



# Wadeland Dairy

## 150-kW Renewable CHP System

### Site Description

Wadeland Dairy is a concentrated animal feeding operation with 1,200 Jersey cows. The dairy is located in West Weber, about five miles northwest of Ogden, Utah.

Wadeland Dairy installed an anaerobic digester and renewable CHP system in 2004 as a joint research project with U.S. Department of Agriculture, U.S. Department of Energy, Utah State University, and Wadeland Dairy.

The digester is built on a 45x45 square foot pad, 18" thick. The engine room is about 16x16 square feet.

### Reasons for CHP

The project was installed to test a new high-rate anaerobic digester, called the Induced Blanket Reactor digester or IBR, developed by Utah State University and since licensed to Andigen for commercial sale. Goals of the new technology included design simplicity and reliability, retention of beneficial bacteria, an ideal environment for digestion, reduced digester plugging, and cost-effectiveness. This was the second IBR digester installed in Utah, and the first at a dairy.

### Quick Facts

**LOCATION:** West Weber, Utah

**MARKET SECTOR:** Dairies

**SIMPLE PAYBACK:** 5 years with government grants, or 10 years without (when <60% of the heat can be profitably used)

**TOTAL PROJECT COST:** \$760,000, or \$633 per cow

**CONTRACT WITH UTILITY:** 4.7¢/kWh

**ANNUAL SAVINGS:** \$50,000–\$60,000 (from reduced energy costs and manure handling costs)

**EQUIPMENT:** Induced Blanket Reactor digester, 150-kW Caterpillar engine genset, heat recovery

**FUEL:** Renewable biogas from dairy manure

**USE OF THERMAL ENERGY:** Heat for the digester

**FACILITY SIZE:** 1,200 cows

**FACILITY AVERAGE LOAD:** 20 kW

**CHP IN OPERATION SINCE:** 2004

**ENVIRONMENTAL BENEFITS:** Reduced odor, pathogens, water pollution, methane emissions, and fossil fuel use



Wadeland Dairy in West Weber, Utah

## Digester Configuration & Operation

The IBR digester at Wadeland has four tanks—three of the tanks are 32x13 feet and hold 30,000 gallons each, and the other is 20x13 feet and holds 20,000 gallons. The IBR system is enclosed in an insulated building and is automated with a computer and programmable logic controller (PLC), requiring very little human intervention. IBR uses a modular design, so that if one tank fails, the rest can keep operating uninterrupted.

The IBR works best with 7–8% solids, but can operate with between 1–10% solids. (Manure from a cow is at about 13% solids, so water is added.) The retention time is six days, much shorter than the typical retention time for other digester types of 20 or more days. This translates to reduced storage capacity and lower capital costs. The solids reduction is 60%, compared to an industry average of 40–50%. For maintenance, sludge and sand from the bottom of the tank is removed 2–6 times a year by opening a bottom valve and letting 20 to 100 gallons flow out.

The digester produces about 70,000 cubic feet of biogas per day at 70% methane content (5 ft<sup>3</sup> gas/1 ft<sup>3</sup> of digester space).



Digester and engine room

## CHP System Configuration & Operation

The CHP system uses a 2406 Caterpillar engine generator set rated at 150 kW. The biogas is conditioned with a demister and ambient cooling to remove moisture and some of the hydrogen sulfide. The system runs 24/7. The recovered thermal energy is used to maintain the digester temperature. Wadeland and Andigen handle most of the routine maintenance.

The farm currently runs the engine at almost 100 kW, based on the available amount of biogas. An average of 74 kW is sold to the utility (1,776 kWh per day), and the remainder is used onsite at the farm.

The system has been running since 2004. Permitting and interconnection with the utility took about 7 months. As of May 2006, the system has logged 8100 hours.

## Economics

The total project (including the anaerobic digester and the CHP system) cost \$760,000, or \$633/cow. The system is estimated to save the dairy \$50,000 – \$60,000 per year in both energy savings and manure handling costs.

PacifiCorp pays Wadeland Dairy 4.7¢/kWh for the renewable power, and it does not charge Wadeland Dairy a standby or backup power charge. Maintenance costs (for outside support) have been about 1.3¢/kWh. Without the CHP system in place, Wadeland would otherwise be paying an average of 6 cents per kWh for electricity (an energy charge of 2.9 cents per kWh plus a demand charge and other charges).

## For More Information

**ANDIGEN**  
Ed Watts, President  
435-770-3766  
Logan, Utah  
[ewatts@andigen.com](mailto:ewatts@andigen.com)  
[www.andigen.com](http://www.andigen.com)

**U.S. DOE INTERMOUNTAIN CLEAN  
ENERGY APPLICATION CENTER**  
Christine Brinker  
720-939-8333  
[tbroderick@swenergy.org](mailto:tbroderick@swenergy.org)

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