



Biomass R&D Technical Advisory Committee

February 27-28, 2014

Elliott Levine

DOE Updates

Welcome New Members

- New Co-Chair: Dr. Pamela Contag
 - Founder & CEO, Cygnet Biofuels
 - Pamela specializes in microbiology, and has experience in renewable fuels and chemicals. She has been involved with the success of several renewable energy and biotechnology companies.
- Dr. Valerie Thomas
 - Anderson Interface Associate Professor, Georgia Institute of Technology, School of Industrial and Systems Engineering, School of Public Policy
 - Valerie is an expert in energy and environmental analysis, as well as economic assessments of energy systems. She also works regularly on supply chain issues in the establishment of feedstock supplies for biorefineries.
- Randy Jennings
 - Director of Program Operations, Tennessee Department of Agriculture
 - Randy is responsible for rules and standards for transportation and heating fuels for sale in Tennessee, including all biofuels. He has a background in agriculture and chemistry, and has been involved with fuel quality standards for over 23 years.

Thanks to Departing Members

- Ronnie Musgrove
Committee Co-Chair
- Jay Levenstein
Deputy Commissioner, Florida Department of Agriculture and Consumer Services
- Huey-Min Hwang
Professor of Biology and Director of Environmental Science Master Program in the Department of Biology, Jackson State University
- Neal Gutterson
President & CEO, Mendel Biotechnology
- Harrison Dillon
Strategic Advisor, Solazyme Inc.

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 the February meeting: **March 14th**

Future Meeting Dates

- Tentative dates for Q2 meeting have been identified below and will be confirmed during the meeting:
 - Q2: Week of June 2-6, 2014
 - Q3: Week of August 18-22, 2014
 - Q4: Week of December 1-5, 2014

Q1 Binder Elements

Contents

1. Biomass R&D Technical Advisory Committee Meeting Agenda
2. Biomass R&D Act (as amended)
3. Biomass R&D Technical Advisory Committee Charter
4. Biomass R&D Technical Advisory Committee Members and Subcommittee Assignments
5. Biomass R&D Board Members and Operations Committee Members
6. Speaker Bios
7. DOE and USDA Biomass Updates
8. Proposed 2014 TAC Meeting Dates
9. 2013 Final Recommendations
10. New Member Bios

Agenda at a Glance - Day 1 of 2

Thursday, February 27th

Introduction and Welcome

- 8:00 am – 8:30 am: Breakfast
- 8:30 am – 9:15 am: Welcome, Introductions, and Feedback from the Board– *Committee Co-Chairs*

Presentations and Updates

- 9:15 am – 9:45 am: Committee Business for 2014– *Elliott Levine (DOE)*
- 9:45 am – 10:00 am: DOE Updates – *Elliott Levine (DOE)*
- 10:00 am – 10:15 am: Break
- 10:15 am – 10:45 am: USDA Updates – *Todd Campbell (USDA)*
- 10:45 am – 11:15 am : USDA NIFA BRDI Update – *Daniel Cassidy (USDA)*
- 11:15 am – 12:00 pm: BETO Overview and Updates– *Jonathan Male (DOE)*

Lunch

- 12:00 pm – 1:00 pm

Presentations and Discussion

- 1:00 pm – 2:00 pm: Update on RFS and Volumetric Requirement for Biofuels – *Paul Argyropoulos (EPA)*
- 2:00 pm – 2:30 pm: Natural Gas to Liquids Workshop Summary – *Zia Haq (DOE)*
- 2:30 pm – 3:30 pm: Bioeconomy Initiative Overview – *Jonathan Male (DOE) and Todd (USDA)*
- 3:30 pm – 3:45 pm: Break
- 3:45 pm – 4:45 pm: Discussion of 2014 Committee Work Plan – *Committee*
- 4:45 pm – 5:30 pm: Instruction for Committee Breakouts – *Committee Co-Chairs*
- 5:30 pm – 5:45 pm: Public Comment

Agenda at a Glance - Day 2 of 2

Friday, February 28th

Welcome

- 8:00 am – 8:30 am: Breakfast

Discussion and Breakouts

- 8:30 am – 9:00 am: Instructions to Committee Breakouts– *Committee Co-Chairs*
- 9:00 am – 11:00 am: Subcommittee Breakouts
- 11:00 am – 12:00 pm: Discussion of Subcommittee Report Outs
- 12:00 pm – 12:15 pm: Finalize Committee Work Plan

