



DAIRY COWS HELP POWER THE GRID

CLEAN, RENEWABLE ENERGY DERIVED FROM DAIRY WASTE
ROUNDS OUT BUSINESS PLAN FOR LOCAL FARMS

Dairy Biogas Projects in Oregon

- Oregon biogas operations process waste from approximately 37,000 Oregon cows, or 26 percent of the state's 140,000 dairy cows
- Existing dairy biogas plants in Oregon as of the end of 2014 represent more than 8.4 megawatts of generation
- Energy Trust has committed more than \$1.88 million to three biopower projects located at dairies
- At the end of 2014, there were seven operating biopower projects in Oregon that use anaerobic digestion technology to produce biogas from dairy cow manure

Jamie Bansen is a third generation owner of the Forest Glen Oaks dairy farm in Dayton, Ore. The farm, established about 70 years ago by her grandparents, runs three related lines of business: production of certified organic milk from 2,000 registered Jersey cows, an internationally recognized breeding program featuring prized Jersey bulls, and most recently the production and sale of electricity derived from dairy waste.

Revolution Energy Solutions, RES, developed, owns and operates the biogas plant that transforms the dairy's 50,000 gallons of cow manure per day into clean, renewable energy. Energy Trust of Oregon provided a \$441,660 cash incentive to support the renewable energy generation.

Al Tank, managing partner/CEO of RES, learned about Forest Glen Oaks' reputation for innovation and leadership through connections at Oregon State University. Tank grew up on a farm in Iowa and developed expertise in dairy biogas production in Brazil and Mexico.

"My business partner, Brian Barlia, and I walked the farm with Jamie, her father Dan and a third co-owner, Robert Kircher, in 2009. They came to view the waste-to-energy operation as an important step in upgrading their farm's sustainability and managing its resources," Tank explained.

Bansen recalled being wary at first. The dairy had been approached by a number of biogas operators, each with different digester technology and financing arrangements. "Al told us to hold off deciding until the first RES project in Oregon, Lochmead Farms in Junction City, started up," she said. "It soon did and we saw that we could integrate a facility like that into our operations fairly easily."



Project owner Revolution Energy Solutions uses digester tanks like these to transform 50,000 gallons of cow manure per day into renewable energy.

In its simplest form, the biogas plant uses anaerobic digestion to transform the dairy waste to energy-rich biomethane.

The process begins by pumping manure from the farm into a pair of tanks. The liquid is heated, maintained at a constant temperature and mixed in an oxygen-free environment. Bacteria in the tanks digest the manure and produce a renewable biogas comprised mostly of methane. The biogas is cleaned of impurities and then used to fuel a co-generation engine, which produces heat for the tanks and renewable electricity that is delivered and sold to Portland General Electric. The facility produces approximately 3.1 million kilowatt hours of electricity annually, enough to power nearly 300 average Oregon homes for a year.

“The system uses heat from the generator engine to maintain a temperature of 70-75 degrees Fahrenheit,” explained Tank. “The relatively low temperature of manure in the digester tanks makes it easier to monitor and control remotely.”

The benefits of the biogas plant extend beyond renewable energy. By burning the gas, the plant keeps methane—a greenhouse gas—from escaping into the atmosphere.

In addition to improving air quality and reducing greenhouse gases, collecting and processing the dairy waste provides material management benefits that can help protect water quality.

While the biogas produced through anaerobic digestion fuels the co-generation engine, two byproducts are put to work on the farm. First, a nutrient-rich liquid provides fertilizer for the organic dairy’s feed crops. “We’re an organic farm and we can’t use commercial fertilizers,” Bansen said. “We used to spread manure on pastures after they were grazed. The pastures bounce back much faster now when treated with the digester liquid, because the nitrogen is in a form that is more readily available to crops,” she explained.

The dairy composts the second byproduct, an inert fiber, for use as clean bedding for dairy cows. Excess fiber is sold to nearby vineyards to be used as mulch around the base of grape vines.

