Methane Energy Recovery on Iowa Farms

Each year, Iowa's animal confinement operations produce 81 million tons of manure. Managing that manure economically while mitigating environmental risks is a growing challenge for the agricultural industry. Methane energy recovery, a renewable energy technology, holds great promise for solving many of these concerns.

What is Methane?

Methane is the main component of natural gas. It is also a major element of biogas, which is produced during the decomposition of organic materials in an anaerobic (oxygen-free) environment. Methane recovery involves the capturing of methane to produce a usable form of energy.

New Opportunities

Interest is growing in methane recovery because of the environmental and economic benefits that can be generated. Capturing methane can reduce odor and decrease the potential for pollution. While systems are currently expensive, their societal and environmental benefits may outweigh those costs. Just as importantly, methane recovery develops a renewable resource, offsets fossil fuel consumption, and reduces environmental pollutants.

However, implementing methane recovery technology is site-specific and dependent upon factors such as the type of livestock, manure management methods and permitting requirements.

Iowa's Leadership

Because of the potential for Iowa, several state, federal, university and industry professionals are working to promote methane recovery opportunities in the state. In 2000, the Iowa Department of Natural Resources (DNR) commissioned a Waste Characterization Study to identify methane recovery potential related to livestock waste. The study found that the amount of manure generated in Iowa could meet the energy needs of 325,000 homes. The complete report is available at: www.state.ia.us/dnr/energy/programs/methane. The DNR also helped sponsor three methane demonstration projects at farms across Iowa, with funding from the U.S. Department of Energy and the USDA Natural Resources Conservation Service.

Learn More

Look inside to learn how three Iowa livestock operations are adopting methane recovery as a viable energy resource. On the back cover, you can find information about financial incentives, along with state and national resources to learn more about the opportunities for methane recovery as a renewable energy technology in Iowa.

Top Deck Dairy, Inc. Westgate, Iowa

About 17,000 gallons of manure produced daily at Top Deck Dairy is scraped to a digester system.

Located near Westgate, one of Iowa's first cow-manure methane recovery system is turning waste into electricity in northeast Iowa. Top Deck Dairy, Inc. is owned by Judy and Roger Decker along with sons, Derek, Jason and Justin. When the Deckers expanded their operation from 300 to 700 cows, they researched the potential of installing an anaerobic digester for electricity production.

The Department of Natural Resources and the USDA Natural Resources Conservation Service (NRCS) provided a $157,900 grant to build the digester, while Alliant Energy supplied $250,000 for the generators and to connect the system to the utility grid. Top Deck Dairy funded the remaining costs of the $502,000 facility.

Construction of the system began in the fall of 2000. Dan Meyer, Iowa State University Extension engineer, coordinated construction of the project, and electricity production began in May 2002. The Deckers installed a system called a plug-flow digester that treats the manure. About 17,000 gallons of manure each day is scraped to the digester, where it decomposes and subsequently produces methane.

The captured methane is sent through a connecting pipe to Alliant Energy's generating equipment, which includes a 150-horsepower engine with a 100kW generator and a 30kW microturbine. The generators produce 864,000 kWh of electricity annually, enough to meet the energy needs of 100 homes. Heat from the engine and microturbine are captured to preheat the manure, improving the anaerobic process, and to heat the parlor area where the cows are housed.

The final report for the project is available on the Iowa DNR Web site at: www.state.ia.us/dnr/energy/programs/methane

Further Help:

For more methane energy recovery assistance and information, contact the Iowa DNR.
Phone: (515) 281-5918
Web site: www.iowadnr.com/energy/

Bell Farms Creston, Iowa

The digester tank at Bell Farms.

Bell Farms is a 5,000 head farrow-to-wean swine facility located in Union County near Creston. The previous owners of the operation, SWIne USA, became interested in methane energy recovery in 1999 as a way to mitigate environmental and odor concerns that could potentially be associated with their facility.

In October of 1999, SWIne USA received $100,000 from the Iowa DNR and $148,000 from the USDA NRCS to install an anaerobic digester and methane recovery system. Total cost of the digester and methane recovery system was $500,000. In 2001, Bell Farms purchased the swine facility and has successfully operated the methane recovery system since then.

Bell Farms operates a complete mix anaerobic digester and methane recovery system. The captured methane powers an engine generator, meeting most of the energy needs of the farm. Waste heat from the engine generator is captured and used to heat the digester. The methane recovery system produces about 7.2 million cubic feet of methane gas and generates 435,000 kWh of electricity, enough to meet the energy needs of 50 Iowa homes.

A detailed project report can be found on the Iowa Department of Natural Resources Web site at: www.state.ia.us/dnr/energy/programs/methane

Northeast Iowa Community College Dairy Center, Calmar, Iowa

In the summer of 2000, Northeast Iowa Community College (NICC) in Calmar opened a 150-cow Dairy Education and Applied Research Facility. The state-of-the-art facility is equipped with modern classrooms, laboratories and a milking parlor. The college also installed a plug flow digester and methane recovery system to generate energy from the dairy manure, reduce odor and produce solids for bedding.

