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BUTLER FARMS – LILLINGTON, NC

SWINE FARM IN NORTH CAROLINA – HARNESSING “PIG POWER”

SYSTEM DESIGN

Butler Farms is a swine-finishing operation located in Lillington, North Carolina. The farm has been in operation since 1995 and has upgraded from two covered lagoons (covers installed in 2008) to a covered lagoon anaerobic digester. In 2012, the new covered lagoon digester was installed, and the digester began operation. The operation has approximately 8,000 head of swine that feed the anaerobic digester. Currently, no codigestion is conducted; however, the farm is considering codigestion of a food waste feedstock: potato sludge. The food waste feedstock will be hauled to the farm in 6,000-gallon tanker trucks.

The new covered lagoon digester is expected to provide odor control, rainwater runoff control, and marketable carbon credits for greenhouse gas (GHG) emissions reductions. These benefits are in addition to the electricity that Butler Farms will generate from the production and use of on-farm renewable biogas.

The digester is a covered, earthen lagoon lined with a synthetic liner. The covered lagoon is a mesophilic, mixed, and insulated anaerobic digester that operates at a temperature of 95°F to 105°F. The digester receives manure from approximately 1.5 swine barn pits each day. The covered lagoon digester dimensions are 190 feet x 85 feet x 18 feet, with a volume of approximately 1 million gallons. The hydraulic retention time for this digester is just over 21 days. The effluent from the covered lagoon digester is sent to one of two covered overflow lagoons (that were part of the farm's previous lagoon system). Biogas is collected from the covered lagoon digester and also from the two covered overflow lagoons receiving digester effluent. Biogas production is estimated to be 12,000,000 standard cubic feet per year. If codigestion is implemented, the biogas yield is expected to significantly increase (up to 3 to 10 times, depending on the waste used). End uses for biogas from the digester include electricity generation, which is sold back through a buy all/sell all utility agreement with the farm's electric cooperative, and use of waste heat to heat the digester. Biogas generated on the farm is scrubbed in a hydrogen sulfide scrubber to remove hydrogen sulfide gas. The digester is equipped with a 180 kW genset used for generating electricity. Approximately 545,000 kWh of electricity are

expected to be produced on the farm annually from swine waste. Waste heat from the genset is captured, recovered, and used to heat the digester to promote maximum biogas production.

As part of their plan to implement codigestion of food wastes, the digester has been equipped with a 20,000-gallon mixing tank. The mixing tank will be used to incorporate off-farm food waste.

The total turnkey cost of the digester and its auxiliary equipment (e.g., mixing tank, lagoon cover, genset, hydrogen sulfide [H₂S] scrubber) is estimated to be \$550,000 to \$650,000. The facility also notes that, in addition to capital equipment costs, an unknown amount of expense was incurred for connecting to the electricity grid, which allows for off-farm use of the electricity generated from the digester biogas. Butler Farms relied on grants, cost-sharing, and cash reimbursement agreements to cover the up-front capital and operating and maintenance (O&M) cost of the digester. The grants, cost-sharing, and cash reimbursement agreements that Butler Farms received include the following:

- A combined \$373,780 grant from the North Carolina State Energy Office and the North Carolina Green Business Fund (both grants were administered at the state level, but ultimately the funds were derived from the federal-level American Recovery and Reinvestment Act [ARRA]);
- A \$116,480 cost-sharing agreement from the United States Department of Agriculture's (USDA) Natural Resources Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP), a \$20,000 grant from the North Carolina Farm Bureau Federation's Farm Energy Efficiency Program (FEET); and
- A 30 percent cash grant of eligible cost spent on the project from the ARRA Section 1603 Program.

Butler Farms estimates that the total out-of-pocket cost of the digester will be approximately \$50,000 over the first year of operation. This out-of-pocket expense includes the remaining capital cost not covered by grants, cost-sharing, or cash reimbursements and the cost of operating and



maintaining the digester over the first year. Butler Farms estimates that the annual O&M cost is approximately \$25,000 (based on estimated O&M costs ranging from approximately \$0.035 to \$0.050 per kWh of electricity produced). The vendor estimated a simple payback period of 8 to 10 years, with the expectation that the equipment has a life of 15 to 20 years. Butler Farms hopes to shorten the simple payback period with increased biogas production from planned codigestion.

PROJECT BENEFITS

Butler Farms expects to generate up to 545,000 kWh of electricity per year from swine waste (and an additional 715,000 kWh from off-farm food waste when planned codigestion begins) for sale to the electric cooperative. Butler Farms estimates that revenue generated from electricity sales from swine waste alone each year will be \$56,500 (and up to \$130,600 per year with codigestion).

Butler Farms is actively researching other revenue streams that could be generated in the waste-to-energy markets, but currently generates revenue only in the form of electricity sold and use of the waste heat.

In 2012, Butler Farms biogas project was featured in The Travel Channel's "Off Limits" program. Additionally, the North Carolina Energy Division showcased the [Pig Power](#) project in October 2012.

"Renewable energy is not a tree-hugger thing. It's just a sensible thing to do with your waste."

—Tom Butler, Butler Farms
As quoted in North Carolina Energy Division

- **Population Feeding Digester:** 7,890
- **Baseline System:** Storage Lagoon
- **Digester Type:** Covered Lagoon
- **System Designer:** RCM Developed by Environmental Credit Corp.; Cover installed by Environmental Fabrics, Inc.
- **Biogas Generation:** 32,000 ft³/day
- **Biogas Use:** Electricity
- **Generating Capacity:** 180 kW
- **Receiving Utility:** South River EMC