



# Holsum Dairy, Irish Road

## 700 kW CHP Application

### Project Overview

Holsum Dairy Irish Road, a 4,000 dairy cow farm located in Hilbert, Wisconsin, owns and operates a 700 kW anaerobic digester gas-fired combined heat and power (CHP) system. The CHP system installation began in 2001 and was completed in 2002 and was one of the early manure treatment systems using anaerobic digestion on a dairy farm in Wisconsin. The generated electricity is used on-site or sold to the local electric utility and the recovered heat is captured and used for the digester, milking parlor, office and holding and transfer areas.

### Incorporating Anaerobic Digestion

Large-scale farming operations face many manure management problems including odor complaints, proper waste disposal and the release of greenhouse gases into the atmosphere. These issues can be addressed through the use and operation of a CHP system. In an effort to control the farm's odor issues and seeing the opportunity to generate electricity from a renewable energy resource, Holsum Dairy decided to install a mixed plug-flow anaerobic digester coupled with a biogas-fired CHP system. Prior to the CHP project, the manure at Holsum Dairy was handled with a flush system and was stored in open lagoons which when decomposed, released large amounts of methane, a harmful greenhouse gas. Since the CHP system has been installed, Holsum Dairy has been pleased with the large reduction of odor and has enjoyed the benefits of the CHP system including:



Caterpillar Engine Generator Set

- Electric/heat generation to use or sell
- Bedding for animals
- Odor reduction
- Increased ammonia control
- Increased fertilizer value
- Pathogen reduction/GHG reduction
- Weed seed reduction
- Low maintenance
- Phosphorous and metal reduction

### Benefits of Anaerobic Digester/CHP

Holsum Dairy utilizes two mesophilic mixed plug-flow digesters that are laid end to end. All the waste is collected in a receiving pit and sent to a concrete vessel. The manure is heated in an oxygen-free environment to convert volatile fatty acids into anaerobic digester biogas. The biogas consists of CH<sub>4</sub> (methane) and CO<sub>2</sub> with trace amounts of other compounds. Cow manure is well suited for anaerobic digestion as a

### Quick Facts

**LOCATION:** Hilbert, WI

**PRIME MOVER:**

(1) 500 kW Deutz Engine

(1) 200 kW Caterpillar Engine

**Facility Size:**

4,000 Holstein Cows

**Operation:** 24/7

**Fuel Type:** Anaerobic Digester Gas

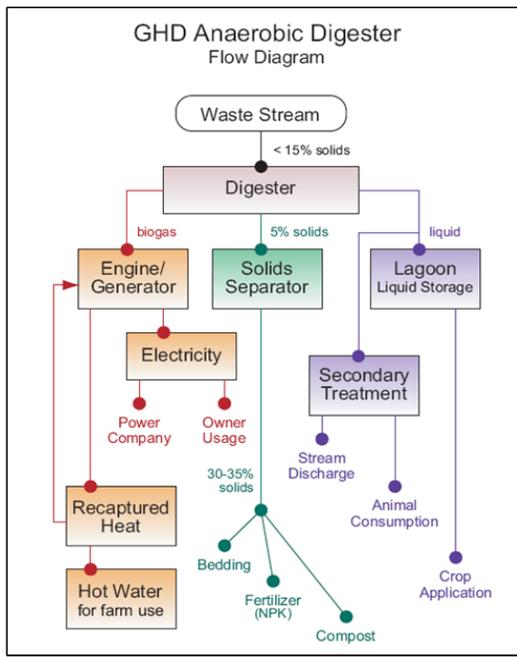
**Installed Cost of Anaerobic  
Digester/CHP Project:**

\$2,000,000

**Simple Payback:** 7 Years

**Year of Installation:** 2001-2002

single cow can produce enough waste to generate 0.1 to 0.2 kW.



Anaerobic Digester System Flow Diagram

Holsum Dairy supplements the waste from its herd with waste from three area food processing facilities. The farm collects tipping fees for the 1 to 1.5 semi loads of waste product that they collect on a daily basis. The collected wastes include food waste, malt ingredients and slaughter-cow waste and are untreated prior to collection.

The biogas, generated from the digestion vessels, is utilized in two engine generator units; a 500 kW Deutz engine and a 200 kW Caterpillar engine. The 700 kW of generated electricity is used on-site by the farm with the excess power sold to the local utility, Wisconsin Public Service under a power purchase agreement. The recovered heat, in the form of hot water, is collected from both the engine jacket liquid cooling system and from the engine exhaust system. A portion of this recovered heat is utilized in the anaerobic digester system to maintain the temperature of the digester at 100°F. The remaining recovered heat is used by the farm as a replacement for hot water production and for in-floor heating of the milking parlor, office, and holding and transfer areas. The farm also has a backup boiler that can run on diesel or biogas to supplement the existing heating system.

*“There are a lot of parts to the digester operation that make it financially feasible. It’s difficult to do it without all these parts working together. The sale of the power generated by the digester, supplemented by the income from selling the carbon credits, along with the use of compost from the digester for bedding, has made it financially feasible to install and maintain the digesters.”*

*–Kenn Buelow, Co-Owner, Holsum Dairy*

Once digested, the waste does not disappear. The majority of the volume remains; however, the effluent that emerges after 22 days is not considered a waste by Holsum Dairy. A mechanical manure separator separates the effluent’s solids from the liquids. The liquid, a clear odorless stream, flows into the farm’s storage lagoon. The viscosity of the liquid effluent is such, as opposed to the raw manure influent, that it can be pumped through an irrigation nozzle for field spreading. The nutrients are taken from an organic-state to an inorganic state, making the liquid “plant-accessible”, meaning it can be applied to growing crop without burning the leaves. The separated solids, having the same odor and pathogen reduction characteristics as the liquid stream, are utilized by the farm for bedding replacement. Use of the separated solids for bedding typically comprises about 40–60% of the separated solids from a typical farm. The remainder can be sold to other farms.

## Incentive for Anaerobic Digester/CHP Applications

If the above advantages of having an anaerobic digester/CHP system were not enough for Holsum Dairy, there are still more. Holsum Dairy, along with its sister farm, Holsum Elm Dairy, receive “funding” from TerraPass for their anaerobic digester/CHP project. TerraPass is an organization committed to helping individuals and organizations be proactive in regards to climate change by funding projects using renewable energy, such as anaerobic digester/CHP systems. By selling carbon offset certificates, Holsum’s was able to improve project economics. Carbon offsets are measured by TerraPass in ‘pounds of carbon dioxide’ offset. Since Holsum’s project primarily offsets methane released into the atmosphere, the emission benefits are converted to ‘pounds of carbon dioxide equivalent’ to determine how many certificates can be sold.

## For More Information

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The Midwest CHP TAP is a U.S. DOE sponsored program managed by the Energy Resources Center located at the University of Illinois of Chicago.