



U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy

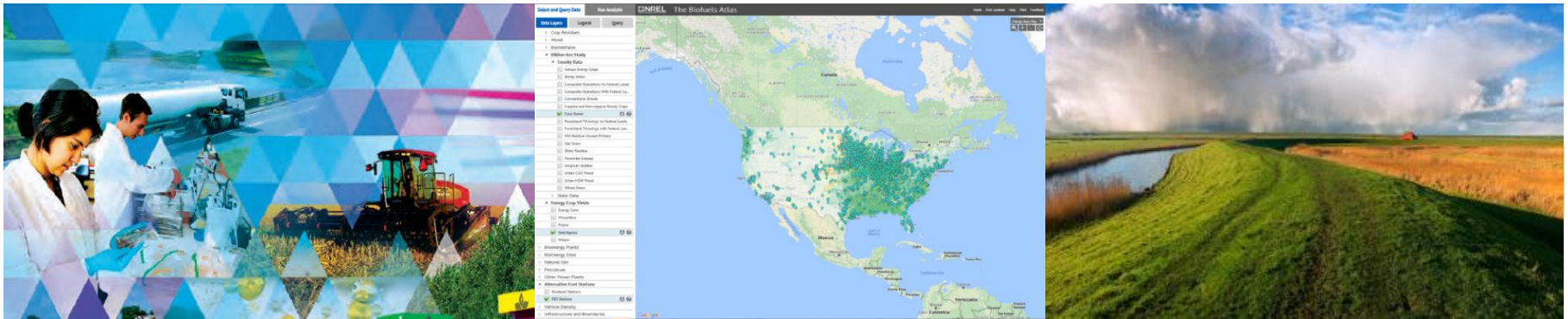
# Bio-Restore Workshop: Background and Objectives

**Bio-Restore Workshop**  
**Lemont, IL**  
**September 25-26, 2019**

**Kristen Johnson**  
Technology Manager  
Bioenergy Technologies Office  
U.S. Department of Energy  
(DOE)

# Outline

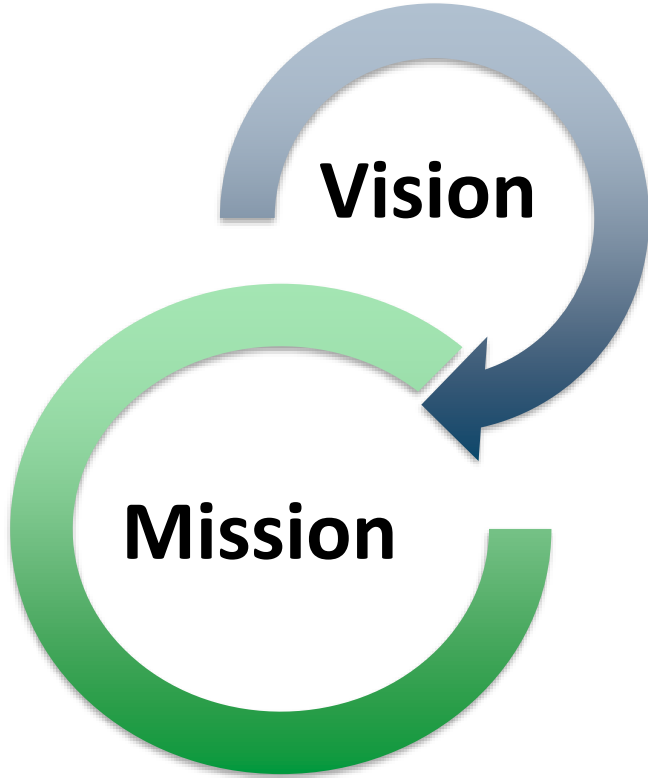
- Workshop purpose
- Bioenergy Technologies Office (BETO)
- Bio-Restore concept
- Agenda for today and tomorrow
- Think Tank overview
- Break-out assignments



# Workshop Purpose

- **Objective:** identify data and R&D needs to enable the use of terrestrial and algal biomass that provides environmental benefits while increasing feedstock supply for the bioeconomy
- **Specific topics**
  - Using dedicated energy crops and other biomass sources to provide environmental benefits
  - Algae technologies (wastewater treatment, direct bloom harvest, turf scrubbers, macroalgae)
  - Quantification and valorization of ecosystem services
  - Low-cost sensors and data management systems
  - Integrating “bio-restore” biomass with supply chain needs

