BIOENERGY TECHNOLOGIES OFFICE

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

Q4 2016 Presentation to the Technical Advisory Committee

Elliott Levine
Designated Federal Official

November 17-18, 2016
Washington, DC

TAC Housekeeping

Travel Process

- Natalie Roberts is the point of contact for all questions related to TAC travel and reimbursement. She can be reached at: natalie.roberts@ee.doe.gov or 202-586-2325.
- Reimbursement deadline for this meeting: December 9, 2016

Future Meeting Dates

- Tentative dates for 2017 Q1 meeting have been identified below and will be confirmed during current meeting:
  - Q1: March 9-10, 2017

2016 Work Plan

Meeting	Objectives
Q1 March 8-9	• Received overview presentations on BETO, EERE Priorities, NIFA and ARS, ARPA-E, Food-Energy-Water Nexus, and the FARB. • Provided feedback on the FARB. • Developed list of potential deep dive topics for Subcommittees
Q2 June 13-14 1 ½ day meeting	• Presentations on BETO MYPP, AFRI, and update on the Bioeconomy. • Selected topics for Subcommittees and begun identifying problem statements.
Q3 August 16-18 1 ½ day meeting (plus site visit)	• Visited Virent, Forest Products Lab (USDA), and Great Lakes Bioenergy Research Center. • Worked in Subcommittees to develop recommendations for agreed upon topics.
Q4 November 17-18 1 ½ day meeting	• Finalize and vote on 2016 recommendations.

TAC Subcommittees

- ❑ Conversion
- ❑ Sustainable Feedstocks, Production and Logistics
- ❑ Products Markets, and Systems

Subcommittees develop:

- Problem Statements: Identify issues/challenges that must be addressed.
- Recommendations: Technical or R&D strategies that address the identified problem statements.
- Information Requests: Requests for speakers, data, reports, or other information that can be given or presented to the committee that assists them in developing their recommendations.

Subcommittees gain wisdom through:

- Assembly of subject matter experts to address cross-cutting challenges.
- Development of workshops and reports based on recommendations.
- Site visits to key resources.

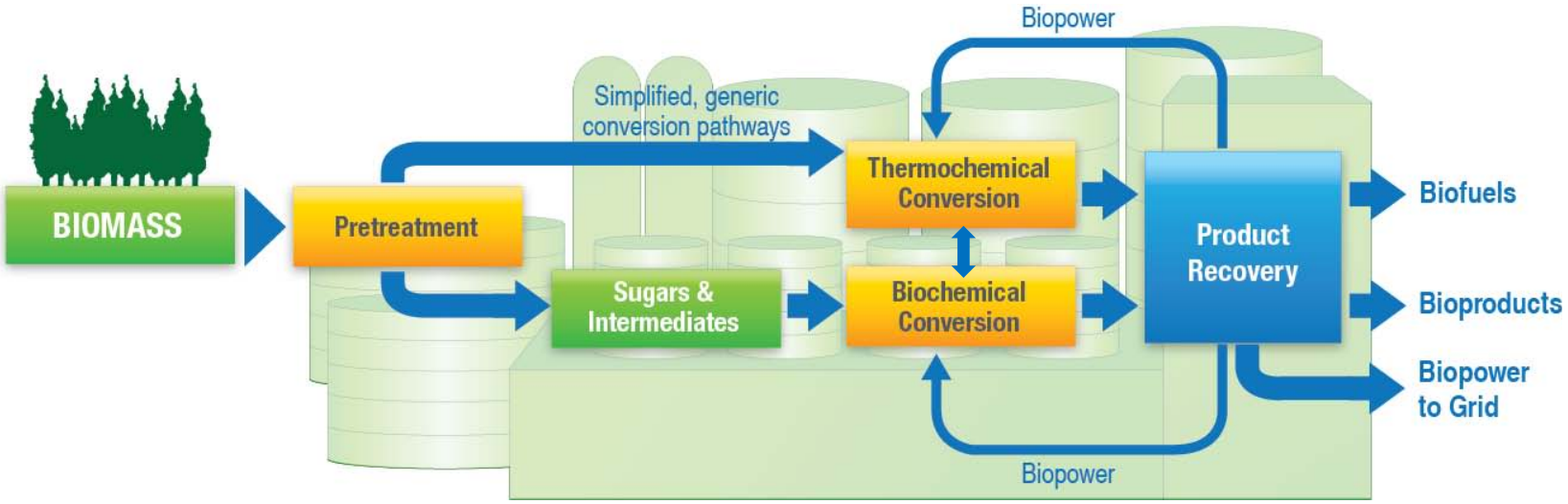
Themes for 2016 Recommendations:

- Improve Profitability of Bioeconomy Industries
- Bioeconomy Market Drivers
- Stimulate Public Awareness and Acceptance

