

# (WILLIAM) GUS SIMMONS, P.E.

Cavanaugh & Associates, P.A.: Director of Bioenergy, Vice President, Owner  
Cavanaugh Energy Group, LLC: Owner

## Career summary

As Vice President and Director of Bioenergy for Cavanaugh & Associates, P.A., Gus has served as Project Manager, Design Engineer, and Principal in Charge for a multitude of food processing, production agriculture, and industrial wastewater infrastructure projects that recover energy and other valuable products from materials disposed as waste. His expertise and experience include: water reclamation, advanced organic waste treatment, waste-to-energy, irrigation, and utility efficiency. Gus has particular expertise in the design, construction, operation and optimization of anaerobic digesters that produce biomethane used to offset facility energy needs and reduce greenhouse gas emissions.

Gus often serves as a guest lecturer, presenter, and technical advisor for bioenergy symposia and events that focus on the production of renewable energy and sustainable agriculture around the globe; focusing on stewardship of our natural resources through near-zero-waste innovations, organic recycling, and waste minimization.

## Work experience –

**Cavanaugh & Associates, P.A.** 2001 - Present

- Joined Cavanaugh in 2001 as Agricultural Services Director serving as Project Manager for the Environmentally Superior Technology Evaluation Project, directed by NC State University, under mandate by the NC Governor's Office and State Attorney General
- Serves as Project Manager, Conceptor, Design Engineer in Responsible Charge, and Technical Advisor for organic waste management systems and organic recycling systems for municipalities, agricultural and industrial facilities across the U.S.
- Oversees Operations, Monitoring, and Regulatory Compliance Reporting for active Bioenergy Facilities and AD systems
- Prepares design, engineering calculations, technical specifications, schematics, and drawings
- Prepares Feasibility Reports including Analysis for Economic, Market, Technical, Operational and Management Reports with Risk Mitigation; including those in accordance with USDA requirements.
- Provides Independent Engineering Reviews of proposed bioenergy projects for lenders and investors
- Performs risk assessments and prepares risk mitigation strategies for bioenergy and AD systems owners

## Education

NC State University 1992-1997  
BS in Biological & Agricultural Engineering  
Concentration: Biological Waste Treatment

## Professional Licenses & Qualifications

NC Professional Engineer #27407 GA Professional Engineer #35541  
VA Professional Engineer #43358 SC Professional Engineer #25757  
IA Professional Engineer #P25407 MN Professional Engineer # 56501  
Certified Irrig Landscape Auditor #57668 USDA Technical Serv TSP-11-7752  
NRCS Technical Service Provider #TSP-11-7752

- Engineering Design
- Bioenergy Systems
- Technical Validation
- Feasibility studies
- Independent Engineering Analysis
- Resource Efficiency
- Resource Optimization
- Biogas Utilization
- Policy Advisory
- Project Implementation

## Industry Associations & Leadership

- Gubernatorial Appointee, NC Energy Policy Council (2018-2020)
- Founder, NCSEA Biogas Working Group (2017)
- Advisory Board Member, Department of Biological and Agricultural Engineering, North Carolina State University (2017-2019)
- Past President, Professional Engineers of North Carolina (PENC) (2013-2014); President, PENC (2012-2013)
- Member, American Society of Agricultural and Biological Engineers
- Member, American Biogas Council
- Technical Advisory Committee for the Development of Wastewater Reclamation and Reuse Regulations, Commonwealth of Virginia (2005)
- NC Reclaimed Water Reuse Rules Review Committee (2005)
- NC Section -American Society of Agricultural Engineers Chair, Planning Committee Chair (2001-2005); President NCASAE 1999-2001
- Instructor, Wastewater Spray Irrigation Design Workshop at the NC State University Land Application Training Unit in Raleigh (2001-2009)

## Innovation Awards

- Awarded 2013 National ACEC Honor Award for Engineering Excellence – Loyd Ray Farms Waste to Energy Project (Yadkinville, NC)
- Awarded NC ACEC Henry A Stikes Grand Conceptor Award Engineering Excellence Loyd Ray Farms Waste to Energy Project (Yadkinville, NC)
- Awarded 2015 ACEC NC Engineering Excellence Award for Karen Beasley Sea Turtle Stormwater Plan
- Coastal Entrepreneur Award for Innovation in Biotech/Energy 2017
- Top Ten of 10 Years, 2018 Coastal Entrepreneur Awards Innovation in Energy
- NC Pork Council's Award for Excellence in Innovation, 2018

