



**MIDWEST
CHP
APPLICATION
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In Partnership with
the US DOE

combined heat & power on dairy farms

Hunter Haven Farms, Inc.

260 kW CHP Application

Project Profile

Quick Facts

- Location:**
Pearl City, Illinois
- Type of Industry:**
Dairy Farmer
- Facility Size:**
 - ▶ 800 dairy cows
 - ▶ 500 young stock
- CHP Electric Capacity:**
260 kilowatts
- CHP Thermal Capacity:**
~1,500,000 Btu/hr hot water heat recovery
- Prime Movers:**
 - ▶ (1) 130 kW Caterpillar G342NA Engine Generator – installed 2005
 - ▶ (1) 130 kW Caterpillar G342NA Engine Generator – installed 2008
- Fuel Type:**
Anaerobic Digester Gas
- Phase I Installed Cost:**
\$960,000 – installed 2005
- Phase II Installed Cost:**
\$199,500 – installed 2008

Project Overview

Hunter Haven Farms, Inc., an 800 dairy cow farm located in Pearl City, Illinois, owns and operates a 260 kW anaerobic digester (AD) gas-fired combined heat and power (CHP) system. The digester / CHP system was designed and installed in two phases beginning in late 2004 and ending in spring 2008. The integrated system was designed by GHD, Inc., an engineering firm located in Chilton, Wisconsin, that specializes in petroleum and farm related environmental engineering.



Hunter Haven Farms – Pearl City, Illinois

Issues Facing Hunter Haven Farms and AD / CHP Solution

Today, large-scale farming operations face many problems that receive increased regulatory attention that can be addressed through anaerobic digester (AD) / combined heat and power projects.

Issues Facing Farmers	Solutions with AD / CHP Projects
Odor complaints	AD / CHP projects can reduce odor from farms by up to 80%.
Government regulations pertaining to manure disposal	AD / CHP projects provide a solution to managing on-farm waste that meet government regulations.
Contaminant leaching to underground aquifers and run-off to surface waters, lakes and rivers	AD / CHP projects are integrated management systems that reduce the likelihood of contaminant leaching and run-off.
Release of greenhouse gas emissions to the atmosphere from livestock manure	AD / CHP projects combust methane to generate electricity and thereby reduce greenhouse gas emissions significantly

To address these regulatory issues, Hunter Haven Farms, in 2005, installed GHD, Inc.'s proprietary anaerobic digester (AD) system and a 130 kW ADG-fired CHP system, utilizing grant-funding from the Illinois Department of Commerce & Economic Opportunity (DCEO) and USDA Rural Development-Section 9006. Building upon the success and reliability of the digester / CHP system installed in 2005 and addressing the concerns of the increased herd capacity of 200 cows in 2007, a second 130 kW genset was installed and integrated into the existing CHP system. The CHP expansion was financed with grant-funding from DCEO and the Blue Moon Foundation.

CHP & AD Flow Process

Digester: Unprocessed cow manure, a renewable resource, is collected in a receiving pit and then sent to a 72' x 112' x 14' 660,000 gallon AD concrete vessel. The manure is mixed and heated with methanogenic bacteria to assist in the conversion process of volatile fatty acids into anaerobic digester gas (ADG), consisting primarily of methane and CO₂.

Electricity: The anaerobic digester gas, collected from the AD vessel, is utilized for fuel in the combined heat and power gensets. The electricity produced by the 260 kW CHP system is used to offset the farm's purchased power while excess power is sold to the local utility under a power purchase agreement.

Heat Recovery: The recovered heat, in the form of hot water, is collected from both the engine jacket liquid cooling system and from the engine air exhaust system. Approximately 30-60% of this recovered heat is utilized in the AD system to maintain the required temperature of the digester. The remaining recovered heat is used by the farm as a replacement for hot water production and for in-floor heating of the farm and holding areas, as required.

Effluent: The digester effluent is pumped from the effluent pit of the AD vessel to a manure solids separator. The mechanical manure separator separates the influent digested waste stream into solid and liquid fractions.

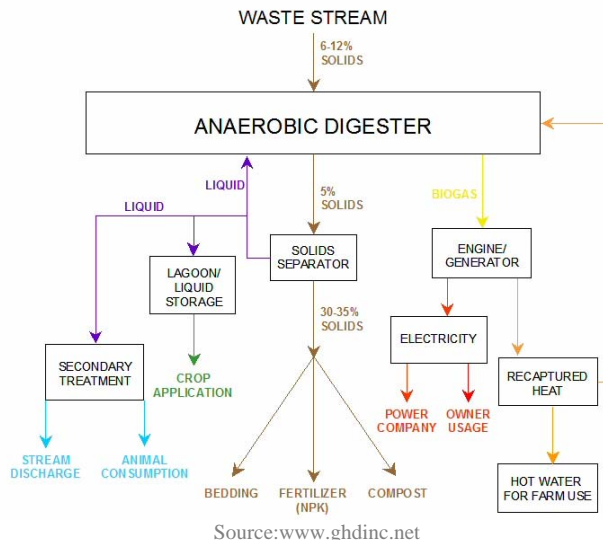
Solids: The solids are dewatered to approximately a 35% solid material. The separated solids, having the same odor and pathogen reduction characteristics as the liquid stream, are utilized by the farm for bedding replacement (an expense reduction). Use of the separated solids for bedding typically comprises about 40-60% of the generated separated solids from a typical farm. The residual 40-60% of non-utilized separated solids may be sold (system-generated income) to other farms for bedding purposes or sold to after-markets, such as nurseries and composters, for soil amendment material.

Liquids: The liquid from the manure separator, now with the majority of the large solids removed, gravity 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.

Source: www.ghdinc.net

Other Notes

- ▶ The installed digester can manage waste from up to 1,200 dairy cows.
- ▶ The additional 200 cows will generate on average 40-50 kW of electricity.
- ▶ The second 130 kW genset meets the peak electric demand of the farm.
- ▶ Manure from five cows typically produces one kilowatts of electricity, or power for one home. The CHP system could power up to 260 homes.



Basic Anaerobic Digester System Flow Diagram



130 kW Caterpillar CHP Genset – installed 2005

“It is my hope that other dairy owners from across the state, and around the nation, will visit these facilities and take this state-of-the-art, environmentally beneficial technology back to their farms.”

--- Rod Blagojevich ---
Illinois Governor

“These are extremely exciting projects which will benefit our farmers by providing new uses for crops and livestock and creating increased value for our agricultural products. These are the kind of clean initiatives that help our nation become less dependent on foreign sources of energy.”

--- Donald Manzullo ---
16th District Illinois Congressman

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