



Windy Ridge Dairy Digester System at a Glance

The digester system at Windy Ridge Dairy:



Includes a 5.0 million-gallon digester



Treats 7,000 cows' manure



Generates 1.42 MW of electricity



Processes digester effluent



Recycles bedding materials

ANAEROBIC DIGESTION TECHNOLOGY IN INDIANA

Windy Ridge Dairy Digester System

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Anaerobic digestion (AD) is an effective technology for managing and treating manure and other organic wastes. Among its multiple benefits, AD can:

- Generate renewable energy
- Reduce greenhouse gas and odor emissions
- Retain manure fertilizer values
- Facilitate organic waste recycling.

Most of the on-farm AD applications in Indiana are on dairy farms. The anaerobic digester system implemented at Windy Ridge Dairy in Jasper County, Indiana, is an example of this technology. This publication describes some of the AD technology used at Windy Ridge Dairy.

The Anaerobic Digester System

Windy Ridge Dairy, LLC is a 7,000-cow dairy farm that was established in 1999. It is a privately held company and a single-location business.

In 2006, Windy Ridge Dairy built a system with a 5.0 million-gallon digester at a total project cost of approximately \$4.15 million. The digester has a belowground Mixed Plug Flow design, developed by DVO, Inc. The digester is 146 feet wide, 342 feet long, and 16 feet deep. The digester handles the manure from all of the farm's cows (in six barns) plus the wastewater from two carousel milking parlors. The equivalent of 1.5 full-time farm employees operate the digester system. Windy Ridge Dairy uses trucks with vacuum tanks to bring all manure and wastewater to the digester (Figure 1). The maximum collection distance is about 2,000 feet.

The operators mix all of these materials to homogenize them, then pump approximately 200,000 gallons of liquid influent into the digester daily to produce biogas. A bio-scrubber removes hydrogen sulfide (H_2S) from the biogas to protect the equipment. The digester operates at 102 to 103°F and has a hydraulic retention time of approximately 24 days. The digester effluent, which has the same volume as the influent, goes through a solid/liquid separation process (Table 1).

Renewable Energy

The digester produces about 0.92 million cubic feet of biogas daily (about 335 million cubic feet a year). In the first six years of operation, the dairy only used a small portion of the biogas in a boiler for digester heating to maintain mesophilic anaerobic digestion. The system flared the remaining biogas.

That changed in 2012 when the farm installed two 710-kilowatt generators for combined heat and power (CHP) production. The total capacity of electricity generation is 1.42 megawatts. The system recovers waste heat from the CHP to heat the digester. The farm

still flares the excess biogas (Figure 1). However, it is currently using 85 to 90 percent of the biogas from the digester in the CHP, and the system generates approximately 11 million kilowatt hours of electricity annually, which the farm sells to the Wabash Valley Power Association via Jasper County REMC (Rural Electric Membership Corporation).

Table 1. Some facts of the digester system.

Parameter	Fact
Initial operation year	2006
Digester volume	5.0 million gallons
Manure treatment	7,000 cows
Digestion temperature	102-103°F
Biogas production	~0.9 million cubic feet/day
Biogas treatment	Uses a sulfur bio-scrubber
Biogas utilization	Produces electricity, heat
Digester effluent treatment	Separates solids
Effluent solid recycling	Recycles bedding material
Equivalent CO ₂ reduction	~31,800 metric tons/year

Digester Effluent Treatment

The Windy Ridge Dairy digester system combines a Trident Nutrient Recovery subsystem with a rotary drum course solid removal subsystem to separate solids from digester effluent. The liquid portion flows into four lagoons and the farm applies it to cropland seasonally as organic fertilizer. The solid portion, which contains about 32 to 36 percent moisture, is temporarily stored in a storage barn before recycling back to dairy barns as bedding material.

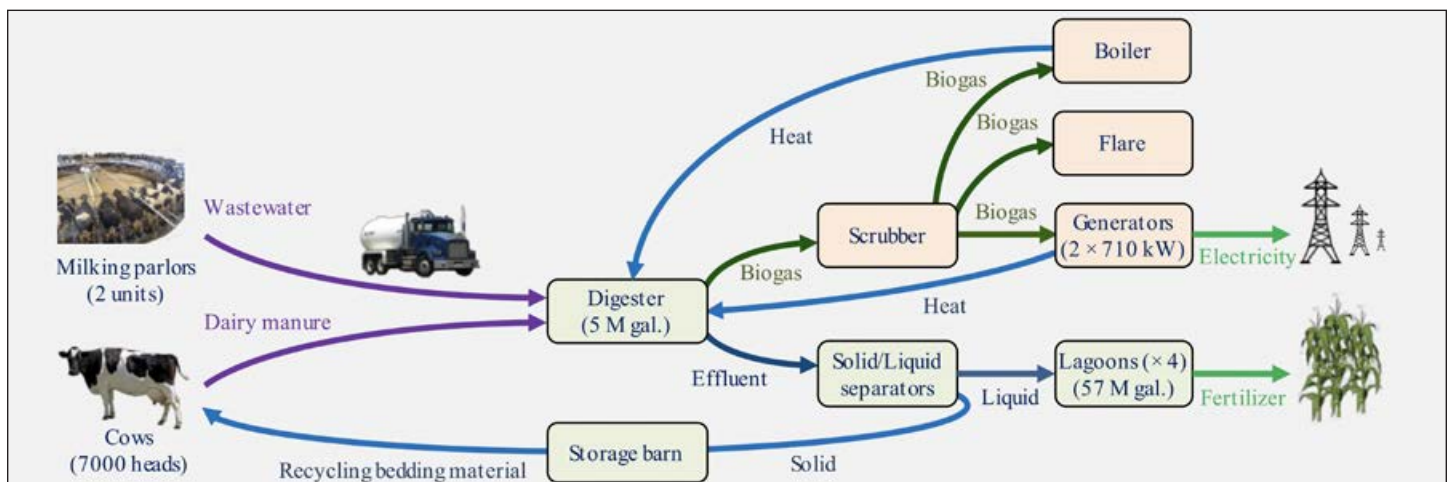


Figure 1. This illustration diagrams the process of the anaerobic digester system at Windy Ridge Dairy.

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Greenhouse Gas Emission Reduction

The Windy Ridge Dairy Digester captures methane (CH₄) from manure that would otherwise be emitted to the atmosphere. Methane is a greenhouse gas that has a higher global warming potential (GWP) of 28 to 36 over 100 years compared with the GWP of 1 for carbon dioxide (CO₂). By burning the methane and converting it to carbon dioxide, the system reduces emissions by the equivalent of about 31,800 metric tons of carbon dioxide per year. The farm converts this emission reduction to carbon credit and sells it in emission markets.

Economic and Environmental Benefits

Among its several tangible benefits, the system

- Provides revenue from selling electricity to the grid
- Offers savings from the Production Tax Credit (PTC) for biomass-to-energy conversion
- Generates revenue from selling carbon credits
- Saves money by recycling bedding material

Among its less quantifiable environmental benefits, the system reduces odor emissions and improves community relationships. Although the system currently cannot break even economically, Windy Ridge Dairy is very satisfied with it because of its combination of economic and environmental benefits.

References

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