## Project Experience (Most recent listed first)

### *Align Preliminary Engineering Review, 2019*

Following the Smithfield Biogas Strategy, a Preliminary Engineering Review (PER) was developed for the Cluster One – BF Grady Road Project. The all-inclusive report included Concept Visualization, On-farm Digester systems, Gas conditioning and Gathering systems, Technology and Execution, Environmental Review, Opinion of probable cost, and design documents. This provided the client with knowledge, layouts and resources to evaluate alternatives, and defined the scope of the project for preliminary funding purposes.

### *Optima TH, 2019-current; Client: Optima Bioenergy*

Under construction in early 2019, Cavanaugh provided design, engineering and construction administration of a biogas project for the Smithfield Foods pork processing facility in Tar Heel North Carolina, which is the largest hog slaughtering facility in the world, which processes 35,000 hogs per day, by over 4,400 employees. The Optima TH project will recapture and harvest the biogas stemming from the plants existing anaerobic digester, and undergo refining to pipeline quality for injection into the adjacent natural gas pipeline. The technology for this project replicates the Optima KV project described below. Cavanaugh facilitated the Construction Administration on this project, and supported the *OptimaBio* team in project feasibility and design, engineering, construction, management, and will oversee its operations once it is commissioned. With the major equipment already in place, the project should be operational in October of 2019, and the interconnection is expected to be completed within a month or two following. This will be the second source of renewable natural gas in North Carolina to ever be transmitted into the state's natural gas infrastructure.

### *Gevo Biogas Sourcing Feasibility Analysis, 2018; Client: Gevo, Inc.*

Assessment of operation feasibility for utilization of sustainable agricultural Biogas feedstock and sources for the Luverne, Minnesota Biogas Project. The scope of this analysis was to evaluate the technical, operations and economic feasibility of potential investment in sustainable sourcing, transport and receiving for utilization of biogas or biogas products to fuel GEVO's operations in its fermentation plant. This analysis created a Biogas Options Economic Model which comparatively looked at several farms, feedlots and other area sustainable sources to evaluate availability and methods, and costs associated with aggregation of feedstocks to help in the production of isobutanol and other products.

### *Poultry Litter and Technology Evaluation, 2017; Client: Equilibrium Capital Wastewater Opportunity Fund*

Cavanaugh performed an evaluation of five technology providers which analyzed their nitrogen removal technologies for maximum efficiency using poultry litter as a feedstock. This report considered which technology minimized the negative impacts of higher nitrogen concentrations and compared and contrasted the providers based on technical feasibility, scalability, operations stability and ideal operating conditions to help the client closely examine compatibility and potential vulnerability and risks associated with each process. The final report ranked the providers and suggested recommendations for project implementation.

### *Optima KV, 2016-current; Client: Optima Bioenergy*

Cavanaugh currently operates the bioenergy system at Optima KV – a project in Duplin County, which we designed to aggregate the manures from five contiguous Smithfield farms housing approx. 60,000 animals, each with a newly constructed anaerobic digester. The project involved pumping stations and pipelines, transporting the manure to the digesters, a gravity pipeline to the existing lagoons, low power compressors at each farm to pull the biogas from beneath the synthetic cover, filter out particulates and moisture. Then directed biogas (RNG) is pumped via small diameter pipes to a centralized location where it is pressurized, cleaned and purified to pipeline quality gas and injected into the Pipeline owned by Piedmont Natural Gas. First project in the state to connect natural resources to the pipeline, which is a significant breakthrough in technology, will provide carbon-neutral fuel for Duke Energy's existing power plants. Commissioned March, 2018.

### *Waverly Mill Analysis, 2018; Client: Smithfield Hog Production*

Evaluation of the opportunity to redirect landfill gas (LFG) from an existing landfill, Atlantic Waste Disposal, to Waverly Feed Mill in Waverly, Virginia. The report gives an assessment and cost summary of raw landfill gas, refined landfill gas, or natural gas to be used for the economic benefit of Smithfield's operations through the displacement of purchased electricity and energy fuels for heat. This evaluation includes an economic analysis that describes the estimated capital and operating costs associated with necessary infrastructure improvements to enable Smithfield to use LFG at its Waverly facility.

