



**Designated Federal Officer
Presentation to the 2016
Technical Advisory Committee**

**Elliott Levine
Q2 presentation**

June 13-14, 2016

2016 TAC New Member Additions

- **Dr. Esteban Chornet** – CTO and Cofounder Enerkem
 - **Proposed Subcommittee:** Conversion
 - **Category:** Biobased Industrial and Commercial Products Industry
 - **Expertise:**
 - Leading waste-to-biofuels and chemicals company
 - Former Principal Research Engineer with the National Renewable Energy Laboratory
 - Experience in biomass conversion, biofuels, and biobased industrial and commercial products, furthermore has extensive expertise in process engineering related to biorefineries
- **Vonnie Estes** – Consultant
 - **Proposed Subcommittee:** Products, Markets, and Systems
 - **Category:** Biobased Industrial and Commercial Products Industry
 - **Expertise:**
 - Served as New Venture Manager for DuPont Advanced Biosciences,
 - Served as Vice President of Business Development at Syngenta
 - Served as Director of Product Development at Monsanto
 - Executive with 25 years of bio-technology industry leadership and global experience in business development
- **Dr. Emily Heaton** – Assistant Professor at Iowa State University
 - **Proposed Subcommittee:** Feedstocks
 - **Category:** Expertise in Plant Biology and Biomass Feedstocks
 - **Expertise:**
 - Research program in the areas of biomass crop production, management and ecophysiology
 - Extension program in the area of biomass crop adoption, production and management

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: **June 28, 2016**

Future Meeting Dates

- Tentative dates for Q3 and Q4 meetings have been identified below and will be confirmed during the meeting:
 - Q3: Week of August 15, 2016
 - Q4: Week of November 14, 2016

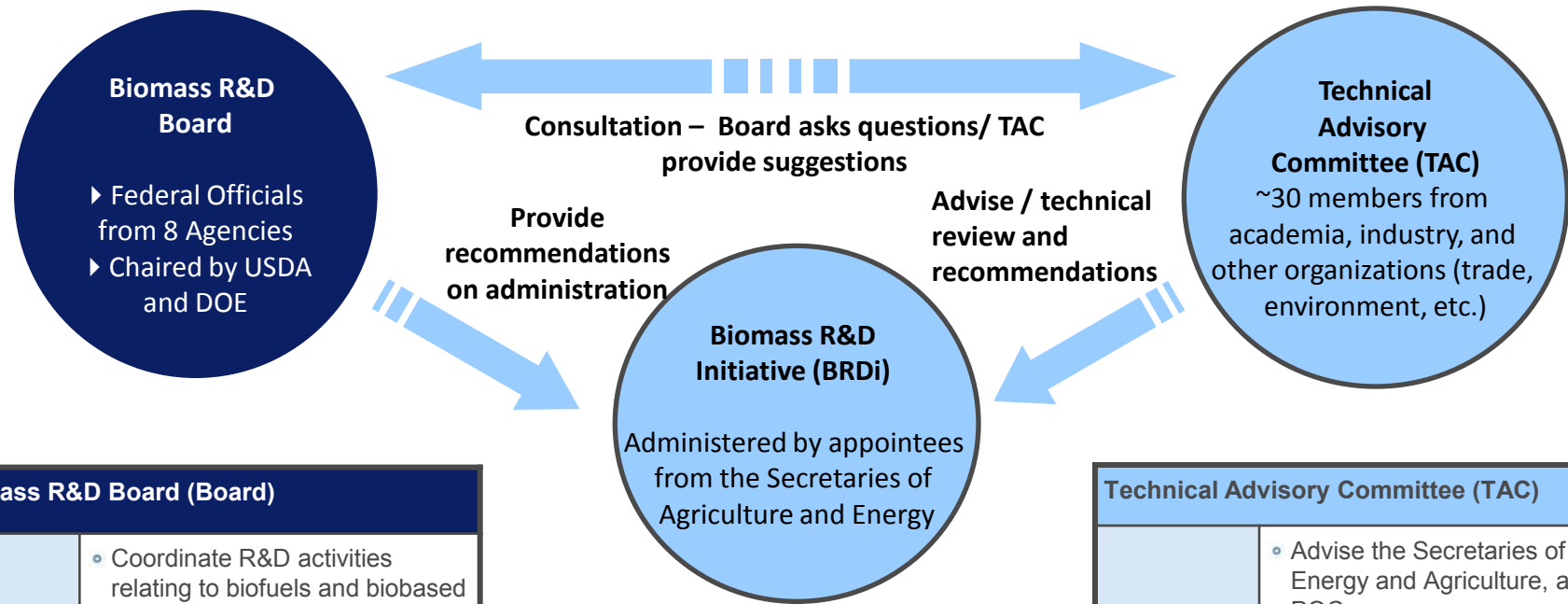
TAC Ground Rules

- TAC conforms to all Federal Advisory Committee Act (FACA) requirements: <http://www.gsa.gov/portal/content/101010>
- Meetings are announced in Federal Register and open to public.
 - Subcommittees are permitted to work in closed sessions.
- Representative vs Special Governmental Employee (SGE)
- Co-Chairs are the spokespersons for the TAC
 - Refer press inquiries to them
- TAC provides suggestions for information requests via DFO and Co-chairs.
- Final recommendations are formed by majority consensus.
- Public policy recommendations are not prohibited

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

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.

