

TECH NOTES

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On-Farm Biogas Recovery Systems

The development of anaerobic digesters for livestock manure treatment and energy production has accelerated at a very fast pace over the past few years¹.

Since 2000, there are approximately 40 farm-scale operating digester systems in the United States. Centralized digester application is also emerging for dairy operations¹.

AgSTAR

The U.S. Environmental Protection Agency (EPA) and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS)

instituted AgSTAR, a voluntary outreach program that helps promote profitable opportunities for reducing methane emissions, an important greenhouse gas. They provide technical assistance and tools to establish biogas technologies that achieve methane emission reduction from livestock waste management operations.

AgSTAR assisted in the development, planning and construction of seven farm-based digester systems in the US. Since the first farm-based digester system was installed in 1998, farmer motivation for building and operating anaerobic digesters has expanded from gaining direct energy benefits from harnessing biogas to now include odor control, manure treatment cost savings, nutrient conversion, odor and pathogen control and by-product recovery².

State funded anaerobic digestion programs also play a significant role in the expansion of on-farm digester projects. For example, a US\$10 million cost-share program for commercially demonstrated anaerobic digestion technologies is available to dairy farms through the California Energy Commission (CEC)².



The NY State Energy and Research Development Authority (NYSERDA) and the Wisconsin Energy Bureau have programs that provide funding to assist livestock producers in establishing digester technologies at their farms².

Federal funding opportunities also play a role in support of anaerobic digestion systems through the Federal Farm Security and Rural Investment Act of 2002. The Act will provide funding under the Environmental Quality Incentives Program (EQIP) and the Renewable Energy Systems sections of the Energy Title. The website, www.usda.gov/farbill can offer additional information on this funding opportunity.

Biogas Recovery System

A biogas recovery system is defined as an anaerobic digester with biogas capture and combustion to produce electricity, heat or hot water. Biogas recovery systems are effective at confined livestock facilities that handle manure as liquids and slurries, typical of swine and dairy farms.

Varec Biogas has been an active participant for On-farm Biogas Recovery Systems since the inception of AgSTAR in the late 1990's. We took part in a research study conducted by the Dairy Research Unit at University of Florida's Institute of Food and Agricultural Sciences. The research involved Fixed Film anaerobic digester, which is an innovative system that stabilizes wastewater; retains valuable fertilizer nutrients and produces energy by turning waste into biogas. It also reduces the offensive odors associated with dairy manures by as much as 90 percent. The study's intent is to develop Fixed Film Anaerobic Digesters for commercial use¹.

Varec Biogas supplied the gas safety and handling equipment including the flare for the study. For additional information on the study and technology, contact:

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Covered Lagoon Systems



One very common method of biogas recovery for farms is using their existing manure lagoons and installing a cover over the lagoon.

Covered anaerobic lagoons typically consist of two lagoons operating in series. The first lagoon is for primary waste treatment, and has a dedicated volume with a fixed operating depth to biologically stabilize waste. This results in Volatile Solids and Chemical Oxygen Demand reduction. A second lagoon is required for adequate waste storage during non-cropping periods.

Biogas production is a by-product of this anaerobic or no-oxygen process. Biogas recovered can be utilized as

fuel to run engine-generators and boiler, or simply flared. It is important to incorporate the proper safety

equipment in the design of the plant because biogas is extremely volatile (methane), hazardous (Hydrogen Sulfide) and corrosive (moisture and hydrogen sulfide). One very common method of biogas recovery for farms is using their existing manure lagoons and installing a cover over the lagoon.

Due to our experience and knowledge as the world's leading supplier of gas handling and safety equipment to the Biogas Industry, Varec Biogas equipment is installed in over 50 percent of the forty on-farm biogas recovery systems currently operating in the United States.

Varec Biogas equipment is used in biogas recovery systems in commercial dairies, cheese processing plants, and beef, poultry and swine farms. We have developed a turnkey system that allows operation of the covered lagoon.



Each lagoon has a separate pipe to the blower building with an isolation valve and a Pressure and Vacuum Relief Valve with Flame Arrester used to protect the lagoon from an overpressure condition. Typically, lagoons have a maximum operating pressure of 2" WC or 50 mm/WC. We provide redundant blowers that can be selected to run separately, together, or on a lead/lag basis.

The system operates based on a PLC controller with multiple timers, and the settings are based on observed gas production. A typical operation is for the blowers to run for two hours in the morning; continuously from NOON to 6 PM which is when gas production is expected to peak; and one hour at night as required. The blower controller includes three start and stop times that are independently adjustable.

The blowers are utilized to pull a slight vacuum on the piping which draws the gas out of the cover. In a typical system with properly sized piping the system pulls 3 – 5" WC vacuum where the Pressure and Vacuum Relief Valve/Flame Arrester is located.



The control system includes a NEMA 4X (NEMA 7 optional) control enclosure with touch screen control, a graphic showing gas flow and total and status of pilot, pilot alarm, blowers and ON/OFF status of the Pressure Relief Regulator and Flame Trap Assembly. There are screens for timer setting and alarm status acknowledgement. The control enclosure includes a gas detection display. We also provide H₂S, O₂ and LEL detection for installation in the blower building. We provide Starters/overloads for the blowers mounted in a separate NEMA 4X enclosure. A single waste gas burner is supplied to

handle the total gas production from the lagoon and is used to combust all of the excess digester gas produced from the lagoons. All the pertinent gas handling equipment like condensate and sediment traps, drip traps and flame trap assemblies required for proper operation and safety are also provided.

Expertise

Varec Biogas offers a comprehensive range of digester cover equipment, inline safety devices, hydrogen sulfide removal, as well as open and enclosed flare systems, which are unsurpassed in their reliability and flexibility.

Varec Biogas has been meeting and exceeding the needs of our customers for over 75 years. With our history of innovation and industry leadership, we have developed a biogas safety system which includes a regenerative blower and control scheme that will safely capture the biogas from the covered lagoon and divert it either for (a) utilization at boilers or engine-generators; or (b) for combustion using our state-of-the-art flare technology.

Service

Our experienced Field Service Engineers will be available to assist in the installation, commissioning and start-up and training of the gas safety system. Varec Biogas Field Service can also provide professional and timely periodic maintenance of the Varec Biogas safety system.

Please contact your local representative for additional information, or for assistance in your next on-farm biogas recovery system project.



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