

Purpose – The purpose of this Feasibility study is to examine the opportunities for NCSU to divert the organic wastes it manages from the current course of disposal to an anaerobic digestion facility serving the University. This feasibility study was commissioned by NCSU to identify and evaluate:

- opportunities to reduce current waste disposal costs
- reduce risks associated with animal manure waste management
- stimulate innovation in manure management
- provide improved sustainability
- foster research, education, outreach, and collaboration.

Approach – A NCSU stakeholder group was assembled, that grew from 3 participants to over 30, spanning multiple colleges and departments. This stakeholder group participated in data gathering and analysis, and participated in interviews and creative sessions to shape the course of the feasibility analysis. Cavanaugh & Associates, P.A., specialists in agricultural bioenergy, facilitated the progression from concept to recommendations. The group collaborated to develop the summary of findings and recommendations that comprises the NCSU Anaerobic Digestion Facility Feasibility Study Report.

Integration – The Anaerobic Digestion Facility supports the NCSU Strategic Plan and the CALS Strategic Plan through:

1. Multidisciplinary research, education, and outreach.
2. Catalyzing innovation.
3. Sustainable Agriculture.
4. Addressing grand challenges for food supply, carbon sequestration, and nutrient management.
5. Enhancing/supporting industry partnerships
6. Fostering collaboration among colleges and campuses.
7. Innovative research.

Concept – NCSU currently manages many types of organic wastes that are disposed of through landfilling, rendering, composting, and land application. These organic wastes include, but are not limited to:

- Animal Manures (Dairy, Swine, Poultry, Fish, etc.)
- Food Waste
- Animal Carcasses
- Landscaping Wastes
- Refuse.

Rather than disposal, these organic materials may be diverted to an anaerobic digester, which breaks down these materials into other, valuable resources. Offtakes, benefits, and products of the anaerobic digestion system include:

- Biogas for fueling generators, buses, farm implements, and equipment
- Heat for farming operations
- Renewable Electricity
- Carbon Offsets
- Improved Nutrient Recovery
- Biopharmaceuticals.

Next Steps:

1. Determine Ownership & Operational Responsibilities.
2. Develop Communication Strategy.
3. Funding Acquisition.
4. Improve Data Confidence.
5. Site Selection / Design.

Recommendations – Many of the organic wastes managed by NCSU are either difficult or too costly to divert, given current technologies available. Advancing these technologies is a great opportunity for NCSU innovators. The dairy farm waste is immediately available for diversion to an anaerobic digestion facility, and can be commercially viable. It is recommended that NCSU implement an anaerobic digestion facility serving the dairy farm as the initial phase of this initiative; estimated to cost approximately \$2.5M. Subsequently, the facility can be expanded to include food wastes (\$2M) ● incorporate swine manures and improved effluent treatment (\$3M) ● fueling buses/vehicles with compressed natural gas (\$1M) ● animal carcass waste digestion (\$2M) ● additional organic waste feedstocks (\$1M). Research facilities can be constructed and supported as funding is allocated.

Benefits - Once operational, the anaerobic digestion system may reduce current waste disposal costs by approximately \$28,000 per year (reduced hauling costs and tipping fees). The additive offtakes of fuel, electricity, heat and carbon offsets may result in annual revenues of \$800,000 and a return on investment (ROI) of 7%, with a simple payback of 14 years. Additional revenues may be realized through improved nutrient recovery and biopharmaceuticals, for example, but are difficult to estimate at present due to technology constraints.