Public Comment

- 12:15 pm– 12:30 pm: Public Comment

Closing Remarks

- 12:30 pm– 1:00 pm: Final Comments – *Co-Chairs*

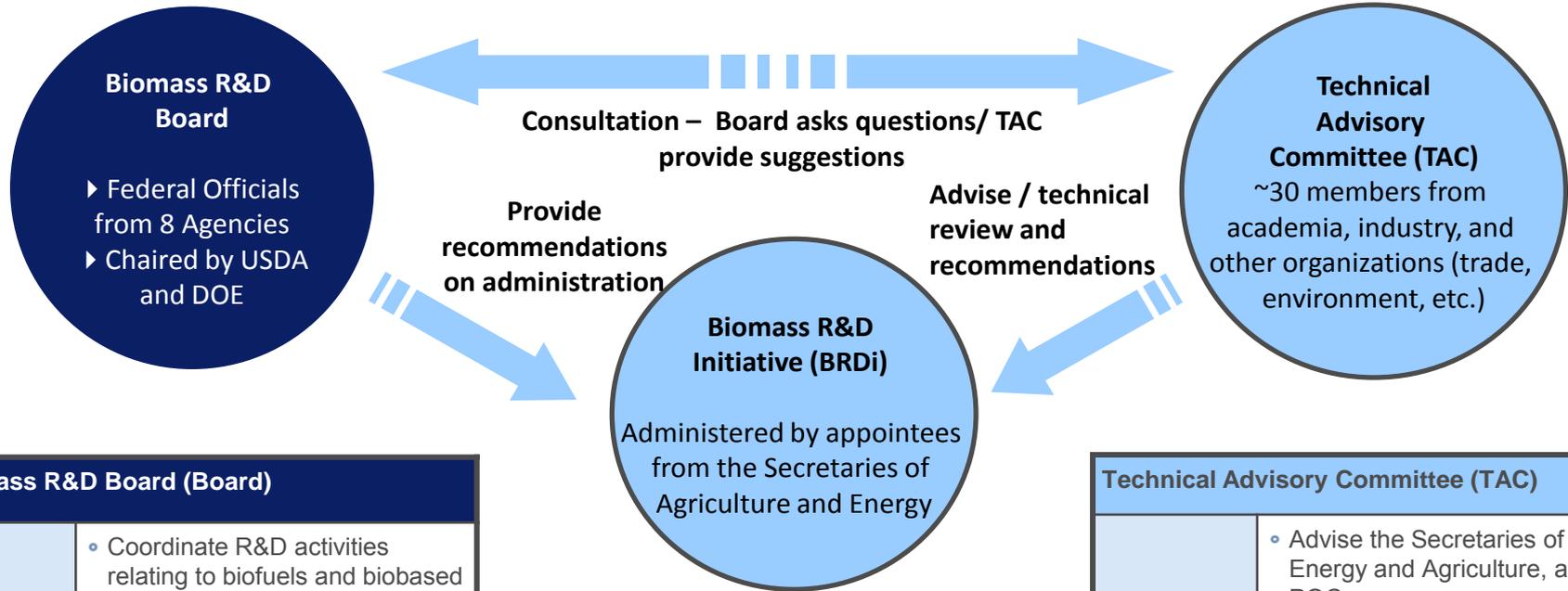
Closed Lunch

- 1:00 pm – 2:00 pm: Lunch (*to be provided for Committee*)

Biomass R&D Act and Authorizations

- The Committee was established by the Biomass Research and Development Act of 2000 (Biomass Act). This has since been amended by the Food, Conservation and Energy Act of 2008 (FCEA). The revised Biomass R&D Act outlines the Committee's objectives, membership requirements, and duties.
- The recent Agricultural Act of 2014 (Farm Bill) reauthorized the Committee. The Initiative was also reauthorized, however the annual mandatory funding amount was cut to \$3M mandatory/year.
- The Biomass R&D Act also established the Interagency Biomass R&D Board and the Biomass R&D Initiative.

Biomass R&D Breakdown



Biomass R&D Board (Board)	
Roles	<ul style="list-style-type: none"> Coordinate R&D activities relating to biofuels and biobased products (meetings at least quarterly) Provide recommendations to the points of contact concerning administration of the BRDi
Public Document	<ul style="list-style-type: none"> The Board released the National Biofuels Action Plan (NBAP) in October 2008 and an update is currently pending. Other Board documents are located on the BiomassBoard.gov website

Biomass R&D Initiative (BRDi)	
Purpose	<ul style="list-style-type: none"> Award competitive grants, contracts, and financial assistance are provided to, or entered into with, eligible entities to carry out research on and development and demonstration of biofuels and biobased products
Public Document	<ul style="list-style-type: none"> The BRDi publishes at least 1 request for proposal (RFP) each year

Technical Advisory Committee (TAC)	
Roles	<ul style="list-style-type: none"> Advise the Secretaries of Energy and Agriculture, and the POCs on <ul style="list-style-type: none"> The technical focus and direction of the BRDi RFPs Procedures for reviewing and evaluating the proposals Evaluate and perform strategic planning on BRDi activities Facilitate partnerships
Public Document	<ul style="list-style-type: none"> All TAC meetings (at least quarterly) are public

Biomass Board - Federal Composition

- **The Board is a panel consisting of senior-level representatives from these agencies:**

- U.S. Department of Agriculture: Co-Chair
- Department of Energy: Co-Chair
- National Science Foundation
- Environmental Protection Agency
- Department of Interior
- Office of Science and Technology Policy
- Office of the Federal Environmental Executive
- Department of Transportation
- Department of Defense

- **Board Co-Chairs**

- Dave Danielson, Assistant Secretary for EERE, DOE
- Cathie Woteki, Under Secretary for REE, USDA



Co-chair



Co-chair



Duties of the Committee Regarding BRDI

- To advise the Secretaries of Energy and Agriculture through the points of contact with respect to the Biomass R&D Initiative.
- To evaluate and make recommendations in writing to the Board to ensure the following:
 - (A) funds authorized for the Initiative are distributed and used in a manner that is consistent with the objectives, purposes, and considerations of the Initiative;
 - (B) solicitations are open and competitive with awards made annually and that objectives and evaluation criteria of the solicitations are clearly stated and minimally prescriptive, with no areas of special interest;
 - (C) the points of contact are funding proposals under this title that are selected on the basis of merit, as determined by an independent panel of scientific and technical peers predominantly from outside the Department of Agriculture and Energy; and
 - (D) activities under this title are carried out in accordance with this title.
- The Committee Charter specifically calls for the TAC to make recommendations related to the BRD Initiative.

