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BIOGAS

PHOTO: AMERESCO

BIG ON BIOGAS: Ameresco says it is seeing a resurgence of interest in biogas production at wastewater treatment plants.

Maximizing Efficiency

Cities around the nation are finding ways to squeeze every drop of value out of biogas generated at their wastewater treatment plants.

BY ANNA AUSTIN

With shrinking budgets and skyrocketing energy costs, U.S. cities are looking at all possible ways to save or make money. One option that is quickly becoming a trend is maximizing utilization of the biogas emitted from anaerobic digesters at city-owned wastewater treatment plants.

By law, wastewater treatment plants are required to destroy, or flare, any unused biogas, due to the pollutants that direct venting would emit into the atmosphere. Flaring is safe and about 98 percent effective, but in some cases it can mean money wasted.

In October 2010, San Antonio became the first city in the nation to treat its wastewater treatment plant's biogas and directly inject it into the natural gas pipeline. Shortly thereafter, the city of Dallas brought a similar project online, and several more projects of the same nature are on the verge of reality in California.

"We're seeing a resurgence of interest lately," says Micheal Bakas, senior vice president of renewable energy at Ameresco, the technology provider for both Texas projects. "There's a reasonable market for these types of projects in the U.S. The big thing

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—**Micheal Bakas**, senior vice president of renewable energy, Ameresco

is that wastewater treatment plant managers need to become better educated about this type of opportunity at their facility because it's a revenue contributor, whether it be royalties for the gas or a cheap source of energy. If they learn that these opportunities are out there, they can investigate whether a project like this is applicable to their plants."

There are a few factors to weigh when making that determination, according to Bakas, and the type of project varies with each treatment plant.

Making it Work

The amount of biogas that could be produced, and whether it's enough to make a project worthwhile, needs to be evaluated at a potential project site. Some wastewater treatment plants already utilize their biogas to a certain extent to generate electricity or heat that is consumed on-site, but often there is excess biogas, says Frank Mazanec of BioFuels Energy LLC, which is developing a project at the Point Loma Wastewater Treatment Plant in San Diego County, Calif. "The question is, do you sell the gas, or do you sell electricity produced at the site?"

If the plant is in a region with low electricity costs, it's harder to make a project work, Bakas says. The facility in Dallas makes heat and electricity from the biogas, and the plant purchases what it needs from Ameresco, which owns the biogas recovery system. "If they're able to buy electricity from the grid very inexpensively, then it's hard to compete with," he says. "The quality of gas from the plant is also a big factor, as well as whether it is consistent and how much clean-up has to be done to it."

In San Antonio, the plant processes the biogas into a natural gas product and injects it into the natural gas pipeline, where it is piped to California and sold to power plants to earn renewable energy credits. A project in Escondido, Calif., being developed by the city and Southern California Gas Co., is currently in the testing stage and aims to do the same thing. Both employ a pressure swing adsorption system to remove CO_2 and nonmethane compounds from the gas, preparing it to sufficient quality (meeting the pipeline owner's gas specifications) for injection into the pipeline.

Ron Kent, technology development project manager at SoCalGas, explains that the project in Escondido consists of nine vessels containing zeolite beads, which are microporous, aluminosilicate minerals commonly used as commercial adsorbents. "The zeolite material preferentially absorbs CO_2 onto the surface, but doesn't adsorb methane, he says. "As you increase the pressure slightly—and it goes up to about 100 pounds—the CO_2 sticks and the methane does not. As you draw down the pressure, the methane is sucked off, and eventually all of the CO_2 is sucked off. All of the vessels alternate being pressurized and depressurized, and split the gas into two streams."

PHOTO: SOUTHERN CALIFORNIA GAS CO.

ESCONDIDO ENERGY: A project in Escondido,Calif., which is in the testing stage, aims to process biogas into natural gas and inject it into the pipeline.

The project being developed by Biofuels Energy at Point Loma has a slightly different twist. The plant already uses two-thirds of its biogas to generate its own

PROJECT PARAMETERS: Ameresco put up the capital costs and owns and operates biogas plants in Dallas and San Antonio, but other projects are set up differently.

electricity, but due to a series of unique constraints, the city was unable to produce additional electrical energy with the remaining biogas—about 1.3 million Btu per day. "We're processing that gas and bringing it up to 98 percent methane," Mazanec says. "Once the gas is processed and the CO_2, sulfur, siloxane and other constituents are removed, it's put into the pipeline and now referred to as direct biogas, so we can get credit for it under the state renewable portfolio standard (RPS).