Key Challenge for Innovation – Lowering Risks

De-risking technologies is central to R&D through **demonstration** with greater **integration** and **scale**. BETO focuses on:

- Advancing renewable gasoline, diesel, and jet fuels technologies
- Technical, construction, operational and financial/market risks



Challenges	Opportunities
• Feedstock availability, quality, and cost	RD&D to reduce feedstock and logistics costs
• Production costs, reliability of supply and quality	Cost-shared pilot and demonstration-scale facilities
• Risk of first-of-a-kind technology	Focus on infrastructure-compatible hydrocarbon fuels
• Inadequate distribution infrastructure	Co-products to improve economics of biofuels
• Public acceptance of bioenergy	Robust communications strategy and engagement with public stakeholders

Inter-Agency Collaboration

Other Federal Agencies

USDA — USDA focuses on feedstock production and rural development, co-chairs the BRDI Board with DOE, and partners with BETO on interagency efforts to support the bioeconomy.

FAA — BETO provides technical expertise on the Farm-to-Fly 2.0 initiative to produce renewable jet fuel.

EPA — The EPA administers the Renewable Fuel Standard and works with BETO on life cycle analysis for different fuel pathways.

DOT — The DOT invests in national infrastructure and works with BETO on challenges related to bioenergy transportation and logistics.

DOD — Under the Defense Production Act, the DOD partners with USDA and DOE to produce drop-in fuels for the military.

NSF — NSF supports innovative chemical, environmental and bio-engineering analysis which informs BETO research.

Key Partnerships of the Bioenergy Technologies Office

Department of Energy

Office of Energy Efficiency & Renewable Energy

- **Vehicle Technologies Office (VTO)** — VTO partners with BETO on fuel and infrastructure characterization and new work on the co-optimization of fuels and engines.
- **Advanced Manufacturing Office (AMO)** — AMO works with BETO to research and develop renewable, low-cost carbon fiber for lightweight vehicles.

Bioenergy Technologies Office (BETO)

BETO's mission is to accelerate the commercialization of advanced biofuels and bioproducts through targeted RD&D supported by public and private partnerships.

- **Fossil Energy** — BETO collaborates with the Office of Fossil Energy to utilize biomass for carbon capture.
- **Office of Science** — The Office of Science focuses on early stage basic science with eventual commercial applications for bioenergy.
- **ARPA-E** — ARPA-E invests in innovative technologies including electro-fuels and the PETRO program for direct biofuel production.
- **ENERGY.GOV Loan Programs Office** — The Loan Programs Office provides loan guarantees for commercial biorefinery projects.
- **EIA** — BETO contributes data to the EIA to support their accurate energy forecasting for consumption and production.

The White House Office of Science and Technology Policy

BETO contributes to White House goals for the reduction of GHG emissions and oil imports under the Climate Action Plan.

National Laboratories

NREL National Renewable Energy Laboratory; INL Idaho National Laboratory; Los Alamos National Laboratory Est. 1943; Oak Ridge National Laboratory; Argonne National Laboratory; Pacific Northwest National Laboratory; Sandia National Laboratories; Brookhaven National Laboratory; Lawrence Livermore National Laboratory; Berkeley Lab Lawrence Berkeley National Laboratory

BETO partners with other DOE Offices, other Federal agencies, and the national labs to achieve U.S. goals on bioenergy

FY 2016 Accomplishments

- **Feedstock Supply & Logistics:** Published a fully integrated assessment of potential available feedstock supplies under previously established environmental and quality criteria.
- **Advancements in Algal Biomass Yield:** BETO awarded $15 million for three projects aimed at reducing the costs of production of algae-based biofuels and bioproducts through improvements in algal biomass yields.
- **Conversion:** Selected and completed preparation of pathways for validation at integrated bench or pilot scale in FY 2017 of modeled mature $3/gge gasoline/diesel blendstock price and progress toward FY 2022 price goals ($3/gge).
- **New Fuels and Vehicle Systems Co-Optimization:** Establishes a link early in the R&D cycle of both fuels and engines for a systems-based approach and to create optimized solutions for fuels and engines. Collaboration with Vehicles Technologies.
- **New Investments in the Integrated Production and Scale-Up of Drop-in Hydrocarbon Fuels:** Released new competitive awards for Validation Phase to scale-up integrated production systems of drop-in hydrocarbon biofuels to accelerate advanced biofuel manufacturing.

