dealers in my area. I was shocked to eventually find what I was looking for at a consumer electronics store. It make sense, though, since the motorcycles have no combustion engines and are composed of as much (or more) electronics as most home electronic equipment.

The store carried at least three different manufacturers, some with various models. I found one that fit my needs for a commuting vehicle based on my speed and range specifications—a 2011 model Vectrix VX1 for about $8,000. That was much more reasonable than the price of an electric car, but it was still too expensive for a limited-use vehicle. With a little more research, I located an unlicensed 2009 model selling for $5,000. It looked identical to the 2011, so I bought it!

As eager as I was to start my electric transportation experiment, it had to wait until I took a motorcycle safety course and obtained the proper insurance, license and endorsement to ride it. I wasn't going to take any shortcuts, legally speaking. Once I started riding my new electric motorcycle, I began collecting the data I would need to analyze the potential benefits and viability of using electricity as a transportation fuel.

Real world data

My daily commute is 30 miles round trip. To determine how much energy my motorcycle was using, I bought a "Kill-A-Watt" power meter. I learned that I needed 4.4 kilowatt-hours (kWh) of electricity for my 30-mile commute. Taking the speed and distance of my commute into consideration, I realized that I would have to charge the scooter at both work and home.

My electric utility, Salt River Project (SRP), offers consumers an energy plan that incorporates on-peak and off-peak rate plan advantages in its use schedule. Customers running "optional" electrical loads during off-peak hours pay a price per kWh that is about half the on-peak rate. I chose to charge my motorcycle during off-peak hours with a simple timer to maximize the advantages of this price structure. Since off-peak rate is about 6.6¢/kWh, my 30-mile

See TRAINING WHEELS, page 5

	 Electric motorcycle	 Gas powered scooter	 Gas powered truck
Cost per trip	$.29	$1.10	$7.58
Cost per year	$58	$204	$1,516
Pounds of CO2 per trip	9.33	5.4	40
Pounds of CO2 per year	1,866	1,080	8,000

(Assuming 200 trips annually at 30 miles per round trip)

Training wheels

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commute costs about 30 cents (4.4 kWh x 6.6 c - kWh = 29.04 cents).

My gas-powered vehicle is a mid-size Dodge Dakota pickup truck that gets about 15 mpg, and uses two gallons of fuel for my commute. With regular gas at about $3.79 per gallon, I pay about $7.58 for my 30-mile commute. For an "apples-to-apples" comparison, I have also included data from a gas-powered scooter that I considered buying before settling on the electric scooter. The Honda PCX scooter boasts an impressive Environmental Protection Agency (EPA)-estimated 110 mpg.

The electric motorcycle provides significant savings over the pickup truck and the scooter.

Reducing pollution

The economic benefit of the electric motorcycle was obvious, but I was still curious about its benefit to the environment. I found a tremendous amount of information about the vehicle and power plant emissions through the Energy Information Administration and the EPA. I learned from these sources how much carbon dioxide (CO2) power plants produce, and how much burning gasoline produces. Burning one gallon of gasoline (6.3 pounds) produces about 20 pounds of CO2. Operating a coal-fired power plant produces about 2.12 pounds of CO2/kWh. Therefore, I can compare the pounds of CO2 my commute by gas vehicle produces with the amount of CO2 produced by charging my electric motorcycle by a coal plant (SRP's primary generation).

From the table above you can see that the gas-powered truck emits four times the CO2 of the equivalent energy of an electric scooter powered by a coal plant. However, the gas-powered scooter actually emits a little less CO2 than the electric scooter.

Commuting with only my electric scooter would reduce my contribution of CO2 emissions more than 6,000 pounds per year over the use of my truck. However, in comparison to the gas scooter, the results are almost even. Keep in mind that my analysis covers only CO2 emissions, and doesn't include the other types of emissions power plants produce.

Fringe benefits

So far my analysis has focused on my finances and personal impact on the environment. Although this is a great starting point, there are several other factors to consider when using electric vehicles for transportation, such as:

- The effects on the nation's power system (If electric vehicles are charged during off-peak hours when power is abundant [and less expensive], we achieve greater efficiency and use of the power grid. Often during the evening hours, power plants being operated for reserve energy struggle to obtain minimum loads required for operation.)
- Smog reduction from replacing gas-powered vehicles with electric ones
- Noise reduction
- U.S. oil imports reduction
- Reduction of pollution from shipping oil across the oceans
- Reduction from pollution from oil processing
- Movement toward our country's energy independence

An unexpected benefit of riding the electric motorcycle is that I have had the chance to interact with interested, inquisitive people. I try to use these opportunities whenever possible to educate people about some of the potential benefits of electric vehicles.

There are still many challenges ahead in providing the infrastructure to accommodate electric vehicles, but the potential benefits appear to be enormous. I'm about 10 months into my experiment with this technology, and I am encouraged about electricity's future in our transportation system. I feel extremely fortunate to be part of an industry that is all about blazing the trail for renewable energy, conservation and sustainable practices for our country's energy future.

