U.S. DEPARTMENT OF ENERGY
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

2021 PROJECT PEER REVIEW
U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

Data, Modeling and Analysis Session Overview

Alicia Lindauer, Technology Manager

Bioenergy Technologies Office Peer Review Meeting, March 9-12, 2021

Logistics

- Presenters and Reviewers should use their **webcam** when speaking.
- All other participants should remain on **mute** and leave their cameras off.
- Presenters were given the option to submit a pre-recorded presentation or present live. All Q&A will be live.
- All presenters must follow **time limits**.
- **Reviewers** should unmute yourselves to ask questions during the Q&A period.
- **General public** should ask any questions in the chat. We will field questions as time allows after the reviewers have asked questions.
- If calling in on a phone, follow the instructions to enter your participant ID.

Agenda Overview

Tuesday

Strategic Analysis, Carbon Dynamics and Life Cycle Analysis

Wednesday

Land Use and Landscape Design, Quantifying Ecosystem Services

Thursday

Sustainability and Environmental Effects Analysis

Friday

Strategic Analysis,

Data Collection and Dissemination, Outreach and Stakeholder Engagement

Thank You Reviewers!

Reviewer	Affiliation
Kevin Fingerman (lead)	Humbolt State University
Kristin Lewis	DOT-Volpe National Transportation Systems Center
Max Broad	Independent Consultant
Nikita Pavlenko	International Council on Clean Transportation
Amy Landis	Colorado School of Mines
Katherine Goodall	Independent Consultant

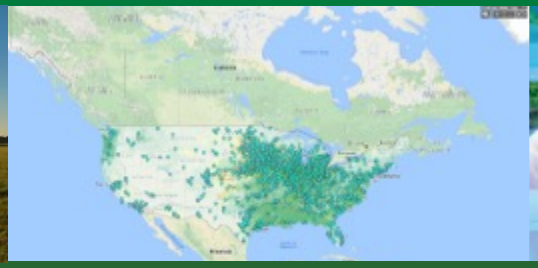
THANK YOU, REVIEWERS!

Analysis Program Strategic Goal and Approach

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.


Analysis Program Goals from the Multi-Year Plan

- **By 2025**, understand and quantify environmental and economic effects associated with emerging biofuel and bioproduct technology pathways and identify R&D needs to enhance benefits, reduce risk, and enable BETO's 2030 performance goal.
- **By 2030**, verify at least two biomass production systems at field scale that provide ecosystem services which, when valorized, equate to at least a 10% reduction in biofuel MFSP.

Environmental Sustainability is a Key Priority

Climate and Air Emissions

Quantify progress towards reducing lifecycle GHGs, regulated emissions, and fossil energy use.

Soil Quality

Develop strategies and tools for producing biomass feedstocks while improving soil quality.

Land Use and Productivity

Advance landscape design approaches that increase biomass production and enhancing ecosystem services.

Water Quantity and Quality

Assess water resource use and water quality of impacts and opportunities for improvement.

