Swine Biogas Is Fueling Homes

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Mustang Sampling

A pig raised as a food source has a short and singularly focused life, with an average lifespan of about six months, gaining weight and producing waste continuously. A typical swine herd numbers in the tens of thousands, with each pig producing several pounds of waste every day. This waste can be processed to produce useful methane gas, the main component in natural gas, which is already a major source of energy throughout the world. The gas from the swine operation is called biogas.

Methane is the simplest hydrocarbon molecule, with one carbon atom and four hydrogen atoms, making it the cleanest (lowest-carbon-footprint) hydrocarbon fuel. In traditional natural gas production, gas is cleansed through an elaborate processing procedure until the mixture is suitable for transportation by pipeline to customers requiring fuel. The natural gas mixture is primarily methane and ethane with some heavier components like butane, propane and pentane. The energy value of the natural gas is managed within a range suitable for burning in homes or for electricity generation. Since biogas is mainly methane, it is a logical choice to be injected into natural gas systems as a recovered, renewable fuel. In addition to its usefulness as an energy source, the capture of biogas reduces methane emissions as methane is a greenhouse gas.

The process from waste to renewable natural gas includes the major steps of waste gathering, decomposition (anaerobic digestion), gas collection, cleaning and injection. The gathering process has not changed significantly in recent decades. Pigs live on slatted flooring, which allows the waste to fall through into a gathering area below. The waste is then transported to an anaerobic digester. The role of the anaerobic digester is to biologically break down the glucose in the waste to create primarily carbon dioxide and methane. The gaseous elements from the digester, or “raw” biogas, gather above the liquid and solid materials and are transported away for processing. The liquid and solids are processed as fertilizer or slurries. Cleaning the biogas is a mainly physical process to remove water, scrubbing to remove carbon dioxide, and a sweetening process to eliminate sulfur and other unacceptable elements. The gas can then be injected into a pipeline for distribution with the proper mixing to an acceptable energy value or used directly to generate heat or electricity at the farm.

Gas sampling is a generic term that describes the process of extracting a small portion of gas from a process and transporting it to an analyzer. Biogas, like natural gas, is not a single component gas but rather a mixture of gases. Changes to the pressure or temperature of the gas sample can cause separation of the components prior to analysis, which is undesirable. Sampling is critical in the production of biogas because only through analysis can the process be controlled, resulting in the correct end product. Mustang Sampling provides the sampling and analysis systems that allow for a controllable, safe and efficient process. In the final step, local distribution companies also rely on proper sample conditioning and analysis to ensure the produced gas meets local and national tariffs for pipeline gas. Methane recovery and renewable gas injection are not possible without proper sample control, conditioning and analysis.

Optima-KV is North Carolina’s first biogas injection project. The project scope includes aggregating

biogas from five individual swine farms, cleaning the gas and injecting the resultant biogas into the Piedmont Pipeline to supply Duke Energy's system for the generation of electricity. The farms involved contain nearly 60,000 pigs, which are expected to produce enough waste to ultimately power the equivalent of about 1,000 households on a continuous basis. Optima-KV took the approach of aggregating the waste from multiple farms to improve the efficiency of the overall process compared to employing five different systems.

Mustang Sampling deployed multiple sampling systems and analyzers to allow for the control of Optima-KV's processes. Three basic systems were deployed to measure the raw digester gas, the cleaned gas and, finally, the gas prior to entering the pipeline. Each system has unique challenges beginning with wet, acidic gas at the digester, requiring hardened materials with filtration and water removal. It is critical to protect the analyzers used for each measurement at all times, including when the system is not in balance. In the final stages prior to injection, a gas chromatograph is deployed to measure each component in the gas mixture. Moisture, carbon dioxide, sulfur, hydrogen sulfide and oxygen are also continuously monitored within the process. Assuming the energy value is suitable for the natural gas pipeline, the gas can be injected into the system.

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