



*Algae Cultivation for Carbon  
Capture and Utilization Workshop  
May 23 – 24, 2017*

*Christy Sterner,  
Technology Manager  
Advanced Algal Systems Program*

# Purpose of the Workshop

- Bring together a diverse group of experts from within and outside the algae industry to discuss the issues with carbon capture and utilization and how algae cultivation can play a role in addressing these issues;
- Address carbon capture and utilization issues within the algae industry and strategize mutually beneficial solutions for both industries;
- Identify gaps and whether or not BETO should and/or could play a role in closing these gaps (in conjunction with Fossil Energy).

# Agenda

**Algae Cultivation for Carbon Capture and Utilization**  
**U.S. Department of Energy, Bioenergy Technologies Office**  
 May 23 - 24, 2017  
 Orlando, FL

**Tuesday, May 23, 2017**

*Subject matter experts will meet to discuss carbon dioxide capture and utilization (CCU) applicability to algae cultivation for the production of biofuels and bioproducts. Following presentations from the Department of Energy offices of Bioenergy Technologies and Fossil Energy as well as project performers, participants will break into small groups to share information about the state of this technology and the challenges that must be addressed to achieve commercial-scale systems.*

Time	Agenda Item	Speaker
8:15 AM – 8:30 AM	Welcome and Introduction: DOE Bioenergy Technologies Office	Christy Sterner, Bioenergy Technologies Office
8:30 AM – 8:45 AM	Introduction to Collaboration Platform	Lauren Illing, BCS, Incorporated
8:45 AM – 9:00 AM	Introduction: DOE Office of Fossil Energy	Lynn Brickett, National Energy Technology Laboratory
9:00 AM – 9:15 AM	Orlando Utilities Commission Interest in CCU	Robert Teegarden, Orlando Utilities Commission
9:15 AM – 9:30 AM	Overview of ASU Project Work in CCU	Thomas Dempster, Arizona State University
9:30 AM – 9:45 AM	Overview of Global Algae Innovations Project Work in CCU	David Hazlebeck, Global Algae Innovations
9:45 AM – 9:55 AM	<b>Break</b>	
		<i>Five minute briefings from pre-selected participants on topics of their interest. Suggested focus on achievements to-date, current barriers, and outlook for the future of CCU and algal CCU.</i>
9:55 AM – 11:45 AM	Open Forum Presentations	
11:45 AM – 12:45 PM	<b>Lunch</b>	<i>Provided</i>
12:45 PM – 2:15 PM	Breakout Session 1: Logistics and Siting Considerations	
2:15 PM – 2:25 PM	<b>Break</b>	
2:25 PM – 3:55 PM	Breakout Session 2: Design and Engineering Considerations	
3:55 PM – 4:05 PM	<b>Break</b>	
4:05 PM – 5:35 PM	Breakout Session 3: Assessment of Potential Commercial Application and Identifying Synergies	
5:35 PM – 5:45 PM	Closing Summary for Day 1	Christy Sterner, Bioenergy Technologies Office

**Wednesday May 24, 2017**

*Day 2 Report Out from Breakout Sessions followed by a Project Site Tour*

8:50 AM – 9:00 AM	Convene	Christy Sterner, Bioenergy Technologies Office
9:00 AM – 11:30 AM	Plenary Report Outs and Group Discussion	Breakout Session Rapporteurs
11:30 AM – 11:45 AM	The Orlando Utilities Commission Algae CO2 Utilization Project	Tryg Lundquist, MicroBio Engineering
11:45 AM - 12:00 PM	Summary Conclusions and Thank You to Participants	Christy Sterner, Bioenergy Technologies Office
12:00PM – 1:00 PM	<b>Lunch</b>	<i>On your own, details for lunch options at Registration Desk.</i>
1:00 PM – 5:00 PM	Project Site Tour	The Orlando Utilities Commission Algae CO2 Utilization Project

# Facilitators/Moderators

- Group 1 – Blue – Salon 1
  - Lauren Illing; Dr. Tom Dempster
- Group 2 – Red – Salon V
  - Ashley Rose; Brendan Scott
- Group 3 – Purple – Salon VI
  - Devinn Lambert; Carlos Villacis
- Group 4 – Green – Salon VII
  - Christy Sterner; Liz Burrows
- Group 5 – Yellow – Salon VIII
  - Mike Resch; Colleen Tomaino

# Acknowledgements

## Special Thank You:

Dr. Tom Dempster (ASU)

Dr. John Benemann (MicroBio)

Rob Teegarden (Orlando Utilities Commission)

Colleen Tomaino (BCS, Incorporated)

Lauren Illing (BCS, Incorporated)

Stacey Young (BCS, Incorporated)

Lynn Brickett (NETL)

Stanton Energy Center

Facilitators/Moderators

Breakout Session Rapporteurs

# Advanced Algal Systems Major Goals FY17-22

## Sustainability

By 2017, model the sustainable supply of 1 million metric tonnes cultivated algal biomass.

