



**Biomass R&D Technical
Advisory Committee (TAC)**
May 20, 2015

Elliott Levine
TAC Designated Federal Officer (DFO)
DOE Updates

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Agenda at a Glance: Day 1

Day 1: Technical Advisory Committee Meeting

May 20, 2015

- 8:00 a.m. – 8:30 a.m. *Breakfast (to be provided for Committee)*
- 8:30 a.m. – 9:00 a.m. *Welcome and Introduction of New Members*
Committee Co-Chairs
- 9:00 a.m. – 9:15 a.m. Opening Remarks: *Cathie Woteki, Under Secretary, Research, Education, and Economics, USDA*
- 9:15 a.m. – 9:30 a.m. Presentation: *Committee Business for 2015*
Elliott Levine, DFO, U.S. Department of Energy
- 9:30 a.m. – 10:00 a.m. Presentation: *U.S. DOE Updates*
Elliott Levine, Bioenergy Technologies Office, U.S. Department of Energy
- 10:00 a.m. – 10:15 a.m. *Break*
- 10:15 a.m. – 10:45 a.m. Presentation: *USDA Update on Biomass R&D Activities*
Todd Campbell, U.S. Department of Agriculture
Marlen Eve, U.S. Department of Agriculture
- 10:45 a.m. – 11:00 a.m. Presentation: *Biomass Research and Development Initiative (BRDI) Solicitation and Update*
Daniel Cassidy, NIFA, U.S. Department of Agriculture
- 11:00 a.m. – 12:00 p.m. Panel: *Manufacturing Innovation*
 - *Todd Campbell, U.S. Department of Agriculture*
 - *Mike Molnar, Advanced Manufacturing Program Office, NIST*
 - *Mark Shuart, Advanced Manufacturing Office, DOE*
 - *Robbie Barbero, Biological Innovation Office Science and Technology Policy*
- 12:00 p.m. – 1:00 p.m. *Lunch (to be provided for Committee) (Ethics Briefing)*
- 1:00 p.m. – 2:30 p.m. Panel: *International Biomass Activities*
 - *Harry S. Baumes, U.S. Department of Agriculture*
 - *Paul Niznik, Strata Advisors, A Hart Energy Company*
 - *Laura Scandurra, Office of Global Analysis, USDA*
 - *Leticia Phillips, UNICA- Brazilian Sugarcane Industry Association*
- 2:30 p.m. – 3:00 p.m. *Break*
- 3:00 p.m. – 5:00 p.m. Panel: *Biomass Research and Development Working Groups 2015 Activities and Priorities*
Alison Goss Eng, Bioenergy Technologies Office, U.S. Department of Energy
- 5:00 p.m. – 5:15 p.m. Public Comment:
 - *Aviva Glaser, National Wildlife Federation*
 - *Andrew Miller, Policy Fellow, Biomass Thermal Energy Council (BTEC)*



Agenda at a Glance: Days 2-3

Day 2: Technical Advisory Committee Meeting

May 21, 2015

- 8:00 a.m. – 8:30 a.m. *Breakfast (to be provided for Committee)*
- 8:30 a.m. – 10:00 a.m. Discussion: 2015 Key Committee Topic Areas and Breakout Instructions
Committee Co-Chairs
- 10:00 a.m. – 12:00 p.m. Subcommittee Breakouts: (closed session)
- 12:00 p.m. – 1:00 p.m. *Lunch (to be provided for Committee)*
- 1:00 p.m. – 5:00 p.m. Subcommittee Breakouts: (closed session)

Day 3: Technical Advisory Committee Meeting

May 22, 2015

- 8:00 a.m. – 8:30 a.m. *Breakfast (to be provided for Committee)*
- 8:30 a.m. – 10:15 a.m. Subcommittee Report Outs:
- 10:15 a.m. – 11:00 a.m. Discussion: Next Steps of Key Topic Areas for 2015
Committee Co-Chairs
- 11:00 a.m. – 11:30 a.m. Discussion: 2015 Site Visit Options
- 11:30 a.m. – 11:45 a.m. Public Comment:
Michele Jalbert, Corinne Young LLC
Susan P. Rupp, Enviroscapes Ecological Consulting
David Waechter, Biomass Check Off
- 11:45 a.m. – 12:00 p.m. Discussion: Meeting Close
Committee Co-Chairs
- 12:00 p.m. – 1:00 p.m. *Lunch (to be provided for Committee)*



TAC 2015 Work Timeline

Date	Committee Objectives
Q1 2015 March 5, 2015 Webinar	<ul style="list-style-type: none"> • Receive presentation on the interactions between the Biomass Board, Operation Committees, and Interagency Working Groups.
Q2 2015 May 20-22, 2015 (2 ½ day meeting)	<ul style="list-style-type: none"> • TAC will consider all inputs and list and rank topics for the TAC to consider. • Agree on TAC 2015 topic areas. • Adjust the TAC sub-committee structures (if necessary) to best address one or more topics per future meeting.
Q3 2015 Week of August 24th	<ul style="list-style-type: none"> • Work in Subcommittees to develop recommendations on agreed upon topic areas. • Possible site visit.
Q4 2015 Week of November 16 th (1 ½ day meeting)	<ul style="list-style-type: none"> • Finalize and vote on 2015 recommendations.

