U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

# 2019 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

## Analysis and Sustainability Program

March 4, 2019

**Alicia Lindauer**

Technology Manager

# Analysis and Sustainability (A&S) Overview

- The Team
- Goals and Objectives
- Approach
- Budget
- Challenges
- Key Accomplishments
- Reviewers

# The A&S Team

## Federal Staff

### Program and Project Management

**Alicia Lindauer**
Technology Manager

**Kristen Johnson**
Technology Manager

### Technical Advisor

**Zia Haq**
Lead Analyst

## Support Staff

### Project Monitors

**Diana Raggio**
AST

**Art Wiselogel**
AST

### Technical Support

**Seth Menter**
BCS

**Shaina Aguilar**
ORISE Scholar

### Management Support

**Carlos Villacis**
The Building People

# A&S Goals and Approaches

**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.*

## Approaches:

- Develop and maintain analytical tools, models, methods, and datasets to support science-based quantification and improved decision-making.
- Ensure high-quality, transparent, reproducible, peer-reviewed analyses.
- Explore the impact of emerging opportunities and identify R&D needs and critical metrics to enable new ideas.
- Develop sustainable system designs that increase bioenergy production while enhancing economic, social, and environmental outcomes.
- Ensure broad engagement with stakeholders.

# A&S Strategic Goals

## Strategic Analysis

Provide context and justification for decisions at all levels by establishing the basis of quantitative metrics, tracking progress toward goals, and informing portfolio planning and management

## Cross-Cutting Sustainability

Understand and promote the positive environmental, economic, and social effects and reduce the potential negative impacts of bioenergy production activities

# Dimensions of Bioenergy Sustainability

A&S considers three dimensions of sustainability:

- Economic
- Environmental
- Social


Water quality and quantity
Soil quality
Air quality
Greenhouse gas emissions

Economic growth and resilience
Affordability
Energy security
Process efficiency
Outputs of desired products

Jobs and workforce development
Health and well being
Food security
Social acceptability

# A&S Plays a Cross-Cutting Role

## A&S PROJECTS

-Standardized methods and analytical approaches

-Development of tools and models to gain insights and improve decision-making

-Research on potential impacts and strategies for beneficial outcomes

## ANALYSIS & SUSTAINABILITY

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## ANALYSIS & SUSTAINABILITY

## PROGRAM INTEGRATION
(FSL, AAS, CONVERSION, ADO)

-Analyses on environmental and economic performance informed by program-generated data

-Analyses to inform R&D priorities to identify new opportunities and challenges

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Analytical basis for strategic planning, decision-making, and assessment of progress to support BETO, EERE, and DOE goals

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Interagency coordination, engagement with external experts, informing international dialogues

# Key Challenges

Meeting A&S program goals will require:

- Analysis to Inform Strategic Direction
- Analytical Tools and Capabilities for System-Level Analysis
- Data Availability across the Supply Chain
- Identifying New Market Opportunities for Bioenergy and Bioproducts
- Quantification of Economic, Environmental, and Other Benefits and Costs
- Science-Based Methods for Improving Sustainability
- Social Acceptance and Stakeholder Involvement
- Consensus, Data, and Proactive Strategies for Improving Land-Use Management

# Key Elements and Approaches


## Models and Tools

- The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model (GREET)
- Biomass Scenario Model (BSM)
- Bioproducts Transition Systems Dynamic Model (BTD)

NREL NATIONAL RENEWABLE ENERGY LABORATORY
OAK RIDGE National Laboratory
INL Idaho National Laboratory
Argonne NATIONAL LABORATORY
Pacific Northwest NATIONAL LABORATORY