FY 2017 Planned Highlights

- **Agile Biofoundry:** A multi-lab Foundry to apply synthetic biology tools to modify organisms, develop robust processing capabilities, and scale-up, which can be easily transferred to industry.
- **Integrated Biorefinery (IBR):** FY17 and FY18 funds are targeting IBR projects during Phase II of the IBR FOA (following a down-select review). Phase II involves construction of up to two demonstration (scale) facilities or up to six pilot-scale facilities to produce drop-in hydrocarbon fuels.
- **Energy Materials Network – ChemCat Bio**: Applying accelerated approaches to advanced materials R&D, develop more robust catalysts with increased conversion efficiencies for more cost competitive biofuels and bioproducts.
- **Co-Optimization of Fuels and Engines:** This crosscutting project simultaneously tackles fuel and engine innovation to co-optimize performance of both elements
- **Advanced Algal Biology**: Future activities will be tightly focused on the biology of algae.
- **Separations Consortium:** Developing and bringing to market high-performing separations technologies through coordinated research at the national laboratories

Recent BETO Undertakings

Co-Optimization of Fuels and Engines
(Co-Optima)

Agile BioFoundry
(ABF)

Separations Collaboration

Chemical Catalysis for Bioenergy
(ChemCatBio)

Co-Optimization of Fuels and Engines

better fuels. better vehicles. sooner.

Draws on collaborative expertise of two DOE research offices, nine national laboratories, and numerous industry and academic partners.

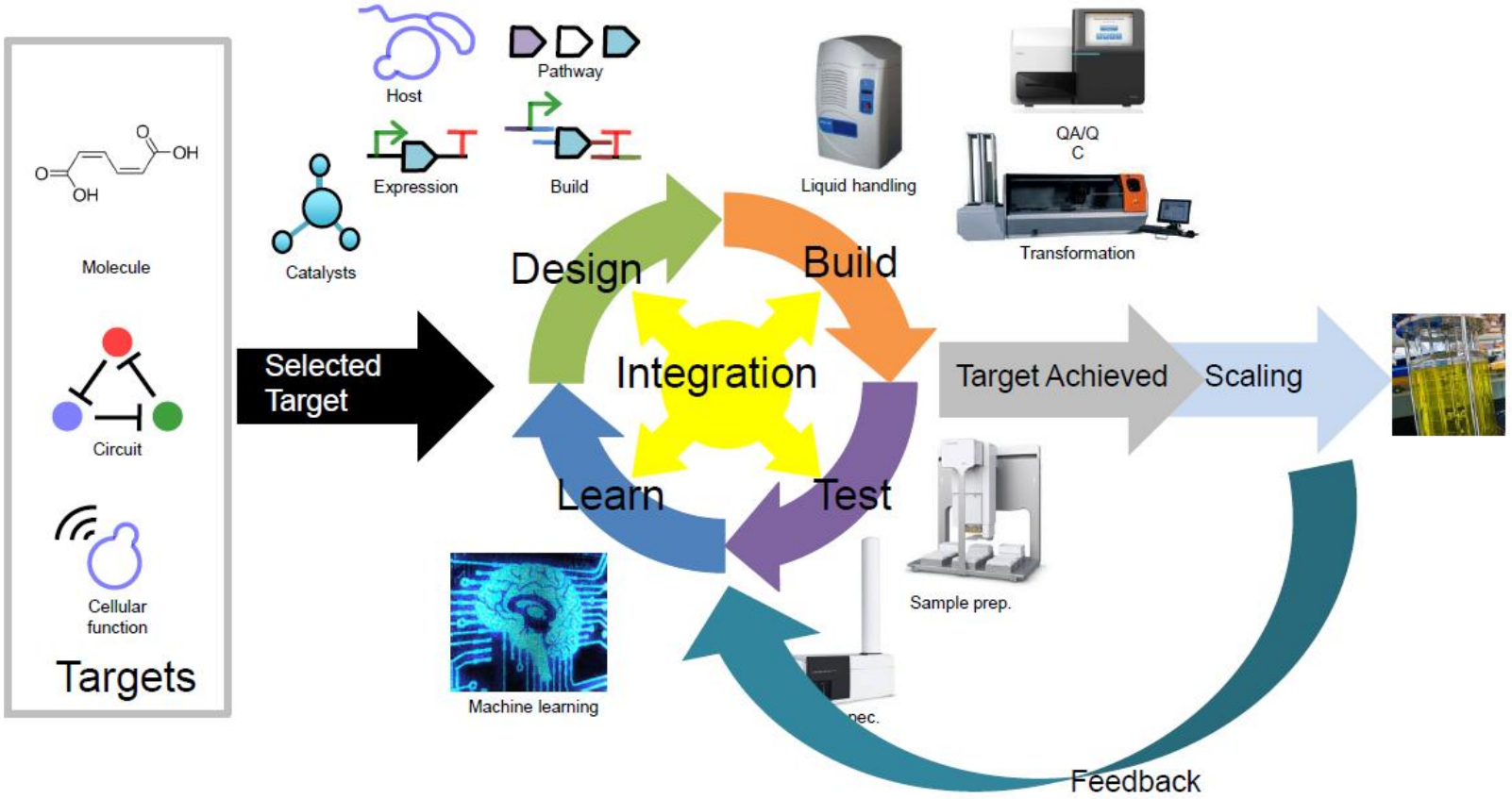
This **crosscutting project** simultaneously tackles **fuel and engine innovation** to **co-optimize performance** of both elements.