The deadline for TAC member nominations is June 30, 2016

Committee Recommendations and Annual Report

DOE and USDA General Counsel have advised that a broader biomass R&D scope is permissible. The 2016 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
 - Product, Markets and Systems
-
- Recommendations are used to inform the Biomass R&D Board and provided to DOE and USDA Programs.
 - A report of consented upon recommendations frame the TAC Annual Report

Biomass Board - Federal Composition

- **The Board is a panel consisting of senior-level representatives from these agencies:**
 - 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
 - Department of Transportation
 - Department of Defense
- **Board Co-Chairs**
 - David Friedman, Assistant Secretary for EERE, DOE
 - Dave Danielson left DOE on 5/30/2016
 - 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.

Online Resources for TAC Members

The Board website contains numerous resources for TAC members:

- Meetings
 - Previous meeting agendas and minutes
 - 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
- The online library is outdated but will be updated with information on recent FOAs in late June.

2016 Work Plan

Meeting	Objectives
Q1 March 8-9	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Presentations on BER and BES, AFRI, and update on the Bioeconomy. Select deep dive topics for Subcommittees and begin identifying problem statements.
Q3 August 17-18 1 ½ day meeting (plus site visit)	<ul style="list-style-type: none"> Site visit TBD Work in Subcommittees to develop recommendations for agreed upon deep dive topics.
Q4 November 9-10 1 ½ day meeting	<ul style="list-style-type: none"> Finalize and vote on 2016 recommendations

2017 Committee Staffing

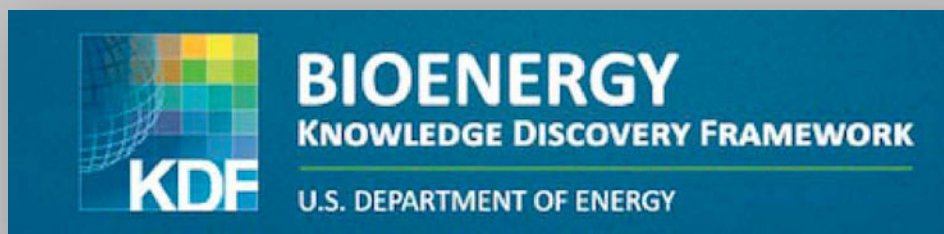
TAC Membership

- An annual Federal Register call is issued for new nominations to the TAC.
- Departing Members at the end of 2016:
 - Committee Co-Chair Kevin Kephart, South Dakota State University
 - Category: Institute of Higher Education w/ Expertise in Biobased Fuels & Products
 - Maureen McCann, Purdue University
 - Category: Engineer/ Scientist from Gov't or Academia w/ Expertise in Biobased Fuels and Products (2)
 - David Nothmann, Consultant
 - Category: Biobased Industrial and Commercial Products Industry
 - William Provine, DuPont
 - Category: Biobased Industrial and Commercial Products Industry
 - James Seiber, UC Davis
 - Category: Institute of Higher Education w/ Expertise in Biobased Fuels & Products
 - John Tao, Consultant
 - Category: Biobased Fuels Industry

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

► Purpose:

- Showcase game-changing technology
- Communicate transformational impact
- Promote US technology leadership
- Highlight strategic collaborations

► Participants:

- UA, DOE/ARPAE, USDA, NSF
- Policymakers and Officials
- National Grower Associations & Media

► Elements:

- Field Demonstration: UA-MAC field Scanalyser
- TERRA platforms: Aerial and Ground Robotics; Data Analytics
- Workshops: multi-agency and crop panels on plant phenotyping
- Sorghum Checkoff announcement of \$500k investment in 3 TERRA programs



TERRA Field Scanalyzer Capabilities

- ▶ University of Arizona/ USDA campus - Maricopa, AZ - Arid Land Agricultural Research Station
- ▶ 4 year biomass sorghum planting plan
- ▶ Field phenotyping detectors
 - RGB
 - Lidar
 - Hyperspectral
 - Thermal
 - Photosynthesis
 - Environmental
- ▶ 1 acre coverage
- ▶ Autonomous operation



Office of Basic Energy Sciences (BES)

Chemical Sciences, Geosciences and Biosciences Division

The BES Biosciences programs, Photosynthetic Systems and Physical Biosciences, support basic research on the physical, chemical and molecular mechanisms that plants and microbes use for **energy capture, conversion and storage**.

- Preapplications and Proposals are solicited through the Office of Science Annual FOA.
 - This FOA is the annual, broad, open solicitation that covers all of the research areas in the Office of Science and is open throughout the Fiscal Year (until September 30, 2016).
- The goal of BES Biosciences is to provide a basic understanding of the biological and biochemical processes that can provide foundational knowledge related to DOE's mission to efficiently capture and utilize solar energy and to convert renewable resources into fuels, chemicals and other energy-enriched products.
- Example Biosciences research areas:
 - Light Harvesting in Natural Systems, Photon Capture and Transfer
 - Charge Separation, Electron Transfer, Redox Reactions
 - Structure/Function of Photosynthetic Proteins, Protein Complexes, Membranes, and Organelles
 - Self-Assembly, Dynamics, Self-Repair of Protein Complexes
 - Carbon Fixation, RuBisCO and Calvin-Benson Cycle
 - Application of Physical Science Tools to Address Structure/Function and Mechanistic Studies
 - Non-RuBisCO CO₂ Reduction, esp. in Archaeal systems
 - Active Site Chemistry, esp of Multi-Electron Redox Reactions
 - Regulation of Electron Flow through Energy-Relevant Metabolic Pathways
 - Biochemistry and Biophysics of Cell Architecture including Cell Wall

Office of Basic Energy Sciences (BES)

Chemical Sciences, Geosciences and Biosciences Division

Basic Energy Sciences Annual Open Funding Opportunity Announcement

<http://science.energy.gov/bes/funding-opportunities/>

For information on the biosciences-focused programs in BES, Photosynthetic Systems and Physical Biosciences:

<http://science.energy.gov/bes/csgb/research-areas/photosynthetic-systems/>

<http://science.energy.gov/bes/csgb/research-areas/physical-biosciences/>

Five of the 32 Energy Frontier Research Centers are related to biosciences. For more information, see <http://science.energy.gov/bes/efrc/>

- Catalysis Center for Energy Innovation (CCEI); Dionisios Vlachos, University of Delaware
- Center for Biological Electron Transfer and Catalysis (BETCy); John Peters, Montana State University
- Center for Lignocellulose Structure and Formation (CLSF); Daniel Cosgrove, Pennsylvania State University
- Center for Direct Catalytic Conversion of Biomass to Biofuels (C3Bio); Maureen McCann, Purdue University
- Photosynthetic Antenna Research Center (PARC); Robert Blankenship, Washington University in St. Louis

Office of Basic Energy Sciences (BES)

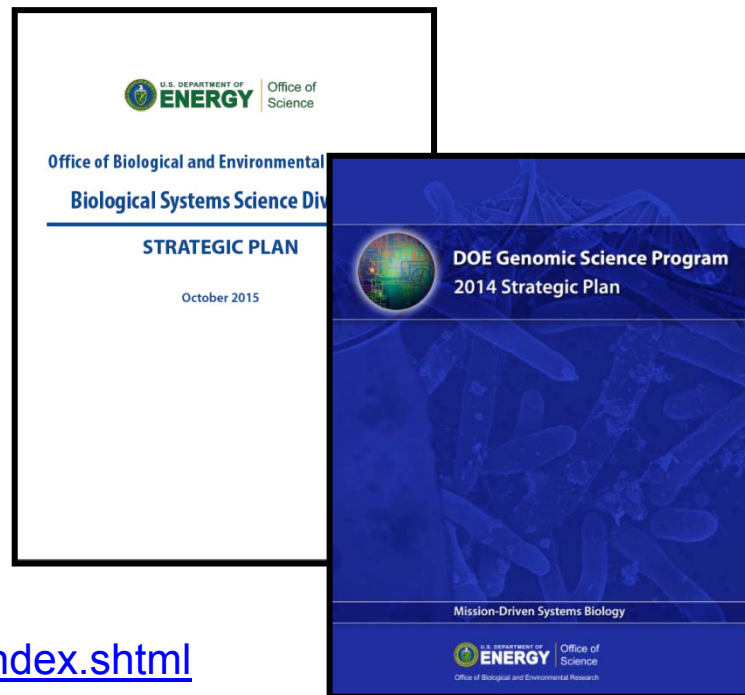
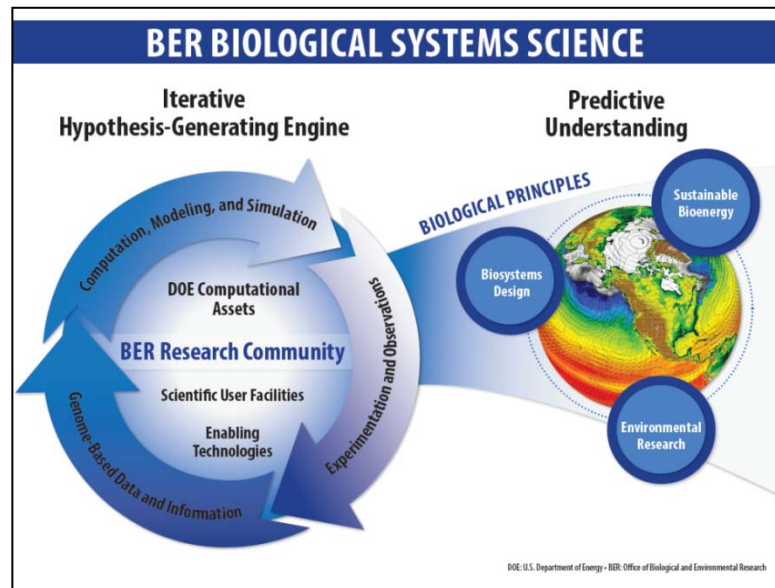
Sustainable Ammonia Synthesis

- A panel of international experts met February 2016 to discuss the state of the art and potential opportunities for basic research in ammonia synthesis.
 - The roundtable report titled “Sustainable Ammonia Synthesis” can found at http://science.energy.gov/~media/bes/csgeb/pdf/docs/2016/NH3_Report.
- Two Funding Opportunity Announcements (FOAs) for new awards in sustainable ammonia synthesis were issued by BES in April, one for universities/institutions of higher education (\$1.8M) and one for Experimental Program to Stimulate Competitive Research (EPSCoR)-eligible applicants (\$1.2M).
 - Focus: Molecular level research that provides the scientific basis for novel catalysts and mechanisms for nitrogen activation. Ideally, the research would produce fundamental knowledge that will lead to future catalytic processes for ammonia synthesis that are energy efficient, use renewable sources of energy, and do not produce greenhouse gases.
 - Mandatory pre-applications were due May 2, 2016 with full proposals due May 31, 2016.
 - Funding decisions will be made by early July.