Biological Diversity

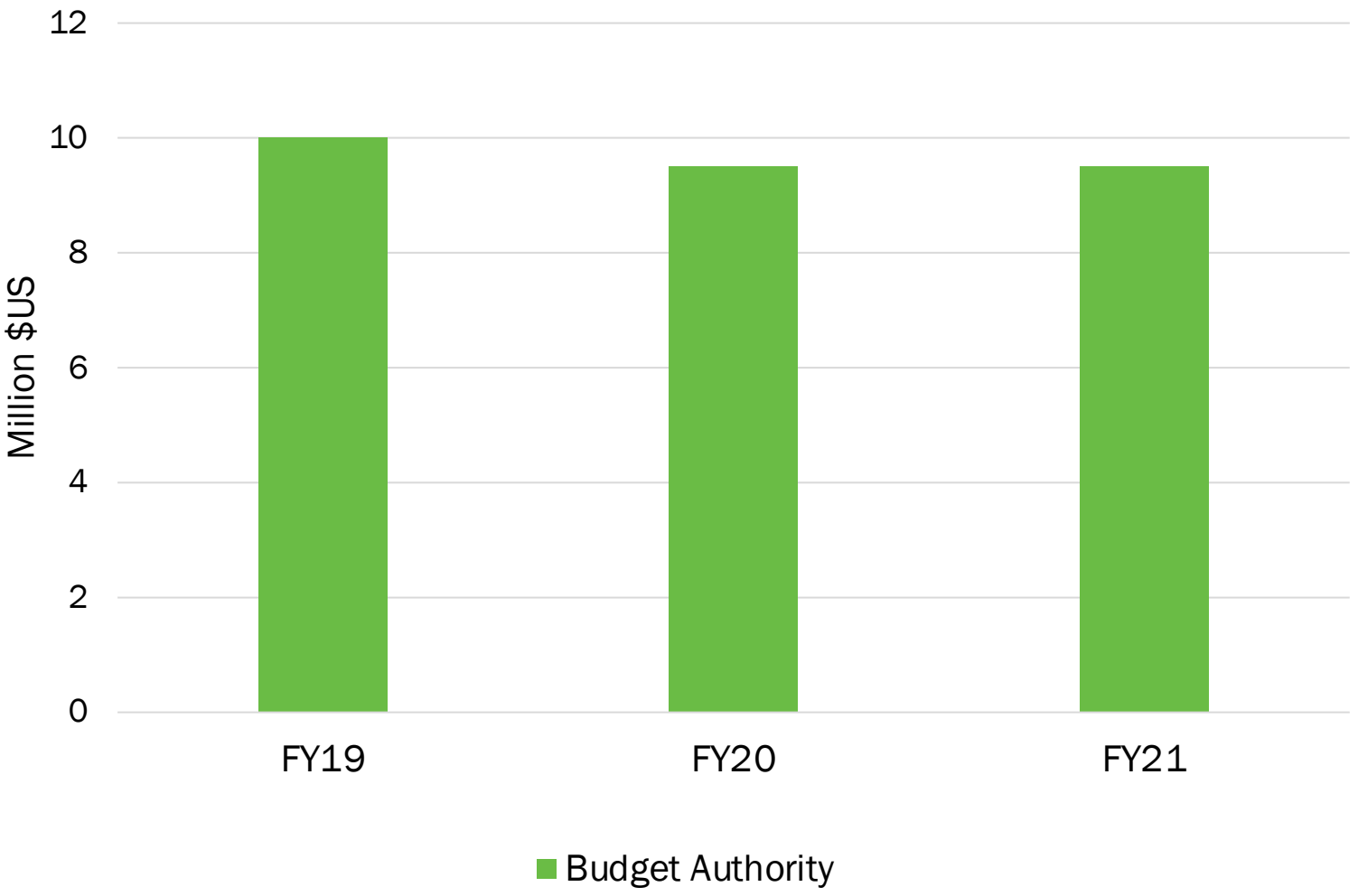
Investigate relationships between bioenergy crops and biodiversity.

Key Challenges

Meeting Analysis 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
- Stakeholder Acceptance and Involvement
- Consensus, Data, and Proactive Strategies for Improving Land-Use Management

Analysis Program Budget



Analysis 2021 Peer Review session includes:

- 21 National Laboratory Projects
- 3 Competitive Projects

- Project and pathway-specific analysis is performed by the R&D Programs
- The Analysis Program works with the R&D Programs to harmonize methods and focuses on cross-cutting analysis

Bio-Restore: Biomass to Restore Natural Resources

- Three selections were made under the topic, totaling over $9 M in federal funding.
- Bio-Restore projects will develop and employ new methods to quantify the environmental and economic benefits associated with growing energy crops on marginal and/or unproductive land with a focus on restoring water quality and soil health.

Awardee	Approach/Objective
University of Nebraska – Lincoln	Quantify ecosystem services resulting from growing perennial energy grasses in agricultural landscapes Northern Great Plains.
Mississippi State University	Evaluate productivity and ecosystem services of short rotation hybrid poplar in riparian and upland areas in Mississippi.
University of Florida	Evaluate energycane for ecosystem services including reduced nitrogen and phosphorus losses and GHG emissions, and improved soil carbon storage and biodiversity in marginal agricultural lands in Florida.