San Diego Gas & Electric did not allow treated biogas to be injected into the pipeline prior to November 2009, so this project will be the first to do so unless Escondido beats it to the punch. Once the gas is in the pipeline, it will flow 25 miles to the University of California-San Diego to power a 2.8-megawatt (MW) fuel cell that Biofuels Energy will have installed there.

In order to make projects pan out financially, they can be set up a number of different ways, Bakas says.

Project Business Models

In the Dallas and San Antonio cases, Ameresco put up the capital costs and owns and operates the biogas plants. "They're capital intensive, so we can finance a project if that's what the facility wants," Bakas says. Ameresco will pay the San Antonio Water System an annual royalty of about $200,000 a year during its 20-year contract, treating and delivering up to 1,060 standard cubic feet per minute.

The project was profitable from day one, but a complete payback comes in about 15 to 20 years, according to Bakas. A local gas utility was purchasing the gas initially, but Ameresco is currently selling it to EDF, a large French utility that is transporting it to California to sell it at a much higher price because of state incentives. "To make this work, you need to be able to recover costs while competing with the current energy market," Bakas says. "In today's economic climate, people are hesitant to pay much of a premium for green gas, but we've managed to do it, and San Antonio is saving money."

In Dallas, the 4.3-MW biogas facility provides power and heat to the water utility's facilities, offsetting 60 percent of the energy that it pulls from the grid, and also uses waste heat from the generators to heat its digesters. About 80 percent of the biogas produced at the facility is being utilized, while a typical electricity production plant might only be able to use 35 percent of its energy product, Bakas says. As a result of the project, the city will save an estimated $1.5 million annually.

Biofuels Energy also finances, owns and operates projects, but rather than send the gas to a customer, the company sends it to itself. "We own the fuel cells, so we're really piping the gas to ourselves," Mazanec says. "In Point Loma, we're selling the energy under a 10-year PPA with UCSD,

and the same thing will happen with the city of San Diego at the South Bay water treatment facility, where we're installing a 1.4-MW fuel cell. We'll direct one-third of that energy and two-thirds of the energy at UCSD to the city of San Diego under a 10-year PPA.

Kent says it hasn't yet been determined who will own the Escondido biogas plant, but assuming the technology being tested proves successful, it could be the city or SoCalGas. So far, SoCalGas has paid to rent the equipment being tested, and has an option to buy it from Canadian technology provider Xebec Inc.

While it seems many customers would rather the developer put up the capital costs and own the facility, others are interested in owning the plants, Bakas says. Ameresco has recently been awarded a contract by the city of Philadelphia for a biogas recovery project at its wastewater treatment plant, and in that case the city will own it, and the company has also been shortlisted on a similar city-owned project in Washington D.C. The cost is different for every project, he adds, as they are all customized.

Finding Financing

"The size or the project, how much clean up you have to do, and how far you have to pipe the gas range all over the board," Bakas says. "Cost is dependent on the nature of the technology you have to install to clean the gas, and the amount of gas you're processing."

Finance markets have been fairly tough and lending has been difficult, but Ameresco has managed to persevere. "We haven't run into a project at a plant that we haven't been able to do, unless it's a technological problem like not enough gas," he says.

The contracting process is another challenge. "It's usually lengthy, because most of these facilities are publicly owned and have to go through a whole design and solicitation process," he says. "The big thing to keep in mind if you are a wastewater treatment plant is to make sure you do a great job qualifying who you partner with, because it's not a simplistic venture. These are long-term marriages so make sure your partner will be there for 20 years, and have the financial wherewithal to do that, as well as the technological depth to perform over those years because inevitably things do come up. You want to make sure you're with a firm that can meet those challenges."

Mazanec says he believes these new projects in California will pave the way for similar projects utilizing landfill gas. The state doesn't currently allow landfill gas to be injected into the pipeline. "It's precluded by regulation, but that will hopefully be the next step," he says.

While California has a strong RPS of 33 percent by 2020, a great incentive for biogas energy projects, it doesn't mean they aren't feasible in states without them, Bakas adds. "Because they are base-load energy plants—unlike wind or solar where power is generated only a portion of the time—they generally they have a lower cost than other renewables because the biogas is always flowing."

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