



## Orlando Utilities Commission Algae Cultivation for Carbon Utilization Workshop

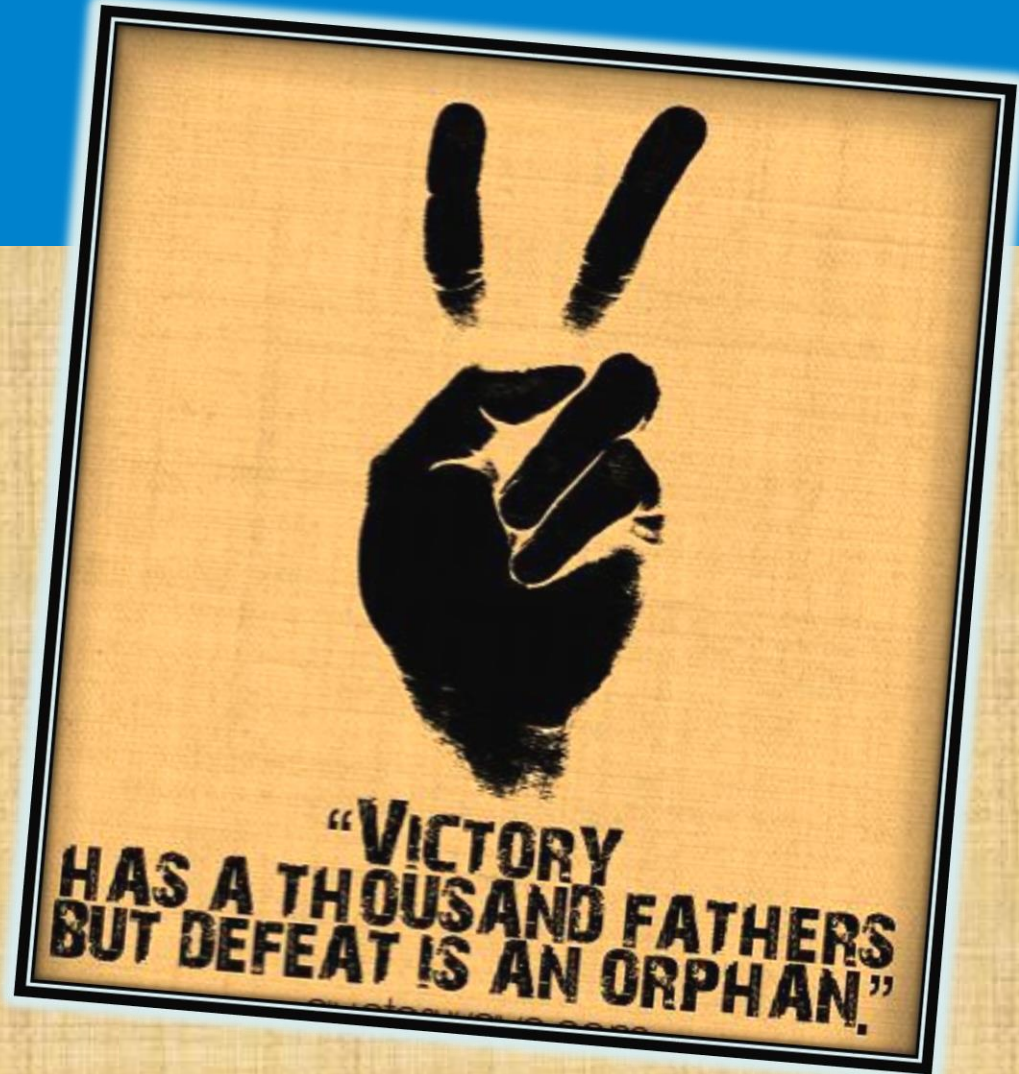
U.S DOE Research for Florida's Conversion to the Bio economy

*Rob Teegarden, Water Policy and Research Officer  
May 23, 2017*

RELIABLE • AFFORDABLE • SUSTAINABLE

**OUC**   
The Reliable One®

*Interpreting the  
Arrows, →  
Learning from  
Our Failures, &  
Recycling Carbon*



*Where do opportunities exist for large scale co-production of algal biomass in a bio refinery context?*