Committee Recommendations and Annual Report

DOE and USDA General Counsel have advised that a broader biomass R&D scope is permissible. The 2014 TAC recommendations should be written to address the findings and needs of the Committee in the following areas:

- Specific Committee Reporting Obligations- BRDI
 - Information Requests from the Board
 - Subcommittee Recommendations
 - Feedstock Recommendations
 - Conversion Recommendations
 - Logistics, Storage, Handling, and Infrastructure Recommendations
- Recommendations are used to inform the Biomass R&D Board and provided to DOE and USDA Programs.
- A report of recommendations consented to frame the TAC Annual Report

Recommended TAC 2014 Work Timeline

Date	Committee Objectives
<p>Q1 2014 February 27-28, 2014</p> <p>Place: Wash, DC</p>	<ul style="list-style-type: none"> • Update on DOE R&D Activities • USDA Update on Biomass R&D Activities and Farm Bill • Subcommittee staffing plan • Determine Initiatives to be examined by TAC--BRDI and others • Determine committee needs to execute assignment • Finalize Work Plan for 2014 • Determine need and location of site visit
<p>Q2 2014 Week of June 2, 2014</p> <p>Place: TBD</p>	<ul style="list-style-type: none"> • Subcommittees to: <ul style="list-style-type: none"> • Identify Challenges/Problem • Discuss Potential Solutions • Suggest recommendations • Discuss crosscut areas
<p>Q3 2014 Week of August 18, 2014</p> <p>Place: TBD</p>	<ul style="list-style-type: none"> • Subcommittees to: <ul style="list-style-type: none"> • Prioritize Challenges/Problem • Flesh out recommendations • Draft Recommendations
<p>Q4 2014 December 1, 2014</p> <p>Place: Wash, DC</p>	<ul style="list-style-type: none"> • Finalize and Approve 2014 Recommendations • Discuss Annual Report and PPT needs and writeup schedule

The Proposed TAC 2013 Grand Challenge

Replace fossil carbon with renewable carbon in all sectors to supply transportation fuels and related products:

- Rapidly expand the emerging biofuels and bioproducts industries achieving 30% penetration of biomass carbon into the US transportation market by 2030 in a sustainable and cost effective manner to create jobs, reduce greenhouse gas impacts, and enhance national security.

Additional Outcomes:

- Enhancing economic development by increasing from 152,000 direct and indirect jobs in 2012 (Bio-ERA Report) to over 1 million direct and indirect jobs by 2022. By 2030 with 45 billion gallons of fuel made with renewable carbon introduced into the biofuel industry, the direct and indirect economic impact should exceed 5 million jobs. Such developments need to be guided by incentives to provide opportunities for disadvantages and minority populations;
- Establishing a cost-effective energy supply that is synergistic with existing fossil-based markets;
- Embracing economic, environment, and social sustainability; and
- Insuring national energy security and decreasing the dependence of national defense on foreign energy supplies.

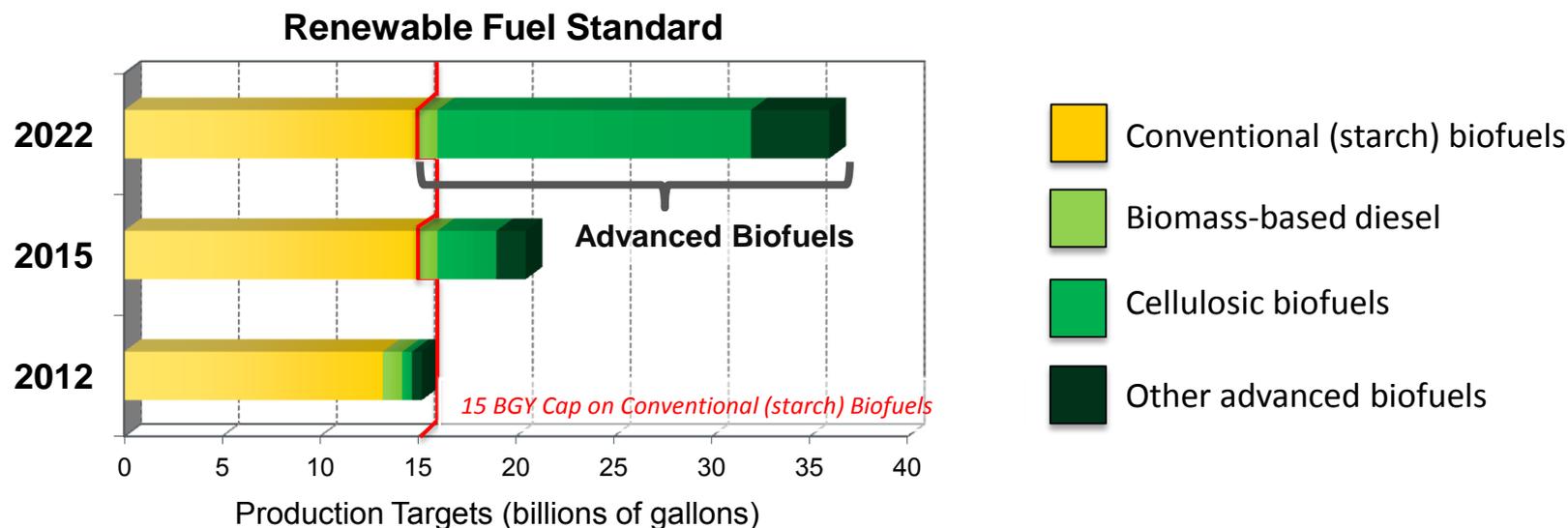
Key Policy Driver: Renewable Fuel Standard Program

The Energy Independence and Security Act (EISA) of 2007 sets aggressive goals:

- Move renewable fuels into the marketplace
- Reduce the nation's dependence on foreign sources of energy
- Reduce GHG emissions from the transportation sector.