Program Interactions and Collaboration

- Monthly calls with national lab researchers and analysts to check in and share updates
- Quarterly check-ins with individual projects to assess progress
- Semi-annual calls with all project performers to increase awareness and encourage collaboration
- Regular interface meetings with other BETO R&D programs and other EERE analysts.
- Quarterly meetings with the Analysis and Sustainable Bioeconomy Interagency Working Groups under the Biomass R&D Board

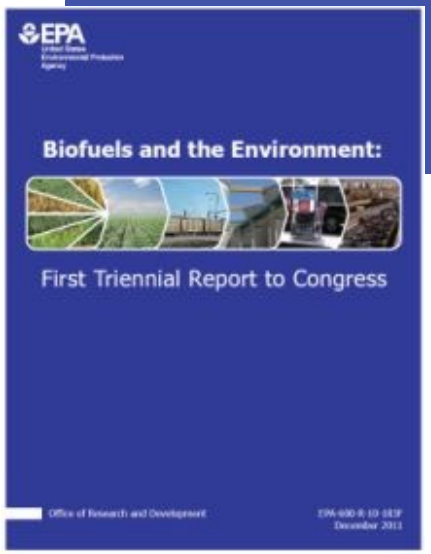
Sustainable Land Management Working Group

- Vision: Leverage DOE BETO-funded research efforts on ecosystem services to inform Integrated Assessment Models. Coordinate efforts across national lab projects.
- FY21 test case: Soil carbon/GCAM
- Supporting US contribution to IEA Bioenergy Task 45
- Participating projects:

PNNL	GCAM Bioenergy and Land Use	3/9/21, 2:05 pm ET
INL	Integrated Landscape Management	3/10/21, 11:35 am ET
ANL	Scaling Up the Ecosystem Services of Bioenergy Landscapes	3/10/21, 12:05 pm ET
ORNL	Geospatial Analysis of Ecosystem Service Portfolios from Biomass Production	3/10/21, 1:20 pm ET
NREL	Integrated Life Cycle Sustainability Analysis	3/11/21, 11:05 am ET
ORNL	Quantifying and Visualizing Progress Towards Sustainability	3/11/21, 11:35 am ET

Biofuels and the Environment:
EPA's Third Triennial Report to Congress

- EISA Section 204: EPA should report to Congress on the environmental and resource conservation impacts of the RFS program
- 3rd report in progress; DOE and USDA are co-authors
- Analysis projects contributing include:

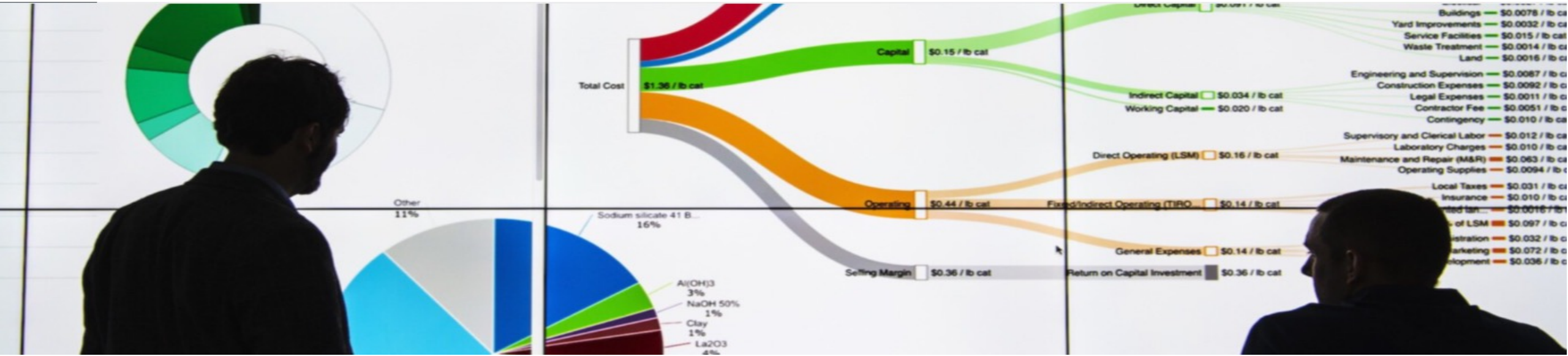


ANL	GREET Development and Biofuel Pathway Research and Analysis	3/9/21, 12:35 pm ET
NREL	Bioeconomy Scenario Modeling and Analysis	3/9/21, 2:35 am ET
ORNL	Ecosystem Service Portfolios of Agricultural and Forestry Biomass Production	3/10/21, 1:20 pm ET
ORNL	Attribution Analyses & Inter-Agency Collaboration	3/10/21, 1:50 pm ET
NREL	Integrated Life Cycle Sustainability Analysis	3/11/21, 11:05 am ET
ANL	Valuation and Visualization of Water Sustainability	3/11/21, 12:20 pm ET
NREL	Biofuel Air Emissions Analysis	3/11/21, 12:50 pm ET

Interactive Bioenergy Models

BETO supports a suite of models and tools that inform research efforts and enhance the economic and environmental value of bioenergy

- https://bioenergymodels.nrel.gov/
- Provides researchers an inventory of interactive bioenergy and bioproducts models
- Explore available models through lists or a dynamic map displaying relationships between models



Bioenergy KDF

The Bioenergy Knowledge Discovery Framework (KDF) provides access to a variety of data sets, publications, and visualization tools that support bioenergy research, analysis, and decision making.

- Users can search for information, explore key topics in bioenergy research and the bioeconomy, download data, and visualize information in an integrated manner.
- Biofuels TEA Database on the KDF promotes transparency and ease-of-access to BETO-supported public studies involving techno-economic analysis.
- Redesigned site was released on Monday, 3/8, includes new Key Topic pages on Sustainable Aviation Fuel, Marine Biofuels, and Sustainability.
- https://bioenergykdf.net

Alicia Lindauer

Technology Manager

Bioenergy Technologies Office

Energy Efficiency and Renewable Energy

U.S. Department of Energy

Alicia.Lindauer@ee.doe.gov

Tuesday, March 9th

Start Time	End Time	Presentation	Organization	Speaker
11:00 AM	11:15 AM	Data, Modeling and Analysis Session Introduction	BETO	Alicia Lindauer
11:15 AM	11:35 AM	Analysis and Sustainability Interface (unscored)	PNNL	Aye Meyer
11:35 AM	12:20 PM	Strategic Analysis Support	NREL	Ling Tao
12:20 PM	*12:35 PM*	*Break*		
12:35 PM	1:20 PM	GREET Deployment and Biofuel Pathway Research and Analysis	ANL	Michael Wang
1:20 PM	1:50 PM	Analysis of the Bioeconomy for Carbon Drawdown	LLNL	AJ Simon
1:50 PM	*2:05 PM*	*Break*		
2:05 PM	2:35 PM	GCAM Bioenergy and Land Use Modeling and Directed R&D	PNNL	Marshall Wise
2:35 PM	3:05 PM	Bioeconomy Scenario Analysis and Modeling	NREL	Emily Newes
3:05 PM	*3:35 PM*	*Comment Review Session*	*All Reviewers*	

U.S. DEPARTMENT OF ENERGY
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

2021 PROJECT PEER REVIEW
U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

Data, Modeling and Analysis Session - Day 2

Bioenergy Technologies Office Peer Review Meeting, March 10, 2021

Wednesday, March 10th

Start Time	End Time	Presentation	Organization	Speaker
11:00 AM	11:05 AM	Data, Modeling and Analysis Session Introduction	BETO	Alicia Lindauer
11:05 AM	11:35 AM	Enabling Sustainable Landscape Design for Continual Improvement of Operating Bioenergy Supply Systems	Antares Group Inc	Kevin Comer
11:35 AM	12:05 PM	Integrated Landscape Management	INL	Mike Griffel
12:05 PM	12:35 PM	Scaling Up the Ecosystem Services of Bioenergy Landscapes	ANL	Cristina Negri
12:35 PM	*12:50 PM*	*Break*	*All*	
12:50 PM	1:20 PM	Sustainable Biomass through Forest Restoration	PNNL	Mark Wigmosta
1:20 PM	1:50 PM	Ecosystem Service Portfolios of Agricultural and Forestry Biomass Production	ORNL	Yetta Jager
1:50 PM	2:20 PM	Attribution Analyses & Inter-Agency Collaboration	ORNL	Keith Kline
2:20 PM	*2:35 PM*	*Comment Review Session*	*All Reviewers*	

