

Landfill Gas Burns Bright

Waste conversion is a vital part of renewable energy mix

By Lee Farren

Trash goes into the landfill and power comes out.

Landfill gas accounts for more than 10 percent of the green power produced in the United States today, according to the U.S. Environmental Protection Agency (EPA), which says the United States has 365 landfill gas energy projects, with a combined generation of 12.5 billion kilowatt-hours (kWh) of electricity a year—enough to power 1.1 million American homes.

The U.S. Department of Energy reports that from 2002 to 2008, landfill

gas energy in the United States increased by 38 percent.

More landfill gas energy projects are on the way. The EPA estimates that by 2015, landfill gas will generate 13.8 billion kWh a year.

Landfill gas—a mixture of 50 percent methane and 50 percent carbon dioxide, with traces of organic compounds—is created as organic waste decomposes.

New landfill gas energy projects in the Pacific Northwest and expansions of some already in operation are part of the national trend.

Klickitat Public Utility District in south-central Washington has run

the H.W. Hill landfill gas generation facility at the Roosevelt Regional Landfill near Roosevelt, Washington, since 1999. The plant's five generators produce 10 megawatts (MW) of power.

"We're working on expanding that so we'll have an additional 20 MW from burning methane," says Klickitat PUD General Manager Jim Smith.

Klickitat PUD decided to expand the landfill gas generating facility because the certified green power it produces commands a premium price on the electric power market. The added income will help offset costs and benefit the PUD's ratepayers, Smith says.

"We've done well with the



existing facilities," he says. "The landfill is growing on an annual basis, so we are expanding as the gas supply expands."

Significant methane production usually begins one to two years after waste enters a landfill and continues for 10 to 60 years, according to the EPA. Klickitat PUD expects the Roosevelt landfill to continue accepting waste, and producing methane, for the next 85 years.

Like the venting flares they replace, landfill gas energy projects produce some emissions, primarily nitrogen oxide and carbon monoxide. Emissions amounts are similar for high-temperature flaring or gas-energy production.

"I look on the rosy side of things," Smith says. "If I generate 10 MW from this facility, someone will shut down 10 MW of coal generation somewhere else."

Utilities Like Green Option

In 2007, the Coffin Butte Resource Project north of Corvallis, Oregon, expanded landfill gas energy generation from 2.5 MW to 5.66 MW.

The project, owned and operated by Power Resources Cooperative with management expertise and staffing from PNGC Power, allows several electric cooperatives to offer green power as a way to support renewable resources.



Finley BioEnergy plant Manager Ed Goebel with one of the facility's Caterpillar engines at the landfill near Boardman, Oregon.

Photo by Lee Farren



The five-generator, 10-megawatt (MW) landfill gas power plant near Roosevelt, Washington, owned and operated by the Klickitat Public Utility District, will be expanded to 20 MW.

Photo courtesy of Klickitat PUD

“It has been a very popular program,” says Kevin Watkins, vice president of engineering at PNGC Power. “Our members are very positive about the project itself and the green power marketing programs. One reason we expanded is that our members’ green marketing programs needed more energy.”

PNGC Power is a cooperatively owned business providing power supply and other management services to 16 electric cooperatives in the Northwest.

PNGC Power appreciates the stability of landfill gas energy, Watkins says. Costs are generally predictable and not subject to fluctuations in petroleum prices. Unlike intermittent resources, such as wind and solar, landfill gas energy projects produce power steadily, consistent and predictable, with a high capacity factor.

“Capacity factor means how much it operates versus how much it could operate,” Watkins says. “Wind projects, for instance, operate 30 to 40 percent of the time. Coffin Butte has a capacity factor over 90 percent, which is extremely high.”

More Plants Are Being Planned

Waste Management Inc., based in Houston, owns or manages 111 landfill gas energy facilities in North America and plans to have more than 160 in operation by 2012.

The newest facility is at the Columbia Ridge Landfill in Arlington, Oregon. Scheduled to go on line in early 2010, the plant will generate 5.7 MW for use by Seattle residents.

The Columbia Ridge facility is the second landfill power plant in Columbia Basin Electric Cooperative’s (CBEC) service area.

“These methane plants are probably the best and the most cost-effective green power generating resource, better than wind and better than solar,” says CBEC General Manager Jerry Healy. “They run 90 percent of the time and they take a greenhouse gas that has to be controlled and burn it for a positive purpose.”

Despite recycling habits that have reduced the overall amount of garbage in the nation’s landfills, the trash continues to pile up, making most people in the power industry optimistic about the future of landfill gas power generation.

“Landfill gas energy is going to continue to grow,” says Tom Frankiewicz, a program manager for the EPA’s Landfill Methane Outreach Program. “There are still a lot of landfills that could have projects. I think landfill gas energy will continue to play an increasing role in power generation.” ■

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Cogeneration Improves Conversion Efficiency

Combined heat and power, or CHP, is technology that works especially well with landfill gas power generation.

CHP consists of a variety of processes that recover the heat normally wasted during power generation. The heat is then used for secondary purposes, usually on site.

According to the U.S. Department of Energy, separate production of usable heat and power is about 45 percent efficient, while CHP systems can achieve efficiency levels as high as 80 percent.

That agrees with the experience of Gerry Friesen, an engineer and partner at Finley BioEnergy, a landfill gas energy facility at Finley Buttes Landfill near Boardman, Oregon. Heat from Finley BioEnergy goes to an onion drying plant located across the road.

“Overall, we’re able to increase our conversion efficiencies from about 40 percent, if the engines were just running to generate electricity, to the 70 percent range,” Friesen says. “We sell them the heat, and they don’t have to pay fluctuating natural gas prices.”

When Klickitat Public Utility District decided to expand the H.W. Hill landfill gas generation facility, the PUD chose combustion turbine engines, in part because the jet-like engines produce hot exhaust that can run through heat recovery steam generators.

“The steam will generate an additional 6 megawatts of electricity without burning any fuel at all,” says PUD General Manager Jim Smith.