NEWTRIENT
INNOVATIVE SOLUTIONS IN RESOURCE RECOVERY

CASE STUDY

DVO Two Stage Linear Vortex™ Anaerobic Digester

Big Sky West Dairy, Jerome, ID

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Industry:
Dairy

Project type:
Anaerobic Digestion as well as solids, nutrient and wastewater treatment

Project goal:
DVO Two Stage Mixed Plug Flow™

Study Prepared by:
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Date of Case Study:
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OVERVIEW

4,300 Wet Cow Equivalents of Manure

Manure is collected via a scrape, flush-flume system prior to entry into a double-U shaped DVO patented mixed plug flow digester. Effluent from the digester is then sent through Houle primary and secondary screens for fibrous solids separation as well as an AL-2 belt-press flocculation separator for additional fine solids separation. Treated wastewater ultimately resides in lagoon storage before field application.

BACKGROUND

Original example of a third-party owned and operated model utilizing DVO's patented mixed plug flow technology.

Dean Foods Company and Ag Power Partners, LLC formed DF-AP, which owns and operates the project entitled DF-AP #1. As a third party owner and operator, it takes the financial burden of the project, providing for all project development, manure supply, financial, and off-take agreements—in turn being responsible for securing payment of loans and return to equity investors.

Dairy manure from the 4,300 wet cow equivalent dairy is scraped and sent to a flush-flume prior to pumping into the mixed plug flow digester.

The digester is designed as a double U, meaning approximately ½ of the pumped manure is sent through one U-shaped pattern that shares a common wall with a second U-shaped pattern treating the other half. The digester operates at 100 degree Fahrenheit, mesophilic temperature using DVO's patented first-in/first-out plug flow design that is also mixed axially via unique gas recirculation design to accentuate manure/bacteria reaction while allowing for a range of manure solids concentrations.

The result is a digester that takes advantage of complete-mix properties while maintaining the forward plug flow property and its ability to supply a guaranteed hydraulic retention time.

Effluent is further treated in Houle primary and secondary screens for separation of fibrous solids. Additional fine solids removal is accomplished through an installed AL-2 belt press flocculation system.

Produced biogas is processed via two SFGLD 560 Guascor engine/generator sets rated for 710 KW each. Engine sets are outfitted with heat recovery units, with recovered heat used to maintain digester temperature throughout the seasons. Excess heat is dumped to the atmosphere through dump radiators.

Electricity and Renewable Energy Credit agreements and off-takes are negotiated via arrangement with Idaho Power. Carbon credits for methane gas mitigation are monetized and fibrous solids are used as both dairy bedding on-farm and as a soil amendment.

Regenis—An Andgar Company is contracted to supply full on-site operation and maintenance starting with the feed to the digester and ending with return of treated wastewater and bedding to the dairy.

RESULTS

Since installation in 2008 and commission in January 2009, the digester and auxiliary systems have been treating 154,799 gallons per day of manure, producing on average 501,231 cubic feet of biogas per day, yielding through the engine/generator sets an average gross electrical production rate of 1,032 kWh/h. The project has also been producing high quality fibrous solids as well as further treated, phosphorus-reduced tea water from complimentary screens and AL-2 polymer belt-press units.

Table 1 (below) summarizes the performance of the digester system, notably producing around 115 cubic feet per cow per day of biogas, which given the approximate total solids and volatile solids being fed to the digester results in around 0.26 cubic meters of methane gas per kilogram of volatile solids fed. This value is commensurate with what literature states is the possible performance from a well working mesophilic digester being fed dairy manure.

Figure 1 (below) is a graphical representation of the 2009-2015 data for manure flow, biogas production and electrical production. As can be seen from the graph, quite consistent operation has occurred with rather consistent electrical production across the years, thanks in part to a historical engine uptime of 98%. Average parasitic electrical load off of the above gross electrical production and 98% runtime is calculated at 8.6% for the digester/engine system and 9.5% when all other processing equipment is included.