# Bioenergy Technologies Office (BETO)

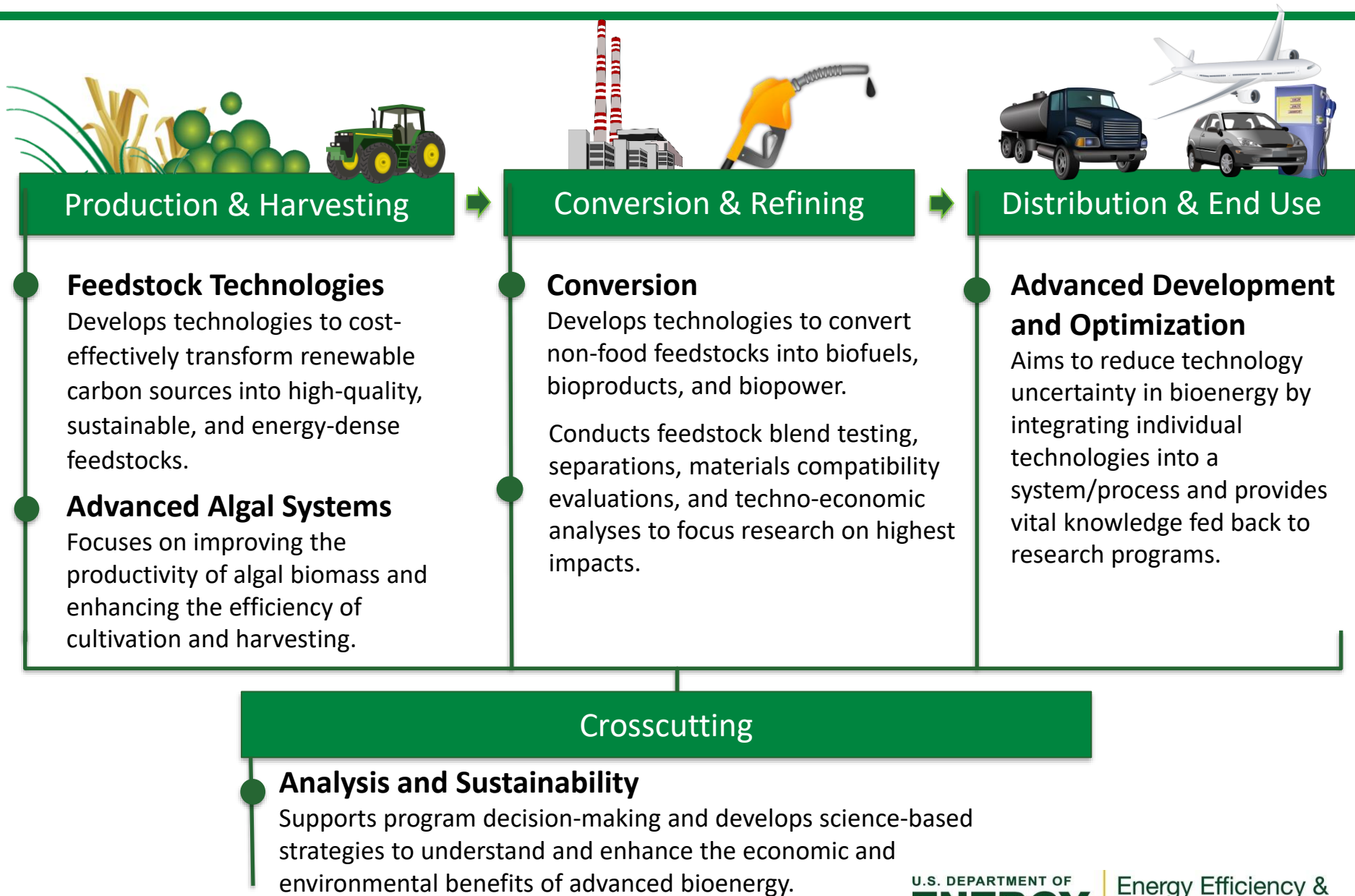


**A thriving and sustainable bioeconomy fueled by innovative technologies.**

**Developing transformative and revolutionary sustainable bioenergy and bioproducts technologies for a prosperous nation.**

*BETO Reduces Technology Uncertainties and Enables Affordability Through R&D*

# Bioenergy Technologies Office's Critical Program Areas





# BETO's Feedstock Technologies Program

Strategic Goal: Develop science-based strategies and technologies to cost-effectively transform renewable carbon sources into high-quality, sustainable, and energy-dense feedstocks for biofuels, bioproducts, and biopower.



