Executive Summary:

On March 14, 2004 an application was submitted to the Renewable Development Fund for a grant to provide a large portion of the funding for a methane digester on the Diamond K Feeds property in Winona County, Minnesota. The project was selected as one of the recipients on August 31, 2004. The digester was designed by RCM International of Berkeley, California and all structural components were certified by Larry J. Roehl, P.E. a registered professional engineer under the laws of the state of Minnesota. Using this digester design, Resource Engineering of Middleton, Wisconsin designed the layout of the project starting with the collection of the manure at the dairy buildings and ending with the production of the electricity in the electrical building. The final digester design and facilities plans were completed in April of 2011. After completion of the final plan, the project could finalize the budget and financing requirements so that construction could begin. Construction and system contractors were selected and contracts were finalized.

Winona County required a conditional use permit which was granted on August 22, 2006 after a public comment period of 30 days. The dairy already had a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit which had been issued on February 3, 2000.

The grant from the Renewable Development Fund was crucial to the project being accepted by our lender and allowing the project to move forward. This project will be a great value for Diamond K in our efforts to minimize our carbon footprint. The collection and use of the methane will keep this gas out of the environment. Hydrogen sulfide emissions will be greatly reduced. Both of these are current air quality concerns. The manure that comes back out of the digester will have virtually no pathogens or weed seeds left in it. This will make this fertilizer a safer product to use on the crop land. Once the manure has gone through the digestion process, the potential to pollute has been reduced by 90%. In other words, the manure from 1,000 cows will be no more of a threat to the environment than the manure from 100 cows. Diamond K is striving to position itself for being a viable dairy production business for the future of the family members currently involved and for the 8 fifth generation Kreidermachers being raised there as well.
Technical Progress:

The plans and specifications for the digester were approved on September 23, 2010 for a digester designed for 2,230 cows. In designing the project, Diamond K was very careful to plan the layout to maximize efficiency, but also to keep the protection of the environment as a top priority. The dairy buildings were already in place, so the layout was planned to utilize gravity flow whenever possible to lessen the need for equipment that would consume power and need maintenance. Great care was taken to be sure that safeguards would be in place to protect the environment from any harm.

New manure collection areas were designed at the ends of each of the existing dairy barns. Manure is scraped into an underground pipe that gravity flows into a 30' x 30' x 12' concrete reception pit. From this central collection pit the manure is pumped into the 106' x 18' round concrete manure digester vessel. The digester is a complete mix system with a floating cover. The flow volume into the digester is 6,375 cu. ft of manure per day. Retention time in the digester vessel is 22 to 24 days which is the optimal time for maximum methane gas recovery. As the gas forms it flows under its own pressure through an underground pipe to the 50' x 40' generator building a few yards away. The digester will recover approximately 141,740 cu. ft of gas per day. There is approximately 1 hour of gas storage space in the digester vessel. Gas produced beyond the capacity to be used right away is flared off. The project is expected to produce 65% more electricity than the dairy will use which will be the equivalent of power for 472 average homes.

As the gas reaches the generator building it is first piped through a gas compression unit and then delivered to the 350 kW Gascor engine which produces electricity to be sent out to the grid. Also housed in the generator building is the hot water exchange unit. The generator uses water to cool the engine. This water comes off the generator at 180 degrees and goes to the hot water exchange unit. There it is cooled to 100 degrees and sent through underground piping to the digester vessel to keep the digester at the 100 degree optimal temperature for gas collection. The dairy is planning to make changes necessary to be able to utilize the 180 degree water at the dairy facility to eliminate having to heat water there and then returning water which will be sent to the digester. The water which comes out of the digester is then piped back to the generator where it is reused to cool the engine. The water is contained in a closed loop system so it is used and reused saving on water consumption. A backup furnace is also available in the engine building to heat the digester should it be needed.

As raw manure is pumped into the digester vessel an equal amount leaves the unit. This digested manure flows to the 20' x 40' separator building where it is sent through a screw press at 300 gal per minute to squeeze out as much liquid as possible. The remaining solid product is undigested forages that the cow has excreted. These solids make a very fine bedding product for the cattle stalls allowing the dairy to eliminate the truck loads of bedding products brought in to the farm from other sources. The liquid portion flows out to a retention pond where it is held until the proper time for application to the crop land greatly reducing the need for commercial fertilizers. In both cases, this saves the dairy money and lessens the farm’s carbon footprint. The liquids and the solids
that have been digested are virtually free of pathogens, making them safer for the environment, weed seeds, reducing the amount of chemicals needed to control weeds in the crops, and odor, making them a much more public-friendly product. The process through the digester also makes the nutrients in the manure ready for immediate plant uptake. Normally when manure is used as fertilizer on crop land it has to go through the nitrification process. In the ground this takes 2 to 3 years to complete. The digester completes this nitrification in three weeks in a controlled environment, therefore making the nutrients usable immediately by the plant. This means that the environmental risk is greatly reduced because the product is used right away by the plant and is not in the soil where it can be susceptible to erosion.

A Conditional Use Permit was granted for the project following a formal public hearing by the Winona County Planning Commission on August 17, 2006 and approved by the Board of Commissioners of Winona County on August 22, 2006. The Conditional Use Permit needed by the dairy for this project is typical for Winona County. Seventy people gathered for the public hearing with a variety of questions and comments ranging from concerns that the digester would explode to interest in the advancement of a renewable energy project in our area. The Permit included 23 conditions placed on the dairy by the County.

Additional Milestones:

Work is currently moving forward on the construction of the digester vessel and the piping to bring the manure to the vessel.

Project Status:

The project is on track for the cover to be placed on the digester on July 9th. The collection areas at the ends of the barns are on schedule to be completed by August 1st. The electric generation building is 50% complete. The generator will be delivered the first week in August.

Legal Notice

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Attachment A: Design Layout

Attachment B Notice of a Public Hearing on a Conditional Use Permit
NOTICE OF A PUBLIC HEARING
ON A
CONDITIONAL USE PERMIT

Please take notice that the Winona County Board of Commissioners shall meet on Tuesday, August 22, 2006 at 7:00 p.m. in the Commissioner's Room, Second Floor of the Winona County Government Center, 177 Main Street, Winona, Minnesota, to consider the petition of Diamond K Feed LLC (Alan, Patricia, Jeremy, and Daniel Kreidermacher) to allow an expansion of an animal feedlot that results in a total feedlot in excess of 300 animal units under Section 603.4 (25) of the Winona County Zoning Ordinance. The feedlot proposed to be expanded is located on 160 acres on land in the NW1/4 of Section 27 of Mount Vernon Township, T108N, R9W, of Winona County, Minnesota. The existing feedlot consist of total confinement barns, earthen lined manure storage basins, earthen and HDPE line manure storage basin, a concrete reception pit, solid manure stacking area, feed storage areas and is designed to house 1499 animal units of dairy livestock. The proposed expansion will consist of a total confinement barn and methane digester (concrete) and is designed to house 2240 animal units of dairy livestock.

This publication shall also constitute as notice per Minnesota Statutes §116.07, subd. 7(a), to each resident and each owner of real property within 5,000 feet of the perimeter of the expanding feedlot as required by Minnesota State Law.

For additional information, you may contact:

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Winona, Minnesota 55987
Telephone: 507-457-6335
Fax: 507-457-6469

Date: August 10, 2006

Robert Reinert, County Administrator