The project will provide industry with the R&D needed to:

- Bring **affordable and scalable near- and longer-term** biofuels and advanced engine solutions **to market more quickly**
- Reduce petroleum consumption by **billions of barrels a year**
- Improve fuel economy **15%–20% beyond projected results** of existing R&D efforts
- Deliver **tens of billions of dollars** in cost savings annually via improved fuel economy
- **Dramatically decrease** transportation sector criteria pollutants and GHG emissions.

Agile Biofoundry

- The Foundry would use standardized biological parts in combination with high performance computing and high throughput screening create a DBTL (Design, Build, Test, Learn) cycle that incorporates data from scaling efforts and enables production of high impact chemical and fuel targets. This will enable the much-needed generalized, integrated, and systematic approach based on synthetic biology tools developed in the last 15 years.



Bioprocessing Separations Consortium

Project Objectives

Develop and transition cost-effective, high-performing separations technologies to market faster through coordinated research at the national laboratories that targets challenges relevant to industry and BETO's priority pathways.

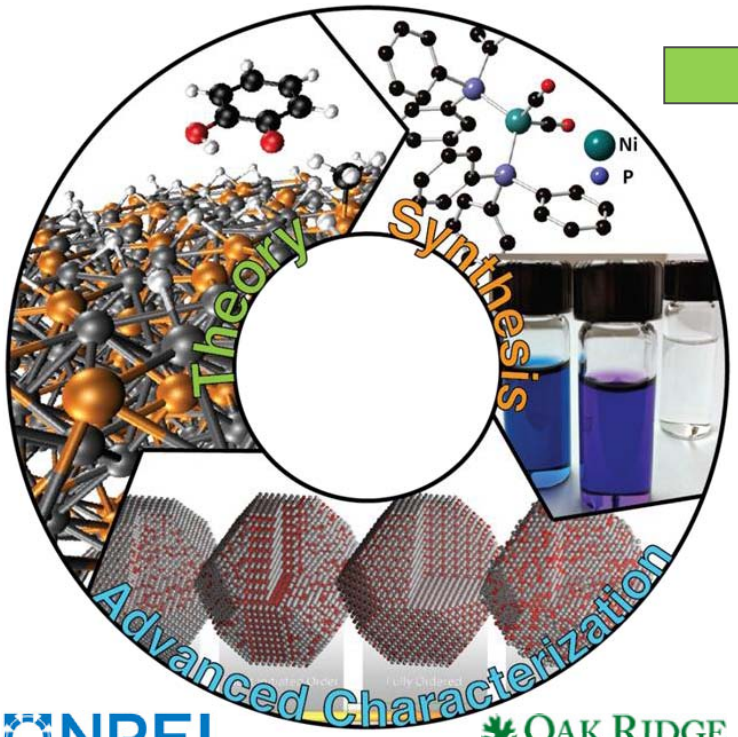
Motivation: Stakeholder input has highlighted the need for cost-effective separations technologies:

- Participants at the July 2015 Bioproducts to Enable Biofuels Workshop stated that upstream and downstream separations and purification are near term challenges associated with bioproducts.

Technical Approach

- Address challenges in biochemical, thermochemical, algal, and ionic-liquid based separations through targeted experimental work.
- Cross-cutting analysis to inform R&D priorities based on process economics and sustainability considerations.
- Advisory board with industrial and academic members, which will meet for the first time in December.

BETO/Energy Materials Network: ChemCatBio



NREL NATIONAL RENEWABLE ENERGY LABORATORY

OAK RIDGE National Laboratory

Pacific Northwest NATIONAL LABORATORY

Argonne NATIONAL LABORATORY

Los Alamos NATIONAL LABORATORY EST. 1943

ChemCatBio
Chemical Catalysis for Bioenergy

Coordinated resource network with a suite of capabilities for advanced materials R&D working to solve critical technical bioenergy challenges

- Addresses that catalytic materials significantly contribute to the cost of making advanced biofuels
- Streamlined processes for accelerated technological advances
- Builds off the successes of the CPC and Catalysis Working Group

*ChemCatBio will bring new catalytic materials to commercial bioenergy applications at least **two times faster** and at **half the cost** by leveraging unique capabilities and experts within the DOE National Laboratories*

New Material Innovations for Clean Energy 2X Faster and 2X Cheaper


BREAKING NEWS
FOAs, RFIs, Projects, and Events

Recent Funding Opportunity Announcements

Incubator 2

- On May 16, 2016, BETO announced up to **$10 million** in funding for six projects to **advance the production of advanced biofuels**, substitutes for petroleum-based feedstocks, and **bioproducts** made from renewable, **non-food-based biomass**, such as algae, agricultural residues, and woody biomass.

