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Quantum Dairy Takes the Modernization Leap

CASE STUDY

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When Richard Wagner made the decision to expand his operation, he did it in a big way. So big, in fact, that he built a new, much larger operation right next door to the existing, still serviceable operation. Quantum Dairy, located in Weyauwega, is principally owned by Wagner and includes partners John Young and Kurt Duxbury.

During fall of 2004, Wagner contacted Fred Daniels, a Focus on Energy Adviser with Business Programs Agricultural Team and Rural Business, to conduct a custom energy audit of the new double 16 milking parlor he was constructing. The findings revealed that he could reduce energy consumption in a number of areas. Focus on Energy's recommendations included installing three scroll compressor units, two 120 gallon refrigeration heat recovery units, a plate heat exchanger, and a variable frequency drive vacuum pump.

The audit also recommended replacing electric water heaters with higher efficiency liquid petroleum water heaters. Annual energy savings will result in an estimated annual cost savings of almost $24,500 and the projected payback on the project is 1.4 years.

"Herd expansion and facility modernization provide great opportunities to install energy efficient equipment. And with increasing energy costs the equipment can pay for itself in no time," said Fred Daniels from the Focus on Energy Agriculture Team.

The largest electricity savings will come from installing the plate heat exchanger; this action alone will reduce electricity use substantially, which translates into an estimated $10,950 in annual cost savings. Plate coolers lower the temperature of milk before it reaches the bulk tank where the cooling traditionally occurred. Well water is piped directly into the plate cooler; this cool water runs through channels/plates in the unit and cools the milk. The milk and water pipes run side by side and the heat is transferred from the warm milk to the cool water. The milk is cooled more quickly and the warmed water is then given to the cows.

The Quantum Dairy plate cooler produced the greatest electric savings of almost $11,000 per year.

The variable frequency drive produced the greatest savings and an annual cost savings of $5,600. The variable frequency allows the 15 HP vacuum pump to run only when it is needed during the three milking and wash cycles each day, instead of running continuously.

On the fuel side, the installation of the refrigeration heat recovery system is expected to save the farm 2,475 therms of LP, which is equivalent to 2,700 gallons of LP and $3,500 in cost savings.

The variable frequency drive installed at Quantum Dairy produced electric savings of almost $6,000.

By installing these energy saving recommendations, Quantum Dairy qualified for a custom incentive from Focus on Energy's Milking Parlor Design Program.

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ENERGY EFFICIENCY IN TANDEM WITH RENEWABLE ENERGY

Installing energy saving measures and maximizing energy efficiency is always a step that Wisconsin's Focus on Energy Program recommends when a business owner or Wisconsin resident considers the installation of a renewable energy system. The energy efficiency work that Richard Wagner did with Focus while his anaerobic digester was being installed resulted in an operation that requires less energy.

Recently, Quantum Dairy's 1,200-head herd grew to 1,400 cows, and Wagner hopes to boost his herd size to close to 2,900 over the next few years. A natural by-product of a large dairy herd, however, is manure that needs to be properly managed in order to minimize the possibility of surface or groundwater pollution and odor. To manage the manure from his herd, Wagner installed a modified plug-flow anaerobic digester.

PHOTO COURTESY OF STEVE DVORAK, GHD INC.

Quantum Dairy's 200 kW engine generator, installed by GHD, Inc., of Chilton, WI, produces enough electricity to power 150 Wisconsin homes.

HOW IT WORKS

The modified-plug flow digester installed at Quantum Dairy works well on a dairy farm. This digester is an underground U-shaped concrete tank that receives manure at one end and extracts digested biosolids at the other end. The manure moves through the tank much like toothpaste is squeezed through a toothpaste tube.

The key energy product from the digester is biogas, which in Quantum's case, fuels an engine-generator that produces both electricity and heat. Quantum's 200 kW engine-generator produces about 1,500,000 kWh of electricity per year - enough to power about 150 Wisconsin homes. From this process, heat is generated and collected, which produces an additional benefit from the digester installed at Quantum. The excess heat from the engine is utilized to heat the milk house, milking parlor, shop, and farmhouse – helping the dairy avoid some of the increasing costs of propane.

MORE THAN JUST HEAT AND ELECTRICITY

Farms using anaerobic digesters have realized numerous environmental benefits. Anaerobic digesters degrade volatile organic compounds in manure, thus reducing odor emissions substantially over fresh manure. The digested solids from a digester have an earthy smell and an appearance similar to dried, chopped grass. Fly numbers are also greatly reduced due to the degradation of volatile organic compounds in the manure.

The biosolids from anaerobic digesters offer an excellent soil amendment as well, either in direct-use or when blended with other materials. When separated from the liquid fraction, digested manure solids contain concentrated amounts of phosphorus and nitrogen that are more easily managed than raw manure. The anaerobic digestion process also significantly reduces pathogenic organisms.

ANAEROBIC DIGESTION: AN INVESTMENT IN ENERGY AND THE FUTURE

Is an anaerobic digester system an economically sound investment? "Farm anaerobic digesters are a means of turning the liability of animal waste into an economic asset," said Larry Krom, of the Focus on Energy Renewable Energy Program. Focus on Energy estimates about a six-year simple payback period without the benefit of grants. This payback period is based on the value of electricity that will be sold to We Energies, the value of the heat utilized from the engine – which will replace propane for space heating – and the value of the solids, which can be used as animal bedding or fertilizer on the farm or sold off the farm. Non-monetized benefits include reduced odor, fewer flies and improved animal health from pathogen destruction, all of which have significant value to dairy farmers.

Quantum Dairy's system cost $1,062,931, but Wagner received financial assistance from a variety of sources in order to make the project possible. Focus on Energy provided $35,000 for the electrical portion of the installation and was able to provide an additional $7,347 for the thermal portion of the system. A substantial USDA grant of $205,991 also helped make this installation a reality.

To find out more about how to produce electricity from manure, contact Focus on Energy at www.focusonenergy.com, or, call 800.762.7077. Focus on Energy staff can provide you no-cost telephone consultation, information resources, and grants for farm anaerobic digester and other renewable energy systems.

Focus on Energy is a public-private partnership offering energy information and services to energy utility customers throughout Wisconsin. The goals of this program are to encourage energy efficiency and use of renewable energy, enhance the environment, and ensure the future supply of energy for Wisconsin. **800.762.7077 focusonenergy.com**

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