# Agenda

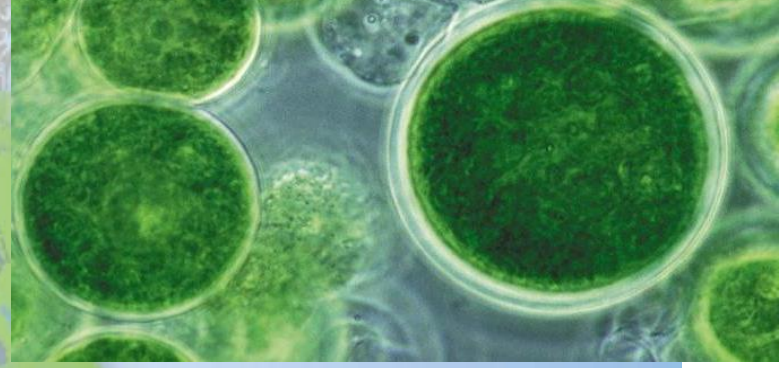
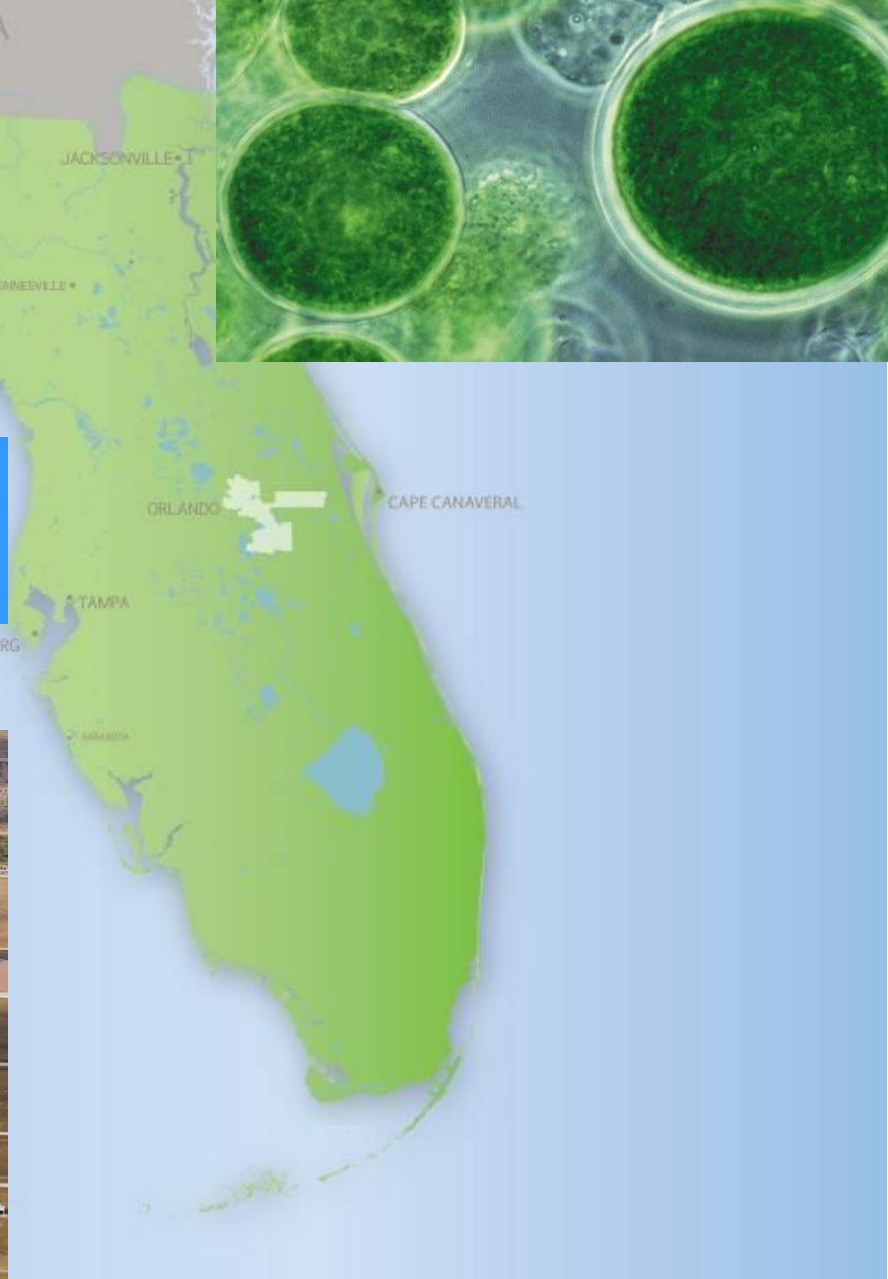
**OUC Background**