Selections:

- **Arizona State University** (Tempe, AZ) will engineer cyanobacteria for the production of ethyl laurate, which is easily converted to drop-in biofuels.
- **Arizona State University** (Tempe, AZ) will develop mixotrophic algae, which can consume CO_2 and cellulosic sugars and significantly improve algal biomass growth.
- **Duke University** (Durham, North Carolina) will enable a dramatic reduction in costs for commercial-scale biorefineries through "dynamic metabolic control."
- **Lygos, Inc**. (Emeryville, CA) will develop microbial catalysts to convert renewable cellulosic sugars into higher-value commodity and specialty chemicals.
- **White Dog Labs** (New Castle, DE) will develop new metabolic pathways in microorganisms so that they can concurrently consume a cellulosic sugar feedstock and CO_2, thus limiting the amount of CO_2 released from the process
- **LanzaTech, Inc**. (Skokie, IL) will work on technologies to enable manufacturing of the high-value industrial chemical building block, acetone, via biomass-derived syngas.

Recent Funding Opportunity Announcements

Advancements in Algal Biomass Yield Phase II (ABY2)

- On July 14, 2016, BETO announced up to $15 million for three projects aimed at reducing the costs of production of algae-based biofuels and bioproducts through improvements in algal biomass yields.

Selections:

- **Global Algae Innovations Inc.** (San Diego, California), will accelerate the commercialization of algal biofuels through development of an integrated, photosynthetic, open raceway pond system to produce algal oil. Their approach is to combine best-in-class cultivation and pre-processing technologies with some of the world's leading strain development laboratories – up to $5,000,000
- **Algenol Biotech LLC** (Ft. Meyers, Florida) has formed a team to advance the state of the art in algal production and biofuel processing with the end goal of a sustainable, economically viable biofuel intermediate through enhanced productivity of cyanobacteria, the conversion of the biomass to a biofuel intermediate, and the cost-sensitive operation of a photo-bioreactor system – up to $5,000,000
- **MicroBio Engineering, Inc.** (San Louis Obispo, California) will deliver integrated technologies that achieve high yields of biofuels, combined with treatment of wastewater, higher value co-products, and carbon dioxide mitigation – up to $4,999,954

“Co-Optima” Funding Opportunity Announcement

Joint BETO-VTO FOA – Released August 1, 2016

- A $7 million university-focused FOA to accelerate the introduction of affordable, scalable, and sustainable high-performance fuels for use in high-efficiency, low-emission engines.
- DOE sought proposals that address one or more of the following sub-topics:
  - Fuel characterization and fuel property prediction
  - Kinetic measurement and mechanism development
  - Emissions and environmental impact analysis
  - Impact of fuel chemistry and fuel properties on particulate emissions
  - Small-volume, high-throughput fuel testing
  - Market transformation strategies
- An informational webinar on Co-Optimization of Fuels and Engines FOA took place on September 14, 2016.
- Submission deadline for full applications was October 16, 2016.
- Applications received are currently undergoing compliance and merit review.
- Successful applicants will be assigned liaison from National Laboratory staff to assure full integration with Co-Optima program.

The Co-Optimization of Fuels and Engines initiative aims to simultaneously transform both transportation fuels and vehicles to:

- **Maximize performance and energy efficiency,**
- **Minimize environmental impact, and**
- **Accelerate widespread adoption of innovative combustion strategies.**

“Co-Optima” – Cont’d.

FY 2017 Activities

- There has been progress on narrowing down the fuels of interest for Thrust 1 (Spark Ignition) – but much work remaining.
- Thrust 1 decision point with Go/No-Go (up to 18 months).
  - Decision Point: Determination whether there is any potential alternative (or supplement) to ethanol in early 2020s.
  - Go/No-Go will be about whether to re-scope the program.
- Develop a market transformation plan and a 5-year strategic plan.
- Shift emphasis more towards Thrust 2 (Advanced Compression Ignition).
  - This is when more engine, and not just fuel properties, may come into play.
  - Longer-term focus; market entry on the 2030-timeframe.

Recent Funding Opportunity Announcements

MEGA-BIO Projects: Bioproducts To Enable Biofuels

- On August 2, 2016, BETO announced $11.3 million for three projects that support the development of biomass-to-hydrocarbon biofuels conversion pathways that can produce variable amounts of fuels and/or products based on external factors, such as market demand.

Selections:

- **The Dow Chemical Company** (Midland, Michigan), in partnership with LanzaTech and Northwestern University, will develop a process for the bioconversion of biomass-derived synthetic gas (syngas) to C6-C14 fatty alcohols as a pathway to biofuels.
- **Amyris, Inc.** (Emeryville, California), in cooperation with Renmatix and Total New Energies, will develop a manufacturing-ready process to produce farnesene, a hydrocarbon building block used in the manufacture of a variety of consumer products ranging from cosmetics to detergents, as well as in the transportation industry for diesel and jet fuel.
- **Research Triangle Institute** (Research Triangle Park, North Carolina) will partner with Arkema and AECOM to investigate the technical feasibility and economic potential, as well as the environmental and sustainability benefit, of recovering mixed methoxyphenols from biocrude as building block chemicals, alongside the production of biofuels.

