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# TOLENAAR HOLSTEINS DAIRY – ELK GROVE, CA

## SYSTEM DESIGN

Tollenaar Holsteins Dairy is located near Elk Grove, California, and has a complete-mix anaerobic digester located on site. The farm has approximately 900 lactating cows producing manure that serves as the feedstock for the complete-mix digester. The digester has been in operation since 2008 and continues to provide a renewable source of energy.

Tollenaar Holsteins Dairy features a mesophilic complete-mix digester that receives manure on a daily basis from approximately 900 cows. The digester is equipped with a 215 kW genset that is employed for electricity-generating purposes. To limit wear and tear on the equipment, the genset runs 3 days on and 1 day off. Currently, the digester receives only animal manure. It is estimated that approximately 113,000 standard cubic feet of biogas is generated on a daily basis.

The total turnkey cost of the complete-mix digester is estimated to be \$1.7 million. The total out-of-pocket costs to the farm operator are approximately \$500,000 and were covered using a conventional bank loan at an interest rate of 5.3 percent. The remaining \$1.2 million in costs were covered using a variety of federal and state cost-sharing and cash reimbursement mechanisms. The grant, cost-share, and cash reimbursement agreements that Tollenaar Holsteins Dairy received included the following:

- a \$500,000 grant from the United States Department of Agriculture's (USDA) Rural Energy for America Program (REAP),
- a \$250,000 cost-share agreement from USDA's Natural Resources Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP),
- a \$250,000 grant from the Sacramento Municipal Utility District (SMUD), and
- a \$200,000 grant from the California Energy Commission.

Annual operating and maintenance costs are estimated to be \$50,000. The farm operator estimates that the simple payback period for the digester is approximately 10 years,

with the expectation that he will continue to receive \$0.06 per kWh of electricity produced from the local utility. The farm has entered into a sell-all utility agreement.

Tollenaar Holsteins Dairy sells animal bedding and compost from the separated solids from the digester. These secondary products currently generate more revenue than the farm operators are able to generate from electricity sales. In addition to these products, the farm operators are experimenting with novel technologies that will reduce emissions of sulfur and nitrogen oxides. Both sulfur and nitrogen oxides are precursors to fine aerosol particulate formation PM2.5. Nitrogen oxides are also precursors to ozone formation, and nitrous oxide is a potent greenhouse gas.



Photo: Tollenaar Holsteins Dairy

- **Population Feeding Digester:** 900
- **Baseline System:** Storage Lagoon
- **Digester Type:** Earth-Supported Mixed
- **System Designer:** RCM International, LLC
- **Biogas Generation:** 113,000 ft<sup>3</sup>/day
- **Biogas Use:** Electricity
- **Generating Capacity:** 215 kW
- **Receiving Utility:** Sacramento Municipal Utility District (SMUD)