TAC Q2 Meeting Inputs and Outputs

Inputs

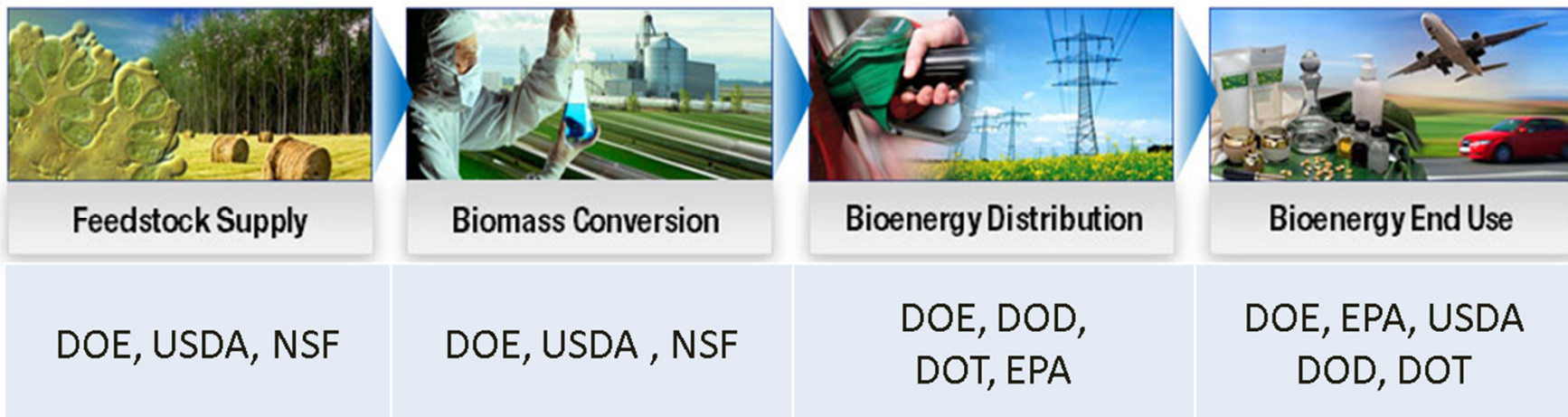
- 2014 Recommendations, parking lot items.
- Committee questions from Q1 meeting.
- Leverage working group related subjects.

Outputs / Deliverables

- Identify key problems to address with recommendations.
- Identify information gaps.
- Frame beginning of problem statements and possible recommendations.
- Review and prioritize list of possible topics.

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.



Summary of Federal Agency Roles across the Biomass-to-Bioenergy Supply Chain (from BETO MYPP, March 2015)

Table 1-2: Summary of Federal Agency Roles across the Biomass-to-Bioenergy Supply Chain