Genomic Science Program

Main Program Topics

- Bioenergy Research Centers (BRCs)
- Systems Biology for Bioenergy
- Plant Feedstocks Genomics
- Biosystems Design
- Carbon Cycle/Environmental Microbiological Research
- Computational Biosciences
- Sustainability Research for Bioenergy



<http://genomicscience.energy.gov/strategicplan/index.shtml>

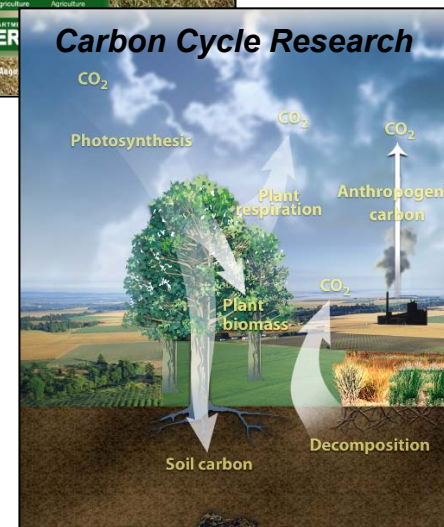
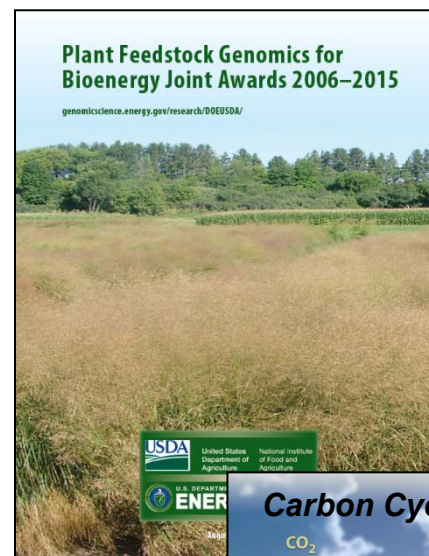
New FOAs for FY 2016

Plant Feedstock Genomics for Bioenergy: A Joint Research Funding Opportunity Announcement USDA, DOE (DE-FOA-0001444) - \$4M (total)

- *Continues research on plant responses to pathogens*
- *Includes a focus on oil seed crops*
- *Selections/awards in progress*

Systems Biology Enabled Research on the Roles of Microbial Communities in Carbon Cycle Processes (DE-FOA-0001458) - \$10M

- *Research to understand the functioning of microbial communities in a wide range of environments and environmental conditions*
- *Research to inform larger scale ecosystem function*
- *Selections/awards in progress*



Bioenergy Research Centers Open Competition



Sustainability



*Feedstock
Development*

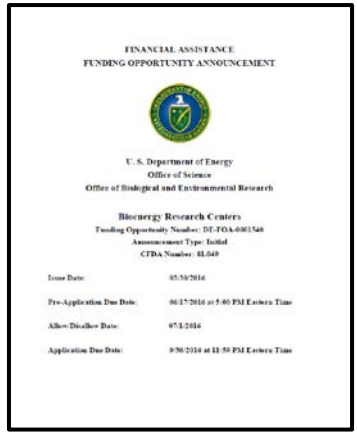


*Biomass
Deconstruction*

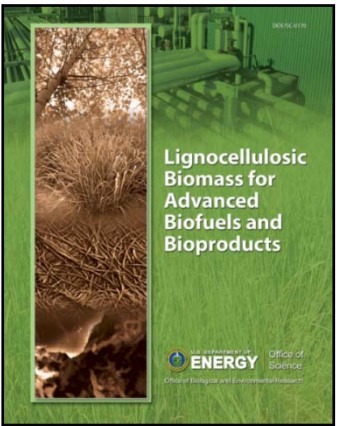


*Conversion
biofuels & bioproducts*

- **Team-based, multi-institutional, cross-disciplinary, integrated systems research centers.**
- **Total requested budget of \$90 million per year.**
- **Center annual budgets may range from \$12.5M to \$30M for up to 5 years.**
- **Open competition for domestic organizations as prime applicant; open to any organization as subawardee**



FOA (DE-FOA-0001540)
Posted - 3/30/2016
Pre-apps due - 6/17/2016
Applications due - 9/30/2016
New Starts – FY 2018



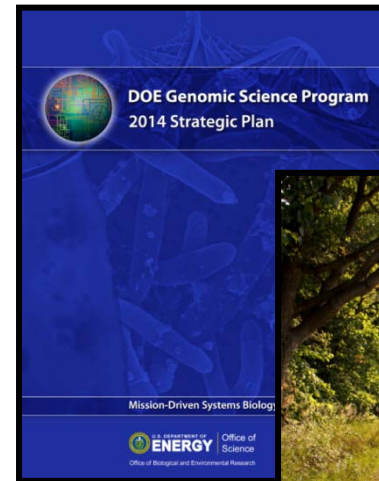
Potential Upcoming Solicitation Topics for FY 2017

Genomic Science Program

Plant Feedstock Genomics for Bioenergy

Biosystems Design

Microbial Systems Biology for Bioenergy



Topics align with the FY17 Budget Request and proposed increases for Mission Innovation Research

SC Investments for Mission Innovation **(\$100M in new funding in FY 2017 overall)**

BER (+\$35M)

- Biosystems design (computationally design and then bio-engineer biosystems) to introduce beneficial traits into plants and microbes for clean energy applications (\$20M)
- Bioenergy Research Centers: New investments to aid transition of 10 years of BRC research to industry (\$15M, \$5M per BRC)

Additional Potential FY 2017 FOA Topic

Microbiome (+10M, FY 17 Request)

BER supports fundamental microbiome research on plant-microbe associations relevant sustainable biomass production, soil microbiomes that impact nutrient availability and carbon cycling processes, and subsurface microbiomes that effect environmental contaminant fate and transport.