**Carbon Utilization**

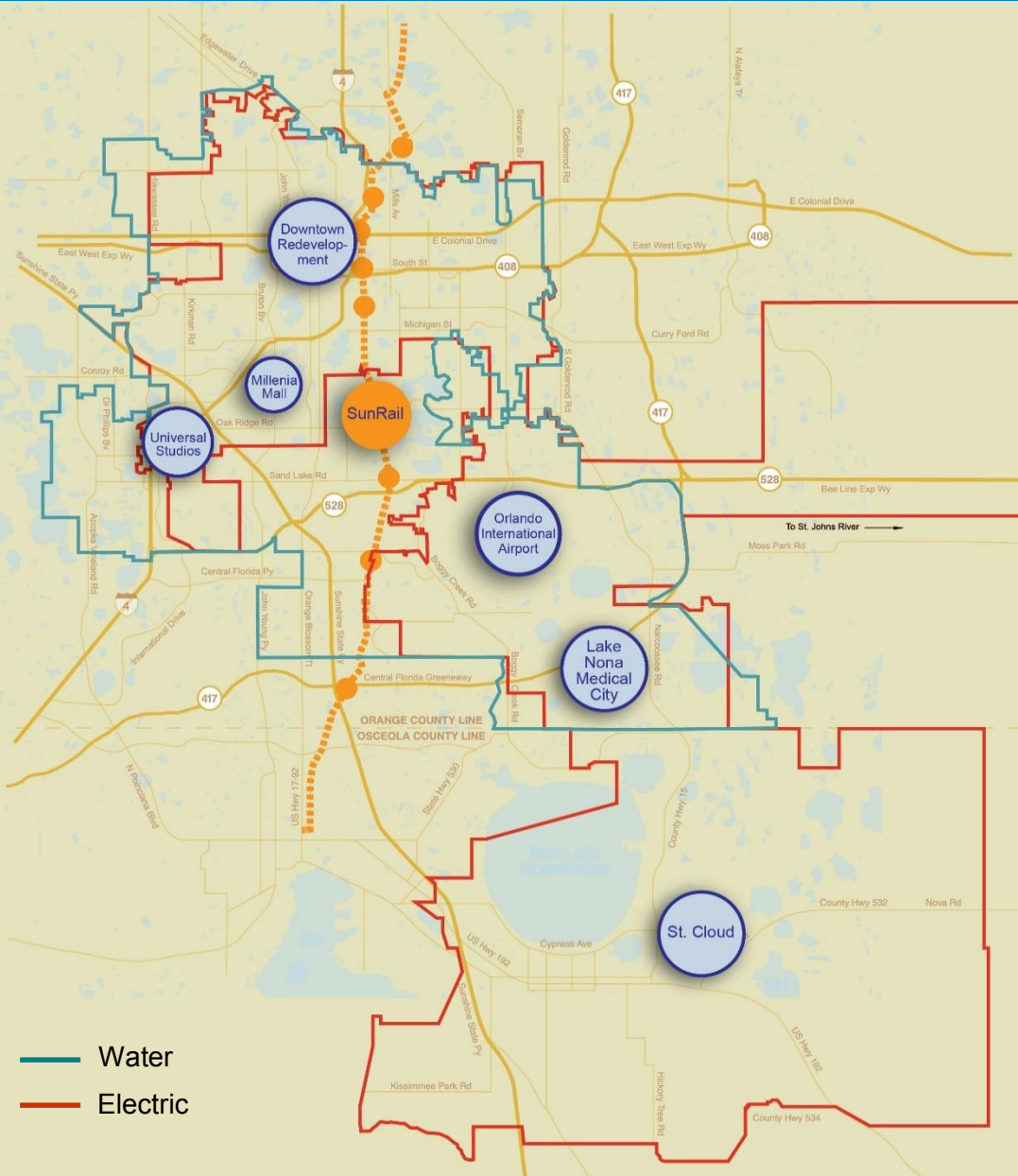
**Southeastern USA Adaptations**

**Recommendations**

# OUC Service Territory & SEC



# Electric & Water Service Territory



## Electric

- Size of service area
  - Orlando: 244 sq mi
  - St. Cloud: 150 sq mi
- Number of customers (meters)
  - Orlando: 180,000
  - St. Cloud: 30,000

## Water

- Size of service area
  - 200 sq mi
- Number of customers (meters)
  - 135,000 water customers

