MIDWEST CHP APPLICATION CENTER

In Partnership with the US DOE

combined heat & power on dairy farms

Holsum Elm Dairy

1,200 kW CHP Application

Project Profile

Quick Facts

Location:
Hilbert, WI
Type of Industry:
Dairy Farmer
Facility Size:
4,000 Holsteins
CHP Electric Capacity:
1,200 kilowatts
Prime Movers:
(2) 600 kW Guascor Engine
Fuel Type:
Anaerobic Digester Gas
Installed Cost of Anaerobic Digester/CHP Project:
$2,400,000
Simple Payback:
5 years

Project Overview

Holum Elm Dairy, a 4,000 dairy cow farm located in Hilbert, Wisconsin, owns and operates a 1,200 kW anaerobic digester (AD) gas-fired combined heat and power (CHP) system. The digester / CHP system installation began in 2006 and was completed in 2007. The integrated system was designed by GHD, Inc., an engineering firm located in Chilton, Wisconsin, that specializes in petroleum and farm related environmental engineering.

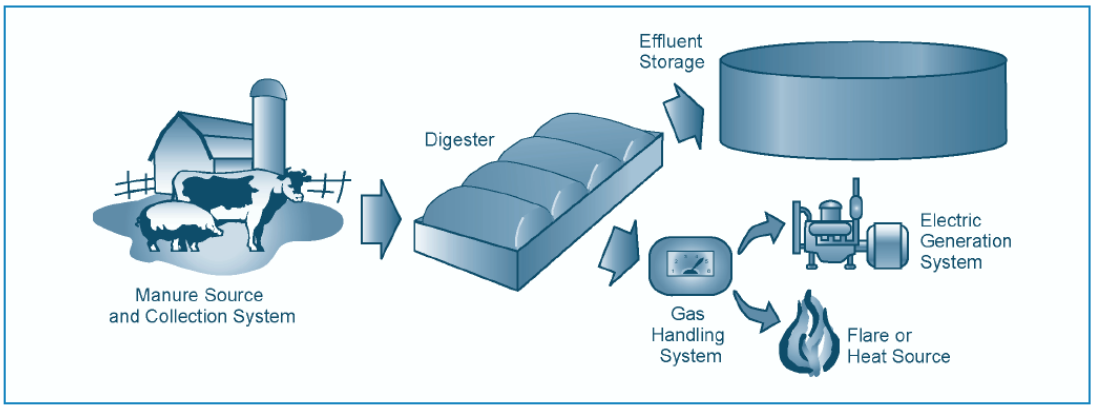
***To the right*: Holsum Dairy, Elm Road Engine Generator Set**

Success with Anaerobic Digestion and Combined Heat & Power

Large-scale dairy operations milk hundreds to thousands of cows. All of these cows produce a great deal of waste. Holsum Elm, however, knew how to handle that. Having installed anaerobic digesters and biogas recovery at their older facility, Holsum Dairy Irish Road, the concepts were replicated at Holsum Elm. However, this time they went with GHD Inc.'s newer patented U-shaped designed anaerobic digester, where the manure enters and exits on the same end of the digester. Like Holsum Irish Road, they also installed a CHP system fired with the biogas produced from digestion. Prior to the AD/CHP project at Holsum Elm Dairy, the manure at Holsum Dairy was stored in open lagoons which when decomposed, released large amounts of methane, a damaging greenhouse gas to the atmosphere and our environment. By producing energy with biogas, Holsum Elm is utilizing a renewable source of energy with much lower environmental impacts than conventional fossil fuel. Also, the methane that would be exposed to the atmosphere is captured and combusted with this biogas utilization project.

Odor Control, Clean Energy, and More

At Holsum Elm the dairy cow wastes, and other facilities' wastes (including food processing wastes), are sent untreated into the U-shaped, below grade, AD concrete vessel. The manure is mixed and heated with bacteria that assists in the breakdown of waste material and contributes to the production of the anaerobic digester gas (ADG). The major constituents of the ADG are methane (60-80%) and carbon dioxide (CO_2) and the ADG is used to fuel the 1,200 kW CHP system that incorporates two 600 kW Guascor engine gensets. The electricity produced by the combined 1,200 kW CHP system is used on-site by the farm, with the excess power sold to the local utility, Wisconsin Public Service, under a power purchase agreement. By using ADG in a CHP system, methane that would have been released to the atmosphere is utilized, and



Basic Anaerobic Digester/Combined Heat & Power System Flow Diagram
Source: www.epa.gov/agstar

CO_2, methane and other greenhouse gases are offset by providing electricity to the utility, and therefore the community, from a renewable resource instead of generating electricity from a typical coal-fired utility power plant.

The heat which results from the electricity production is recovered, in the form of hot water. It is utilized in the AD system itself to maintain the required temperature of the digester. The remaining recovered heat meets the farm's need for hot water and for in-floor heating of the milking parlor, office, shop, and holding and transfer areas.

Once digested the manure takes the form of an odorless effluent. It is pumped from the effluent pit of the AD vessel to a manure solids separator. The mechanical manure separator separates the solids from the liquid fractions. The liquid from the manure separator, now with the majority of the large solids removed, flows into the farm's storage lagoon. A large advantage of the effluent from the AD treatment process is that the viscosity of the effluent is such, as opposed to the raw manure influent, that the liquid effluent can be pumped through an irrigation nozzle for field spreading. Holsum Elm's liquid effluent goes to farmers who grow feed for the dairy as crop fertilizer. 75% of the liquid is piped, and the rest is trucked; 95% of the effluent is transported within 4 miles. The separated solids, having the same odor and pathogen reduction characteristics as the liquid stream, can be used for bedding, potting soil and mulch. Holsum Dairy produces 16 semi loads of digested semi loads of digested solids per week. One third of the digested solids are used for the farms own bedding needs and the remaining two thirds is sold to 10 other area dairy farms at $15 per ton. Combined with the solids from their other dairy, Holsum saves $360,000 annually on bedding, by utilizing the solids on site and from sale to other farms. Co-owner of the farm, Kenn Buelow, is also looking into using the solids in other revenue streams such as pelleting for wood burning stoves, particle board and plastic piping.

AD/CHP Technologies to Fit Your Farm

U.S. Environmental Protection Agency AgSTAR has identified that the most viable agricultural candidates for AD projects are dairies with 500 or more animals. Other factors to consider are how often the manure is collected and the solids content of the waste. Facilities with stable year-round manure production which collect at least 50% of their manure daily are well suited for these types of systems.

According to AgSTAR, the digester technologies that can be utilized on a farm include covered lagoons, complete mix digesters and plug-flow digesters. Holsum Elm Dairy utilizes a two-stage mixed plug-flow digester system as this technology meets the farm's requirements for treating the farm's slurry manure with a total solids content of 3 to 10 percent.

The ideal prime mover technologies for most dairy farms utilizing biogas from anaerobic digesters are reciprocating engines, microturbines, and fuel cells.

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"We originally installed the digesters to control odor and provide energy. The plan was to break even on our investment. But since installing the digesters, we have been able to increase revenues and reduce our cost."

--- Kenn Buelow ---
Co-owner, Holsum Elm Dairy