Forest Glen Oaks is the third biogas project in Oregon for developer RES. Each project uses the same patented low-temperature anaerobic digester technology that was introduced by RES to the United States at Lochmead Farms in 2012.

Oak Lea Farms in Aumsville, the second Oregon biogas project for RES, also received support from Energy Trust. More projects are in planning stages.



Waste from Forest Glen Oaks' dairy cows is used to produce biogas and generate renewable electricity at the Dayton farm.

PROJECT-AT-A-GLANCE

Project team

- Forest Glen Oaks Dairy
- Revolution Energy Solutions, LLC
- Energy Trust
- Oregon Department of Energy
- Portland General Electric
- The Climate Trust
- McMinnville Water & Power

Project details

- 50,000 gallons of feedstock (dairy waste) daily
- Two Bio-Terre Systems low-temperature sequencing batch tanks designed for biogas handling and storage
- Gas treatment system by 2G Cenergy, including dryer/dehumidification and removal of biogas contaminants
- 370-kilowatt combined heat and power system using a MAN engine from 2G Cenergy

Project benefits

- Generates approximately 3.1 million kilowatt hours of electricity annually
- Improves management of animal wastes, odor control and water quality
- Produces useful byproducts: organic liquid fertilizer and a fiber for animal bedding
- Reduces emissions of methane
- Created 25 skilled jobs during construction and one to two ongoing full-time rural jobs

Financial analysis

- \$2.2 million project cost
- \$441,660 Energy Trust cash incentive, based on renewable energy generation
- \$400,000 Oregon Business Energy Tax Credit
- Oregon biomass producer/collector tax credits



This partially buried tank is a plug-flow anaerobic digester that collects and transforms dairy waste into biogas. The gas is then conveyed through the yellow pipe to fuel the co-generation engine.

PROJECT-AT-A-GLANCE

Project team

- Misty Meadow Dairy
- Farm Power
- Energy Trust
- Oregon Department of Energy
- Pacific Power
- Tillamook People's Utility District
- Bonneville Power Administration

Project benefits

- Generates approximately 5.7 million kWh of electricity annually
- Produces useful byproducts: liquid fertilizer and fiber for animal bedding and soil amendment
- Reduces emissions of methane

Financial analysis

- \$4.85 million project cost
- \$1 million Energy Trust cash incentive, based on renewable energy generation
- Oregon Business Energy Tax Credit
- Oregon biomass producer/collector tax credits
- U.S. Department of Agriculture grant

MISTY MEADOW DAIRY, TILLAMOOK COUNTY

Farm Power, a biogas energy project developer in the Pacific Northwest, brought its second Oregon biopower project on line in spring 2013 in Tillamook County with financial support from Energy Trust.

The biopower project collects dairy waste from about 2,500 cows located at the Misty Meadow Dairy and processes the material in a plug-flow anaerobic digester. The digester is a large, partially buried tank that maintains the dairy waste temperature at a steady 100 degrees Fahrenheit.

Inside the million-gallon tank, bacteria biologically digest the heated dairy waste and produce biogas, which fuels a co-generation engine that produces electricity. "Energy Trust support has enabled Farm Power Misty Meadow to complete one of the most innovative manure digesters in North America," said Kevin Maas, president, Farm Power.

The 750-kW co-generation engine produces approximately 5.7 million kWh of electricity annually, enough to power more than 500 average Oregon homes for a year. Electricity generated is then delivered to Pacific Power customers.

In addition to generating power, the project helps protect water quality in the Tillamook watershed. Processed manure is returned to the dairy farmers as an organic fertilizer. The project helps the dairy manage more than 50,000 tons of dairy cow waste per year and produces usable liquid and fiber byproducts. The liquid fertilizer, rich in phosphorous and nitrogen, offsets the need for conventional fertilizers. The fiber portion, the texture of spongy compost, is used for animal bedding and as a soil amendment.



To learn more about Energy Trust assistance and incentives for biopower projects, visit www.energytrust.org/dairy or call **1.866.368.7878**.