Improve the Quality and Quantity of Renewable Carbon Feedstocks

Reduce Cost of Renewable Carbon Feedstocks



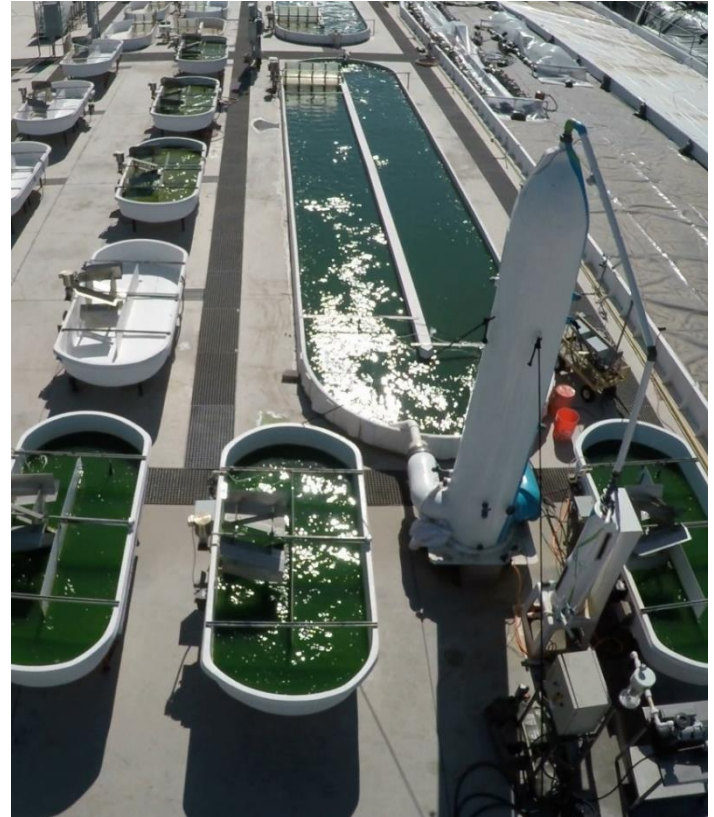
Strategies focus on improving the *efficiency* and *reliability* of harvesting/collection, storage, preprocessing, and transportation.

# BETO's Advanced Algal Systems

**BETO funds R&D to strategically address lowering costs, improving quality, and increasing productivity of algal biomass.**

BETO partners are developing sustainable, scalable algae cultivation systems and approaches to:

- maximize reliable annual biomass yield and quality, and
- minimize energy use, water consumption, land use, and nutrient additions.



Arizona Center for Algae Technology and Innovation testbed facility at Arizona State University

# BETO's Analysis & Sustainability Program

**Strategic Goal: Develop science-based strategies to understand and enhance the environmental, economic and social benefits of advanced bioenergy and bioproducts relative to conventional energy systems.**



Supports analysis and R&D focused on promoting benefits and minimizing negative impacts.



Identifies strategies for reducing costs by increasing efficiency and providing ecosystem services.