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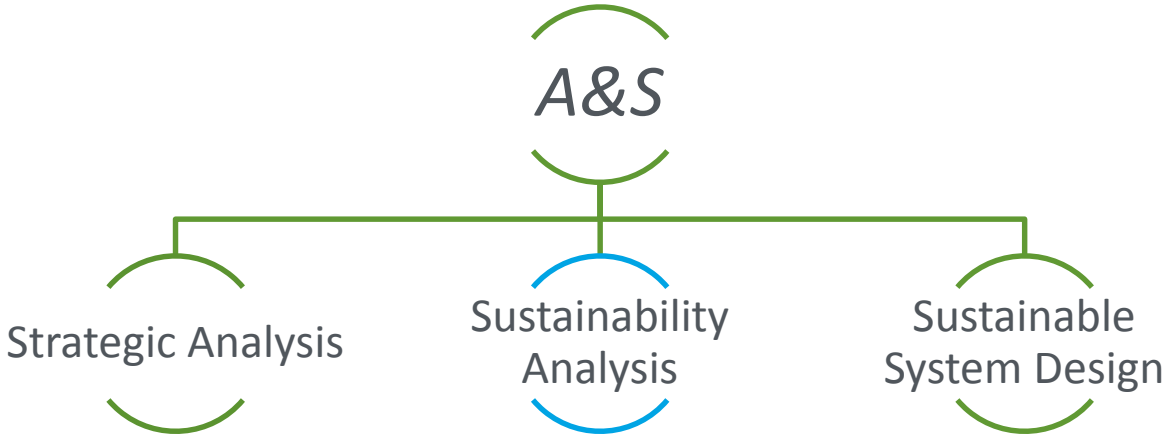
# Key Elements and Approaches




## Models and Tools

- Jobs and Economic Development Impact (JEDI) Models
- Feedstock Production Emissions to Air Model (FPEAM)
- Landscape Environmental Assessment Framework (LEAF)
- Water Assessment Tool for Energy Resources (WATER)
- The Soil & Water Assessment Tool (SWAT)

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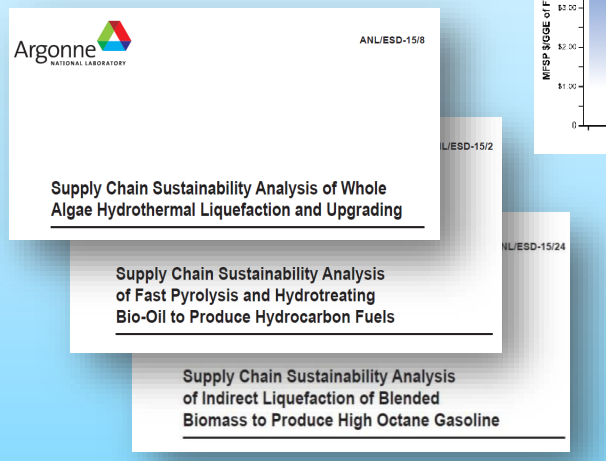
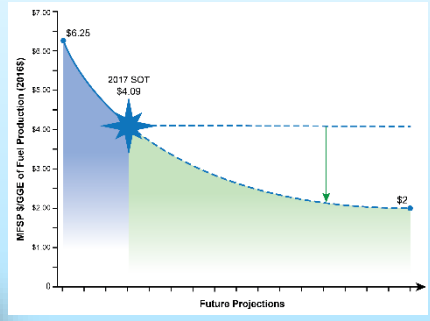
# Key Elements and Approaches


- Techno-economic analysis
- Lifecycle analysis
- Economic and security benefits
- Systems analysis



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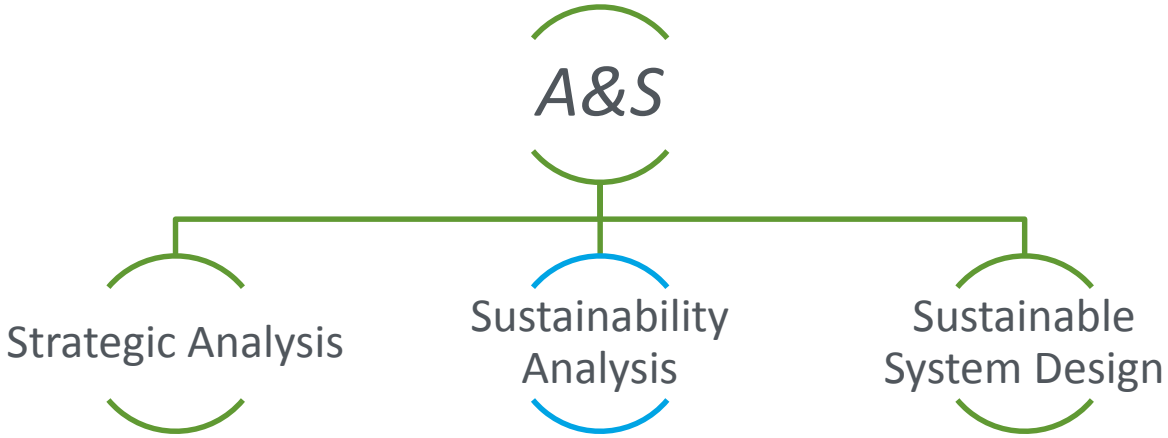
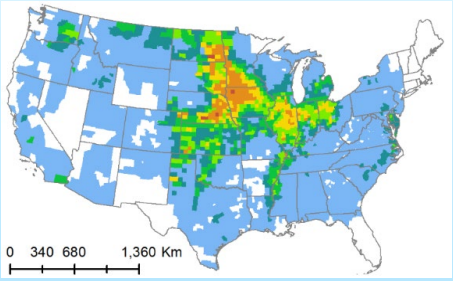
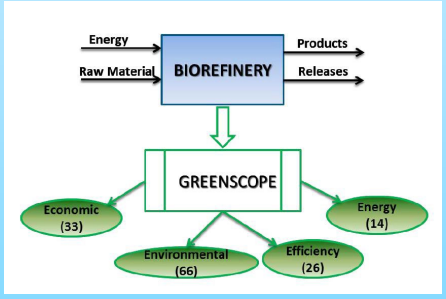