NSTC Life Sciences Subcommittee chartered a fast track interagency working group to identify current Federal R&D investments and key priorities in microbiome research

Significant recommendations:

- Development of high resolution analytical technologies is needed to characterize and quantitatively measure microbiome processes
- Databases, bioinformatics, and computational modeling will be critical to advance predictive understanding of microbiomes

New collaborative, multidisciplinary microbiome research efforts incorporating:

- experimental systems biology
- genome enabled environmental research
- predictive computational modeling
- partnerships between DOE National Laboratories, academia, and field research facilities

Goal: Understand the role of microbiomes in key DOE mission relevant environments such as:

- Biomass focused agricultural systems
- Terrestrial ecosystems particularly vulnerable to climate change variables, including permafrost, taiga, wetlands, and arid ecosystems.

Bioenergy Technologies Office (BETO)



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

**Developing and demonstrating
transformative and revolutionary bioenergy
technologies for a sustainable nation**

- By 2017, validate at least one pathway for \$3/GGE* hydrocarbon biofuel with $\geq 50\%$ reduction in GHG emissions
- By 2022, validate at least two additional pathways at pilot or demonstration scale (>1 ton/day)

*Mature modeled price at pilot scale.

BETO reduces risks and costs to commercialization through RD&D

The Challenge and the Opportunity

THE CHALLENGE

- More than **\$1 billion** is spent every three days on U.S. crude oil imports
- Transportation sector accounts for **67%** of petroleum consumption and **26%** of GHG emissions in the U.S.



THE OPPORTUNITY

- More than **1 billion tons** of biomass could be sustainably produced in the U.S.
- 1 Billion tons of biomass could displace **30%** of U.S. petroleum use by 2030 and reduce annual GHG emissions by **400 million tons**

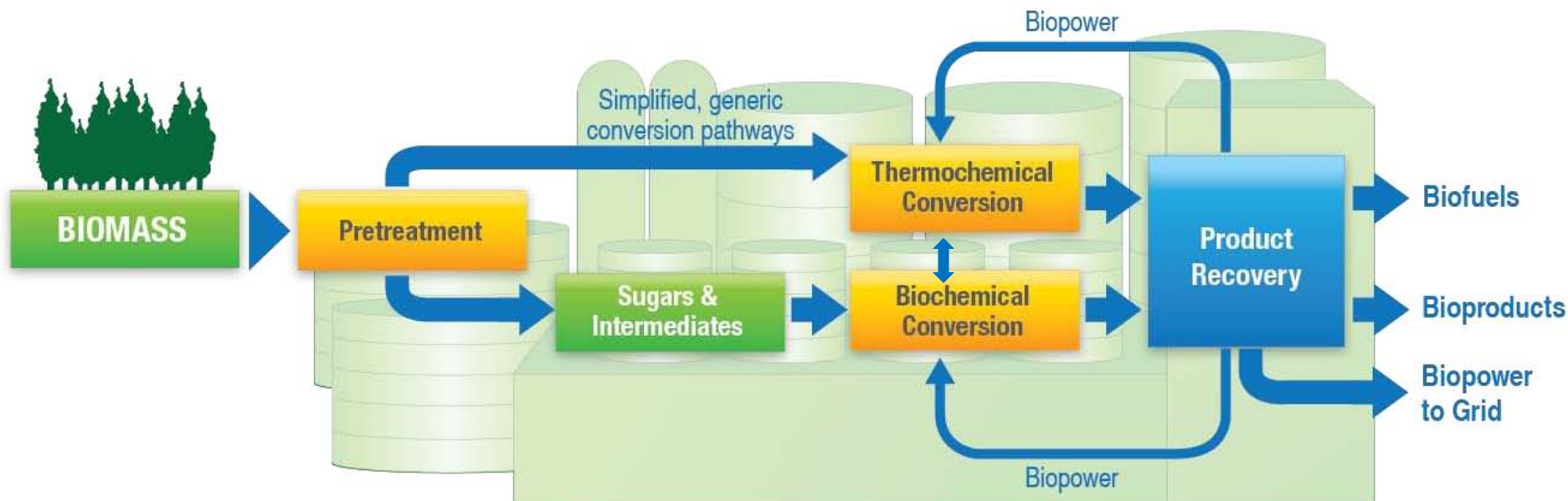


America's biomass resources can help mitigate petroleum dependence

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



Key Challenges

Biomass	Pretreatment	Conversion	Product
<ul style="list-style-type: none">• Reliable supply• Consistent quality• Affordable delivery	<ul style="list-style-type: none">• Biomass feeding, sizing and moisture• Solids handling• Construction materials	<ul style="list-style-type: none">• Products Yields• Construction materials• Catalysts• Fermentation organisms	<ul style="list-style-type: none">• Separations• Catalytic upgrading• Recycle loops

Purpose of Multi-Year Program Plan (MYPP)

- Articulate BETO's mission and goals to internal and external stakeholders
- Provide budget request justification
 - Explain how pieces fit together and build to long term goals
- Operational guide
 - To help the Office manage and coordinate its activities
- 5-10 year planning horizon (2022 goals and beyond)
 - Office goals
 - Technology Area/Program Plans
 - Integrated across programs
 - Regularly updated using change control