CONCLUSION

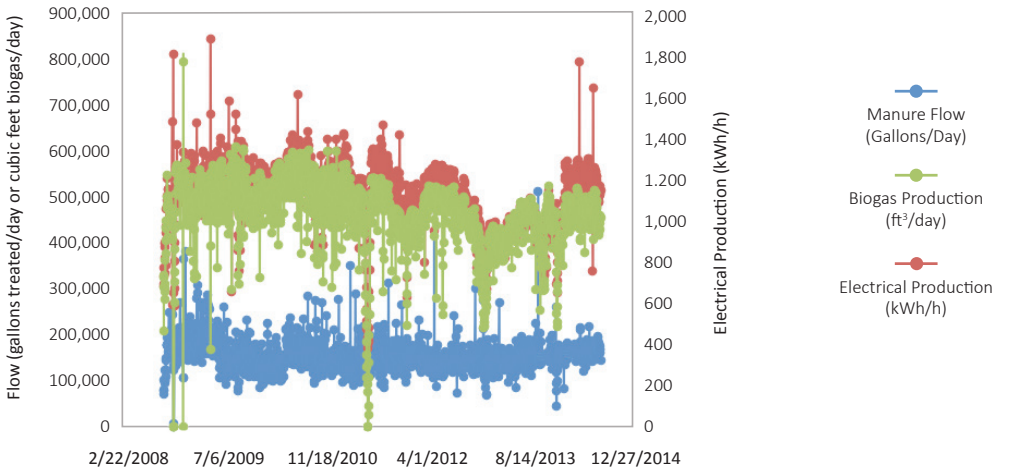
The Big Sky West project leads the way in proving a viable third-party investor/operator model for dairy anaerobic digestion and continues to offer sought after economic returns as well as manure management benefits to both the investors and the dairy. Core to this is the effective operation of the DVO Two Stage Mixed Plug Flow™ anaerobic digester that via extensive released data shows strong uptime, low parasitic electrical use, and high biogas performance.

TABLE 1. PERFORMANCE OF THE DIGESTER SYSTEM

Parameter	Units	Average Production
Cows	#	4,300
Total Solids	%	6.9
Volatile Solids	% of TS	70
Manure Flow	gallons/day	154,799 +/- 33,094
Biogas	ft^3/day	501,231 +/- 67,999
Electrical Production	kWh/h	1,032 +/- 165
Performance	ft^3/cow/day	116 +/- 16
Performance [1]	m^3 CH_4/kg VS	0.26

[1] Approximate values of TS, VS and digester has very small, intermittent substrate addition, so not totally dairy manure based value.

FIGURE 1. PRODUCTION DATA BIG SKY WEST DAIRY ANAEROBIC DIGESTER 2009-2014



Key Benefits & Results Summary:

- Unique project partnership between dairy, third-party developer, technology provider and contracted O/M specialist.
- Effective business plan for net revenues to payback initial investment from gross receipts related to electricity, fiber, and environmental credits.
- Biogas production on the order of 115 ft3 per cow per day, producing over 1 MW of electrical production as well as treated effluent and separated fibrous solids.
- Improved manure management thanks to reduction of odors and pathogens from the digester as well as reduced nutrients from use of the screens and polymer flocculation systems.

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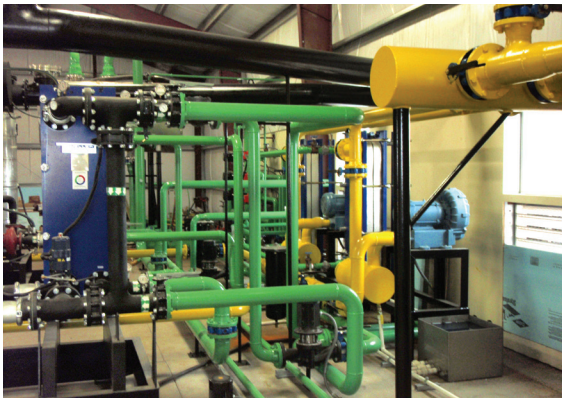
FINANCIAL INFORMATION

Capital investment	$4.68 million dollar construction and $5.3 million total development costs using 2009 dollars.
Annual operating and maintenance cost	Annual operating and maintenance for the project including digester, engine/electrical system and fibrous screening is $70/cow/year or roughly $300,000 per year.

Two SFGLD 560 Guascor engine/generator sets rated at 710 KW each.



Gas, hot water, and gas recirculation mixing piping within engine/electrical building.

Ammonia-free fiber is used as cow bedding.

For more information about DVO Incorporated, or to join our mailing list, email info@newtrientllc.com.

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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