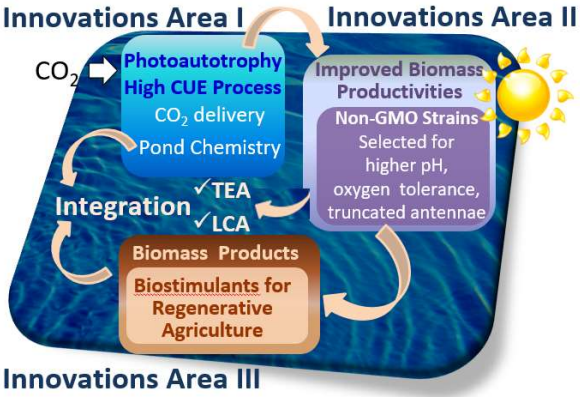
"Cultivation-Ready Improved Algae Strains (CRIAS) for Increased Carbon Utilization Efficiency"

Applicant: MicroBio Engineering Inc.
Principal Investigator: Dr. Juergen Polle
Topic: Topic 2 Algae-Based Technology to Utilize Anthropogenic CO_2 from Utility and Industrial Sources.
Major Participants: Heliae Development LLC (Heliae), Gilbert, AZ
New Mexico State University (NMSU) Las Cruces, NM
California Polytechnic State University(Cal Poly), San Luis Obispo, CA
Los Alamos National Laboratory (LANL), Los Alamos, NM

Project Description: MicroBio Engineering Inc. has teamed with Heliae, NMSU, Cal Poly, and LANL to develop and demonstrate innovative technologies for increasing the Carbon Utilization Efficiency in microalgae cultivation, through innovative CO_2 delivery and cultivation strategies. These will be coupled with selection of high productivity microalgae strains for economic & sustainable production of crop biostimulants and other bioproducts for regenerative agriculture. Our project objectives are to increase CUE to near 70% and to create novel non-GMO algal strains of the green alga *Scenedesmus obliquus* that achieve biomass productivity of 25 g AFDW/m^2-day, of ash-free-dry-weight biomass required for commercial viability. Techno-Economic analyses and life cycle assessments (TEA/LCA) studies will model the process for algae biomass production, to provide a trajectory to meet the market requirements for production scale-up of biostimulants. Improved algal strains will be developed by advanced laboratory evolution technology for tolerance to stress factors such as high O_2, high light, and low CO_2 availability, all required to minimize CO_2 losses. This project will utilize CO_2 from the flue gas produced at a wastewater treatment plant for power generation by combustion of biogas. Microalgae will be cultivated using non-potable reclaimed municipal waters in outdoor 1000-L raceway ponds. This project will lead to validation of our innovative technologies summarized in the below schematic.

Project Objectives:

- Exceed FOA Carbon Utilization Efficiency and biomass productivity targets in open pond microalgae cultivations.
- Demonstrate the value of algal biomass derived biostimulants for crops.
- Model the integrated process in techno-economic and life cycle assessment studies informed by experimental data.
- Advance diversity, equity, and inclusion by integrating students from diverse backgrounds into our research and career development pipeline.



Potential Impacts: This project integrates innovative engineering and biology approaches to make algae cultivation on CO_2 and sunlight economic and sustainable, while creating bioproducts that will revolutionize regenerative agriculture. Our project team represents a diverse workforce at all levels poised to bring underrepresented students into the biotechnology field.