EISA established production volumes for the Renewable Fuel Standard Program (RFS), increasing the supply of renewable fuels to 36 billion gallons by 2022.

The U.S. Department of Energy's (DOE) Bioenergy Technologies Office focuses on developing advanced biofuels to help meet the RFS goals.



Online Resources for TAC Members

The Board website contains numerous resources for TAC members

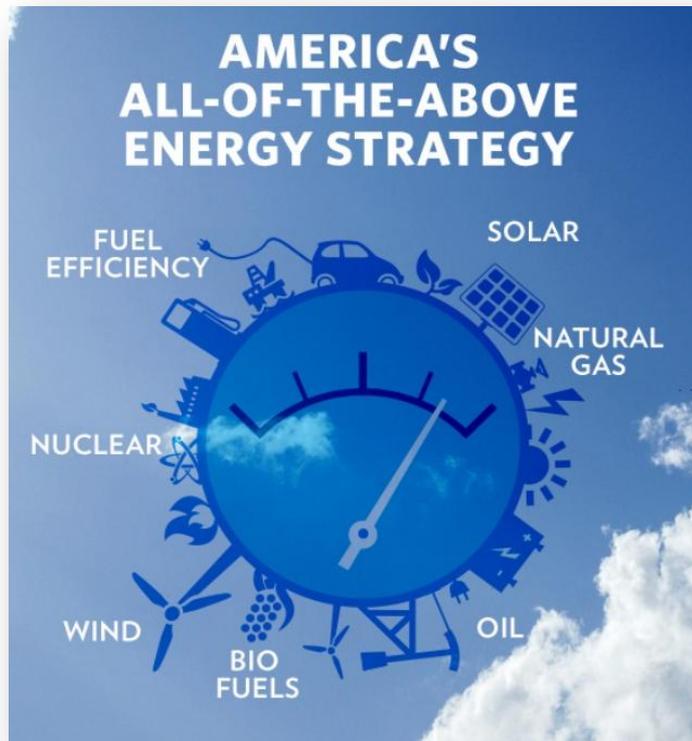
- Meetings
 - Previous meeting agendas
 - Previous presentations
- Work Plans
 - Work plans for the last 10+ years
- Reports
 - Bioenergy roadmaps
 - Workshop summaries
 - DOE and USDA reports and portfolio analyses
 - Previous TAC recommendations
- TAC Library
 - Outlined in next slide

Online Resources for TAC Members

TAC Library:

- BRDI Materials
 - Solicitations and Awards
 - Annual Reports
 - Prior TAC Recommendations
- Related Solicitations and Awards
 - DOE FOAs
 - ARPA-E FOAs
- Additional Information
 - DOE and USDA factsheets
 - DOE and USDA roadmaps and research
 - BETO's Multi Year Program Plan

US DOE's BETO Announcements & Updates



Recent BETO Initiatives

Incubator Program

- DOE is creating a dedicated, annual funding mechanism to support innovative technologies that are not represented in DOE's existing technology portfolio

Renewable Carbon Fiber

- DOE is working to produce innovative new materials from biomass, by utilizing sugars, lignin, and other biorefinery products, to enhance industry economics

Natural Gas-Biomass to Liquids

- DOE is exploring opportunities to combine biomass with low-cost natural gas for the production of liquid fuels
- Zia Haq will be providing the TAC with more information on the outcomes of our recent Natural Gas-Biomass to Liquids (GBTL) Workshop today at 2:00 PM

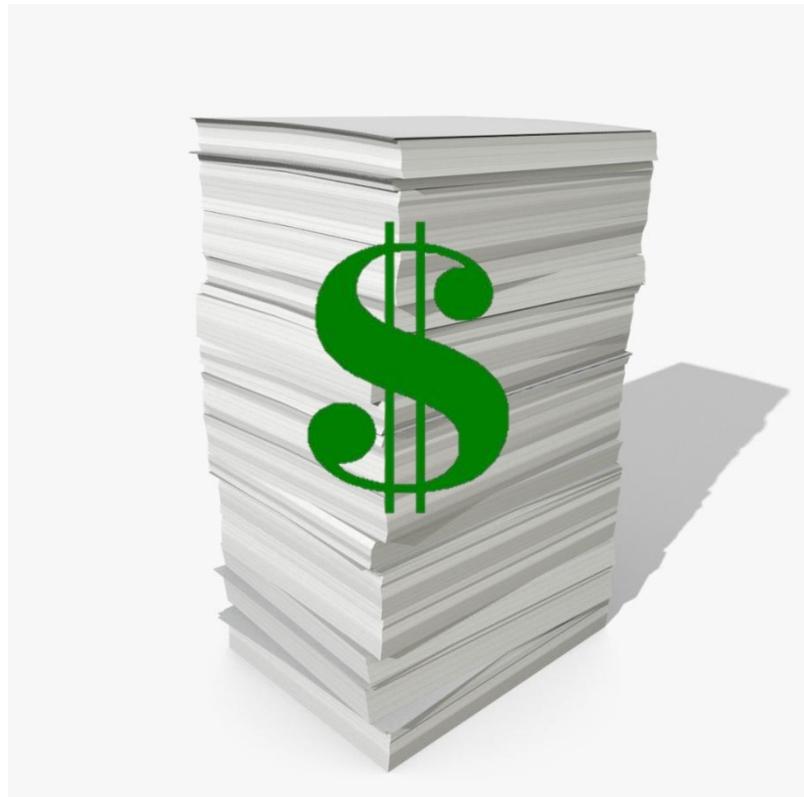
New BETO Incubator FOA (DE-FOA-0000974) Announced

