

# End-User Considerations for Biogas

*Matt Haakenstad*

U.S. manufacturing industries have closely watched as the federal government continues to debate and potentially approve new climate legislation that would make businesses accountable for carbon emissions and implement a carbon cap-and-trade market. Prior to the approval of this legislation, the Environmental Protection Agency (EPA) has begun drafting rules requiring certain energy users, including manufacturing facilities and power plants across a range of industries, to report greenhouse gas (GHG) emissions beginning sometime in 2010.

The pending legislation is seen as a hindrance to some companies consuming large amounts of energy generated from fossil fuels and a potential boon for others already implementing methods to obtain renewable energy sources. As a result, many companies are beginning to search for and implement new and cleaner methods for generating energy.

Another key factor prompting businesses to explore the potential of renewable energy is the extreme volatility in energy prices seen in the past three years. During the course of the last 24 months, natural gas has ranged between \$3 and \$13 a million Btu's on the futures market. Lately, this volatility has decreased, but for businesses that rely heavily on energy to operate large facilities, the possibility of returning high levels can make the businesses' profitability less certain.

**Matt Haakenstad** ([mhaakenstad@usenergyservices.com](mailto:mhaakenstad@usenergyservices.com)) is manager of commercial services for U.S. Energy Services. Aided by his more than 20 years' experience in minimizing energy costs and maximizing energy value, he advises his clients about natural gas and electricity supply management and procurement, price risk management, and plant site development.

Thus, companies have begun to look for alternative ways to obtain consistent, reliable pricing.

### BIOGAS ALTERNATIVE

Burning biogas, the result of the biological breakdown of organic matter, has become one of the leading alternatives to burning natural gas in the United States. When gas builds up and is slowly released into the atmosphere as a result of decomposing waste such as wood chips or plants, the methane emissions can be captured and generated into a clean form of renewable energy. The process of burning biogas, a renewable fuel, has been used for centuries, but new technology and an increase in efficiency has allowed plants to aggressively tap into the process in the last couple of years. With fewer greenhouse gas emissions being emitted, the process of burning biogas is proving to be an economic stimulus as well as a long-term asset for some industries.

There are a number of industries that can use biogas as a viable energy source; however, the manufacturing and the biofuels sectors have made the most significant advances in the implementation of biogas technologies. Manufacturing operations often produce some type of waste or by-product during the production process. In many instances, that abundant waste resource can be converted into biogas or another form of renewable energy that in turn can be used to power the manufacturing plant and help reduce the reliance on a more volatile energy source. Other industries that may benefit from harnessing biogas include food processing operations and wastewater treatment plants.

Before choosing to offset a fossil fuel with a renewable biogas, a business needs to decide which method of creating biogas best fits its operation. Some businesses create naturally occurring waste as part of a production process. For example, the paper and pulp industries have

been applying a waste-to-energy process for decades. Paper and pulp manufacturers commonly produce waste consisting of wood chips, tree trimmings, and sawdust. Instead of sending the waste to a landfill, these companies burn the wood to create steam or electricity to power other portions of the facility.

The key is to reexamine an operation's various forms of industrial waste and look at them as potential cost-saving renewable energy sources. If a facility needs to landfill a waste item or to further process it before sending it to a landfill, the cost of doing this should be properly evaluated to determine whether converting the waste to an energy source that can be reused at the plant is more advantageous than simply discarding it.

If a facility needs to landfill a waste item or to further process it before sending it to a landfill, the cost of doing this should be properly evaluated to determine whether converting the waste to an energy source that can be reused at the plant is more advantageous.

## OPTIONS FOR PRODUCING BIOGAS

Fortunately, technology has evolved and previously complex and wildly expensive methods of converting a wide variety of waste into energy have become a more cost-effective reality for many companies. The three most common methods for producing biogas are gasification, anaerobic digestion, and tapping into nearby landfills. Businesses should closely assess the various options among these.

### Anaerobic Digestion

Anaerobic digestion breaks down animal manure using naturally occurring microorganisms to produce biogas. According to the U.S. Department of Energy, anaerobic bacteria break down or “digest” organic material in the absence of oxygen and produce biogas as a waste product. The biogas produced in anaerobic digesters consists of methane (50–80 percent) and carbon dioxide (20–50 percent) and can be burned as a lower-quality substitute for natural gas generated by fossil fuels.