Federal Agency	Feedstock Production	Feedstock Logistics	Biomass Conversion	Demonstration	Biofuels Distribution	Biofuels End Use
Department of Energy	<ul style="list-style-type: none"> Plant and algal science Genetics and breeding Feedstock resource assessment Sustainable land, crop, and forestry management Algal feedstock cultivation and production systems. 	<ul style="list-style-type: none"> Sustainable logistics systems, including harvesting, handling, storage, & preprocessing systems Testing logistics systems at demonstration scale. 	<ul style="list-style-type: none"> Biochemical conversion (pretreatment/enzyme cost reductions) Recalcitrance of all biomass resources Thermochemical conversion to increase yield of hydrocarbons to fuel blendstocks and energy (gasification and pyrolysis). 	<ul style="list-style-type: none"> Cost-shared projects and/or loan guarantees to biorefineries to demonstrate and deploy integrated conversion processes at pilot, demonstration, and pioneer scale. 	<ul style="list-style-type: none"> Flexible, compatible, sustainable, and cost-effective biofuels Transportation/distribution systems development Material compatibility Alternative fuel dispensing infrastructure. 	<ul style="list-style-type: none"> Engine compatibility and optimization Vehicle emissions testing Bioproduct testing for market acceptance Education to improve awareness regarding positive impacts of biofuels.
Department of Agriculture	<ul style="list-style-type: none"> Sustainable land, crop, and forestry management Plant science Genetics and breeding Planting/ establishment payments to biomass crop producers. 	<ul style="list-style-type: none"> Sustainable harvesting of biomass crop and forest residue removal Equipment systems related to planting. 	<ul style="list-style-type: none"> Biochemical conversion (pretreatment/enzyme cost reductions) Recalcitrance of forest resources Thermochemical conversion to fuels and power On-farm biofuels systems. 	<ul style="list-style-type: none"> Loan guarantees to viable pioneer-scale facilities and grants to demonstration-scale facilities Payments to existing biorefineries to retrofit power sources to be renewable Producers to support and expand production of advanced biofuels refined from sources other than cornstarch. 	<ul style="list-style-type: none"> Loan guarantees and grants to support (1) safe and sustainable biofuel transportation/distribution (2) Refineries & blending facilities development (3) Flex-fuel pumps installation (4) Financing of transportation/distribution industry/businesses. 	<ul style="list-style-type: none"> Market awareness and education for end users on advantages of increased biofuels use.
Environmental Protection Agency	<ul style="list-style-type: none"> Effects of feedstock production systems, including effects on ecosystem services (water quality, quantity, biodiversity, etc.) Assessment of bioenergy crop impacts. 		<ul style="list-style-type: none"> Biowaste-to-energy Characterization of air, water, and waste emissions Regulations/permitting TSCA review of inter-generic genetically engineered microbes used for biomass conversion Testing protocols and performance verification. 	<ul style="list-style-type: none"> Health/environmental impacts of biofuels supply chain life cycle Characterization of air, water, and waste emissions; regulations/permitting Policy and research on waste to energy Testing protocols and performance verification Market impact of biofuels production. 	<ul style="list-style-type: none"> Permitting, air emission characterization Regulation of underground storage tanks Emergency management and remediation of biofuel spills. 	<ul style="list-style-type: none"> Engine optimization/certification Characterization of vehicle emissions and air quality, and environmental, and public health impacts Regulation of air emissions Market awareness/ impact of biofuels on public health, ambient air, and vehicles.
Department of Commerce/ National Institute for Standards and Technology			<ul style="list-style-type: none"> Catalyst design, biocatalytic processing, biomass characterization, and standardization Standards development, measurement, and modeling. 		<ul style="list-style-type: none"> Materials reliability for storage containers, pipelines, and fuel delivery systems. 	<ul style="list-style-type: none"> Standard reference materials, data, and specifications for biofuels.

Summary of Federal Agency Roles across the Biomass-to-Bioenergy Supply Chain (from BETO MYPP, March 2015) – Cont'd

Federal Agency	Feedstock Production	Feedstock Logistics	Biomass Conversion	Demonstration	Biofuels Distribution	Biofuels End Use
Department of Transportation		<ul style="list-style-type: none"> Feedstock transport infrastructure development. 			<ul style="list-style-type: none"> Safe, adequate, cost-effective biofuels transportation/distribution systems development. 	<ul style="list-style-type: none"> Promotion of safe and efficient transportation while improving safety, economic competitiveness, and environmental sustainability.
Federal Aviation Administration			<ul style="list-style-type: none"> Techno-economic analysis of processes that convert biomass to jet fuel. 	<ul style="list-style-type: none"> Builds relationships, share and collect data, identify resources, and direct research, development and deployment of alternative jet fuels by supporting Commercial Aviation Alternative Fuels Initiative. 	<ul style="list-style-type: none"> Safe, adequate, compatible, cost-effective biofuels transportation/distribution system. 	<ul style="list-style-type: none"> Working toward certification of bio-derived jet fuels in coordination with the American Society for Testing and Materials with the entire aviation supply chain.
National Science Foundation	<ul style="list-style-type: none"> Plant genetics, algal science, and other paths to improve biofuels feedstocks and wastes as energy sources. 	<ul style="list-style-type: none"> Basic research on modifications or processes to improve feedstock preprocessing. 	<ul style="list-style-type: none"> Basic and applied research on catalysts, processes, characterization for biochemical and thermochemical conversion technologies Life-cycle analysis Environmental impact amelioration. 	<ul style="list-style-type: none"> Supportive R&D on health/environmental impacts of biofuels and bioproducts 		<ul style="list-style-type: none"> Supportive R&D on health/ environmental/ safety/social issues of biofuels use.
Department of the Interior	<ul style="list-style-type: none"> Forest management. 	<ul style="list-style-type: none"> Forest management/ fire prevention (recovery of forest thinnings). 	<ul style="list-style-type: none"> Biorefinery permitting on Department of Interior-managed lands. 			
Department of Defense	<ul style="list-style-type: none"> Basic R&D on feedstock processing (municipal solid waste/waste biomass). 		<ul style="list-style-type: none"> Solid waste gasification Applied algal and cellulosic feedstock conversion R&D Partner in Defense Production Act. 	<ul style="list-style-type: none"> Through Defense Production Act, support biorefineries to demonstrate and deploy integrated conversion at commercial scale. 	<ul style="list-style-type: none"> Safe, compatible, cost-effective biofuels transportation/distribution systems developed for military use. 	<ul style="list-style-type: none"> Biofuels testing Standard reference materials, data, and specifications for biofuels Biofuel use in military vehicles/crafts.

