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**Industry:**

Anaerobic Digester  
 Equipment Vendor

**Project Type:**

Anaerobic digester project located on the 350-cow dairy in Rutland, MA producing energy, heat, bedding and crop fertilizer with a blend of 25% manure and 75% food waste.

**Project Goals:**

- The digester produces enough biogas to generate electricity for the farm and with excess to export into the local distribution grid.
- The digester system generates approximately \$200 per cow per year in revenue and cost savings to the dairy.
- Jordan Dairy Farms is an example of how a digester is helping Massachusetts solve food waste recycling mandates in the state.

**Study Prepared By:**

Jerry Bingold, VP Energy & Business Development

**Date of Case Study:**

August 2, 2018

# Small Farm Digester – Stabilized long term energy costs, reduced odor, land applied natural fertilizer, alternative waste organics management supporting State mandates

Jordan Dairy Farms, Rutland, MA

**OVERVIEW**

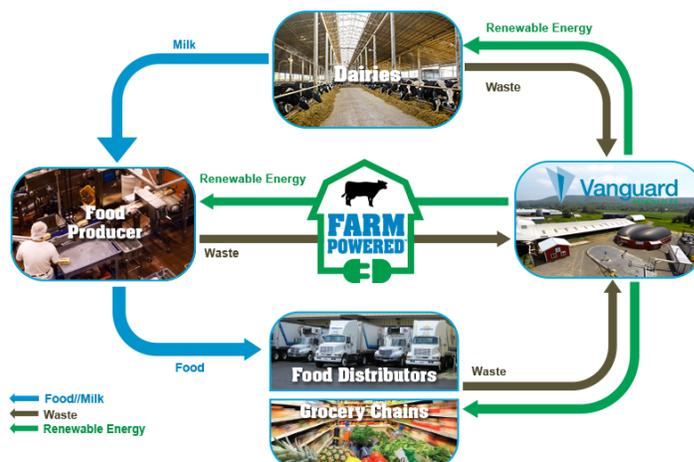
Jordan Dairy Farms, located in Rutland, MA was the first dairy farm in Massachusetts to use anaerobic digester technology to blend farm manure, food scraps, and food processing by-products to produce biogas that is converted into electrical power. The digester system, owned and operated by Vanguard Renewables, has been in operation since 2011 and uses approximately 25% manure from 350 cows and 75% off farm biomass. Off farm waste streams are delivered to the farm daily with tipping fees as revenue for the project. The digester generates approximately \$200 per cow in revenue and cost savings for the dairy from power, heat, bedding, and fertilizer which improves soil carbon and tilth along with improved crop yields.

**BACKGROUND**

Randy Jordan is not tied singly to dairy revenue in his farm, with the digester he adds some additional leverage to the economic swings of farming. Although larger dairy farms have been utilizing digesters for several years, the expertise, time and financial requirements of a digester project can be burdensome for smaller farms. Jordan

collaborated with Vanguard Renewables (AGreen Energy at the time) to build and operate the Farm Powered anaerobic digester. quasar energy group designed, supported the environmental permitting and electrical interconnection process, built, commissioned and trained the operational staff. The quasar anaerobic digestion laboratory worked in conjunction with Vanguard. Once commissioned, the plant was producing biogas

**Vanguard Renewables Closed-Loop Farm Powered™ Process**



that exceeded the design expectations and Vanguard subsequently installed a larger gen-set. “The farmers can’t do it on their own,” says Gerald Palano, Alternative Energy Specialist at the MA Dept of Ag. “The dairies need to partner with companies that specialize in financing, building, and operating farm-based digesters, such as Vanguard.” (quote from CommonWealth Magazine, 1/9/18).

Jordan Dairy Farms recognized that a manure-only anaerobic digester was not economically feasible and sustainable. Without additional revenue from tipping fees and an increase in the amount of daily food waste, the project was not viable. To address this problem, Jordan Farms partnered with what is now Vanguard Renewables to move the project forward, gain the benefit of adding food waste to the digester recipe for a profitable operation. In 2014 when Massachusetts became the first US state to require organic food waste be handled via a method other than landfill deposition, the alternative of sending food waste to an on-farm digester became increasingly appealing. This shift resulted in the availability of enough food waste to assure profitability of the digester while also eliminating landfill use, and reducing greenhouse gas (GHG) emissions, odors, and chemical fertilizer application.

## KEY LEARNINGS

**The Jordan Farms digester is an example of collaboration and third-party investment that delivers results despite challenges. Key points resulting in a successful food waste/manure digester project:**

- Start the process for interconnection with the utility early in the project so that this hurdle doesn’t delay the start up of the plant.
- Work with a respected design-build firm like quasar; one with operational experience, has a dedicated anaerobic digestion lab, thinks like an owner, and will stand behind their design with process and performance warranties.
- Keep as much of the work within contract as possible to eliminate project coordination and communication issues.

- The digestate from the digester is a high value replacement to commercial fertilizer and provides improved tilth, adds needed micronutrients to support improved soil carbon, has increased yields, and improves drought resistance.
- With the excess hydronic heat from the engine (gen-set); Jordan can make plans to heat a greenhouse operation which will provide an additional revenue source for the farm.

## KEY BENEFITS

**Power savings/Production** — Vanguard Renewables owns and operates the AD system located on Jordan Dairy Farms. The digester system supplies the total electricity needs of the farm. Because the entire farm’s power is supplied by the digester, the farm no longer pays the utility for electricity.

**Electricity sales** — The digester is producing enough electricity to power the farm and provides energy via net metering credits to area businesses. Polar Beverages and Wachusett Brewing Company purchase all of the electricity produced at the farm.