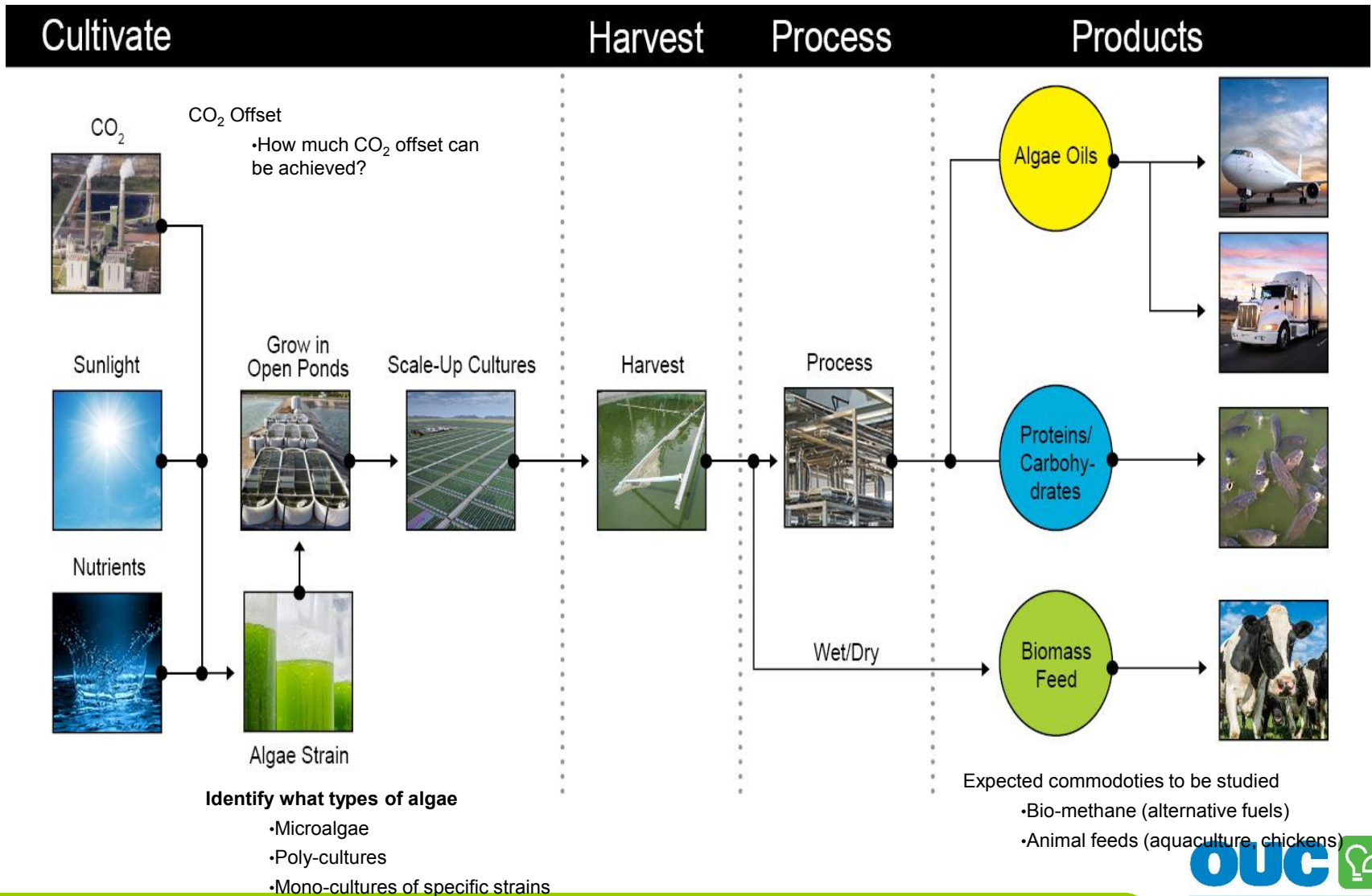
# Opportunities for Carbon Utilization Success