### *Brunswick Glynn Biogas Recovery Site Assessment, 2017; Client: Brunswick-Glynn Co. Joint Water and Sewer Commission*

This report describes the feasibility of various options available to Joint Water and Sewer Commission that could make use of the biogas, and the economics associated with each. Additionally, this report described other potential sources of organic wastes that could be utilized to increase the existing biogas output from the ACWPCP, and analyzed the return on investment of the Biogas Production Utilization options.

### *Smithfield On-Farm Biogas Strategy, 2017; Smithfield Foods, Hog Production Division*

The purpose of this study was harvesting organics resource streams for optimal biogas production, which generated a strategy and vision for achieving additional, optimal commercial value streams from swine farming manure systems. The report evaluated the best strategies for aggregation of feedstocks for optimal energy recovery while at the same time creating a plan for the reduction of carbon and greenhouse gas emissions in improved manure environmental performance by the farms and optimization of swine waste treatment.

### *Duke University Directed Biogas Pricing Analysis and Market Strategy, 2017; Duke University*

Cavanaugh prepared this analysis to study the demand signals, availed options and other factors that influence the cost of Directed Biogas to be considered by Duke University to for energy utilization needs. Duke University's sustainable carbon emission goals are leading them to investigate better use of natural resources in generating energy for its campus, which lead to this report, which helped them to better understand the application of swine and hog manure resources, and how that is conveyed and translated in RINS and RECS, and the associated values for bioenergy pricing.

### *[International Manufacturer] Landfill Gas Utilization Opportunities in the USA, 2016; Unnamed Client per NDA*

This report was an evaluation of landfill gas availability to Inform potential investment in Chemical and Polymers production in the United States for the utilization of landfill gas as a feedstock. It identified landfill datasets in close proximity to seaports, current uses of the distressed bio-fuels, and estimated which landfills could potentially be sourced for usage by this manufacturer.

### *Asheboro Biogas Feasibility Study, 2016; Client: City of Asheboro, NC*

The City of Asheboro contracted Cavanaugh & Associates to evaluate the opportunities to expand and enhance the biogas utilization initiatives of the City, with particular focus on the biogas resulting from its wastewater treatment facilities. An evaluation of Asheboro's current anaerobic digester system, biogas utilization system, and proposed improvements to these systems serving the City's WWTP. This report explored alternative ways to derive increased value from the biogas system, including various energy offtakes.

### *Loyd Ray Farms (2010-present); Client: Duke University*

Cavanaugh collaborated with Duke University and Duke Energy on this project which is the first biogas system to generate renewable energy certificates (RECs) from a swine waste system. Cavanaugh designed and permitted the mixed plug flow anaerobic digester for this 8,600-head pig farm. The pig manure flows into the anaerobic digester and is then converted into energy through a microturbine electricity generator. The innovative environmental treatment system creates carbon off sets by reducing greenhouse gas emission of odors, ammonia, disease transmitting vectors, provides improved water quality for the community, and supplies the farmers with electricity and fertilizer. Cavanaugh continues to manage the energy operations at this project site in Yadkinville, NC.

### *NCDA New Ag Markets Report and Findings, 2016; Client: North Carolina Dept. of Agriculture and Consumer Services*

Report utilized support systems and tools for the realization of new and expanding markets for the North Carolina agriculture and forestry sectors, for the specific benefit of farmers and land owners in accessing new and emerging markets available to our State. This work required facilitating information exchange with multiple stakeholders and agencies leading to a report of findings and recommendations for NCDA, which identified barriers hindering and strategies needed to improve market development.

### *GEFA Biogas Technical Assistance Workshop, 2016; Client: Georgia Environmental Finance Authority*

In 2016, Gus facilitated a program and workshop for the State of Georgia for the purpose of informing municipalities on opportunities to harvest and repurpose existing, unused biogas; and connect biogas generators with buyers and developers to facilitate the stewardship of this previously wasted resource. GEFA followed this program with a grant program to assist municipalities with taking the next steps to capitalize on these opportunities.