**Environmental benefits** — Food manufacturers and users can comply with the Massachusetts organic food waste ban by sending food waste to the digester that would have previously gone to a landfill. They can also purchase power from the Farm Powered digester via net metering credits. These sustainability initiatives can be important to meet corporate sustainability goals and appeal to sustainably-conscious customers.

**Sustainability benefits** — By incorporating the Farm Powered anaerobic digester, the dairy reduces greenhouse emissions, farm odors, and phosphorus and nitrogen soil loading and runoff, as well as the farm’s dependence on synthetic fertilizer.

**Economic benefits** — The added revenue and cost reductions from the digester operation provide income to help sustain the dairy.

## Key Benefits & Results:

- Jordan Farms is a unique partnership between the dairy, third-party developer and technology suppliers.
- It is an effective business plan for large and small dairies to pay back initial capital investments from gross receipts from electricity, bedding fiber, tipping fees and environmental credits.
- The digester annually produces 7,008 MWh of renewable energy, which is equivalent to the annual energy needs of 1,600 homes while offsetting 19,779 lbs. of CO<sub>2</sub> emissions daily.
- The system improves manure management, reduces odors and produces fertilizer to increasing crop yields.
- In excess of 20,000 tons of food waste is diverted from New England landfills or waste treatment plants supporting the state organics mandates.
- The digester fits seamlessly into this New England Dairy Farm and has revolutionized how the farm gets electrical power.



### NEWTRIENT

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## RESULTS

More than 20,000 tons of food waste annually from food processors and users is combined with more than 9,000 tons of manure a year from the farm in a 500,000-gallon digestion tank. Manure and food waste are mixed and microorganisms convert sugars, fats, and other compounds into biogas annually producing more than 7,008 MWh of renewable energy and odor-free, organic, liquid fertilizer to increase crop yields. The anaerobic digester has revolutionized how the farm gets power, while fitting seamlessly into this New England dairy farm.

## CONCLUSION

Since becoming the state's first farm to co-digest food and manure in 2011, Jordan Farms has been successful enough to increase digester biogas production and its electric generator size from 300 kilowatts to 800 kilowatts. Randy Jordan, who runs the fifth-generation family farm with his brother Brian, plans to add a one-megawatt system on another farm they own in nearby Spencer. "People ask if we're successful. And the way I describe success is that the doors are still open," says Jordan. "We're still making milk and we're still making electricity."

CommonWealth Magazine 1/9/18



Anaerobic Digester at Jordan Dairy Farm.

### Organizations Involved:

#### Farm or facility

Jordan Dairy Farms

#### Design/builder

Quasar Energy Group

#### Developers

Vanguard Renewables

#### Electrical utility

National Grid

### Funding and Assistance:

1603 Investment

Tax Credit program

#### Bank or lender

Farm Credit

### Equipment and Technology:

#### Manure collection

Scraped from slat barn into pit and pumped to digester

#### Digester

Complete Mix, quasar energy group

#### Preprocessing

Food waste receiving, testing and manure mixing tanks

#### Energy systems

Martin Energy Group



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## JORDAN DAIRY FARMS DIGESTER PROJECT BY THE NUMBERS

<b>Location type</b>	Located in Rutland, MA Jordan Dairy Farms, Inc. is a 5th Generation Dairy Farm run by brothers Randy and Brian Jordan. Jordan Dairy Farms, Inc. is home to 800 head of Holsteins, milking 300 cows three times per day. The farm utilizes 950 acres of fields planted with corn or hay.
<b>Number of animals</b>	350 milking head
<b>Type of bedding</b>	Manure fiber
<b>Manure collection</b>	Scraped from slat barn into pit and pumped to digester
<b>Daily flow</b>	Complete mix designed to process 65,000 gallons/day of 25% cow manure and 75% food waste
<b>System designed by</b>	Vanguard Renewables, LLC and quasar energy group, LLC
<b>Date operational</b>	June 2011
<b>Energy Produced/required</b>	800 kw with a15% parasitic load
<b>Biogas production</b>	200,000 standard cubic feet/day
<b>Installed electrical generation</b>	800 kW
<b>Products produced</b>	Electricity, fertilizer, bedding, compost, heat
<b>Residual materials</b>	Separated solids and liquids
<b>Residual storage</b>	Lagoons
<b>Residual use</b>	Crop application that reduces fertilizer purchases
<b>Electric utility</b>	National Grid
<b>Engine brand</b>	Martin Machinery
<b>Feedstock</b>	Food waste and manure
<b>Products/by-products</b>	Electricity/fertilizer/bedding/compost
<b>Ownership structure</b>	Vanguard Renewables (developer owned and operated)

## FINANCIAL INFORMATION

<b>Investment</b>	\$3.4 million, including equipment and installation costs (site work, electrical, etc.), engine, development/management, legal, accounting, administrative fees
<b>Annual operating and maintenance cost</b>	\$100,00 to \$200,000
<b>Revenue</b>	\$500,000 annually
<b>Payback period</b>	7 to 9 years (with Investment Tax Credits)

For more information about quasar energy group, visit our website at [www.quasareg.com](http://www.quasareg.com), email us at [info@quasareg.com](mailto:info@quasareg.com), or call us at 216-986-999, x117.

Newtrient’s mission is to help all dairy farmers reduce the environmental footprint of manure while enhancing their economic opportunities and their social license to operate. The information contained in this case study was developed with the cooperation of the organizations involved and Newtrient has endeavoured to make sure it is accurate and complete as possible.



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