- Multi discipline approach
- Harmonization of models
- Scale, Scale, & Scale

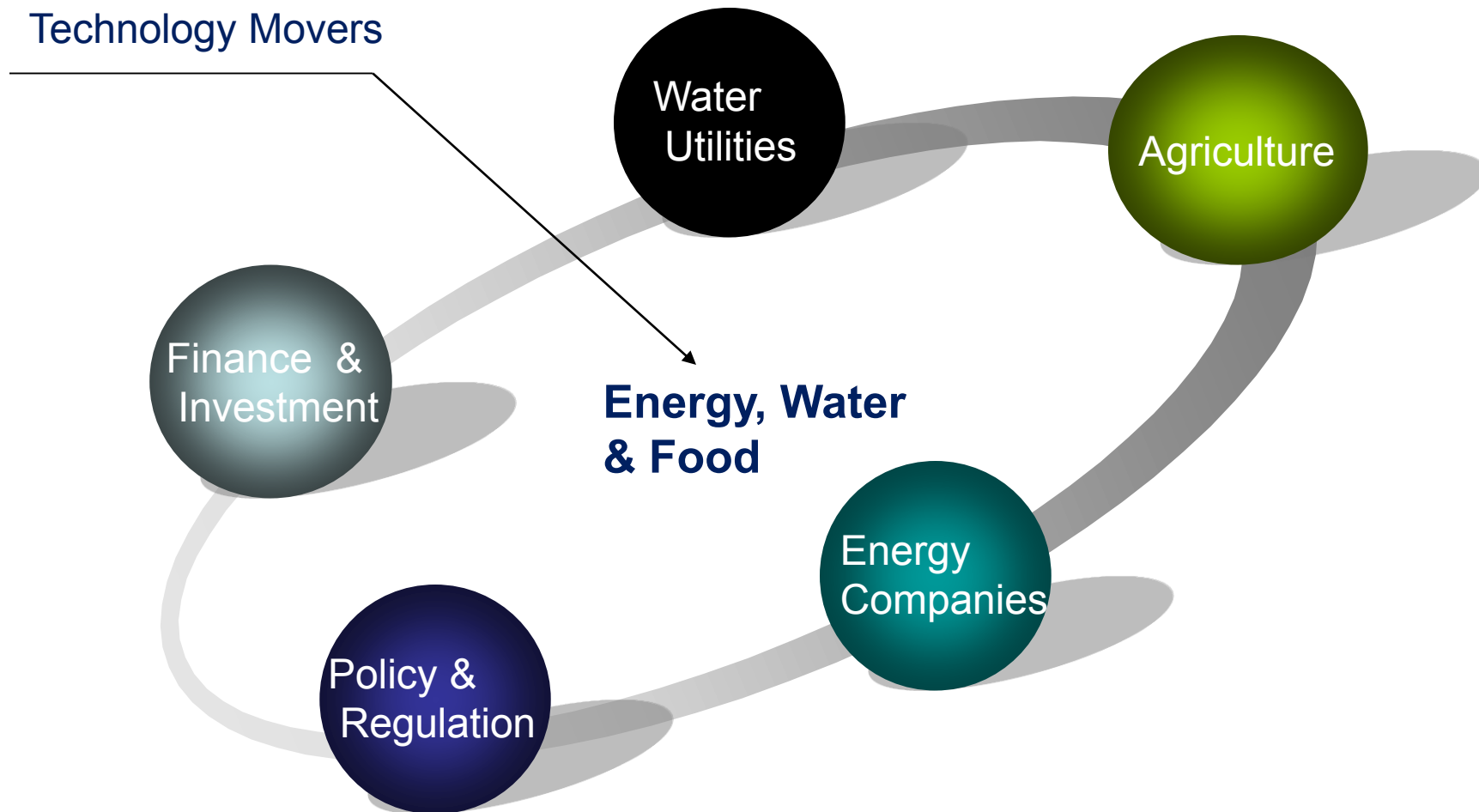


# Goals of the Research

## Can Flue Gas + Algae = Future Commodities

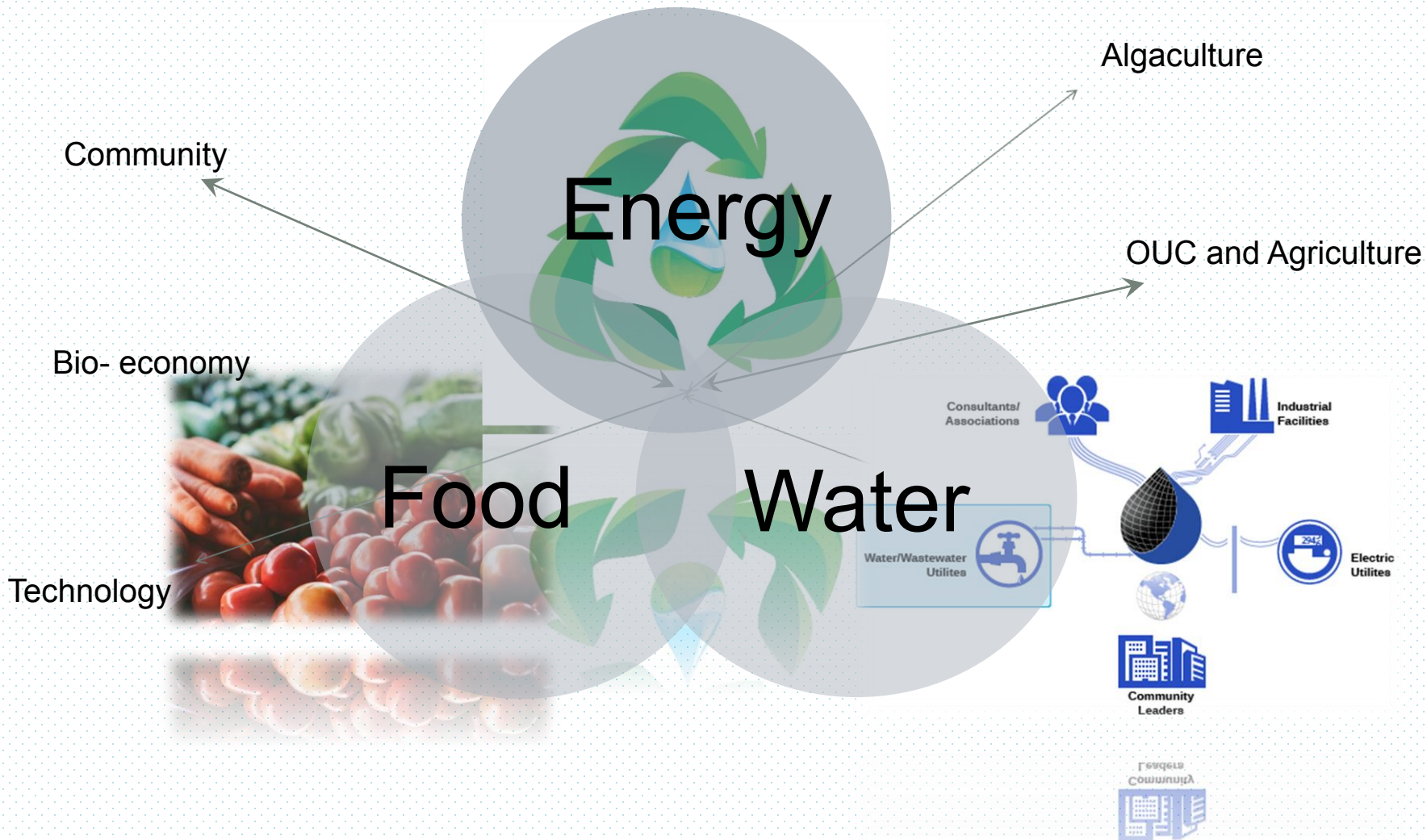


# Multi Disciplinary Approaches – Leadership and Advocacy for a sustainability master plan





# The Right *Energy* for the Right Use...



# Aquaponics Project Planning – Fabricate and Produce Fish Feed

**Life Cycle Case # 1**

**2017**

- Multi party approaches and crosscutting partnerships of agriculture, energy and water

**2018**

- Grow to scale and demonstrate viability to agriculture
- Validate growth rates/ composition analysis for large scaleability
- Develop regulatory timelines for intended markets

**2019**

- Improve cultivation performance
- Protect crop yield against culture crashes
- Reduce costs of cultivation – suitable soils to support unlined ponds
- Reduce cost and increase efficiency of dewatering

**2020**

**2021**

- Identify opportunities for lower carbon cost and nutrient sources
- Develop new conversion processes that recycles nutrients
- Demonstrate food safety for its intended use with the FDA