- FOA released 2/25
 - Concept papers due 3/31, Full proposals due 5/23
- 5 awards expected to be issued
- Open FOA for “off-roadmap ideas*” for ideas at TRL 2-4
- \$10M Total Funding, award size between \$0.5 - \$2.0M, for 12-24 months; open eligibility
- 20% cost share required
- Webinar 3/3 @ 1 pm (EST)
- BETO to review concepts papers (4/1 – to 4/18)
 - Binary decision: encourage/discourage full application
- See FOA for CP and full application criteria

* Not found in BETO MYPP

FY2014 BETO Budget and Current Solicitations

- Will be covered by Jonathan Male – Director of Biomass Energy Technology office in a subsequent presentation today



Upcoming BETO Workshops and Events (1 of 3)

Demonstration and Deployment Strategy Workshop

March 11–12, 2014

The Workshop intends to discuss, reassess, and prioritize the D&D efforts needed to realize affordable, scalable, and sustainable production of hydrocarbon biofuels. This workshop was announced in the Federal Register on February 4, 2014, and will be held at Argonne National Laboratory just outside of Chicago, Illinois.

Biomass Indirect Liquefaction Workshop

March 20–21, 2014

The focus of this workshop is to support research and development planning efforts within the thermochemical conversion program. This workshop will discuss and develop ideas and research areas to advance a potential funding opportunity solicitation. This workshop will take place, in Golden, Colorado.

Algal Biofuels Spring Strategy Workshop

March 26–27, 2014

BETO's Algae Program is hosting the spring Algal Biofuels Strategy Workshop, which will focus on the research and development needed to achieve affordable and sustainable algae-based biofuels. The event is a follow-up to the November workshop, and will take place in Charleston, South Carolina.

Bio-Oil Co-Processing: Expanding the Refinery Supply System

April 3, 2014

This workshop plans to have renewable technology developers engage with conventional petroleum refiners to clear up any misconceptions about using biomass-derived oils as additional feedstock. Participants will be engaged in discussions about the potential advantages, disadvantages, and challenges of bio-oil integration in the current U.S. petroleum refinery infrastructure. The event will be held in New Orleans, Louisiana.

Upcoming BETO Workshops and Events (2 of 3)

Woody Feedstock Workshop

March 4–6, 2014

BETO is hosting a forestry-focused workshop to assess the state of the science, current research needs, and tools and methodologies for deploying landscape design for bioenergy systems. The event is invitation only, and will be held in New Bern, North Carolina.

Herbaceous Feedstock Workshop

June 24–26, 2014

BETO is hosting an agriculture-focused workshop to assess the state of the science, current research needs, and tools and methodologies for deploying landscape design for bioenergy systems. The event is invitation only, and will be held in Chicago, Illinois.

Additional Events

- Advanced Biofuels Leadership Conference 2014
April 21–23, 2014, National Harbor, Maryland
- 36th Symposium on Biotechnology for Fuels and Chemicals
April 28–May 1, 2014, Clearwater Beach, Florida
- TCS2014 Symposium on Thermal and Catalytic Sciences for Biofuels and Biobased Products
September 2–5, 2014, Denver, Colorado

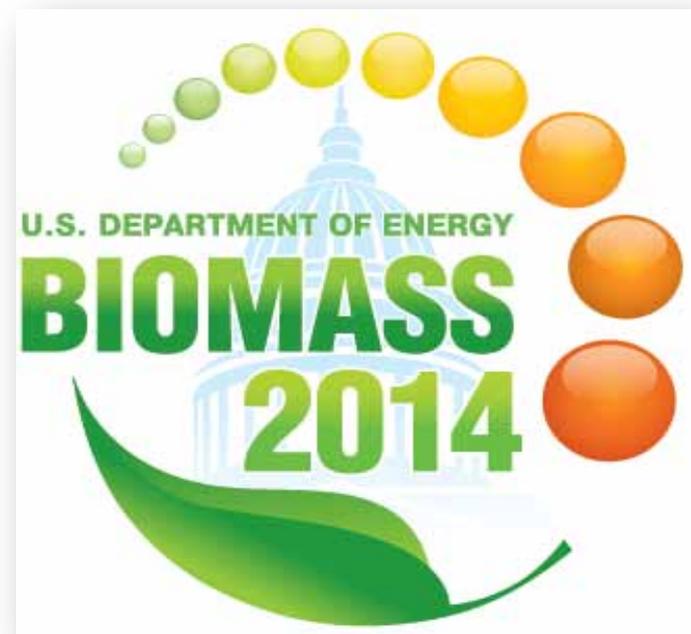
Seventh Annual Biomass Conference (3 of 3)

Biomass 2014: Growing the Future Bioeconomy

Planned for July 29-30, 2014 at Washington Convention Center

- **Topics & Themes**

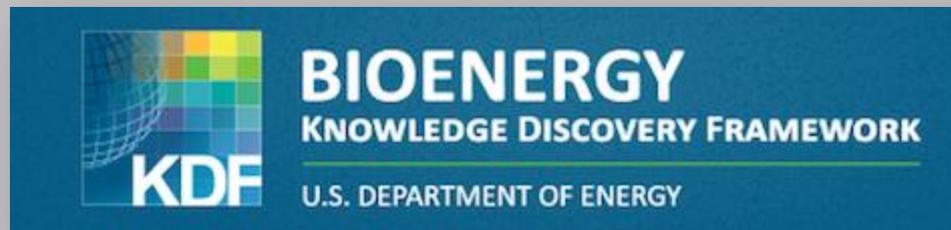
- Bioproducts Enabling Fuel Production.
 - Risk and Finance
 - Early Market Adoption and Identification/Incubator & Off Roadmap Opportunities (On and Off Ramps)
 - Deployment Success & Innovation/Priority Pathways
 - How DOE/BETO rigor enables innovation
 - Industry and Small Business Success Stories
- A Bioeconomy Workshop will be held in conjunction with Biomass 2014
 - More information to come



Bioenergy Knowledge Discovery Framework (KDF)

What is the Bioenergy KDF?

