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PRO-DAIRY

Anaerobic Digestion at Aurora Ridge Farm: Case Study

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Contents:

Anaerobic digestion overview

Digester type	Plug-flow with biogas recirculation
Digester designer	GHD
Date commissioned	August 2009
Influent	Raw manure
Stall bedding material	Post-digested separated solids
Number of total cows	2,000
Rumensin® usage	Yes
Dimensions (length, width, height)	248’ x 72’ x 16’
Cover material	Pre-cast concrete, spray foam insulation, spray sealer
Design temperature	100°F
Estimated total loading rate	61,000 gallons per day
Treatment volume	1,912,837 gallons
Estimated hydraulic retention time	20 days
Solid-liquid separator	Yes; separated manure solids used for bedding
Biogas utilization	600-kW (operating at 500-kW to net meter)
Carbon credits	No
Monitoring results to date	None

Farm overview

- Aurora Ridge Dairy is a 2,000-cow dairy operation located near the Village of Aurora in Cayuga County, New York.
- The farm is owned and managed by William Cook.
- Digester construction began in late summer 2008 and commissioned August 2009.
- Digester construction was funded in part by a USDA Rural Development grant and by NYSERDA.
- Digester effluent is separated using FAN screw-press separators and post-digested separated solids are used for freestall bedding.

Why the digester?

The farm is located a few miles East of Aurora in the Cayuga Lake watershed and overall the farm felt constructing the digester is the right thing to do. Specifically, the goals were to install a digester system that could demonstrate cost-effectiveness and provide the following benefits:

- Reductions in greenhouse gas and odor emissions
- Pathogen reduction
- Reliable energy production
- Separated manure solids for bedding
- Purchased heat savings

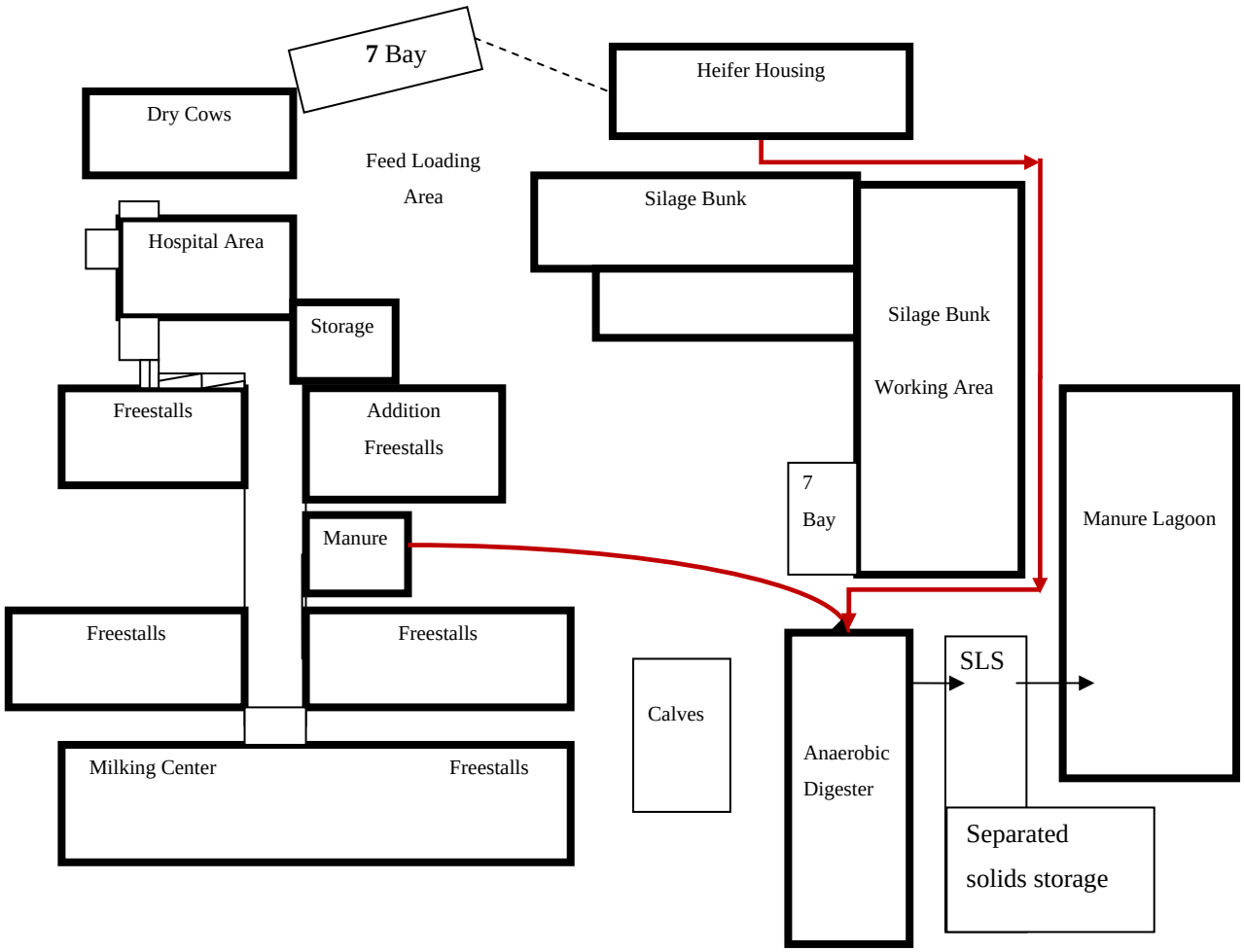
Digester System

System and process description

The Aurora Ridge digester system, designed by GHD, is composed of several components:

- Manure collection/pumping
- Influent heating
- Hair-pin, plug-flow digestion
- Biogas recirculation
- Biogas utilization: engine-generator set and boiler
- Separation of post-digested effluent
- Separated manure solids storage
- Pump system to transport separated liquid effluent to existing long-term storages

The digester vessel, a below-grade rectangular insulated cast-in-place concrete tank has a hard top cover. The digester has a longitudinally oriented divider wall resulting in a hair-pin configuration; digester influent and effluent enter and exit the digester on the same end-wall of the digester. A portion of the biogas produced and collected is reintroduced back into the digester vessel with the goal of providing agitation of digester contents. A forty-Hp blower is used to force recycled biogas thru aerators located near the bottom of the vessel. Water jacket and exhaust heat from the engine-generator set is harvested and used to heat digester influent to operating temperature and also to provide maintenance heat. Additional heat is provided by a 4 mmBtu duel-fuel boiler. Heating pipes are located within the digester vessel and controlled on a zone basis.



Liquids and solids process description

Digester influent is comprised of manure from 2,000 dairy cows and from 1,300 other dairy animals, milking center wastewater, bunk silo low-flow, and used bedding. Digester influent is pumped from two manure collection pits, one located in the adolescent heifer barn and the other centrally located adjacent to the cow barns. Manure is pumped to the digester 3-4 times per day.

Digested effluent is aggregated and subsequently processed by multiple FAN screw-press solid-liquid separators (SLS) with SLS liquid effluent pumped by a centrifugal pump to a remote earthen long-term storage. Storage contents are recycled to the farm's land base in accordance with their CAFO permit. Some of the separated manure solids are further processed by FAN Bedding Recovery Units (BRU). (A BRU is essentially a rotary-drum composting unit that has sufficient retention time for the manure solids to be heated to about 145°F before being discharged.) BRU solids are used for freestall bedding, sold or recycled to the land base.

Heat and electricity generation

Biogas that has undergone hydrogen sulfide (H_2S) reduction by a GHD biological H_2S removal system is used to fuel:

1) 4 mmBtu duel-fuel boiler (also runs on No.2 fuel oil)
2) 600-kW Guascore engine-generator set

Excess biogas is currently combusted by a flare.

The duel-fuel boiler is used as the secondary means to heat the hot water circulation loop that provides the heat source to the shell and tube heat exchanger. In the future, the farm plans to use excess heat in a greenhouse application.

Benefits and Considerations

Benefits	Considerations
• Odor control • Potential revenue from: 1) Value-added products 2) Reduction of purchased energy 3) Sales of excess energy 4) Carbon credit sales • Nutrient conversion, allowing use by plants as a natural fertilizer, if effluent is spread at an appropriate time • Pathogen reduction	• Possible high initial capital and/or high operating costs • Long and tedious contracts with the local utility; may require special equipment for interconnection • Dedicated management of the digestion system is required • Careful attention to equipment maintenance and safety issues due to the characteristics of raw biogas

Lessons Learned

The following are the lessons learned as reported by the farm after operating their anaerobic digester system for 3 months.

Do your homework first. The time spent visiting several other farmers with anaerobic digesters along with other farmers considering them was well worth the time, effort, and expense. This took many years to do but in the end was an important part of the decision making and early planning processes.

Grants. Although grant dollars are in the end helpful in offsetting the capital construction costs, loans had to be secured for the full construction contract amount in order to pay contractors and suppliers in a timely fashion. Grant funds are slow to come, thus a producer needs to have financing lined up to cover the bills and avoid late fee charges.

Utilities. Be committed to working early and often with the utility representative as best as possible. The utility generally avoided putting anything in writing and preferred talking on the phone rather than answering e-mails. Although it is prudent to get things in writing, concern exists that this could significantly slow the process down more so.

Committed farm member required. An individual on the farm is needed who is passionate about the anaerobic digester system and austere equipment in order for it to be a success. This person needs to be mechanically-oriented and enjoy the challenge of operating the digester and trouble shooting problems that arise. Although an anaerobic digester is the extension of a cow's rumen in some aspects, don't assume that all dairy farmers will be capable or enjoy this line of work.

Carbon credits. Generated income from the anaerobic digester system on a cash flow analysis should not include any money as a result of selling carbon credits. Currently, the cost to measure and verify carbon reductions due to the digester are more than the revenue provided under some of the carbon marketing plans.

Who to Contact

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