**Business Plan # 1**  
**Recycle nutrients, CO2**

**Success #1 – 2 to 3 companies**  
**With > \$ 1 B in sales**

**2022**

- Report sustainability data of large scale production
- Finance the projects

**2023**

- Preliminary and final design of biorefinery #1 for fish feed

**2024**

- Viable food chain for animal feed

**2025**

• X tons fish feed/ year

**2026**

• Biorefineries are commissioned for 3 – 4 valuable bio -products

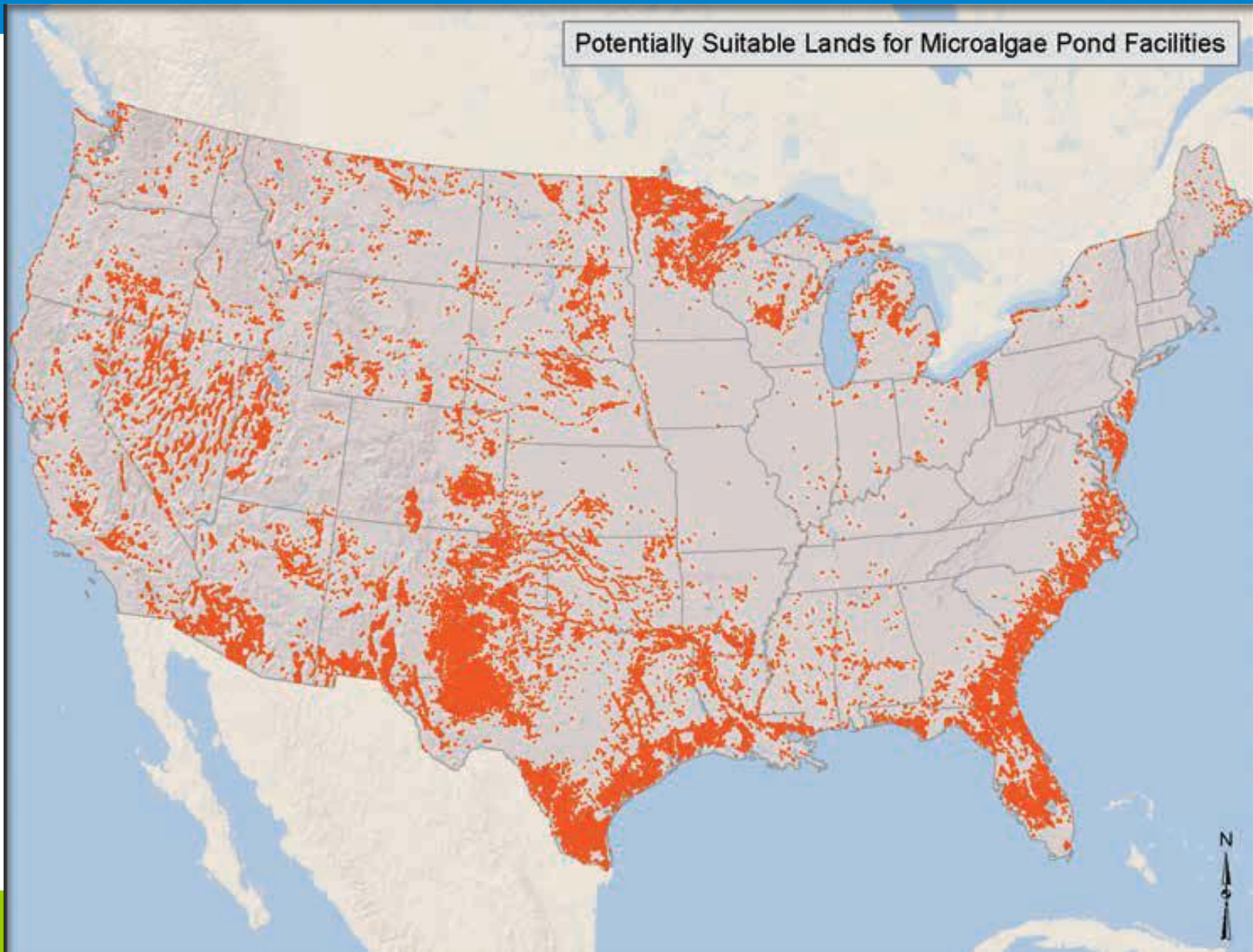
# Stanton Energy Center





# Questions

# Biomass Assessment Tool Results – shows ~ 74K unit farms of 1200 acres each



# Research Background and Objectives

## Background

- DOE's National Energy Technology Laboratory (NETL) Strategic Center for Coal and Power Research & Development issued a Request for Proposal for Microalgae Commodities from Coal Plant Flue Gas in February, 2015
- DOE awarded a grant to MicroBio Engineering/ Research Teams & OUC/ in August, 2015

## Objectives

- Research Goals for Flue Gas –  
Need to Answer 3 Questions:
  1. How much CO<sub>2</sub> offset can be achieved through algae cultivation?
  2. Are their benefits beyond CO<sub>2</sub> capture (commodity opportunities)?
  3. What problems exist and what technology advances are needed?
- Research is over a 2 year period
- OUC's Stanton Energy Center is the host site for CO<sub>2</sub> coal flue gas pilot studies