It's an information-sharing network, an online collaboration toolkit, and a data resource that facilitates informed decision making. The KDF provides a full range of stakeholders with a means to access, contribute, synthesize, analyze, and visualize vast amounts of bioenergy information in a spatially integrated manner.



CONTRIBUTE DATA



FIND DATA



VISUALIZE DATA



FIND TOOLS & APPS

KDF Legislative Library

Bioenergy KDF Tracks Congress and Connects the Industry

- The Legislative Library is a new development of the recently revamped [Bioenergy KDF](#). The Legislative Library allows users to track federal legislation proposed in the 112th and 113th Congresses (i.e., the current and most recently passed sessions of Congress) relevant to the production and use of biofuels in the United States.

The Legislative Library is organized into three sections:

1. Legislators

Look up state senators and representatives to see what activities they've been involved with in the area of bioenergy. Users have the ability to filter results by congressional session, political party, state, and chamber.

2. Related Bills

Search for bioenergy-related bills and filter results by session, chamber (House or Senate), and status—whether the bill was just introduced, had a hearing, reached a mark-up session, was put to a vote, or got elevated to the President's desk. Links are also provided to full-text versions of each bill through Congress.gov; to the bills' status through govtrack.us (including a breakdown of votes for bills that have reached this stage); and to the primary sponsor's official website.

3. Committees

Select a Senate or House committee related to bioenergy, see which legislators make up the committee, and see what bills they have sponsored. Users can click on the additional links provided to learn more about the bills and their sponsoring legislators.

Workshop Reports

Natural Gas-Biomass to Liquids Workshop

- BETO hosted the Natural Gas-Biomass to Liquids Workshop in Chicago, Illinois, on September 3, 2013, on Natural Gas-Biomass to Liquids (GBTL) research needs and technology options.
- Summary report planned for release in the Spring of 2014
- Webinar recently conducted February 6, 2014—participants from US and abroad.

Symbiosis Biofeedstock Conference

- Summary report released in January 2014
- BETO hosted the two-day “Symbiosis Biofeedstock Conference” at Cornell University in Ithaca, New York, on June 20–21, 2013. The conference focused on expanding commercialization of products incorporating mutualistic microbes in order to increase biomass production. The Office has subsequently compiled the discussions, findings, and resulting recommendations into a [summary report](#).

Peer Review Final Report Released

- The 2013 Final Peer Review Report has been completed, and is available on the [BETO website](#).
- Results of the Peer Review inform strategic planning, budget formulation, upcoming FOA development, and other budget and funding decisions.

HEAT AND POWER

BIOENERGY/ BIONANOTECHNOLOGY PROJECTS
(WBS# 77219)

Project Description

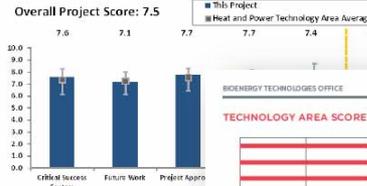


This project focused on immobilizing cellulase for reuse to reduce ethanol costs in commercial-scale reactors. Three objectives were defined for this project: immobilizing enzyme on surfaces, demonstrating reuse for multiple batches, and refining a scalable and automated immobilization process. Immobilization of cellulase using layer-by-layer nano self-assembly was tested, however, bioavailability of successive layers was a challenge. Effective immobilization was achieved on glass, silica, molecular sieve, and silica gel surfaces using self-assembled monolayers. The efficiency of activity compared to a similar mass of free enzyme was demonstrated to achieve the desired 10% for flat surfaces such as glass and silica (the total activity of three-dimensional surfaces such as molecular sieve and silica gel was higher, but the specific activity compared with free enzyme was lower). A limited number of reuses were demonstrated with glass, silica, and molecular sieve. Outstanding reuse was observed for silica gel. An automated immobilization process was developed, along with an overall economic analysis. The physical integration and automation of the process was not a challenge. More work needs to be done on the leaching/diffusion that occurs from the surface that can create challenges for the layering solutions to be recycled (a necessity for

Recipient:	Louisiana Tech University
Presenter:	James Palmer
Total DOE Funding:	\$264,924
DOE Funding FY1:	\$0
DOE Funding FY2:	\$20,299
DOE Funding FY3:	\$30,895
Project Dates:	2010-2012

Overall Project Score: 7.5

■ This Project
■ Heat and Power Technology Area Average



Whiskers represent the range of scores for each category

BIOENERGY TECHNOLOGIES OFFICE

TECHNOLOGY AREA SCORE RESULTS



5

HEAT AND POWER



TECHNOLOGY AREA

IBR Recommendations from 2013 Peer Review

- “[The] biggest strengths of the portfolio were the actual construction of facilities which were preparing to produce significant quantities of advanced biofuels.”
- “[The] BETO program is doing an excellent job supporting a variety of technologies with varying TRLs.”
- Fund more pilots, less demo’s and even fewer commercial commercial/FOA facilities to prove a pathway
- Explore potential synergies with natural gas and syngas technologies

Overall Recommendations from 2013 Peer Review

Key Findings

- Positive overall assessment of the Office and much of BETO's current research approach and technical strategy.
- Support for the shift in focus from R&D in ethanol to hydrocarbon fuels and for the diverse mix of feedstocks, conversion pathways, targeted end products, and technology scales in the Office portfolio.
- Many IBR projects were seen to be nearing completion and on the verge of adding significant production volumes to industry capacity. BETO's high-tonnage feedstock logistics projects and several major consortia, including NABC, were identified as key assets.
- Both national laboratory and competitively selected projects scored well, but a number of the public-private partnerships which leveraged the resources of both sectors, stood out as exemplary projects. Generally most, but not all, of the Congressionally directed projects scored on the lower end of the project spectrum.