## Value

By 2019, demonstrate production of valuable co-products that can increase the value of cultivated algal biomass by 30%.

## Yield

By 2020, demonstrate, at non-integrated pre-pilot scale, yield of 3,700 gallons or equivalent algal biofuel intermediate per acre, annual average.

## Cost

By 2022, demonstrate yield of 5,000 gallons of algal biofuel intermediate in support of modeled \$3 per gallon (gasoline equivalent) algal biofuels.



# Advanced Algal Systems Accomplishments FY12-16



## Market Transformation

- The Consortium for Algal Biofuel Commercialization developed a number of genetic tools for green algae, cyanobacteria, and diatoms that are now available for purchase online through Life Technologies.



## Significant Biomass Yield Improvements

- Projects in the FY13 Advancements in Algal Biomass Yield Phase 1 portfolio met a crucial milestone, demonstrating their ability to produce 2,500 gallons of biofuel intermediate per acre on an annual average.



## Workforce Development

- Algae Technology Education Consortium developed a certificate program for students who are interested in specializing their degree in algal sciences.

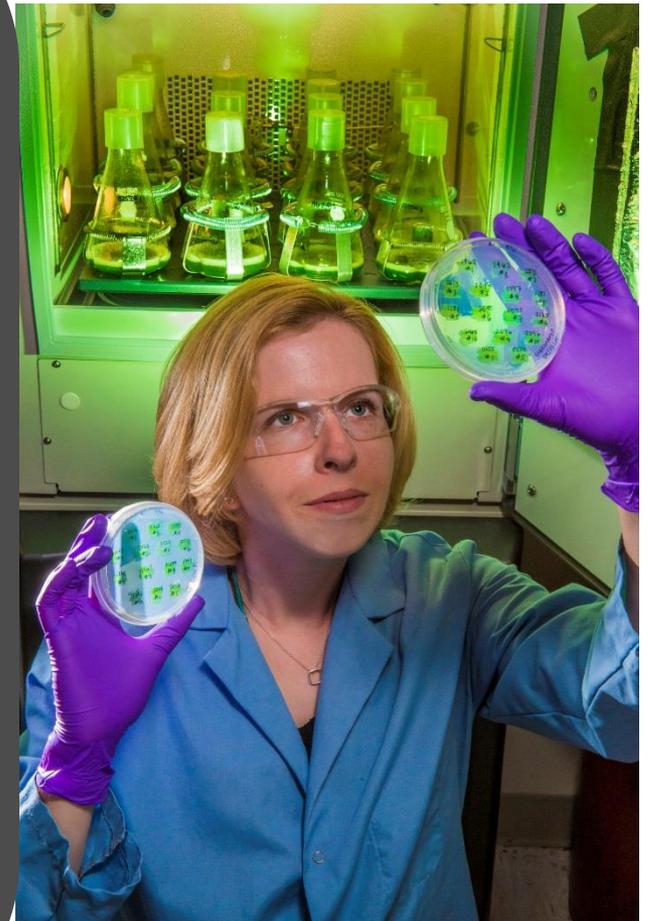


## Industry Standards

- The Algae Testbed Public-Private Partnership collected unified field data from diverse geographic sites to inform national laboratory analyses.
- NREL published standardized laboratory methods for industry use.

# Advanced Algal Systems FY17 Activities

- In coordination with PNNL and ORNL lab partners, released the Billion Ton Report Volume 2 with “Qualitative Analysis of Environmental Sustainability for Algae” Chapter.
- National Laboratory consortium (PNNL, NREL, SNL, LANL) will apply complementary core competencies to rapidly and cost effectively identify superior algal biofuel production strains for outdoor deployment.
- The Advancement in Algal Biomass Yield Phase 2 awarded projects will initiate the next phase of research on yield improvement towards FY20 goal of 3,700 gal of intermediate/acre/year.
- Aiming to select projects focusing on breakthroughs in advanced biology as well as biology-based tools and data sharing from the Productivity Enhanced Algae and ToolKits FOA.



# Advanced Algal Systems Highlighted Initiatives

## Potential Environmental Benefits of Algae Production

BETO funds strategies to investigate and improve the potential value in leveraging algae for:

- Wastewater treatment
- Absorbing waste CO<sub>2</sub> from fossil-fired power plants
- Cleaning polluted water bodies

Sandia National Laboratory has demonstrated stable, highly productive filamentous green alga and delivered >20 Kg of biomass to characterization and processing teams from their Texas AgriLife facility. Sandia plans to evaluate the potential for this system to reduce pollutants in the Salton Sea, CA



Benthic Algae Biomass Production  
at Texas AgriLife, Corpus Christi

# Advanced Algal Systems Highlighted Initiatives

## National Algal Biofuels Technology Review

BETO hosted multiple public workshops, worked closely with research partners, and received review and comment from over 76 independent subject matter experts to summarize the state of technology for algae-based fuels and document the research and development challenges associated with producing them at a commercial scale.

**This 2016 report has proven critical to the research and development community.**



# Contact

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- Questions?
- Contact Information:

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