

FINAL REPORT

NRCS 68-3A75-6-167

Eric Shafer Renewable Energy Generation on Broiler Poultry Farms

Project Status:

The construction phase of the project is complete and the system startup has begun. There have been several changes to the original design of the system. There were changes brought about by technological improvements, but the most significant change was due to unforeseen problems with the interconnection of the system to the local power grid. The state of Mississippi currently has no net metering legislation. The local power provider is an REA, rural electric authority, co-operative that does not benefit from federal and other incentives to use "green" energy. To date they have not been willing to come up with an equitable interconnect agreement. This unfortunate situation has led to the change from an interconnected system to a self-generating system.

As a result of the change to a self-generating system another problem was created in the utilization of the gas produced from the system. The digester gas production is at a fairly constant rate, but the farm consumption is at a very erratic rate. The farm will consume gas energy to produce heat and electricity. Consumption can be very low or very high depending on several variables such as weather, age of flock, and other farm demands. Interconnection with the local power authority would have been beneficial by providing a constant usage for the energy produced from the gas as well as an economic benefit.

Several issues arose, during the construction phase of the system, that led to long unforeseen delays and expense adjustments. There were long lead times in the manufacturing of some of the major components necessary for the system. There was a lack of specialized labor in the local area, resulting in the necessity to contract labor from other areas sometimes from very long distances. The project did exceed predicted budget expenses, see attached spread sheet. The overages were a result of material price increases due to the extended length of construction and by the previously mentioned design changes and labor expenses.

To date, the initial data predictions concerning the by-product discharged from the system is positive. This data reflex significant benefits to both air and soil in the nutrient values and environmental values in the usage of this by-product for fertilizers. These benefits may even out way the energy benefit. Because of this data, design of the out flow filter system is still ongoing and will be based on environmental and market considerations of both liquid and solid fertilizers.

The future of the project looks very positive. In spite of the delays and other issues the project is expected to function and produce well, and will benefit the environment and the farm successfully. The reduction of farm energy costs will be significant as well as the significant impact on environmental quality through the production and usage of "green" energy. The enhanced nutrient values of the by-product will also add an economic benefit. Hard data on the output production of both gas and by-product of the system is of course not available yet, as the system is just now starting up. This information will be forwarded in future reports as it becomes available.

The use of knowledge gained and data collected on this project will benefit future systems of its kind. It will enable construction cost to be lowered, time constraints shortened, and better legislation to be passed regarding interconnected systems. This will also add to the economic benefit from the sale of electricity and the environmental benefit with the production of "green" energy. There are also several other uses and processes that are being examined that are believed will further enhance the production and usage for the system.

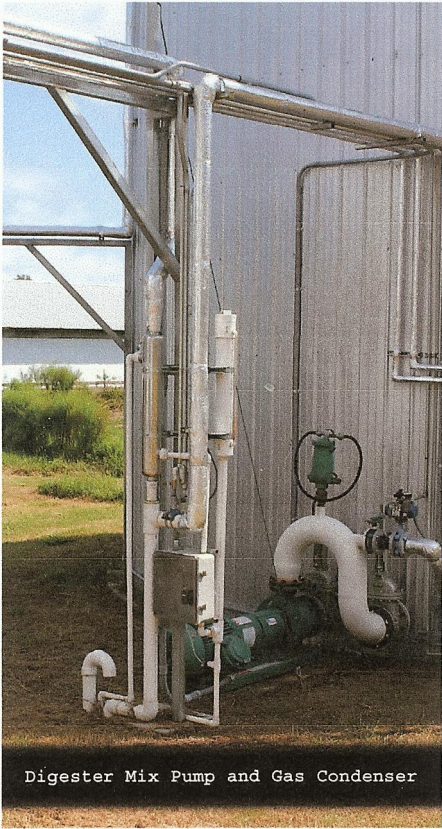
Eric Shafer
Renewable Energy Generation on Broiler Poultry Farms

Anaerobic Digester Construction and System Layout

- I. The system consists of a series of tanks with interconnecting piping and various pumping, mixing, and control apparatus.
 - Tank 1: 18,000 gallon insulated hot water tank.
This tank is heated by a boiler and captured heat from the generator exhaust.
 - Tank 2: 9,000 gallon insulated premix tank.
This tank blends the chicken waste with hot water to form a slurry before transferring to the digester tank.
 - Tank 3: 238,000 gallon insulated digester tank.
This tank produces the methane. The chicken waste slurry is processed (digested) by the microbes. This tank is also heated by the boiler.
 - Tank 4: 1,000 gallon sump tank.
This tank collects filtered outflow water from the digester. It is collected and recycled back through the system.
 - Tank 5: 20,000 gallon recycle water and liquid fertilizer settling tank.
This tank collects the sump tank water. The top level of this tank is recycled back to the hot water tank. The lower half concentrates to a high grade liquid fertilizer.
- II. The gas process is as follows:

Methane gas is produced by the microbes and rises to the top of the digester. This gas is then drawn off and passed through a condenser to remove moisture. It then goes through a scrubber to remove H₂S (Hydrogen sulfide) followed by a sock filter. The gas is then compressed to 200 psi in two high pressure tanks for storage and use. This gas pressure is then regulated down and piped to the system boiler, electric generator, and chicken house heating systems.
- III. The liquid out flow is processed as follows:

Liquid out flows from the digester in direct proportion to the feed rate. This liquid has any solids filtered out. The liquid is recycled back into the system. The solids are collected as a high grade fertilizer.
- IV. The entire system is operated and monitored by a computer controlled PLC system. This system is also used to log all data in the process.



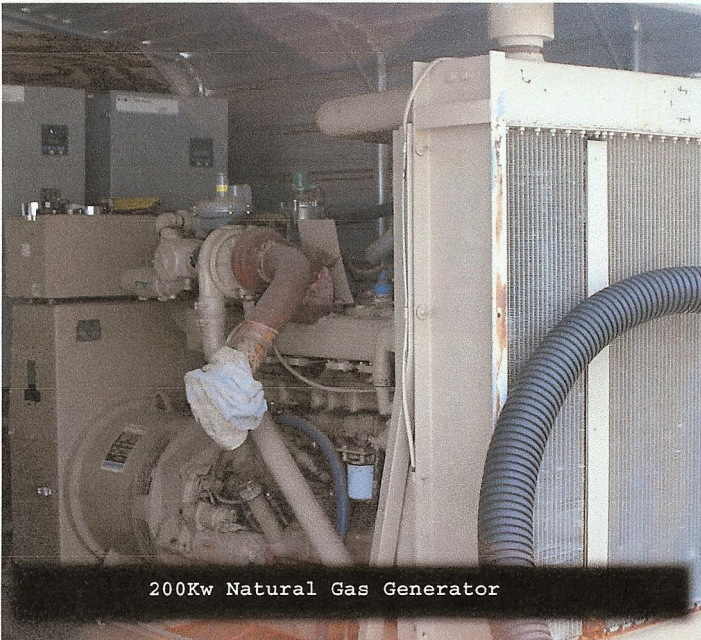
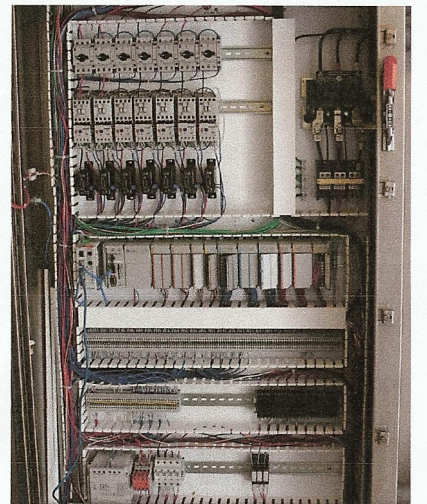
Digester Mix Pump and Gas Condenser