For years, dairy farmers have been criticized for the amount of harmful gas emissions (i.e., methane and nitrous oxide) generated by cow manure—a natural waste generated in the dairy

production process—and released into the atmosphere. However, in recent years, some dairy operations have begun to realize the energy potential in manure thanks to anaerobic digestion. As a result, some dairy farmers have implemented anaerobic technology to capture the harmful emissions and convert them into a renewable energy source to help power their farms.

Currently, a cheese manufacturing plant in Wisconsin is conducting a feasibility study to implement anaerobic digestion to reduce the need for natural gas, while reducing wastewater and odor. In this instance, emissions from manure can be controlled in an anaerobic digester: a sealed tank in which a naturally occurring bacteria converts manure into biogas and digested solids. The biogas is then used by the dairy producer to generate heat or electricity to power other portions of the dairy operation instead of relying on natural gas.

Anaerobic digestion is used on farms across the country, and larger dairy operations have invested in specific manure storage systems that promote methane production and capture the gas emissions that can be reused to power the farm operation.

### Gasification

Gasification is another popular form of waste-to-energy conversion that uses heat, pressure, and steam to convert raw waste material into biogas composed primarily of carbon monoxide and hydrogen. The biogas produced by the gasification process can be burned in the same manner as natural gas.

The ethanol industry relies heavily on natural gas as an input to satisfy thermal requirements. Volatility in the natural gas markets can often pose a risk to profitability. Producing biogas from inexpensive and abundant waste material can help ethanol plants curb input-price volatility by offsetting natural gas usage with a reliable source of biogas.

For example, the Chippewa Valley Ethanol Cooperative (CVEC) located in Benson, Minnesota, has successfully used gasification technology to convert biomass material into renewable natural gas. As a result, CVEC has offset approximately 20 percent of its natural gas usage by converting biomass (e.g., wood chips, corn cobs, and crop residue) into biogas. The biogas produced in the gasification process is used to power other operations at the plant.

By using available waste material, CVEC reduced its dependence on natural gas and its risk to price volatility. As part of its future long-term goals, CVEC is planning to invest in the technology necessary to offset 90 percent of its energy usage with renewable biogas produced through its onsite gasification chamber. As an additional benefit of producing and using this renewable energy, CVEC may also reap benefits allotted by the federal government, such as tax credits, under its pending climate and carbon legislation.

### Landfill Gas

If a business does not want to make any changes to its current equipment or does not have access to an inexpensive and abundant source of waste to convert to energy, it still has the option of using landfill gas to create a biogas. Although many companies may not see a landfill as a good neighbor to have, it can serve as a relative benefit for businesses searching for a renewable natural gas supply. The materials decomposing in a landfill give off methane, which can be harnessed and burned as an energy source. Installing a network of piping beneath area landfills ensures that methane can be collected and transported to businesses within a defined radius around the landfill.

This method of creating and using biogas is replicated around the country. At a Jackson County, Missouri, ethanol plant, medium-Btu gas from a landfill less than one mile away from its facility provides the methane to help power the plant. The landfill also benefits from the additional revenue of selling its methane, and implemented a cleanup and conditioning system to upgrade its renewable natural gas to pipeline quality, enabling it to distribute its waste gas nationwide. In this instance, both the ethanol plant and the landfill benefit from the generation and use of renewable biogas in terms of price, reliability, and fossil-fuel conservation.

### INCENTIVES

To assist businesses in taking advantage of biogas and greening their energy operations, there are federal and state programs available that offer funding for renewable energy projects. Lately, most of the funding is coming from federal initiatives, such as the American Recovery and Reinvestment Act, which extended production tax credits and investment tax credits. Both are critical to the growth of renewable energy

and to help the development of sustainable energy processes. Also included in the Recovery Act is the Clean Energy Finance Authority program, which is expected to invest nearly \$100 billion into clean energy projects (of which biogas conversion and use would qualify) to increase energy efficiency and create green jobs.

Lately, most of the funding is coming from federal initiatives, such as the American Recovery and Reinvestment Act, which extended production tax credits and investment tax credits. Both are critical.