Recent Funding Announcements

Small Business Vouchers (SBV) Pilot: Round 2

- On August 19, 2016, BETO announced $1 million in vouchers to assist five companies through the SBV Pilot, which is part of DOE's EERE National Laboratory Impact Initiative.
- In collaboration with national labs, the SBV Pilot supports small businesses to advance energy technology and help transform our biomass resources into commercially successful, high-performance biofuels, bioproducts, and biopower.

Selections:

- **ZymoChem** (Berkeley and Emeryville, California), in partnership with LBNL, will work with the LBNL Advanced Biofuels Process Demonstration Unit (ABPDU) to validate E. coli's capability to tolerate high product concentrations during fermentation and demonstrate the ability to recover purified products for customers to evaluate.
- **HelioBioSys** (Woodside, California), in partnerships with LBNL and SNL, will evaluate growth on a larger scale in outdoor conditions to obtain monomeric sugar types and yields, fermentation suitability, and by-product opportunities in order to validate cyanobacteria as a renewable source of sugar for biofuel production.
- **Virent** (Madison, Wisconsin), in partnership with ANL, will work with the Advanced Photon Source, a unique user facility with special equipment at ANL, to understand the deactivation mechanisms of their catalysts.
- **Mango Materials**, (Albany, California), in partnerships with LBNL and LANL, will seek to improve its ability to cost-effectively separate and de-water polyhydroxyalkanoates (PHA) from the fermentation broth and non-PHA cell mass.
- **Avatar Sustainable Technologies** (Syracuse, New York), in partnership with NREL, will evaluate the performance of NREL's advanced enzyme, "CelA" (cellulase from the bacterium Caldicellulosiruptor bescii), to improve performance of industrial-grade sugars. NREL will help Avatar develop a value proposition for paper mills while simultaneously processing significant waste (200 tons/day of paper mill waste) that is landfilled.

Biorefinery Optimization Workshop

Understanding Scale-Up and Operational Challenges for Integrated Biorefinery Optimization

Workshop was held October 5-6, 2016, Rosemont, IL

- Aimed to gather information on challenges encountered with the successful scale-up and reliable operation of integrated biorefineries (IBR).
- Inclusive of all pathways, methods, and technologies employed to convert woody biomass, agricultural residues, dedicated energy crops, algae, municipal solid waste (MSW), sludge from wastewater treatment plants, and wet solids, into biofuels, biochemicals, and bioproducts.

Next Steps

- Reducing the timeline between a FOA being conceived and a project being awarded.
- Reforms to cost share requirements are needed to lessen the burden on innovators.
- Reforming FOA guidelines to allow applicants to propose new technologies
- FOAs should integrate a better understanding of market variability to increase the likelihood of project success.
- Further consortia and workshops are needed to address issues in:
  - Value chain bottlenecks
  - Engineering
  - Transportation, storage, and logistics
  - Political/governmental barriers

Alternative Aviation Fuel Workshop

Date: September 14-15, 2016

Location: Macon Marriott City Center, 240 Coliseum Drive, Macon, Georgia

Purpose: Workshop was held to advance the understanding of current technical barriers for increasing the competitiveness of aviation biofuels.

The workshop was organized into three parallel breakout sessions that will focused on the following technical areas related to aviation biofuels from lignocellulosic biomass:

- Enhancing the economic and technical competitiveness of aviation biofuels from lignocellulosic biomass,
- Environmental and sustainability considerations and opportunities to improve the life-cycle benefits of aviation biofuels from lignocellulosic biomass, and
- Ensuring robust feedstock and product supply chains to support aviation biofuels from lignocellulosic biomass.

Recent Events

October 25–27, 2016

Commercial Aviation Alternative Fuels Initiative (CAAFI) General Meeting:

- CAAFI is a coalition that focuses the efforts of commercial aviation to engage the emerging alternative fuels industry.
- BETO's Zia Haq took part on the Federal Alternative Jet Fuel R&D Strategy Federal Agency Panel.
- The meeting was held at the Walter E. Washington Convention Center, Washington, DC.
- For more information, see: 2016 CAAFI General Meeting web page