For links to more resources, visit http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb3.aspx

Technology Spotlight:

Save money with a commercial building energy audit

Commercial building audits can save money, reduce greenhouse gas emissions and save energy. According to the 2003 U.S. Energy Information Administration and the Energy Department (DOE), commercial buildings consumed 17.9 quads of primary energy in 2009, representing 46 percent of building energy consumption in the country. Residential, industrial and agricultural buildings combined were responsible for the other 54 percent of building energy consumption. Any commercial building that has not had an energy audit in more than five years would likely benefit from an updated audit.

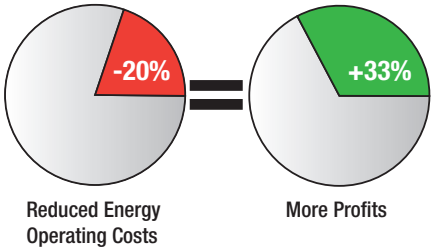
How much savings?

Building owners must consider many factors when identifying energy conservation measures (ECMs) and estimating potential savings, including facility use, age and size; equipment type and age; current utility bills and occupant behavior. Typically, energy savings from implementing ECMs recommended in audits range from 10 to 30 percent!

Energy Star for Restaurants notes that since business owners keep the money they save on operating costs, a 20 percent savings from energy-efficiency can increase profit as much as one third. Commercial buildings commonly present opportunities to save 20 percent of current energy costs.

Understanding the audit

Energy audits should be verified by someone who knows the building inside and out. Building managers are the best people to verify the audit findings. They should coordinate with their utility representative before the energy audit begins, so that both parties understand what to expect from the process.



Pick the right auditor

Many auditors specialize in one area, such as lighting, but do not have a deep understanding of other systems. A commercial building audit requires an auditor with in-depth knowledge of the broad spectrum of technologies. The auditor should be certified by the Association of Energy Engineers as a Certified Energy Manager (CEM) or have a Professional Engineer's license.

The ideal auditor has many years of experience in the commercial building sector, including design, construction and maintenance. The next best choice is an auditor who is trained to recognize energy-saving opportunities in each of the facility's major systems.

Make sure your potential auditor can handle complex commercial audits by asking about their background with non-standard measures. For example, ask how they would replace a standard compressor with an inverter-driven compressor, or how they determine potential savings of non-standard measures.

Be sure to request at least three references, preferably from your peers who have seen the auditor in action at a facility similar to yours.

Prepare for the audit

An experienced auditor will have a list of requests and questions for you and the facility manager even before the audit begins. The information they need will likely include:

Type of activity that occurs in the facility

- Square footage
- Year built
- Building envelope and insulation
- Type and age of HVAC system, domestic hot water, commercial cooking system, etc.
- Documentation of regular maintenance
- Building drawings
- Twelve months of utility bills
- Utility rate schedules and alternative rate schedules

Work with the building manager to compile a thorough checklist to help ensure that the auditor examines the same items in each facility. The Washington State University (WSU) Energy Program is developing a training program so auditors with diverse and unique backgrounds can:

- Capture significant yet comparable opportunities
- Estimate energy savings
- Determine installation costs and payback
- Commission the installation

You can see examples of the forms in the Washington State University Energy Program Energy Audit Workbook.

Many utilities have tools to calculate energy savings from simple ECMs and incentives to encourage building owners to implement them. In the commercial sector, a good auditor will uncover more complex opportunities for energy savings, so make sure your auditor knows about all of the incentives offered by your utility so these can be included in the audit report.

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Website of the month:

TopTen USA www.toptenusa.org

Every purchase of an item that uses power is an opportunity to save energy—if consumers do their homework. Make it easier for your customers to learn which appliances, which cars, which televisions are the most energy-efficient by introducing them to TopTen USA.

The nonprofit organization's mission is to identify and publicize the most energy-efficient products on the market. Covering a wide array of common household products, from laptop computers to clothes washers to LED lighting, the site offers consumers an easy way to compare energy details. Even better, it is optimized for mobile devices, so you can do your research right in the store.

Product ratings

To learn about a particular appliance, select from the list located just below the site banner. The page will display the top ten most energy-efficient models in order. Users also have the option of sorting the list by price.

Next to each rated product are the energy details, such as annual energy use, energy savings compared to the average for that type of appliance, cost per year to operate and other relevant criteria. When available, the summary includes information on the price and where to find the product in the user's area. Click on the product picture to learn more details, including size, power, online retail outlets and locally available rebates.

TopTen Tips related to each product are located on the left of the page. These, too, vary a little for each product, but most have an FAQ for the appliance and a link to general energy-saving tips and news. The list may also include recommendations for buying or operating specific to the appliance.

Evaluation method

Energy efficiency is the key standard TopTen USA considers when rating products, but environmental, health and safety concerns may also be factored into the evaluation. Data comes from product tests and analyses by government and independent institutions, as well as random tests the organization performs on some products. Ratings may draw on label statements and manufacturer declarations; however, TopTen USA maintains its independent from manufacturers.

