

# NC porkreport

## North Carolina's new biogas facility



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# First of its kind renewable energy project will include North Carolina-derived gas injected into natural gas pipeline by 2018

**A** RENEWABLE ENERGY PROJECT in Duplin County is expected to become fully operational in early 2018 in a moment that will trigger a number of firsts for the first-of-its-kind project in North Carolina.

The project, Optima KV, is a collaboration between two local farmers, Smithfield Foods, investors and Cavanaugh Associates LLC. And while it's not the first renewable energy project to capture methane gas from hogs, it is the first one in North Carolina that will inject that gas into the natural gas pipeline to be used by local utility companies.

But most significantly, it will be the first North Carolina-derived gas in the pipeline. Despite many years of debate among policy makers about the potential for hydraulic fracturing ("fracking") in the state, the first native gas in the pipeline won't be from shale gas; it will be from hogs.

The inaugural five farms that make up Optima KV (the KV stands for Kenansville) are owned by two farmers: John Kilpatrick and Greg Brown.

For Brown, who has been in the hog business for 45 years, the decision to take part in the Optima KV project was largely an economical one. "The value of having the methane converted to

natural gas was worth it...well worth it," he said.

## CAPTURING THE METHANE

Gus Simmons of Cavanaugh LLC, and the designer of the project, explained that the system works much like other swine waste-to-energy projects, in that the methane is captured in an anaerobic digester that is similar in its appearance and operation to a covered lagoon.

In this case, manure and wastes from the animal barns are flushed into a newly constructed, synthetically lined and covered in-ground digester that services each farm or cluster of barns. The digesters, which are lined and covered



Stations next to each covered digester pre-conditions the bio-gas before going to the refinery.



with a 60 ml impermeable plastic cover, range in size from 1.7 million gallons to 3 million gallons each.

Lift stations are installed at each farm to pump manure from the hog houses to the new digester. A gravity bypass line routes the flow of flushed manure to the existing lagoon in the event of disruption in operations of the digester, which maintains farm operations at all times. Additional pumps used to mix the digesters can also be used for sludge removal on a more regular basis.

The farms' former lagoons are used to store the effluent after it leaves the digester. The nutrient content (PAN) of the effluent remains largely unchanged by the digester. However, the resulting nitrogen is more soluble and ready to be used by plants, which will have a benefit in the fields.

"The covered digester provides a more optimal environment for the naturally occurring anaerobic bacteria to consume organic material in the manure and wastes," said Simmons. The bacteria respire biogas, which is comprised of about 65 percent methane and 34 percent carbon dioxide.

At each farm, a small, low-power compressor pulls biogas from beneath the cover, filters the biogas for particulates, and removes moisture through a simple condenser, a step referred to as pre-conditioning.

The pre-conditioned gas is then transmitted to a central refinery through low-pressure, small diameter pipes. Each participating farm is less than three miles away from that refinery, which is located on land owned by Smithfield Foods.

### INTO THE PIPELINE

At the central refinery, a series of filtration processes remove the carbon dioxide and other constituents, which are separated and flared. This process leaves a product gas that is at least 96 percent methane, or natural gas. Once refined, the product gas (also known as renewable natural gas) is pressurized to 1000 psi for injection into the existing pipeline network, owned by Piedmont Natural Gas.

Duke Energy has committed to buying the swine waste-derived biogas, which will help the company meet



Covering the lagoon



Gus Simmons, designer, and project partner Mark Maloney stand on the inflated digester cover at one of the farms.



Methane goes through a multi-stage cleaning process and automated testing before being released into the pipeline.



## WILLIAM G. "GUS" SIMMONS, JR., PE

Gus Simmons is the director of bioenergy for Cavanaugh LLC, a consulting firm that develops solutions and programs that optimize water efficiency and waste-to-energy. But he's no stranger to the pork industry. His father, W.G. Simmons, is a retired extension agent and a member of the N.C. Pork Council Hall of Fame.

Talking to Gus, it's obvious that he found his passion in his job, which combines his agricultural background and his love of design and engineering.

He joined Cavanaugh in 2001 as project manager for the firm's efforts to assist the State of North Carolina with projects to evaluate innovative approaches to managing agricultural wastes. Gus has led the development of innovative organic waste treatment solutions for the municipal, industrial, and agricultural sectors. In all of these cases, a commitment to stewardship can be observed – through pollution control, financial efficiency, and beneficial reuse of water, carbon, and nutrients.