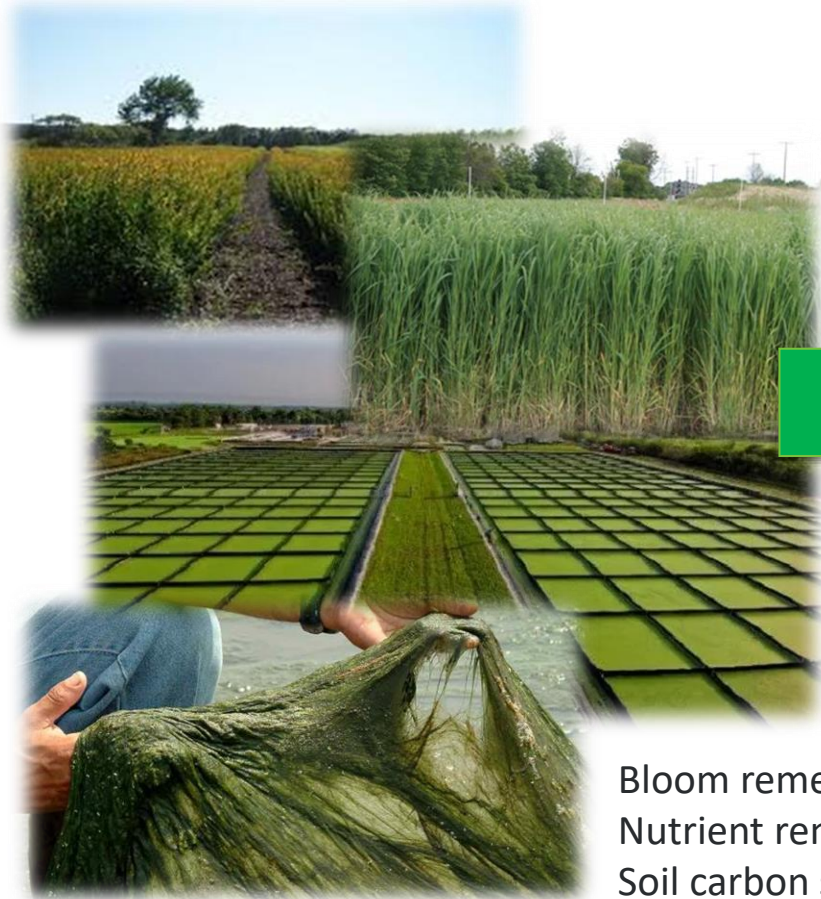
# The Bio-Restore Concept

- **The Challenge:** Current land management practices contribute to environmental problems such as soil erosion, “dead zones” in aquatic systems, and habitat/wildlife disturbances.
- **The Opportunity:** Terrestrial and algal biomass has the potential to reverse and prevent environmental degradation while increasing feedstock supply for the bioeconomy.
- **The Impact:** Increased availability and reduced costs of bioenergy and bioproducts while cleaning up water resources, enhancing soil health, and providing other benefits.
- For the purpose of this workshop, “bio-restore” biomass refers to terrestrial/algal biomass that can be used for energy or products while providing environmental benefits (i.e., ecosystem services).



# The Bio-Restore Concept

BETO is interested in how to leverage **ecosystem services** provided by algal and terrestrial biomass to reduce costs of production of **bioenergy** and **bioproducts**.



Bloom remediation  
Nutrient removal  
Soil carbon sequestration



# Agenda for Today and Tomorrow

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- Day 1
  - Topic overview presentations
  - State-of-technology presentations
  - 3x5 presentations
  - Break-out discussion on state-of-technologies, costs, and values of “bio-restore” biomass
- Day 2
  - Break-out discussion on data gaps, R&D needs, and success metrics

# Reminders and Additional Guidance

## BETO's Mission

- Applied R&D program
  - Not policy, basic science, or demonstration/deployment
  - Not focused on genetic development or breeding of terrestrial biomass crops
- Focused on bioenergy and bioproducts
  - Interested in nexus between biomass that can be used for energy/products AND provides environmental benefits
- Goal- and target-driven
  - Break-out discussions will include questions on appropriate metrics and targets for “bio-restore” projects



## Types of biomass relevant to BETO and this workshop

- Terrestrial: energy crops (herbaceous and woody) and other cellulosic biomass, waste biomass, or biomass that when produced/harvested provides environmental benefits
  - Not of interest: oilseed crops or crops generally grown for food/feed
- Algal: wastewater treatment algal biomass, algal blooms, algal turf scrubbers and attached growth systems, macroalgae
  - Not of interest: algae grown in artificial light conditions or other energy-intensive cultivation designs.

# Think Tank Overview

ThinkTank Login

thinktank.inl.gov/login.html

## Account Holder

Need an account?

Username Password

Username Password **Log In**

[Forgot your password?](#)

## Guest Login

Session ID Passkey

Session ID Passkey

Email Address

Email

Screen Name

Screen Name

**Enter Session**

6.0.0.107 [Contact Support](#)

# Think Tank Overview

## 201: Bio-Restore Algae Group

- 6 **Cost**  
 What is the cost of algal biomass?  
 2:00pm
- 7 **R&D Opportunities**  
 How can BETO support lowering algal biomass costs?  
 8:30am
- 8 **Data & Information Needs**  
 How can BETO support closing data and information gaps?  
 9:30am
- 9 **Success Metrics**  
 How can we best measure progress for R&D Projects?  
 Time Allowing

**Cost**

▼ WHAT ARE THE COSTS OF "BIO-RESTORE" ALGAL BIOMASS?

<b>1</b>	What are the costs associated with harvesting algae blooms?	0
2	What are the costs associated with harvesting purpose-grown "turf" algae?	0
3	What are the costs associated with harvesting purpose-grown macroalgae algae?	0
4	What are the costs associated with cultivating and harvesting WWT algae?	0
5	What logistics costs must be considered in biomass transport?	0
6	What are the costs of conversion	0

[Click here to add WHAT ARE THE COSTS OF "BIO-RESTORE" ALGAL BIOMASS?](#)

**IDEAS**

What are the costs associated with harvesting algae blooms?

[Click here to add IDEAS](#)

Designer

Thinkers

Navigation

# Thank you from the BETO Team!

Kristen Johnson – Analysis & Sustainability (A&S)

Alicia Lindauer – Analysis & Sustainability

Mark Elless – Feedstock Technologies (FT)

Dan Fishman – Advanced Algal Systems (AAS)

Camryn Sorg – supports A&S

Art Wiselogel – supports FT

Colleen Tomaino – supports AAS



Breakout Session Room Locations		
Session	Day 1	Day 2
Algae	1416	1416
Terrestrial 1	1404	1404
Terrestrial 2	1405	1405
Terrestrial 3	6172	1172

# Algal Systems

The program is interested in how to leverage algal **ecosystem services** such as **nutrient removal** and bloom remediation to reduce costs of production of algal **bioenergy** and **bioproducts**.