### *NCSU Anaerobic Digestion Facility Feasibility Study Report, 2014; Client: North Carolina State University*

In 2014, North Carolina State University engaged Cavanaugh to analyze the feasibility of implementing an organics recycling program to include modernization of the waste management system serving the University Research and Teaching Farms in Raleigh, along with other organic wastes such as pre- and post-consumer food waste from University Dining. This work effort guided NCSU in the process of discovery to see if an anaerobic digester for organic waste recycling would benefit the university, and brought together stakeholders from many university departments, and helped them identify costs, benefits and return on investment.

### *McCall Farms WWTP System Expansion, 2013, Client: Karesh Environmental Services*

Engineering consultancy regarding the expansion of wastewater treatment facilities for the sweet potato facility which is expanding their product line. The existing WWTF had a nominal capacity of 600,000 gallons per day. Proposed process improvements included an influent pump station, grit-removal system, converting the existing, unused anaerobic treatment basin, to an equalization basin, with improvements to include synthetic liners, baffles, and covers, mixing pumps, and biogas flare. A jet-aeration system, fixed elevation decanter and sludge-removal system, that will return the waste sludge to the anaerobic digester via the EQ basin, and tertiary filtration were some of the improvements, recommended in the expansion.

### *Directed Biogas Study for Duke University, 2012; Client: Duke University's Nicholas Institute for Environmental Policy Solutions*

In 2012, Duke Energy and Duke University hired Cavanaugh to perform the technology evaluation and serve as contributing author for a study of technologies and approaches to bridge the gap between on-farm electricity generation from swine waste and centralized digesters, seeking to overcome the challenges of both to accelerate the deployment of agricultural biogas projects. The results of this effort were published by Duke University in 2013. The resulting report was: *A Spatial-Economic Optimization Study of Swine Waste-Derived Biogas Infrastructure Design in North Carolina*. [https://nicholasinstitute.duke.edu/sites/default/files/publications/ni\\_r\\_13-02.pdf](https://nicholasinstitute.duke.edu/sites/default/files/publications/ni_r_13-02.pdf)

### *Bruce Foods Irrigation Calibration, 2014; Client: Bruce Foods, McCalls Farm at Wilson Plant*

Completed Design and Permitting of equalization basin, covered anaerobic digester, return system, and approximately 13 million gallons of treated effluent storage for sweet potato-processing facility. Designed and permitting of approximately 60 acres of solid-set irrigation system utilizing various grass and forest receiving crops. Compiled an Environmental Assessment and Operations Manual for the wastewater management system. Monitoring and permitting sludge and soils report.

### *Surf City Wastewater Treatment Plant Upgrades Phase 1, 2013; Client: Town of Surf City*

Expansion of 600,000 GPD wastewater treatment facility to 1,500,000 GPPD with tertiary treatment. SBR facility funded through NC Construction Grants & Loans.

### *Wilson Biogas Feasibility Study*

Development of Preliminary Engineering Report (PER) for biogas (methane) capture and reuse for renewable energy project at City of Wilson Hominy Creek WWRF. Assessment of current biogas production volumes, monetary value of biogas volume, and evaluation of best options for biogas capture and reuse in a closed circuit energy loop within the WWRF. Advised client on best alternatives for biogas recycling and reuse as alternative energy source for WWRF facility operation and power generation. The PER provided a decision matrix to evaluate financial, operational, and Renewable energy credit benefits for the project.

### **Prior Experience**

Director of Environmental Affairs and Engineering Services, for a major agricultural producer, Browns of Carolinas, managing engineering and construction for facilities in the U.S. and Europe. Gus designed, permitted and managed over 3,000 acres of wastewater irrigation in North Carolina, as well as several thousands of acres of wastewater irrigation in the Western United States. Manager of all engineering and construction projects, including schedules and budgets, for facilities in North Carolina, south Carolina, Virginia, Iowa, South Dakota, Minnesota, Colorado, and Utah, as well as Poland.