The methane recovery system cost about $217,000, with the USDA Natural Resource Conservation Service providing $97,000 through the Iowa DNR, and the RC&D of Northeast Iowa donating $50,000. The Northeast Iowa Community-Based Dairy Foundation raised the remaining $70,000 to complete the project.

Manure from the freestall barn is mechanically scraped to a reception pit at the end of the barn, and then pumped to the digester. Methane gas from the digester is burned in a nearby boiler, with the hot water heating the digester and portions of the milking facilities during cold months. Heat generation has been approximately 2.7 million Btu per day. A solids separator has been installed and is being monitored for its potential to provide bedding and lower the accumulations of solids in the bottom of the digester.

Because methane production has been higher than expected, the college is now considering adding a microturbine or fuel cell to use extra gas. For more information, contact Dan Meyer with ISU Extension at (563) 425-3331.

Methane Recovery at Iowa Landfills

Landfills can provide a valuable source of renewable energy. As organic materials deposited in a landfill decompose, landfill gas (LFG) is produced. LFG can be burned to genearte electricity, heat, fuel or used in industrial processes.

Decomposing waste in a landfill can produce gas for as many as 30 years. Today more than 325 U.S. landfills collect LFG and 750 landfills have been identified as economically viable future projects.

Iowa has three landfill-gas-to-energy projects. Metro Waste Authority East Sanitary Landfill servicing Des Moines has generating capacity of 6.4 MW and sells the electricity to MidAmerican Energy. Landfill gas collected at Bluestem Solid Waste Agency Sanitary Landfill, Cedar Rapids, is burned in a boiler to produce 4.5 MW of electricity. Scott County Sanitary Landfill is located at a quarry where methane provides fuel to heat a kiln. The landfill can produce 1,000 cubic feet of biogas per day for that purpose.

According to the U.S. Environmental Protection Agency, Iowa has at least 12 additional candidate landfills for methane recovery, Together, these landfills possess an electricity generation potential of about 31 MW, the equivalent to powering about 27,000 homes, with emissions reductions equal to removing 235,000 cars from Iowa roads.

(Left): Northeast Iowa Community College in Calmar operates a 150-cow dairy operation with a digester system to capture methane.

Methane Energy Financial Incentives & Resources

Financial Incentives

Property Tax Exemption for Landfill Gas

Incentive: 100 percent exemption of applicable property taxes

Summary: Iowa Code 427.1(29) exempts personal property, real property, and improvements to real property used to collect and convert methane gas to energy from property tax. If the property also burns another fuel, the exemption applies to the portion of the value of the property that equals the ratio of its use of methane gas to total fuel consumed.

Methane Energy Replacement Generation Tax Exemption

Incentive: Six hundredths of a cent per kWh

Summary: Iowa Code 437A.6 exempts electricity generated by methane energy conversion property from the replacement generation tax, which is six hundredths of a cent per kilowatt-hour.

Iowa Energy Center Alternate Energy Revolving Loan Program

Incentive: Interest-free financing for up to 50 percent of the loan amount (up to $250,000)

Summary: The AERLP provides funding for biomass, small wind, large wind, solar, and hydro projects. Go to: www.energy.iastate.edu

Rural Economic Value-Added Mentoring Program (REVAMP)

Incentive: Up to $1,000

Summary: REVAMP pays qualified consultants to work with innovative value-added businesses that want to start or expand in Iowa to develop or refine a business plan. Once the plan is completed, the applicant may apply for funding through VAAPFAP (see below). Go to: www.agriculture.state.ia.us/revrev.html

Value-Added Agricultural Products and Processes Financial Assistance Program (VAAPFAP)

Incentive: Forgivable and traditional loans

Summary: The program offers a combination of forgivable and traditional loans, with the interest rate typically the prime rate. Research and development projects are not eligible for this program. Go to: www.iowasmart.com/services/entrepreneurial/vaapfap.html

Methane Web Sites

Iowa DNR Energy and Waste Management Bureau: www.iowadnr.com/energy/
Iowa Energy Center: www.energy.iastate.edu
Iowa State University Extension: www.exnet.iastate.edu/Pages/communications/EPC/F99/methane.html
Iowa State University Agricultural and Biosystems Engineering Department: www.abe.iastate.edu/
AgStar: www.epa.gov/agstar/
U.S. Department of Energy (DOE) Information on Methane: www.eren.doe.gov/consumerinfo/refbriefs/ab5.html
National Renewable Energy Laboratory: www.nrel.gov/clean_energy/biopower.html
U.S. DOE Energy Efficiency and Renewable Energy Network: www.eren.doe.gov
Database of State Incentives for Renewable Energy: www.dsireusa.org

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