Overcoming DMT Challenges

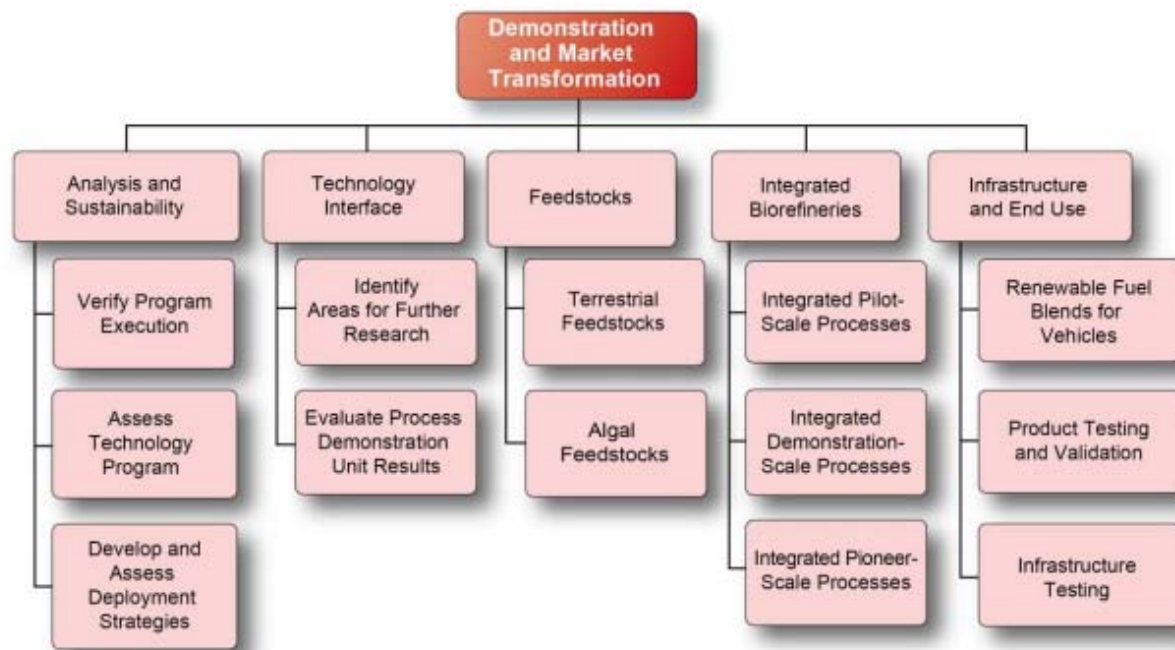


Figure 2-32: Demonstration and Market Transformation work breakdown structure

Integrated Biorefineries

Validating performance at integrated pilot, demonstration, and pioneer scales is essential to de-risk technology and enable financing that will catalyze the transition to large-scale renewable fuel production.

Infrastructure and End Use

In addition to the significant risks involved with scaling-up new biorefinery technology, other market barriers related to infrastructure and end use also limit advanced biofuel production. Efforts in this area focus on enabling higher rates of renewable fuel usage in current markets while addressing barriers for expansion into new markets.

Analysis and Sustainability

Both project-specific and portfolio-wide evaluations assess progress toward objectives and sharpen the focus of DMT strategies on the areas with the highest potential impact to the industry.

Technology Interface

These activities help identify (1) times when technologies are ready for piloting and scale-up, (2) entirely new feedstock logistics systems or conversion technologies, or (3) improvements to a smaller set of unit operations.

Feedstocks

Efforts to improve the supply and logistics system are essential for commercial operations. These activities span both terrestrial and algal feedstock systems to identify areas for improvement in feedstock supply and logistics systems and in the development of advanced feedstock logistics systems.

FY 2016 Priority Activities and Goals

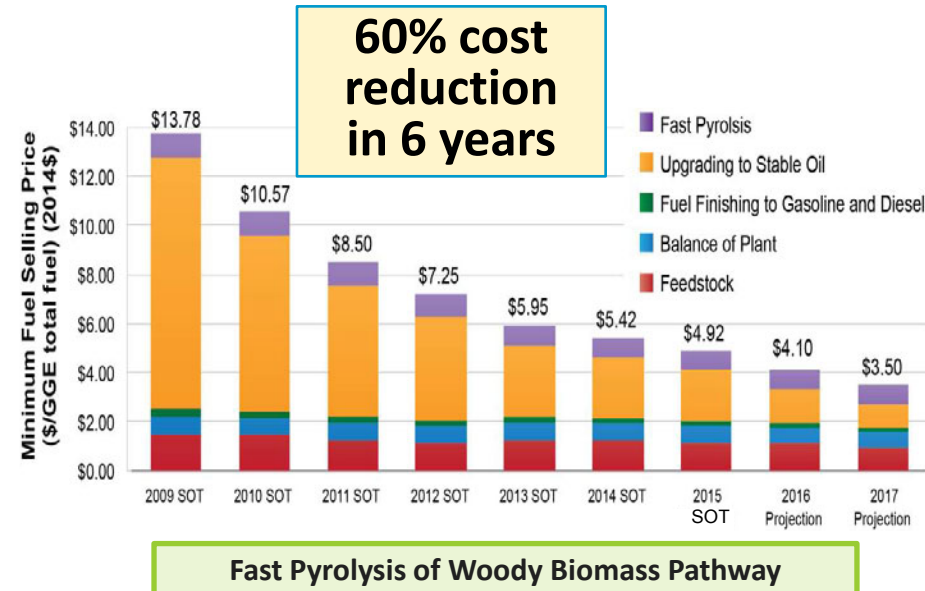
- **Feedstock Supply & Logistics:** Produce an updated, fully integrated assessment of potential available feedstock supplies under previously established environmental and quality criteria.
- **Advanced Algal Systems:** Pursue new research in advanced biology and carbon dioxide utilization to address yield, productivity, and integration of downstream logistics at the pre-pilot scale.
- **Conversion:** Select and complete preparation of at least two 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:** Make selections in October 2016 for new competitive awards for Validation Phase to scale-up integrated production systems of drop-in hydrocarbon biofuels to accelerate advanced biofuel manufacturing.
- **DPA:** Support the military-specification jet fuel in collaboration with DoD and USDA through the Defense Production Act.

Bioenergy Technologies Office – Summary

Accelerate the commercialization of first-of-a-kind technologies designed to utilize the Nation's abundant biomass resources for the production of advanced biofuels and biobased products.