### **Publications, Presentations & Papers**

#### **2018**

*"Optima KV: Aggregation of Multiple Farm Biogas sources to Achieve Economies of Scale and Pipeline Injection of Renewable Natural Gas," Georgia Environmental Conference, Jekyll Island, NC*

*"One Big Step in NC's Bioenergy: Swine Waste Project Connects to the Natural Gas Pipeline," International Biomass Conference, Atlanta, GA*

*"Above the Dirt: A Look into NC's Bioenergy Resources through Organic Waste Harvesting." Biogas Panel of NC State Energy Conference, Raleigh, NC*

*"On-Farm Aggregation Project Achieves Economies of Scale," BioCycle West Coast, San Diego, CA*

*"The Optima Solution: Optima-KV, Generating Energy from Waste," SWANApalooza: Landfill Gas and Biogas Symposium, Denver, CO*

*"Above the Dirt: A Look into NC's Bioenergy Resources through Organic Waste Harvesting." NC Pork Council Annual Conf, Raleigh, NC*

#### **2017**

*"The Biogas Market; Overcoming Obstacles with Finance." Clean Energy Finance Conference, Durham, NC*

*"Productive Partnership: How they are created and funded." Sustainable Fleet Technology Conference, Raleigh, NC*

*"Optima KV: Project Update." Advisory Committee for Biotechnology in the Southeast, Raleigh, NC*

*"Above the Dirt: A Look into NC's Bioenergy Resources through Organic Waste Harvesting." NC ASABE State Section, Raleigh, NC*

*"Recycling Organics to Fuel our Future." E4 Carolina Energy Leadership Seminar, Wilmington, NC*

*"Above the Dirt: A look into NC's Bioenergy Resources through Organic Waste Harvesting." NCDEQ Animal Operations, Kenansville, NC*

*"Above the Dirt: A look into NC's Bioenergy Resources through Organic Waste Harvesting," NC Biotechnology Center, Wilmington, NC*

*"Above the Dirt: A look into NC's Bioenergy Resources through Organic Waste Harvesting," Poultry Grower Meeting, Kenansville, NC*

*"Renewable Set Asides Push Biogas to Pipeline." Waste to Worth Conference, Raleigh, NC*

*"Renewable Set Asides Push Biogas to Pipeline." BioCycle East Coast; Ellicott City, MD*

*"Opportunities for Growth in the Bioenergy Sector." UNC Clean Tech Summit 2017*

*"Above the Dirt: A look into NC's Bioenergy Resources through Organic Waste Harvesting," NCDA & CS Commissioner's Ag Forum, Raleigh, NC*

*"Swine Waste to Value." NC Pork Council Annual Conference 2017*



## 2016

*"Biogas Projects and Opportunities in North Carolina and Recent Breakthrough Connection to Natural Gas Pipeline."* **E4 and Duke Energy Symposium**, Charlotte, NC

*"Above the Dirt: A Look into North Carolina's Bioenergy Resources through Organic Waste Harvesting."* **Conservatives for Clean Energy's 2<sup>nd</sup> Annual conference**, Greensboro, NC

*"Connecting to the Grid with North Carolina's Anaerobic Digester projects: Loyd Ray Farms and Optima-KV."* **NC Pork Council's Swine Waste to Energy Day**

*"Biogas Opportunities and Associated Policy Needs for North Carolina."* **Conservatives for Clean Energy**, Greensboro, NC

*"UNTAPPED: Bioenergy Overview in Georgia and the U.S."* **Workshop: GEFA Biogas Technical Assistance Program**, Peachtree City, GA

*"Swine Waste Project Connects to Natural Gas Pipeline."* BioCycle REFOR16, Orlando, FL

Moderator – **NCSEA Making Energy Work**, Raleigh, NC

*"North Carolina Biogas Projects and Opportunities."* **PENC Seminar: The Power of Eastern North Carolina**, Wilmington, NC

*"Monetizing Biogas and Conversion Technology,"* **Georgia Environmental Conference**, Jekyll Island, GA

*"Bioenergy Roadmapping: State Incentives to Strengthen Economic Development in Bioenergy Markets."* **Waste Conversion Technology Conference**, San Diego, CA

Panel Moderator – **NC State Energy Conference**, Raleigh, NC

*"Above the Dirt,"* and *"Money to Burn: How to Capitalize on BioCNG at your Wastewater Plant."* **International Biomass Conference & Expo**, Charlotte, NC

*"Waste to Worth: Harvesting the Energy Value from Animal Manure."* **SWANApalooza**, Charleston, SC.