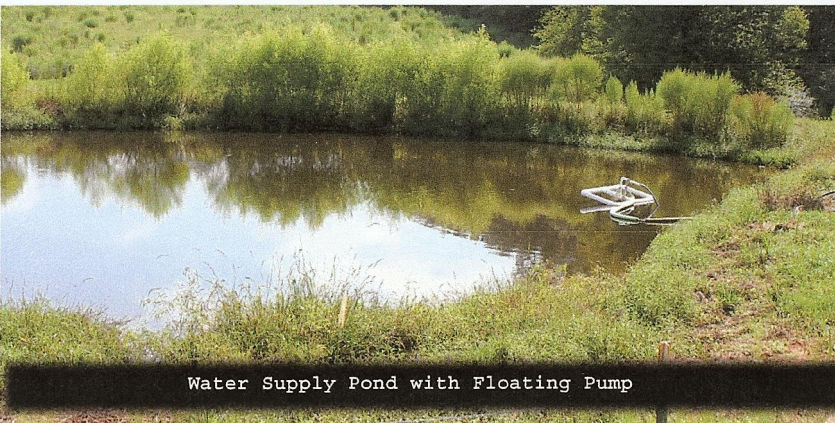
Boiler and Air Compressor



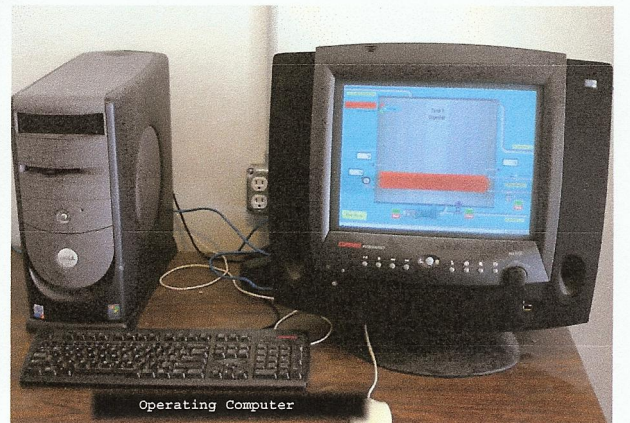
Variable Frequency Drives



200Kw Natural Gas Generator



Water Supply Pond with Floating Pump



Operating Computer



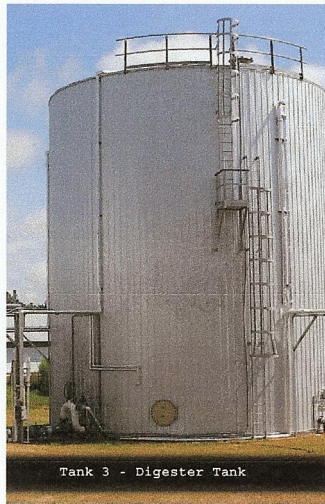
Tank 1 - Hot Water Tank



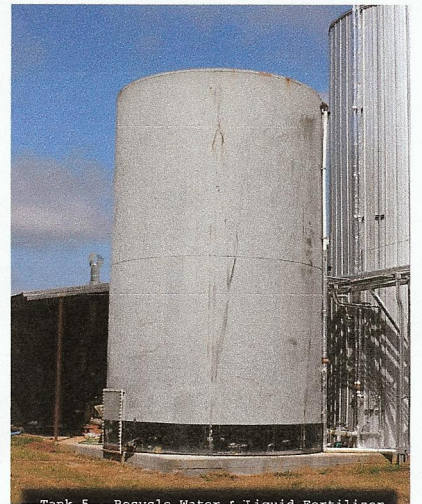
Overall View



Tank 2 - Pre-Mix Tank (Side View)



Tank 3 - Digester Tank



Tank 5 - Recycle Water & Liquid Fertilizer



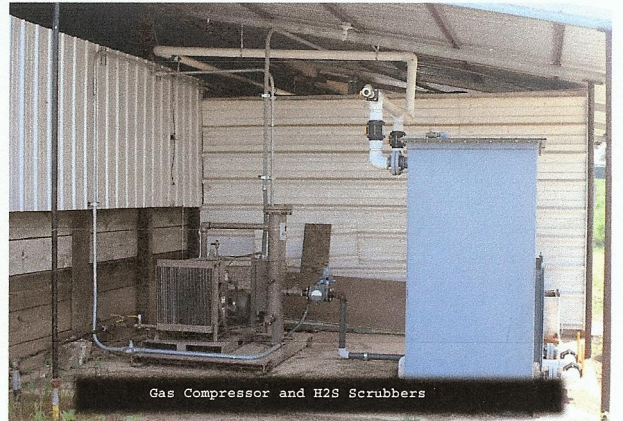
Tank 2 - Pre-Mix Tank (Front View)



Outflow Filter Shed with Underground Sump Tank - Tank 4



Gas Storage Tanks



Gas Compressor and H2S Scrubbers

Summary Expense Report

PURPOSE: Digester Construction

FARM INFORMATION:

Name	<u>Shafer Farm</u>	Position	<u>Owner</u>
Farm Division	<u>Farm Digester</u>	Manager	<u>Eric Shafer</u>

Year	Month	Total
2007	May	\$2,000.00
2007	August	\$173,663.63
2007	September	\$43,559.66
2007	October	\$3,922.05
2007	November	\$61,822.94
2007	December	\$52,687.03
2008	January	\$4,378.32
2008	February	\$23,269.20
2008	March	\$2,268.45
2008	April	\$23,816.66
2008	May	\$34,445.46
2008	June	\$5,938.28
2008	July	\$998.43
2008	August	\$454.58
2008	September	\$114.51
2008	October	\$102.42
2008	November	\$380.96
2008	December	\$6,869.13
2009	January	\$1,267.53
2009	February	\$3,413.88
2009	March	\$28,074.71
2009	April	\$31,237.01
2009	May	\$84,087.02
2009	June	\$162.90
2009	July	\$2.75
2009	August	\$346.31
2009	September	\$0.00
		\$589,283.82

Start Budget	\$608,300.00
Expense	\$589,283.82
Expense (In-Kind)	\$75,000.00
Outstanding Invoices	
Balance Budget	\$55,983.82