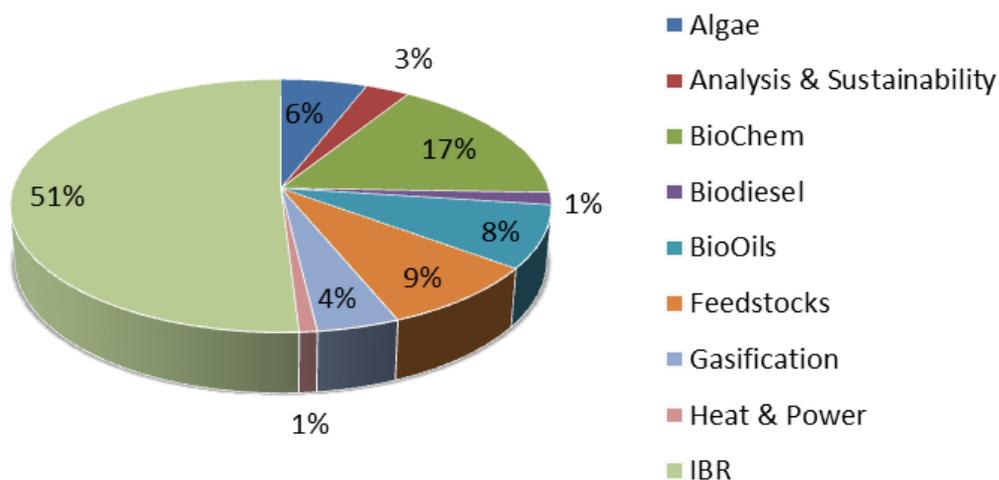
Next Steps

- BETO is moving forward with many of the recommendations provided by the reviewers.
- The Office plans to establish a petroleum industry coordinating group and explore additional ways to interface with the petroleum and refining industry.
- At the portfolio and project level, the peer review provided a number of valuable insights and specific recommendations which will continue to be utilized in managing specific projects and ongoing improvements in portfolio planning and oversight.

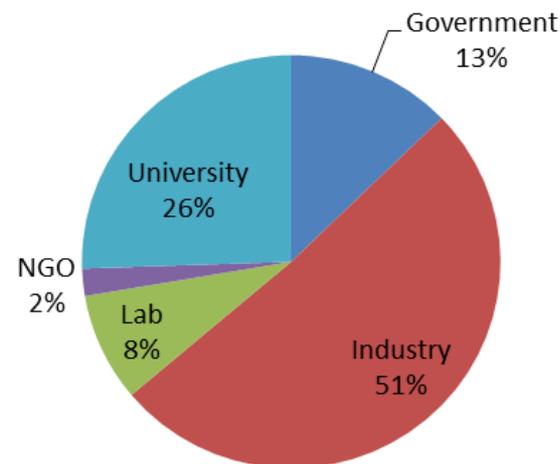
2013 BETO Peer Review Report Released

- 219 projects were reviewed across 9 technology areas, representing a DOE portfolio investment of \$1.6B over the lifetime of the projects (~86% of the BETO portfolio)
- 42 independent expert reviewers from industry, academia, and other government agencies
- Results of the Peer Review inform strategic planning, budget formulation, upcoming FOA development, and other budget and funding decisions

Reviewed Portfolio - By DOE Funding



Reviewers - By Affiliation



BETO on Social Media (through the Bioenergy KDF)

- Social media expansion:
 - Increased [Facebook](#) “likes” by more than 75% in 2013
 - More than doubled our [Twitter](#) followers – follow BETO on @BioenergyKDF
 - BETO has also been active on [LinkedIn](#) via the Bioenergy KDF Group and Jonathan Male’s profile page
 - News of the [Bioenergy KDF](#) re-launch received the most views on Facebook (315)



Federal Partnerships

- The Bioenergy Technologies Office works directly within the Department of Energy and with other cabinet agencies on a number of high-level initiatives.
- By coordinating efforts across agencies, our Office can tap into others' expertise, leverage existing initiatives in the Federal government, and stay informed on the latest innovations in the field.
- BETO works diligently to ensure steady collaboration across the entire supply chain – bringing together experts in the field to solve the major challenges facing the industry today.



Feedstock Supply

DOE, USDA, NSF



Biomass Conversion

DOE, USDA, NSF



Bioenergy Distribution

DOE, DOD,
DOT, EPA



Bioenergy End Use

DOE, EPA, USDA
DOD, DOT

BETO and VTO Collaboration: Green Racing Challenge

- Ineos has provided cellulosic E-10 and E-85 for Daytona 24-hour race in January. Primary feedstock for fuel is organic waste.
- Two diesel powered Mazda engines were fueled with synthetic diesel produced by Dynamic Fuels. Primary feedstock for fuel is poultry processing residues.
- These fuels will be used at Sebring, FL during March
- 10 additional races in 2014 are expected to have a category of Green Fuels.
- Green Challenge racing will demonstrate new, green technologies to the public as they are tested under the harshest conditions possible and thereby continue to show relevance to the consumer market