*State to State: A Comparison of Water Loss Training Programs Across Multiple States*, **SC Environmental Conference**, Myrtle Beach, SC.

## 2015

*"Waste to Worth: How a Pig Farm Generates Environmental Revenue" and "Next Generation Manure Technology – Waste to Energy and Environmental Revenues"* (invited/accepted but could not attend) AD14 – **IWA's 14th World Congress on Anaerobic Digestion**, Viña del Mar, Chile

*"Good Earth = Good Business: Cavanaugh's Stewardship through Innovation."* **Cucalorus Connect Green Biz Entrepreneurial Section**, Wilmington, NC

*"RECs and RINs – the RPS Opportunities for Biogenic Carbon."* **Clean Energy Alliances National Summit on RPS**, Washington, DC

*"Waste to Worth: How a Pig Farm Generates Environmental Revenue"* **BioCycle's REFOR15** (Renewable Energy from Organics Recycling) and Northeast Residuals and Biosolids Symposium, Boston, MA

*"Above the Dirt: Harnessing Energy Value from Organic Waste"* Brunswick Community College **4<sup>th</sup> Sustainability Summit and Expo**, Leland, NC

*"Farms of the Future: Seeking Agriculture Energy Independence"* **Waste Conversion Technology Conference**, San Diego, CA

*"Revenue Optimization and Improved Utility Asset ROI."* **GA Coastal Regional Commission, Coastal Wastewater Practicum**, Darien, GA.

*"Beneficial By-products of Anaerobic Digestion."* **UNCC Bioenergy Symposium**, Charlotte, NC

*"Irrigation Uniformity: Ensuring Maximum Sustainable Site Life and Cost Efficiency", "Designing Wastewater Irrigation Systems", "Managing Seasonal Sewer Flows", and "Remote Telemetry"* **Georgia Water Resources Conference**, Athens, GA

*"Farms of the Future: Seeking Agriculture Energy Independence."* **NC State Energy Conference**, Raleigh, NC

*"Money to Burn: How to Capitalize on BioCNG at Your Wastewater Plant", "The Great Biogas Gusher", "Farms of the Future: Seeking Agriculture Energy Independence", and "Above the Dirt."* **Waste to Worth Conference**, Seattle, WA

*"Above the Dirt – Georgia Bioenergy Potential."* **GAWP Industrial Conference & Expo**, Athens, GA

*"North Carolina Bioenergy Potential"* Presentation for **American Council of Engineering Companies** – North Carolina, Raleigh, NC

*"Wastewater Irrigation Performance Auditing"* **Industrial and Commercial Water Reuse Conference**, Austin, TX

## 2014

*"Farms of the Future: Seeking Agricultural Energy Independence," and "Next Generation Manure Technology – Waste to Energy and Environmental Revenues."* Posters: *"Money to Burn? How to Capitalize on BioCNG at your Wastewater Plant,"* and *"Waste to Worth: How a Pig Farm Generates Environmental Revenue."* **Venice 2014: International Symposium on Energy from Biomass/Waste, Venice, Italy.**

*"Innovative Statewide Water Efficiency Training Program sets Precedent for Future,"* and *"Waste to Worth: How a Pig Farm Generates Environmental Revenue,"* **WEFTEC**, New Orleans, LA.

*"Money to Burn? How to Capitalize on BioCNG."* **Waste Conversion Technology Conference**, Denver, CO

**National Summit on Renewable Portfolio Standards** in Washington, D.C. – Panel participant

*"Agricultural Water Use in the Savannah River Region."* **Confluence Conference**, Savannah, GA.

*"Going Viral: Validated Benchmarks for Water Efficiency – Water Loss in North America."* *"Innovative Solutions for Managing a Remote Wastewater Site."* **WRRRI Annual Conference**, Raleigh, NC

*"Remote Telemetry: Innovative Solutions for Managing a Remote Wastewater Site,"* **SC Environmental Conference**, Myrtle Beach, SC

*"From Waste to Worth – How a Pig Farm Generates Environmental Revenue."* **Nexus 2014: Water, Food Climate & Energy Conference**, UNC Chapel Hill, NC