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## Integrating Agricultural, Algal, and Bioenergy Systems for Nebraska: Fruition of the SUPER Loop

### **Abstract.**

Based on prior funding from NCESR, great breakthroughs have been developed to digest or convert feedlot cattle manure into biogas (methane) and digestate (portion left following digestion). We have demonstrated that methane yield is impacted by diet fed to cattle. Likewise, experimental comparisons illustrate that methane can be produced from manure collected from open lots, the most common housing method for feedlot cattle, and a common production setting in Nebraska, which is now the #1 feedlot cattle producing state in the U.S. We have also demonstrated that algal growth is similar when grown on digestate or normal growth media in the greenhouse. All of these breakthroughs resulted in additional funding to construct a pilot-scale facility at the Agricultural Research and Development Center (ARDC) to scale up this system. While funding is sufficient to build the infrastructure, the funding is insufficient to operate (demonstrate feasibility), monitor nutrient, water, and yield of components of a SUPER Loop, and to test different growth options to improve efficiency of the facility prior to commercialization. Integration of the components within the SUPER Loop system is critical to evaluating size requirements and ensuring feasibility of methane and algal biomass production from integrated systems that fit Nebraska. The goal of this project is to evaluate nutrient, water, methane, and algae yields of the integrated system to establish feasibility of commercializing SUPER Loops for Nebraska. The objectives of this proposal are to: 1) evaluate algal growth in open raceways using digestate, runoff water from open lots, or commercial nutrients, 2) quantify digester yields from manure of varying quality, and 3) determine the nutrient and energy value of algal biomass as a potential cattle feed. Costs will cover technical support, operation expenses for two years, and graduate student assistantships.