October 27, 2016

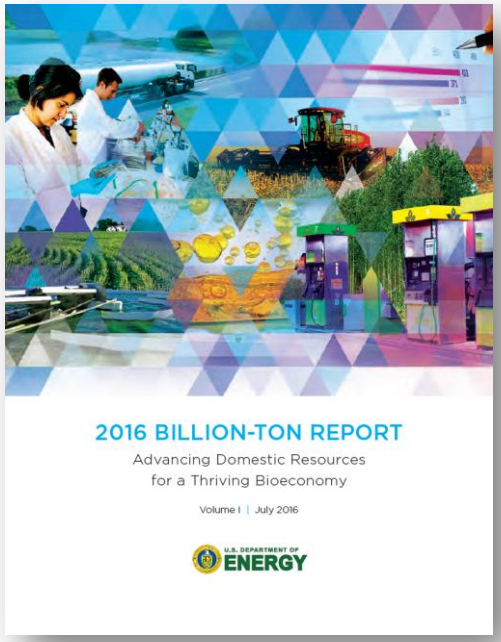
IEA Webinar: Biomass Torrefaction—Technology Status and Commercialization, Applications for Torrefied Biomass and its Role in Logistics and Trade:

- Webinar is part of the International Energy Agency's (IEA's) Bioenergy Internal Webinar Series.
- The webinar discussed many topics, including challenges faced by torrefaction developers and commercialization of the torrefied product and its technology.

Next Steps

- Incentivize investment into torrefaction technology R&D in order to:
  - Insure volumetric energy densification of the raw biomass feedstock.
  - Increase the ability of biomass pellets/briquettes to compete with fossil fuels.

Upcoming: Billion-Ton Report – Volume 2



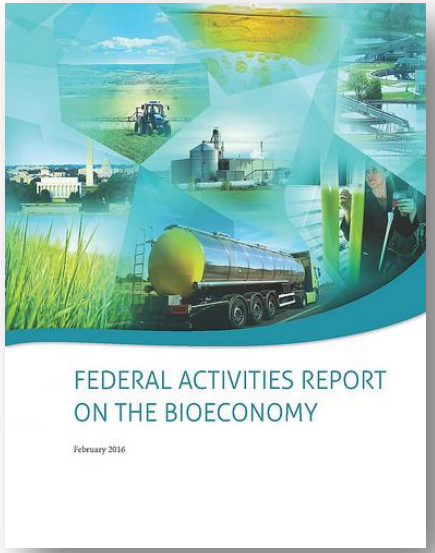
Volume 1
Released in July 2016

Volume 2

- Soil Carbon and Greenhouse Gas Emissions (Agriculture and Forestry)
- Water Quantity for Forestry
  Water Quality for Forestry
  Water Quality for Agriculture
- Biodiversity for Agriculture and Forestry
- Air Quality (Agriculture and Forestry)
- Climate Variability and Climate Change Impacts on Feedstock Productivity
- Land Use Change and Indirect Effects
- Strategies to Enhance Environmental Sustainability
- Qualitative Analysis of Environmental Sustainability of Algae

Release date TBD

The Bioeconomy Initiative Report Series



Federal Activities Report on Bioeconomy (FARB)

- Released February 2016.

The Billion Ton Bioeconomy Initiative

- You heard it here first!
- The result of a series of five stakeholder workshops to identify challenges and opportunities in developing and expanding the bioeconomy.

The Bioeconomy Initiative: Action Plan

Bioeconomy Initiative Action Plan

- Target release FY17 in next Administration's 1st 100 days.

2017 BETO Peer Review

Date: March 5-10, 2017

Location: Sheraton Downtown Denver (1550 Court Pl, Denver, CO 80202)

Approximately 90% of projects in BETO's RD&D portfolio will be reviewed by external subject-matter experts from industry, academia, and federal agencies.

The 2017 Peer Review will include simultaneous review sessions of projects across BETO's technology areas:

Bioenergy Upcoming Workshops & Events

- 26th Western Photosynthesis Conference; January 5-8, 2017; Marshall, California http://www.westphotosynthesis.org/
- Advanced Bioeconomy Leadership Conference; March 1-3, 2017; Washington, DC
- 39th Symposium on Biotechnology for Fuels and Chemicals; May 1-4, 2017; San Francisco, California http://www.simbhq.org/sbfc/
- National Science Teachers Association Conference; December 1-3, 2016; Columbus, Ohio https://www.nsta.org/