Portfolio with Strategies on:

- **Terrestrial Feedstock Supply:** By 2022, validate FSL systems to supply 285 million dry tons/year to a biorefinery at a cost of \$84/dry ton.
- **Conversion R&D:** By 2022, validate an n^{th} plant modeled cost of \$3/GGE for a total of 3 pathways to hydrocarbon fuels with GHG emissions of >50% compared to petroleum.
- **Demonstration and Market Transformation:** By 2027, validate mature modeled performance goals for hydrocarbon fuels using data from an operating biorefinery.



Challenges

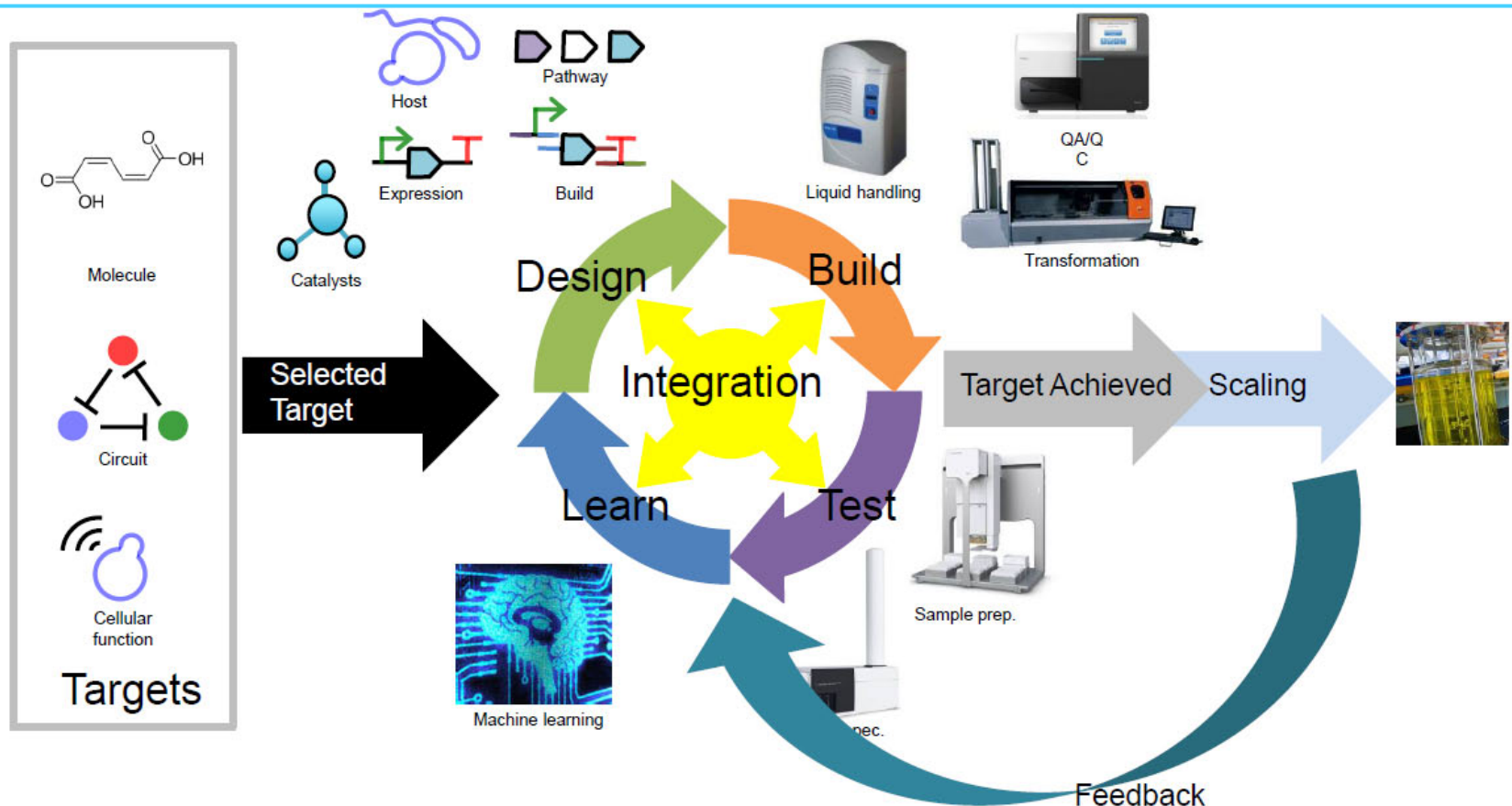
- Feedstock Availability and Cost
- Risk of first-of-a-kind technology
- Inadequate distribution infrastructure
- Production costs and market uncertainty
- Public acceptance of bioenergy

Opportunities

- RD&D to reduce feedstock logistics costs
- Cost-shared pilot and demonstration-scale facilities
- Focus on infrastructure-compatible hydrocarbon fuels
- Co-products to improve economics of biofuels
- Robust communications strategy and engagement with public stakeholders

Synthetic Biology (SynBio) Foundry

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.