This summer, Gov. Roy Cooper appointed Gus to the N.C. Energy Policy Council, citing his extensive knowledge and experience in natural gas and associated hydrocarbon exploration, development and production.

The N.C. Energy Policy Council advises the governor and General Assembly on legislation and rulemaking that addresses domestic energy exploration, protects the environment and encourages economic development. Council responsibilities include developing a comprehensive energy policy that addresses present and future needs, while moving North Carolina and the country toward energy independence.

state-mandated goals. Under North Carolina's Renewable Energy Portfolio Standard (REPS) law, electric utilities must meet specific compliance targets for swine and poultry waste.

According to Duke Energy, under a 15-year term, Optima KV is expected to

produce about 80,000 MMBtus of renewable natural gas a year. Duke Energy should yield about 11,000 megawatt-hours of renewable energy annually – enough to power about 880 homes for a year.

Unlike existing swine waste-to-energy projects where the electricity is created

onsite, the Optima KV biogas will be nominated for use at two of Duke Energy's power plants located in Wayne and New Hanover counties. The actual swine biogas molecules won't likely be used at these plants, but by other customers connected to the pipeline system. Rather, the purchased biogas will offset what Duke would already be pulling out of the pipeline.

This approach, known as "directed biogas," has its benefits over creating electricity on the farm site. Duke's power plants are more efficient than any on-site generator would be. Further, this approach allows the farmer or project developer to bypass the need to connect to the electrical grid where the wait time for interconnection has – in some cases – taken several years.

Directed biogas also has its challenges. The equipment required to refine the biogas is costly and with the current natural gas pipeline infrastructure in eastern North Carolina, the locations where this exact model could work are limited.

### SEEING THE POTENTIAL

Despite those challenges, the directed biogas model has a lot of potential. In fact, Simmons says the Optima KV central refinery is built for more capacity than will be currently utilized and the opportunity exists for more farms to be connected.



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Not only that, he says North Carolina is recognized for having the third greatest bioenergy potential in the U.S., mostly because of the opportunity to capture biogas from the swine industry.

“Since renewable natural gas can be used for any purpose currently met by conventional natural gas – such as electricity generation, transportation fuels, grain drying, manufacturing – this creates great opportunities for the North Carolina swine industry to export farm-based energy to customers across the country,” said Simmons.

Duke Energy sees the potential too.

“Duke Energy recognizes the promise of renewable natural gas – in particular, RNG derived from swine waste – as a part of its future energy mix,” said Travis Payne, Duke Energy Business Development Manager. “Optima KV is just the first of what we expect to be many directed biogas efforts in the state.”

It’s a sentiment that is echoed by Kraig Westerbeek senior director of Smithfield Renewables and Hog Production Division Environmental Affairs, who is hopeful that the project can be replicated on more farms in eastern North Carolina.

“Biogas capture and conversion to renewable natural gas is very much aligned with our recently announced carbon reduction initiative, and consistent with other renewable energy projects that are located on Smithfield farms across North America,” Westerbeek said. “This approach takes advantage of the developing market for renewable natural gas, while reducing issues related to creating electricity at the farm level. We are hopeful that directed biogas will provide an opportunity for many more farms in Eastern N.C. to participate in similar projects moving forward.”


#### ABOUT REPS

North Carolina’s Renewable Energy Portfolio Standard became law in 2007. It requires investor-owned utilities to generate up to 12.5 percent of their energy needs through renewable energy resources and energy efficiency programs by 2020. In addition, the law mandates that utilities use hog waste

to generate a portion of their renewable energy requirements.

The swine waste requirement has been delayed by the N.C. Utilities Commission several times due to a lack of viable swine waste-to-energy projects. Beginning this year, utilities are required to generate 0.07 percent of its energy (approximately 91,000 MWh) from hog waste. Within five years, the requirement increases to 0.2 percent (more than 200,000 MWh).

While many other states have adopted renewable energy portfolio laws, North Carolina remains the only state in the nation that encourages swine waste-to-energy projects with such a law.

There are many projects that came before Optima KV. To see the other “firsts” in the industry, check out the Summer 2014 issue of the N.C. Pork Report at [www.ncpork.org/news/pork-report/](http://www.ncpork.org/news/pork-report/). 



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