- Economic, environmental, and/or social sustainability of bioenergy and bioproducts
- Land-use impacts
- Analysis of benefits, trends, and possible trade-offs

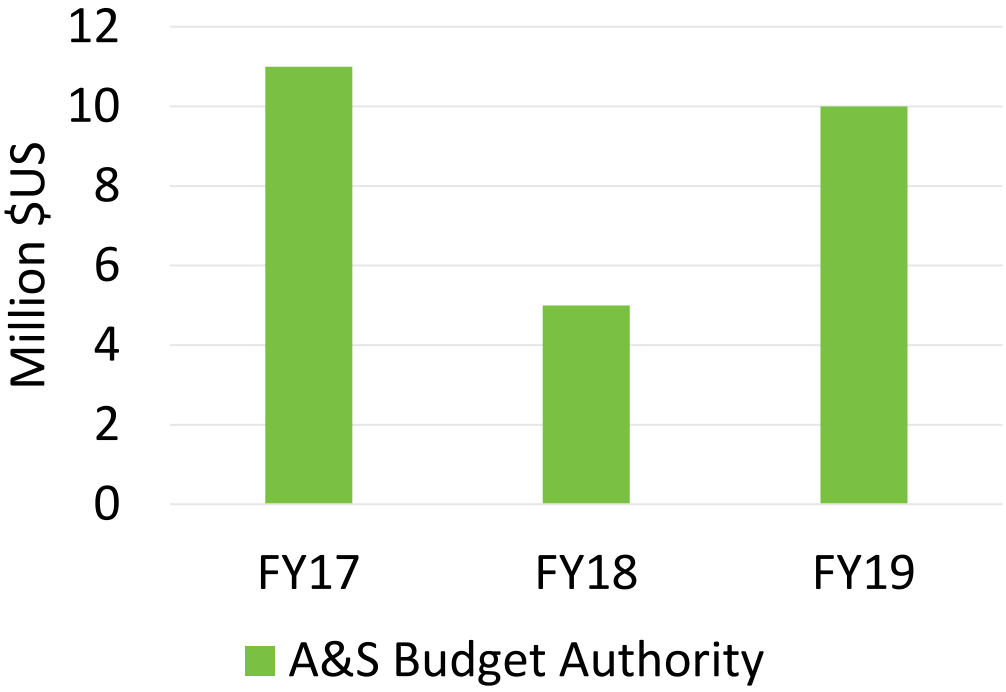


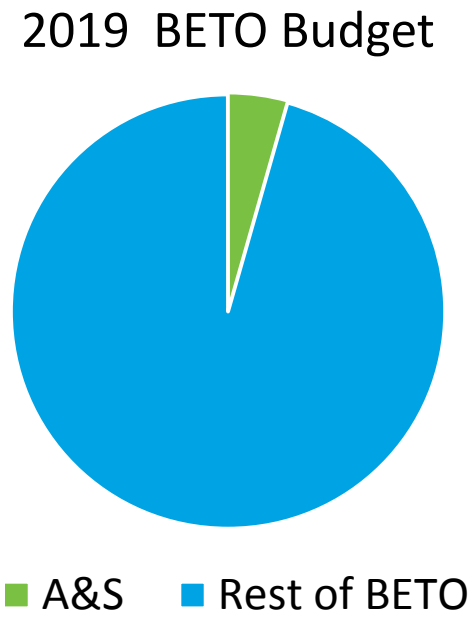



# Key Elements and Approaches


- Stakeholder-driven design
- Watershed modeling
- Field research
- Valuing ecosystem services to reduce the cost of biofuels