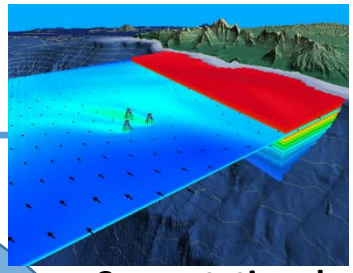
from Other DOE Offices

- **ARPA-E**

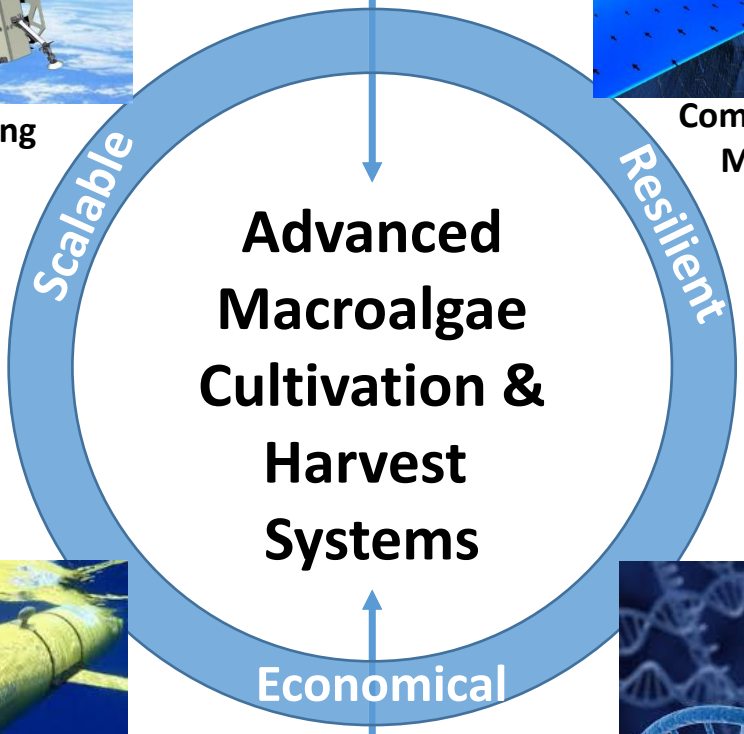
SEAS Macroalgae Production

Scalable Energy from Aquatic Sources

Remote Sensing



Computational Modeling



Robotics & Automation

Breeding & Genetics

Mariculture Biomass:

- No Land
- No Freshwater
- No Fertilizer

SEAS creates new biomass production opportunities for the vast ocean resources of the United States.

Anticipated FOA release in December 2016.

SEAS
Macroalgae
Production

Scalable Energy from Aquatic Sources

Direct link to Teaming List

http://go.usa.gov/xKFYh

U.S. Department of Energy
Advanced Research Projects Agency – Energy

Announcement of Teaming Partner List
for an upcoming Funding Opportunity Announcement:
SCALABLE MACROALGAE CULTIVATION TECHNOLOGIES FOR FUELS AND CHEMICALS

The Advanced Research Projects Agency – Energy (ARPA–E) intends to issue a new Funding Opportunity Announcement (FOA) in November, 2016, for the development of advanced cultivation technologies that enable profitable and energy efficient production of macroalgal-biomass (seaweeds) in the ocean. These technologies are expected to be deployed and support cultivation of macroalgal-biomass feedstocks at a scale relevant for the production of commodity

https://arpa-e-foa.energy.gov/
Please email Program Director Dr. von Keitz for more information:
Marc.VonKeitz@hq.doe.gov

Online Resources for TAC Members

The Board website (http://www.biomassboard.gov) contains numerous resources for TAC members:

- **Meetings**
  - Previous meeting agendas and minutes
  - Previous presentations
- **Work Plans**
  - Work plans for the last 10+ years
- **Relevant Agency Reports**
  - Bioenergy roadmaps
  - Workshop summaries
  - DOE and USDA reports and portfolio analyses
  - Previous TAC recommendations
- **BRDI Materials**
  - Solicitations and Awards
  - Annual Reports
  - Prior TAC Recommendations
- **Related Solicitations and Awards**
  - DOE FOAs
  - ARPA-E FOAs

Links for Additional Information

- Federal Advisory Committee Act (FACA) requirements:
  - http://www.gsa.gov/portal/content/101010
- Biomass R&D Board and TAC Website:
  - www.biomassboard.gov
- TAC Library:
  - http://biomassboard.gov/committee/tac_library.html
- Federal Register call for new nominations to the TAC:
  - https://www.federalregister.gov/articles/2016/05/25/2016-12319/biomass-research-and-development-technical-advisory-committee
- Bioenergy KDF:
  - https://www.bioenergykdf.net/
- BETO Website:
  - http://www.energy.gov/eere/bioenergy/bioenergy-technologies-office
- BETO MYPP:
  - http://www.energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-march-2016
- ARPA-E Website:
  - http://arpa-e.energy.gov/
- Office of Science Website:
  - http://science.energy.gov/

Departing TAC Members 

- **Dr. Kevin Kephart (Co-Chair)**, Vice President for Research, and Dean of Graduate School, South Dakota State University
- **Dr. Maureen McCann**, Professor, Director of the Energy Center, Discovery Park, Purdue University
- **David Nothmann**, Vice President, AgriFood, Battelle Memorial Institute
- **Dr. William Provine**, Director of DuPont Biochemical Science and Engineering – BioFuels
- **Dr. James N. Seiber**, Chair, Department of Food Science and Technology, UC Davis
- **Dr. John Tao**, CEO, O-Innovation Advisors LLC


THANK YOU for
all the hard and
dedicated work,
and the great
memories!!..