# Chilled Water, Lighting and Other Energy Business Services

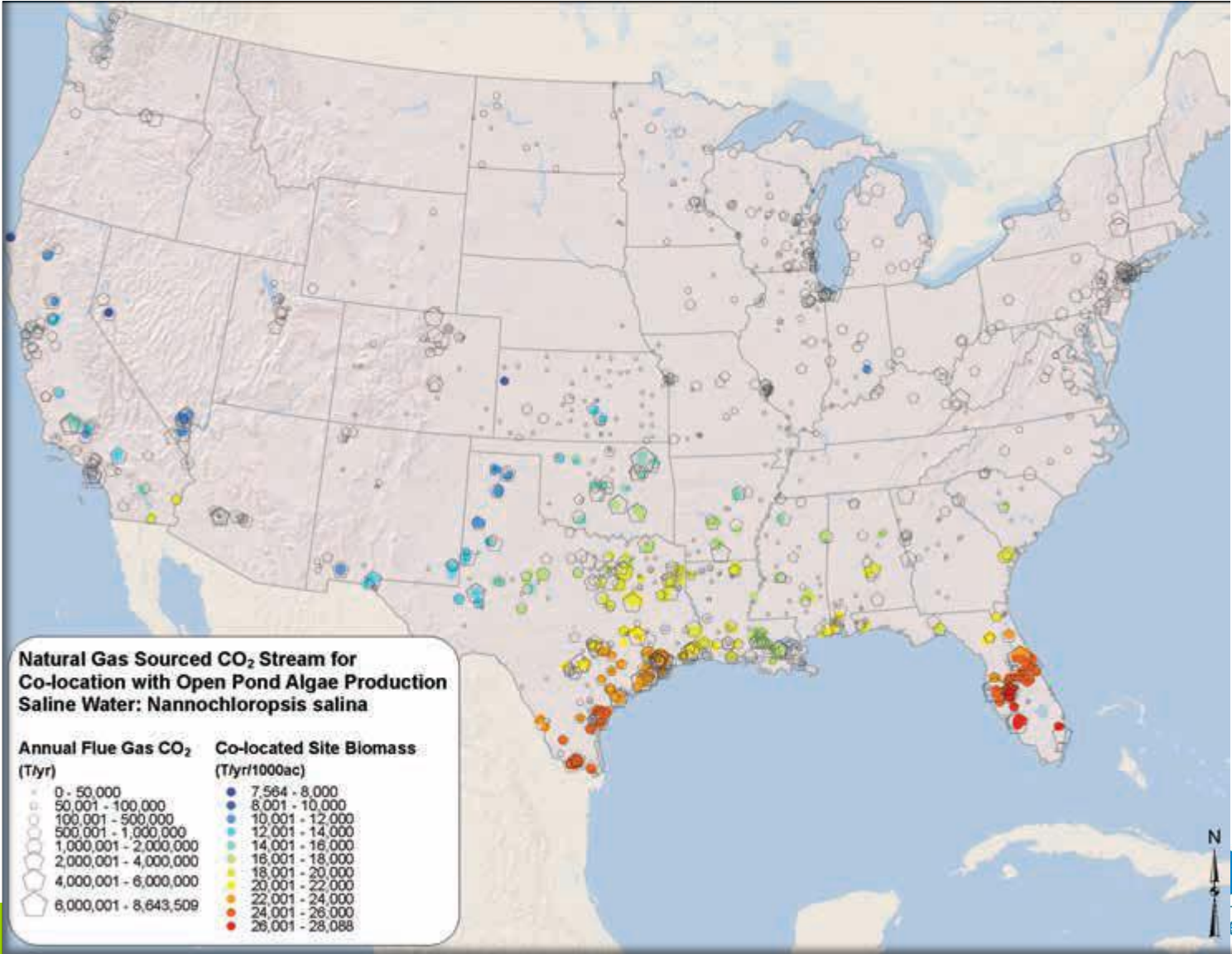
**OUCooling**  
**\$30 MILLION**

**OUConvenient LIGHTING** Indoor & Outdoor Solutions  
**\$8.1 MILLION**

Home Warranty Programs  
**\$800 THOUSAND**

EV Charging Station Programs  
**COMING SOON**

# Co-location of open pond algae farms – saline water with EGU natural gas





# Learning from Our Failures

“Success is stumbling from failure to failure with no loss of enthusiasm.” - Winston Churchill

**“Coming together is a beginning; keeping together is progress; working together is success.” —Henry Ford**

“I have not failed. I've just found 10,000 ways that won't work.” - Thomas A. Edison