# A&S Budget



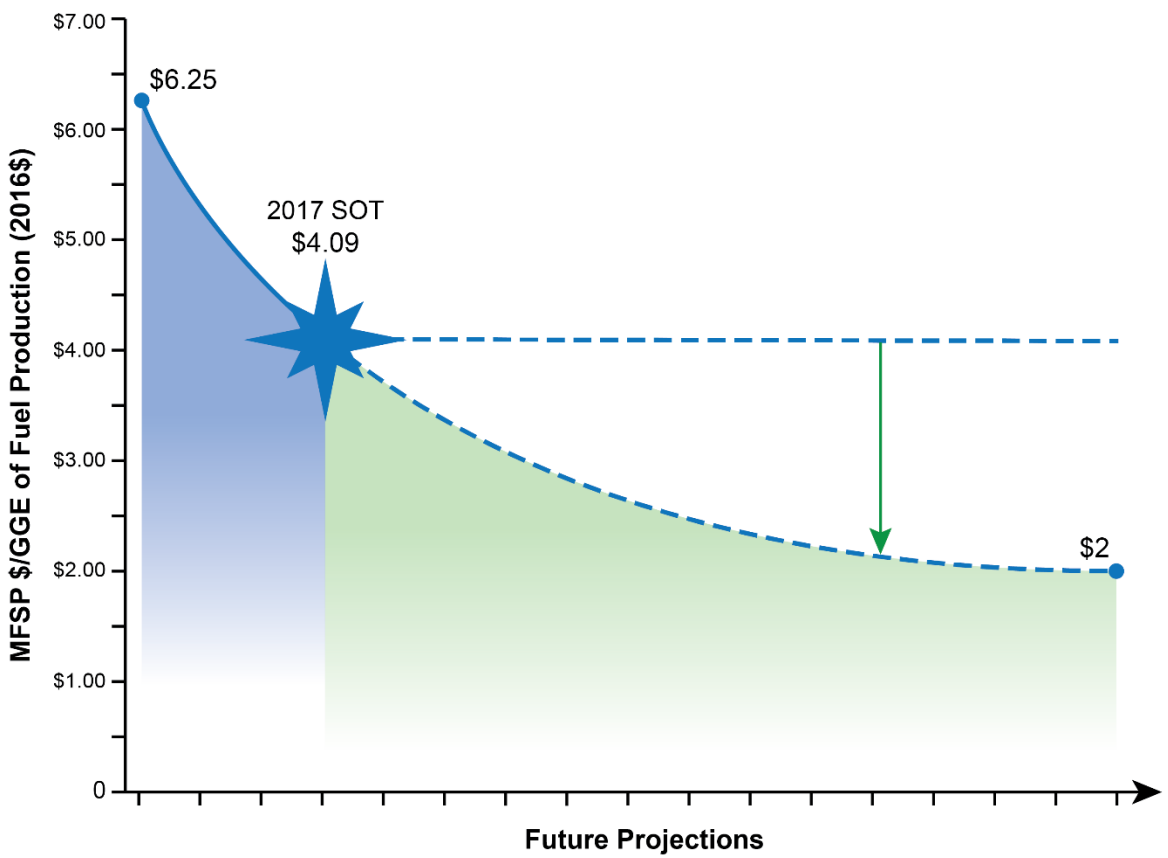




A&S 2019 Review Session includes:

- 24 National Laboratory Projects
- 2 Competitive Projects

# Key Accomplishments: Support of BETO Cost Goals

Completed an analysis of strategies to reduce the cost of biofuels toward $2/GGE







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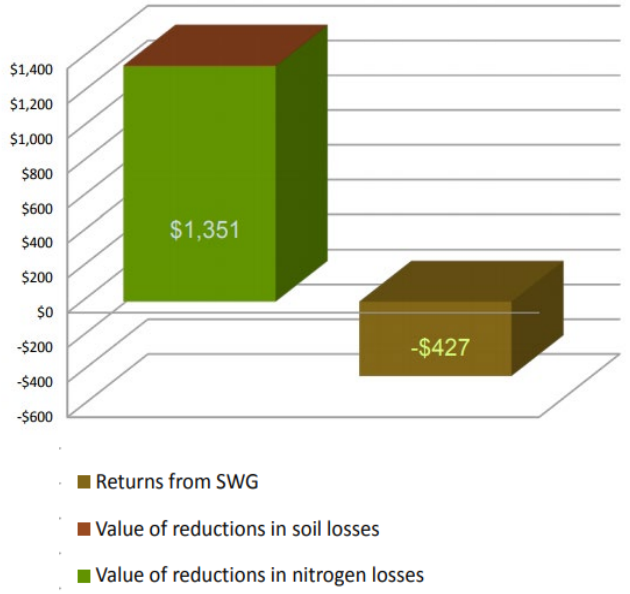
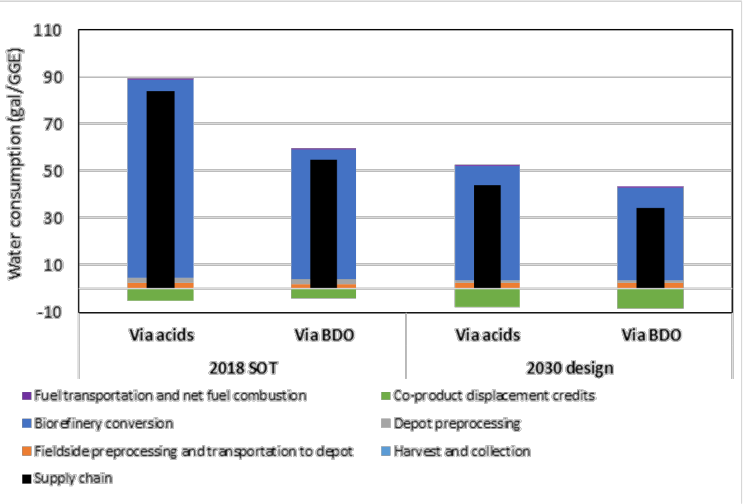
# Key Accomplishments: Support of BETO Cost Goals

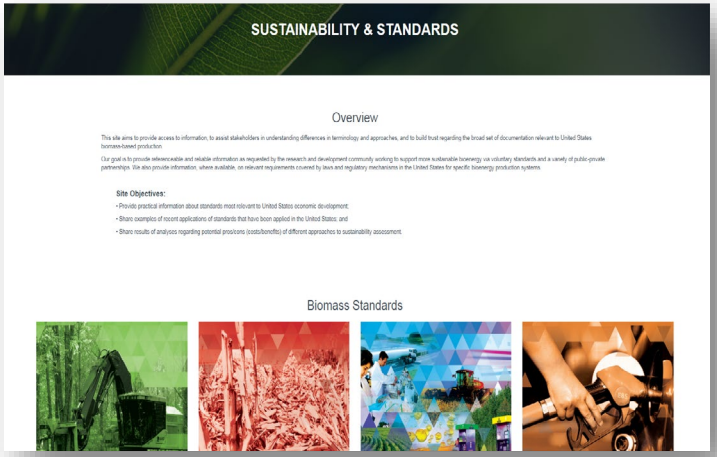
- Identified **integrated landscape management strategies** to reduce biomass access costs by 20% while resulting in improved agricultural field economic performance and environmental metrics
- Considered how **valuing ecosystem services** could reduce the cost of biofuels and quantified ecosystem services of case study agricultural and forestry systems
- Completed **techno-economic analysis for multiple biojet fuel pathways** to explore opportunities and research needs to produce jet fuel at $2.5/GGE




# Key Accomplishments: Model Development and Application

- Released a public version of the **Biomass Scenario Model**
- Tested and refined **BioSTAR** visualization tool
- Improved **GREET** model including: soil organic carbon, co-product handling methodology; representation of woody feedstocks considering temporal effects
- Published **supply chain sustainability analyses** for several pathways
- Quantified **green water availability** for bioenergy production
- Completed a **Sustainability Landing Page** on the Bioenergy KDF