In addition to the overview, the site lists evaluation criteria for each product. Most include:

- Product definition or scope of product category
- Market segmentation
- Performance criteria
- Test methods
- Data sources and quality assurance
- Market availability
- Families of similar products
- Product ranking

Several products include a glossary, Energy Star information and additional resources.

Rebate finder

People generally do their shopping on evenings and weekends, when their utility's customer service center isn't open to answer questions about energy-efficiency incentives. The local rebate database is a handy feature that can answer those questions when your staff isn't available, or just help consumers with their research before they hit the stores.

Users select the product type and enter their zip code to get a list of models that are eligible for rebates from their utility or other regional organizations. The information includes the amount of the rebate, the entity offering it, valid dates and important details. You can even download the form to apply for the rebate.

Utilities and other agencies offering incentives should check the database to make sure that their programs are listed, and that the details are accurate. As a nonprofit organization, TopTen USA would no doubt welcome any assistance in keeping its information current.

Forearmed to save

TopTen USA can be more than another way to spread the word about your energy-efficiency rebates (though that's a great way to use it). Program planners can use the site to research appliances and equipment for future incentives.

Even if you don't have a rebate program, you can still encourage customers to buy the most efficient products available by placing a link to TopTen USA on your own website. Make sure your member services representatives know about it too, so they can share the resource when a consumer asks about energy-efficient products.

The fact is that appliances are big purchases that most people make only when they are forced to. Arming your customers with a handy reference like TopTen USA will help them make the most of these unexpected energy-saving opportunities.

For links to more resources, visit http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb5.aspx

Avon recreation center *from page 3*

tap a source of constant temperature. Avon's system offers a few advantages over these buried geothermal systems, noted David Parry, senior vice president of CDM-Smith. "The source is right at the surface." Parry said, "There was no capital cost associated with drilling well fields or other deep excavations."

Temperatures of treated wastewater are warm—about 60 degrees in the winter and exceeding 75 in the summer, compared to an average geothermal temperature of 55 degrees. The sanitation district is looking at more potential uses for the waste heat, including building heating, treatment processes and possibly pre-heating sludge prior to aerobic digestion. "The heat pump is loaded only at about 30 percent right now," said Strehler. "Doubling the load wouldn't change operating costs more than about 10 percent. By increasing the loading, the coefficient of performance goes up, producing heat energy more efficiently."

There are a lot of potential loads for the Avon Heat Recovery Facility to serve, all of which would replace or displace fossil fuel heating. When the delayed hotel project moves forward, both the hotel and the transit plaza sidewalk snowmelt system could connect to the system. Provisions to expand the system to heat other buildings and replace hot water boilers are already in place. Strehler envisions a district heating enterprise fund that would enable any adjacent business or resident in Avon's urban core to install a solar thermal collector, plug into the system, and buy and sell heat as needed.

Success on many fronts

While Strehler is eager to see the system reach its full potential, the project is already a success. The Avon Recreation Center has reduced its annual CO2 emissions by about 456 tons, and the pools can now be kept at a warmer 85 degrees at no greater operational cost. "Pool users love it," she pointed out.

Add the snowmelt load to the waste heat recovery system, and the town could prevent more than 770 tons of additional CO2 from entering the atmosphere, compared to a conventional natural gas-fired snowmelt system.

There are other benefits as well. The heat extraction system cools the treated water before discharging it into the Eagle River. Cooler water temperatures are good for the local trout population, a fact that fishermen will be happy to hear. And though the goals of project were environmental, it doesn't hurt to know that the price of captured waste heat is far more stable than that of fossil fuels. It is easy to see why Strehler is proud of the Avon Community Heat Recovery System. "It is the most innovative, most collaborative project I've ever worked on," she declared.

For links to more resources, visit http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb2.aspx

Technology Spotlight *from page 6*

Findings from audit, report

The audit should include interviews with facility managers and inspections of lighting, HVAC, controls, envelope and equipment. The auditor will need to be accompanied by someone who understands the building, is familiar with energy audits and can answer technical questions.

The audit report should:

- Focus on ECMs and explain them so potential energy savings are clear, understandable and professionally substantiated.
- Provide enough information about the scope of work for each ECM so the facility manager can get three bids.
- Provide an estimated cost to implement the ECMs and document the sources for the estimate.
- Include payback calculations and note how interactivity among ECMs can affect payback estimates. For example, a lighting retrofit will likely reduce waste heat from inefficient lighting so the cooling load will decrease, likely affecting payback calculations.
- State the facility's current energy consumption for at least the last year. Energy savings should be a reasonable percentage of the total current energy use. Typical savings from implementing common ECMs are provided in:
  - Western's Energy Services
  - Energy Star
  - DOE Office of Energy Efficiency and Renewable Energy

For links to more resources, visit http://ww2.wapa.gov/sites/western/es/pubs/esb/Pages/esb4.aspx