Beneficial Reuse of CO$_2$ from Coal Fired Power Plants for Production of Animal Feeds

Cooperative Agreement DE-FE0031717, 2019 –2020

MicroBio Engineering, Inc.
San Luis Obispo, California

Tryg Lundquist, Ph.D., P.E., CTO
Principal Investigator for the Project

Pittsburgh, Pennsylvania | August 29, 2019
The Technology: MicroBio Engineering RNEW® Process
Algae wastewater treatment with commodity production: recycled water and biomass for animal feeds or biofuels+biofertilizers

Recycle
Nutrients
Energy
Water
The Location: Florida has great potential for algae farming: sun, water, warmth ... and, at Orlando Utilities Commission, flat open land + flue gas.
Phase-2 Project Participants

• MicroBio Engineering Inc.
  – Lead, cultivation, TEA, LCA
• Orlando Utilities Commission
  – Customer, site hose
• Cal Poly State University
  – Feeding trials
• University of Central Florida
  – Carbon mass tracking
• Global Thermostat
  – Flue gas transport scale-up design
Facility Designs
Algae Equipment
Research and Development
Business Consulting
Techno-Economic Analyses
Life Cycle Assessments
27 staff members
• Coal-fired power plant
  – 900-MW, completed 1980
  – 4:1 turndown on coal
  – Coal, biogas, natural gas
• Electric Service
  • 210,000 meters
• Water Service
  • 135,000 meters
• Central cooling plant
• Photovoltaic farms
Hurricane Dorian Churns Toward Florida Coast, Expected To Bring 125 MPH Winds

August 29, 2019 9:22 AM ET, NPR
Two Scenarios for CO\textsubscript{2} utilization were evaluated in Phase-1.

Biogas / Renewable natural gas production in conjunction with wastewater treatment & carbon credits

Commodity animal feeds production for large market. Offset GHG emissions from new soybean farming
Case 2. Algae animal feed production design

Future Algae Farm
(100 ponds; 1,000 acres)

Flue Gas CO₂ & Electricity

Animal Feeds

Freshwater + Fertilizers

OUC-SEC
~900 MW Coal-fired PP
Phase-1 Project Conclusion: Premium animal feeds increase utilization at a lower cost.

- 400-ha farm
- Orlando
- Breakeven at $1,000/Mg algae
- Therefore, algae must be a premium feed with omega-3 fatty acids, nutritional pigments, etc.
Phase-2 Technical Tasks

• Task 2: Strain selection, cultivation, optimization and biomass analysis in lab and small raceways (MBE)
  – Goal: highly productive, robust and stable strains in outdoor cultures
• Task 3: Algae feed production using flue gas CO$_2$ (MBE/OUC)
  – Goal: Efficient and low cost harvesting, dewatering and drying
• Task 4: Carbon balances during algal flue gas utilization (UCF)
  – Goal: Determine the carbon utilization efficiency using mass balances.
• Task 5: Poultry feeding trials with algal biomass (Cal Poly)
  – Feed manufacturing and layer & broiler chicken feeding trials
  – Goal: Determine value of algae component for feed
• Task 6: Engineering design, techno-economic and life cycle assessments (MBE/OUC/GT)
  – Goal: Use project outcomes to evaluate the economic and environmental impact potentials of the process.
Focusing on filamentous algae for easy biomass harvesting.
Site plan includes production and experimental raceways, and harvest area.
Strain selection and small pond cultivation underway. Large pond installation after Dorian.
Thank you!

TrygLundquist@
MicroBioEngineering.com