Update ARPA-E Electrofuels and REMOTE Programs

Electrofuels: Chemoautotrophic CO₂ to Fuels (PD Ramon Gonzalez, ramon.gonzalez@hq.doe.gov SETA Chad Haynes, chad.haynes@hq.doe.gov)

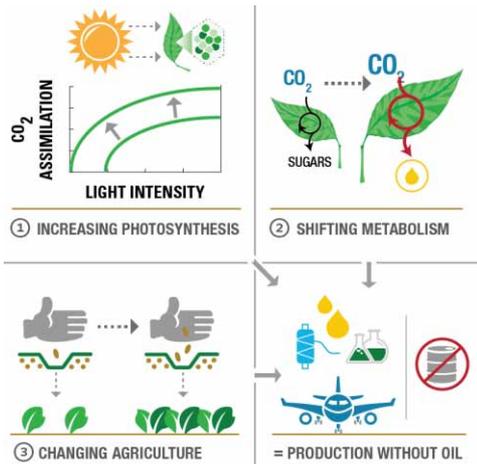
- Demonstrated remarkable success developing new genetic tools for engineering traditionally genetically-intractable microorganisms.
- Demonstrated production of fuel and/or fuel precursors from CO₂ and several inorganic energy sources, including direct current and hydrogen.
- Demonstrated production of alcohols from formate, derived from the electrochemical reduction of CO₂.
- Developed sophisticated techno-economic models for various Electrofuels processes to evaluate CAPEX and performance sensitivities.

REMOTE: Reducing Emissions using **M**ethanotrophic **O**rganisms for **T**ransportation Energy/Bio-conversion of Methane to Liquid Fuels (PD Ramon Gonzalez, SETA Chad Haynes)

- Biological conversion of low cost methane to liquid fuels as an alternative to large scale, capital intensive gas-to-liquids processes.
- Newly deployed program targets high energy efficient and carbon efficient bio-based conversion of methane to fuels, as well as bioprocess intensification to dramatically improve system productivity.
- Performance metrics strongly influenced by techno-economic relevance.
- 15 projects, approximately \$35,000,000 ARPA-E investment.

Collaborations with ARPA-E

Advanced Research Projects Agency-Energy



PETRO technical overview



- Contributes regular communications on the development of enhanced crop feedstocks for bioenergy production, primarily in the Plants Engineered to Replace Oil (PETRO)* program.
- Provided an additional \$19M funding to PETRO projects that met key intermediate milestones.
- Initiated a Programmatic Environmental Impact Statement to assess potential impacts of deploying Engineered High Energy Crops.

LBNL project producing oil in tobacco biomass

DOE-SC has issued two FY14 funding opportunities announcements (FOAs) for basic research relevant to biofuels production from biomass:

DE-FOA-0001034: Plant Feedstock Genomics for Bioenergy: A Joint DOE-USDA Funding Opportunity

- Approximately \$5M available for fundamental research building on plant genomics for improvement biomass traits relevant to biofuels production and accelerate breeding of dedicated bioenergy feedstocks.
- Issue Date: 11/19/2013
- Application Due Date: 2/25/2014

DE-FOA-0001060: Systems Biology of Microbes to Enable Next-Generation Biofuels Production

- Approximately \$8M available for fundamental research aimed at advancing systems biology understanding and developing genetic tools for microorganisms relevant to deconstruction of plant biomass and synthesis of next generation biofuels.
- Issue Date: 12/20/2013
- Application Due Date: 3/14/2014

Useful Links

References:

1. Inspector General Report <http://energy.gov/sites/prod/files/2013/09/f2/IG-0893.pdf>
2. D&D Strategy Workshop Web page http://www1.eere.energy.gov/bioenergy/demonstration_deployment_strategy_workshop.html
3. Algal Biofuels Strategy Workshop Web page http://www1.eere.energy.gov/bioenergy/algal_strategy_workshop.html
4. BETO's Meetings Web page <http://www1.eere.energy.gov/bioenergy/meetings.html>
5. Biomass Indirect Liquefaction Workshop Web page http://www1.eere.energy.gov/bioenergy/biomass_indirect_liquefaction_workshop.html
6. Natural Gas-Biomass to Liquids Workshop http://www1.eere.energy.gov/bioenergy/aviation_fuels.html
7. Symbiosis Biofeedstock Conference http://www1.eere.energy.gov/bioenergy/past_meetings.html
8. Peer Review Report http://www1.eere.energy.gov/bioenergy/peer_review2013.html
9. Bioenergy KDF <https://www.bioenergykdf.net/>
10. Bioenergy KDF Facebook <https://www.facebook.com/BioenergyKDF>
11. Bioenergy KDF Twitter <https://twitter.com/BioenergyKDF>
12. Bioenergy KDF LinkedIn <http://www.linkedin.com/groups/BioenergyKDF-3901719>
13. Bioenergy KDF YouTube <http://www.youtube.com/user/BioenergyKDFChannel>
14. Office of Science Solicitation (1 of 2) http://science.energy.gov/~media/grants/pdf/foas/2014/SC_FOA_0001034
15. Office of Science Solicitation (2 of 2) http://science.energy.gov/~media/grants/pdf/foas/2014/SC_FOA_0001060.pdf
16. Board Resources Library http://www.biomassboard.gov/committee/tac_library.html
17. Committee Resources Library <http://www.biomassboard.gov/committee/committee.html>

Useful Links:

1. BETO News and Announcements <http://www1.eere.energy.gov/bioenergy/news.html>
2. Upcoming Solicitations http://www1.eere.energy.gov/biomass/biomass_solicitations.html
3. 2013 Peer Review http://www1.eere.energy.gov/biomass/peer_review2013.html
4. Biomass R&D Board <http://www.biomassboard.gov/>