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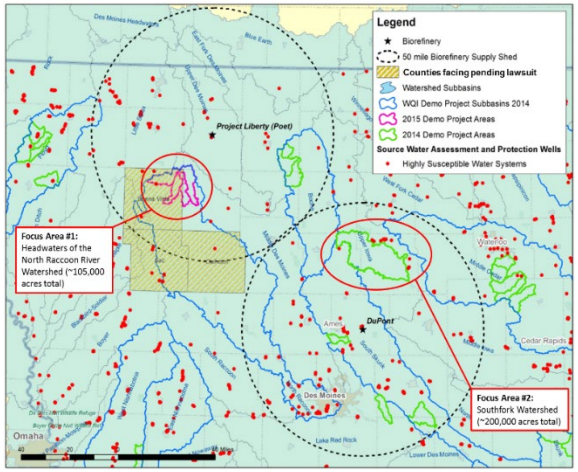
# Key Accomplishments: Landscape Design

- Completed eight-year evaluation of environmental effects of short-rotation loblolly pine cover
- Established over 3,000 acres of perennial grasses for monitoring and quantifying environmental effects (e.g. water quality, soil carbon)
- Developed framework to evaluate strategies that can provide bioenergy resources, improve streamflow, and reduce wildfire risk in forests
- Developed technique for estimating field efficiency for fields of irregular geometries and applied to establish feedstock logistics cost baseline to assess corn stover management options

ORNL Short Rotation Woody Pine Research




Antares project watersheds

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# Affordable and Sustainable Energy Crops (ASEC) FOA

- This FOA is a collaborative effort between A&S and FSL
- Projects will conduct field testing of new varieties of energy crops, measure crop performance and environmental effects, and define cost-effective logistics strategies.
- Projects selected:
  - University of Illinois (switchgrass)
  - Texas A&M Agrilife (energy cane, biomass sorghum)
  - North Carolina State University (miscanthus)

# Reviewer Comments from 2017 Peer Review

- Clarify where projects fit relative to other BETO projects and the program's goals
- Greater focus on integration
- Establish consistency and agreement across projects


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# Key Changes Since 2017 Peer Review

- ✓ Model and Tool Mapping Project
- ✓ Emphasis on application of tools
- ✓ Involvement in the Sustainability Interagency Working Group under Biomass R&D Board to facilitate more consistency and communication across agencies


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# Engagement with Diverse Stakeholders

- **Organized Workshops and Conference Sessions**
  - Bioeconomy 2017, Arlington, VA - Jul 2017
  - "Modeling the Bioeconomy in 2018 and Beyond" workshop, Golden, CO - June 2018
  - Summit on Realizing the Circular Carbon Economy, Denver, CO - July 2018
  - ABLC Global, San Francisco, CA – November 2019
- **Participated in Workshops and Technical Meetings**
  - Crop Residues for Advanced Biofuels Workshop, Sacramento, CA - Aug 2017
  - SAE Government Industry Meeting, Washington, DC - Jan 2018
  - Fuels Institute Annual Meeting, Chicago, IL - May 2018
  - EPA Nutrient Challenge Meeting - June 2018
  - "Building the Data Capacity for Food-Energy-Water Research Workshop", NCSU, Sept 2018
  - CRC Workshop on Lifecycle Analysis of Transportation Fuels, Argonne National Lab - Oct 2017
  - "LCA XVIII", Fort Collins, CO - Sept 2018
- **Continued Engagement International Sustainability Efforts**
  - IEA-Bioenergy Task 38 meetings, Gothenburg, Sweden – May 2017 and Uppsala, Sweden - Aug 2018

# Reviewers

| Reviewer | Affiliation |
|---|---|
| Kristin Lewis (Lead Reviewer) | US DOT Volpe Center |
| Harry Baumes | Retired from USDA |
| Kevin Fingerman | Humboldt State University |
| Chris Clark | EPA ORD |
| Bret Strogen | US Army - ASA(IE&E) and DASA(E&S) |

U.S.ARMY

U.S. Department of Transportation Volpe Center

HUMBOLDT STATE UNIVERSITY

USDA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

**THANK YOU, REVIEWERS!**