



Sievers Family Farms

1 MW CHP Unit

Project Overview

Sievers Family Farms, established in 1873, is a family owned cattle farm located in Stockton, Iowa. The owner of the farm, Bryan Sievers, is an enthusiastic environmental steward of the land and prides himself on using all available resources. In 2007, this attitude became the motivation behind implementing the CHP project. Mr. Sievers was looking to dramatically expand the farm's feedlot, but had significant concerns about any of the expansion's effects on the



Sievers Family Farms- Stockton, Iowa
PHOTO COURTESY OF SIEVERS FAMILY FARMS

carbon footprint. The solution was a 1 MW Combined Heat and Power (CHP) system fueled by the methane produced from an anaerobic digester utilizing cow manure and other substrates. The system consists of a Caterpillar 3516A Engine Generator with heat recovery and produces enough electricity to power the entire feedlot. Excess electricity is purchased by Alliant Energy, a parent company to Interstate Power & Light. The remaining liquids from the digester are used as fertilizer, and the solids for animal bedding and compost. The project was completed in September 2013 and fully operational by December.

Quick Facts

LOCATION: Stockton, Iowa
MARKET SECTOR: Agriculture
FACILITY SIZE: 2,400 head of cattle
GENERATING CAPACITY: 1 Megawatt
EQUIPMENT: (1) Caterpillar 3516A Engine Generator
FUEL: Anaerobic Digester Biogas
BIOGAS PRODUCTION: 390,000 scf/day
IMPLEMENTATION COST: \$7.0 Million
THERMAL APPLICATION: Heating for anaerobic digester
BEGAN OPERATION: 2013

Anaerobic Biomass Digestion and CHP

Bryan Sievers in front of the two anaerobic digester tanks
PHOTO COURTESY OF JOHN SCHULTZ

Expansion of the farm became a reality in 2011. The construction of two barns enabled the farm to increase the head count of cattle from 400 to over 2,400, and with that came a need for better waste management. Instead of stockpiling the manure, which creates an environmental concern, the manure is processed through an anaerobic digester to create biogas combustible in the new CHP unit.

Sievers Farms primarily uses manure from the cattle and ground corn cobs from the cattle feed as the input material for the digester. There are two digesters with a volume of 970,000 gallons each. Approximately 30,300–35,000





Sievers Family Farms' Caterpillar 3516A Engine
PHOTO COURTESY OF SIEVERS FAMILY FARMS

gallons of manure are fed into the tanks alone. The mixture of manure and corn cobs has a solid detention time of roughly 40 days before being utilized. After hydrogen sulfide is removed with scrubbers, the resulting gas quality produced by the digester is extremely favorable — 60–70% methane, 30–32% carbon dioxide. The digestate, or by-product from the anaerobic digestion process, is reused to fertilize corn and soybeans, the primary source of food for the cows.

The digester gas drives a Caterpillar 3516A Engine Generator which generates up to 1 MW of power. An average of 125–145 kW is used onsite for farming operations, and 800 kW is sold to Interstate Power & Light through a Power Purchase Agreement (PPA) at

6.40 cents/kWh. The waste heat from the engine is recovered with a hot water loop to be transferred to the digesters, scraper alleys, reception pits, and bio-fiber drying process. Odor is a miniscule problem as the digestion process removes 99% of the pathogens found in the manure. The majority of the maintenance of the CHP system is performed in-house.

Project Development and Achievements

Bryan Sievers, along with father Glenn and son Jon, traveled to Belgium to visit the headquarters of a leading company in construction of anaerobic digestion plants, Organic Waste Systems (OWS), and to explore similar farm operations in Europe using biogas CHP systems. Ultimately, the farm worked with OWS and Specialty Concrete Construction to design and implement the two 85 feet complete mix digesters, the digestate processing system, and the 1 MW Caterpillar 3516A Engine Generator combined with heat recovery system. Sievers Family Farms and Sievers Renewable Energy also partnered with a local investor, Davidson Renewable Energy, to form AgriReNew, a joint venture to manage the income from sales of energy, environmental credits, bedding and fertilizer from the anaerobic digestion and CHP system.

The entire project totaled \$7 million, including the engine generator, anaerobic digester, effluent storage structures, separated solids storage structures, biomass storage structures, separators, dosing units, pumps, etc. The project used an innovative array of funding sources to pay for the project. In addition to the financial contributions of the owners:

- Caterpillar Financial provided a loan to the project;
- USDA's Rural Energy for America Program (REAP) provided a grant of \$500,000;
- the Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) contributed a grant of \$250,000; and
- Alliant Energy awarded a grant of \$200,000.

The USDA REAP and NRCS EQIP are federal programs that provide agricultural producers financial assistance for renewable energy and energy efficiency improvements and design and implementation efforts that promote clean water, air, and land.

"The project was another step in building an increasingly sustainable business model for the 5th generation of Sievers to farm this fertile land in Eastern Iowa."

-American Biogas Council

The completed Sievers Farm project was awarded Biogas Project of the Year by the American Biogas Council in 2014.

For More Information

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The Midwest CHP TAP is a U.S. DOE sponsored program managed by the Energy Resources Center located at the University of Illinois of Chicago