Landscape Design for Sustainable Bioenergy Systems

- Objective: support the design of sustainable bioenergy systems that maintain or enhance the environmental and socio-economic sustainability of cellulosic bioenergy through improvements in feedstock production, logistics systems, and technology development.
- Jointly funded by the Analysis and Feedstocks programs.
- One project selected in 2015

Antares Group Inc.
Enabling Sustainable Landscape Design for Continual Improvement of Operating Bioenergy Supply Systems

U.S. DEPARTMENT OF ENERGY
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

2021 PROJECT PEER REVIEW
U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

Data, Modeling and Analysis Session - Day 3

Bioenergy Technologies Office Peer Review Meeting, March 11, 2021

Thursday, March 11th

Start Time	End Time	Presentation	Organization	Speaker
11:00 AM	11:15 AM	Data, Modeling and Analysis Session Introduction	BETO	Alicia Lindauer
11:05 AM	11:35 AM	Integrated Life Cycle Sustainability Analysis	NREL	Patrick Lamers
11:35 AM	12:05 PM	Quantifying and Visualizing Progress Towards Sustainability	ORNL	Esther Parish
12:05 PM	*12:20 PM*	*Break*		
12:20 PM	12:50 PM	Water Resource Management for Bioenergy and Bioproducts	ANL	May Wu
12:50 PM	1:20 PM	Biofuel Air Emissions Analysis	NREL	Danny Inman
1:20 PM	1:50 PM	Spatially Resolved Measurements of Environmental Sustainability Indicators For Bioenergy	ORNL	Natalie Griffiths
1:50 PM	*2:20 PM*	*Comment Review Session*	*All Reviewers*	

U.S. DEPARTMENT OF ENERGY
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

2021 PROJECT PEER REVIEW
U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

Data, Modeling and Analysis Session - Day 4

Bioenergy Technologies Office Peer Review Meeting, March 12, 2021

Friday, March 12th

Start Time	End Time	Presentation	Organization	Speaker
10:30 AM	10:35 AM	Data, Modeling and Analysis Session Introduction	BETO	Alicia Lindauer
10:35 AM	11:05 AM	Biofuels Information Center	NREL	Kristi Moriarty
11:05 AM	11:35 AM	Biofuels National Strategic Benefits Analysis	ORNL	Rocío Uría-Martínez
11:35 AM	*11:50 AM*	*Break*	*All*	
11:50 AM	12:20 PM	Biobased and Biobenign, an Environmental Reference Framework for Product Design: RIPE	ANL	Margaret MacDonell
12:20 PM	12:50 PM	Agent-based Modeling for the Multi-objective Optimization of Energy Production Pathways: Integrated Techno-economics and Life Cycle Assessment	Colorado State	Jason Quinn
12:50 PM	1:20 PM	Multi-Input, Multi-Output Biorefineries to Reduce Greenhouse Gas and Air Pollutant Emissions	UC Berkeley	Corinne Scown
2:20 PM	2:35 PM	Break	All	
1:35 PM	1:55 PM	Accelerating Bioenergy Technology Advancement Through FAIR Data Delivery	ORNL	Bruce Wilson
1:55 PM	2:15 PM	Bioenergy Knowledge Discovery Framework	ORNL	Aaron Myers
2:35 PM	3:05 PM	Comment Review Session	All Reviewers	

Reducing Water, Energy, and Emissions in Bioenergy FOA Topic

- **Objective:** Bring new performers and ideas into the analysis portfolio to help inform BETO's R&D using a broader set of metrics to arrive at optimal solutions.
- **Impact:** Analysis will identify biofuel and/or bioproduct pathways with the greatest potential to reduce water consumption, energy consumption, and emissions relative to existing conventional fuels or products.
- Two selections were awarded in FY19, totaling $2M in funding:

Berkeley UNIVERSITY OF CALIFORNIA	**University of California, Berkeley** Multi-Input, Multi-Output Biorefineries to Reduce Greenhouse Gas and Air Pollutant Emissions
Colorado State University	**Colorado State University** Agent-based Modeling for the Multi-objective Optimization of Energy Production Pathways