Chemicals from Biomass - Market Assessment Report

March 2016 | NREL

- Reviews the broad range of chemicals that can be produced from biomass
 - Current state of field
 - Identifying clear market potential
- Focus on subset with prospects for near-term deployment
- Detailed discussion of existing markets, future potential for bioproducts
 - Competition with fossil-derived products
 - Production leaders scaling up
 - Market champions and large consumers
 - Drivers and challenges
 - Opportunities for direct and functional replacements
 - Impact on biofuel production



- Focus chemicals:
 - Butadiene (1,3-)
 - Butanediol (1,4-)
 - Ethyl Lactate
 - Fatty Alcohols
 - Furfural
 - Glycerin
 - Isoprene
 - Lactic Acid
 - Propanediol (1,3-)
 - Propylene Glycol
 - Succinic Acid
 - Xylene (para)

Small Business Vouchers (SBV) Pilot Program: Bioenergy

- **Purpose:** To help small businesses bring clean energy technologies to market faster by enabling access to national lab expertise and tools *easily* and *affordably*
- SBV (www.sbv.org) is a pilot program coordinated by EERE that matches selected clean energy small businesses with experts from the national labs and awards the businesses vouchers valued at \$50K to \$300K that they can exchange for national lab technical assistance.
 - 5 lead national laboratories (ORNL, NREL, LBNL, PNNL, and Sandia)
 - All DOE national laboratories are eligible to participate
- **BETO has allocated \$1.9 million in FY16**, spread over three rounds. The results of the first round of funding are:

Lygos (\$300K in BETO funding)

- To demonstrate process scaling and robustness, Lygos needs access to large fermentation vessels to validate their biobased production of malonic acid and to generate performance data. Lygos also needs to test their process on lignocellulosic sugars to validate biomass-based feedstocks for their product. Lygos will work with NREL and LBNL to test the scale-up of their process

Visolis (\$300K in BETO funding)

- Visolis will utilize fermentation expertise and equipment at NREL to scale-up fermentation of cellulosic sugars to mevalonic acid, in addition to catalysis expertise and equipment at PNNL to optimize process parameters to convert mevalonic acid to isoprene. The intended outcome is to refine techno-economic analyses and further define scale-up for the Visolis process.
- Second round currently in the selection process—announcements expected **July 2016**

Funding Opportunity Announcement: Conversion

MEGA-BIO: Bioproducts to Enable Biofuels

- **\$11.3 million** in funding to **develop flexible biomass-to-hydrocarbon biofuels** conversion pathways that can be modified to produce advanced fuels and/or products based on external factors, such as market demand.
- **Goal: Meet the 2022 cost target of \$3/gasoline gallon equivalent (gge)** for the production of renewable hydrocarbon fuels from lignocellulosic biomass and other types.
- **Closing Date:** April 15, 2016

Stakeholder feedback on bioproducts solicited in a July 2015 workshop. Workshop report can be found [here](#) or on the BETO website under Information Resources -> Publications.



Funding Opportunity Announcement: Algae

Advancements in Algal Biomass Yield Phase II (ABY2)

- Up to **\$15 million** in funding to **develop technologies** that are likely to succeed in **producing 3,700 gallons of algal biofuel intermediate** (or equivalent dry weight basis) **per acre per year** (gal/acre/yr) on an annualized average basis (not peak or projected) through multiple batch campaigns or on a semi-continuous or continuous basis, in an outdoor test environment.
- **Goal:** Achieve **3,700 gallons of algal biofuel per acre by 2020.**
- **Closing Date:** March 25, 2016



Funding Opportunity Announcement: IBRs

Project Development for Pilot- and Demonstration-Scale Manufacturing of Biofuels, Bioproducts, and Biopower

- Up to **\$90 million** in funding for projects focused on designing, constructing, and operating **integrated biorefinery facilities** that manufacture **biofuels, bioproducts, or biopower**. The FOA seeks applications for projects to first design (Phase 1), and then construct and operate IBR facilities (Phase 2).

Topic Areas:

1. **Pilot-scale production** of biofuels from **high-impact cellulosic, algal, or biogas feedstocks**. Minimum feedstock throughput is **1 dry metric ton (DMT) per day** or equivalent of algal biomass or biogas.
2. **Demonstration-scale production** of biofuels from **high-impact cellulosic, algal, or biogas feedstocks**. Minimum feedstock throughput must be **50 DMT per day** or equivalent of algal biomass or biogas.
3. **Production of biopower or biofuels** from **biosolids** and other allowable **wet-waste feedstocks**. Minimum feedstock throughput must be **1 DMT per day**.

- Concept Paper Submission Deadline: **6/6/2016 5:00 PM ET**
- Full Application Submission Deadline: **7/22/2016 5:00 PM ET**
- All inquiries must be submitted to PB2B3@ee.doe.gov

Bioenergy 2016 and Sustainable Transportation Summit



*MOBILIZING THE BIOECONOMY
THROUGH INNOVATION*

JULY 12-14, 2016

Walter E. Washington Convention Center
Washington, DC

*Sustainable
TRANSPORTATION*



Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Bioenergy 2016

Dates:

July 12, 2016, Tuesday afternoon –
July 14, 2016, until Thursday noon

Location:

Walter E. Washington Convention Center
801 Mount Vernon Place, NW
Washington, DC 20001

Partnered with:

Clean Energy Research
& Education Foundation



Sustainable Transportation Summit

Dates:

July 11, 2016, Monday afternoon –
July 12, 2016, until Tuesday noon

Location:

Walter E. Washington Convention Center

Register Today!

ceref.org/bioenergy-2016

***Early bird discounts run through June 17!** Register now for a discounted general public rate of \$150.

***Receive 10% off admission** when you register for both together!

Bioenergy Upcoming Workshops & Events

- **Waste-to-Energy Workshop**
 - June 22-23 in Golden, CO
- **The 6th International Conference on Algal Biomass, Biofuels and Bioproducts**
 - June 26-29 in San Diego, CA
 - <http://www.algalbbb.com/>
- **2016 ASABE Annual International Meeting**
 - July 17-20 in Orlando, FL
 - <http://asabemeetings.org/>
- **Biorefinery Optimization Workshop**
 - October 25-26 in Chicago, IL

Links for additional info

- 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/>