If biogas projects meet the established federal guidelines, they may qualify for a 30 percent tax credit. Like any federal program, there is a lot of paperwork required to gain the credit, but there are energy management providers, including U.S. Energy Services, who can assist businesses throughout the process.

Additional legislation currently being developed to help facilitate the move to renewable energy sources includes the Jobs Bill, which has tax incentives for companies who use liquid biofuels.

### CHALLENGES

While there are incentives for businesses to implement renewable energy processes, there are obstacles to overcome in order to implement green energy practices. A short-term challenge is justifying investing capital on renewable energy projects at a time when natural gas prices are relatively low.

A short-term challenge is justifying investing capital on renewable energy projects at a time when natural gas prices are relatively low.

### Natural Gas Price Risk

Using renewable energy may prove to be more cost-effective in the long run, but given the uncertain economic conditions, it is not always an easy sell. As is the case with many capital investments, there are risks associated with implementing biofuels systems. Although companies have begun evaluating the possibility of renewable energy sources like biogas, momentum toward investing in renewable technology has slowed due to the current economic recession and lower energy costs.

Recently, the natural market has refocused beyond the seasonal winter weather demand and has broken below a price range held since early December (\$5.11–\$6.03 a million Btu's). The demand for natural gas remains relatively constrained, meaning that the 2010 increases in demand from residential, commercial, and industrial sources will likely be more than offset by demand losses in the power sector. It would take an unforeseen, major shift in demand to sustain a tighter market—an event that currently appears unlikely in 2010.

It would take an unforeseen, major shift in demand to sustain a tighter market—an event that currently appears unlikely in 2010.

While 2010 will continue to be oversupplied, the supply/demand balance will likely be tighter than 2009, and companies are more susceptible to upside risks. For the near term, North American natural gas supply seems to be in good shape due to prolific shale gas resources and tempered industrial demand.

### Regulatory Risk

The environmental benefit of biogas continues to be a wild card. In anticipation of impending federal legislation regulating carbon emissions, many businesses are taking a wait-and-see approach to investing in renewable energy. A steady movement toward harnessing and using biogas has been put on hold multiple times because the extent of future regulation remains unknown, so businesses are apprehensive to invest in bioenergy before potential federal parameters are set.

### Operational Risk

No matter what source businesses use for biomaterial, it is a good idea to have a backup plan in the event that the amount of biogas a plant typically relies on cannot be produced. There are several risks that lie within the biomaterial chosen, including maintaining adequate supply and moisture control, that make it a good idea to continue to have natural gas available. To make sure that there are no service disruptions, using a predetermined amount of biogas and making up the difference with natural gas has proven to be an efficient system for many businesses. To help determine the right blend of fuel sources, businesses lean on their energy manage-

ment providers to make sure they're getting the quality and supply they need to operate.

There are several risks . . . that make it a good idea to continue to have natural gas available.

### PROCESS

Before deciding to outfit a plant for renewable energy consumption, businesses should consider conducting a feasibility study to assess the potential pros and cons of using a specific renewable fuel source. Some companies that sell equipment will fund these studies, which can be a double-edged sword. If you get a study done for low or no cost by partnering with a vendor, the results of that study may be oriented toward that particular vendor's equipment.

A more objective analysis can be determined by enlisting an energy management provider to provide an unbiased opinion and help sort through and understand the differences in the various projects proposed by multiple vendors. Sometimes engineering firms are also brought into the process to conduct an evaluation on the legitimacy and effectiveness of the vendor proposals.

### MANAGING ENERGY BUDGETS

When it comes to the economics of evaluating different sources of energy supply, including finding the delivered price of natural gas, results will vary based on the location of the business and the alternative supply sources of particular biogasification projects. An advantage to finding a long-term energy management partner, like U.S. Energy Services, is that it can determine the most cost-effective near-term and long-term options.

As companies plan for the future of their business, energy will continue to be an important but volatile factor. Although energy prices are currently holding at relatively low levels, the need for reliable energy sources will be more evident as the economy begins to recover. Renewable energy may not be the right fit for every business, but companies must begin planning for the likely rebound in energy prices and the pending federal climate legislation that will impact tens of thousands of U.S. businesses. During this period of low prices and slow economic growth, it may be the perfect time to begin evaluating how your company obtains and consumes energy in order to make more profitable energy decisions in the future. 