BETO Announcements and Updates



Biomass Research & Development Initiative (BRDI)

BRDI FOA was released on February 26, 2015

- USDA-NIFA-9008-004957 (full solicitation information is available on [Grants.gov](https://www.Grants.gov))
- This opportunity addresses USDA and DOE programmatic objectives, administrative roles, and areas of interest in implementing Biomass Research and Development Initiative grants.
 - USDA anticipates awarding grants and DOE anticipates awarding Cooperative Agreements under this FOA
 - Anticipated funding level: \$8.7M (USDA: \$5.7M, DOE: \$3.0M)
 - Awards range: \$500K – 2.0M
- Concept Papers were requested to address one of three technical topic areas:
 1. Feedstocks Development
 2. Biofuels and Biobased Products Development
 3. Biofuels and Biobased Products Development Analysis
- Concept Papers were due: 03/27/2015 – 379 received
- Full Application due date: 7/27/2015, 5:00 p.m. EST



Targeted Algal Biofuels and Bioproducts Funding Opportunity

- **Goal:** The [Targeted Algal Biofuels and Bioproducts \(TABB\) FOA](#) seeks to reduce the cost of algal biofuels from \$7 per gallon – the current projected state of technology for 2019 – to less than \$5 per gallon algal biofuel by 2019.
- **Topics:** The FOA selection process will identify projects in two topic areas:
 1. Multi-disciplinary consortia that bring together upstream and downstream expertise to develop algae cultures that produce **valuable bioproduct precursors, and fuel components**, to increase the overall value of the biomass; and
 2. Single investigator or small team technology development projects focused on developing **algae culture protection and CO₂ uptake improvement** technologies to increase yields.
- Topic 1 consortia award size of \$5M to \$10M (1-3 awards)
- Topic 2 project award size of \$500K to \$1M (3-7 awards)
- 20% Cost Share is required.
- Up to 4 year project durations (to accommodate multiple growing seasons), with external validations and Stage Gate reviews.
- **Status:**
 - Closed December 19, 2014
 - Awards anticipated in June 2015

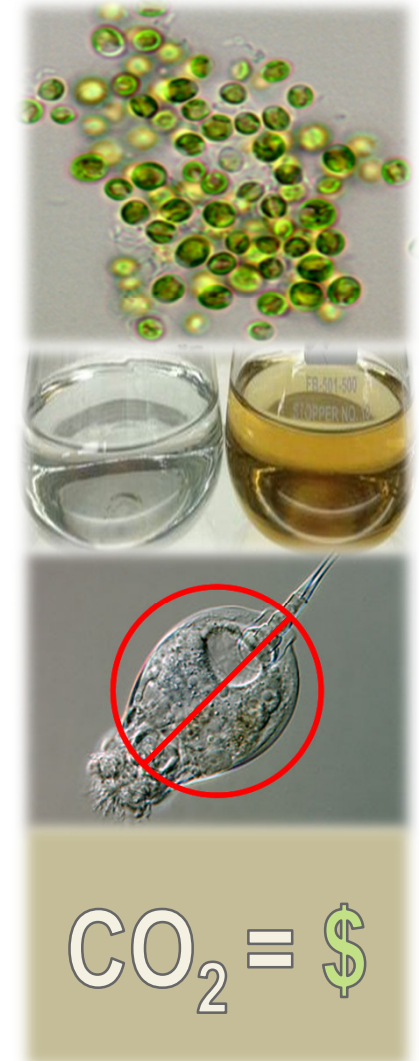


Photo credits FSU and NREL

Landscape Design FOA

Landscape Design Funding Opportunity Announcement (FOA)

- Released on October 20, 2014.
- DOE announced up to \$14 million to support landscape design approaches that maintain or enhance the environmental and socio-economic sustainability of cellulosic bioenergy.
 - Examples might include growing energy crops on marginal lands to improve both agricultural productivity and water quality, or utilizing agricultural residue in a way that enhances both profitability and soil quality.
- Previous DOE projects have shown the potential for improved sustainability by strategically placing bioenergy feedstock production within a landscape.
- Applications were submitted on January 26, 2015.
- Evaluation of applications is currently underway.
- Expected date for EERE Selection Notifications: June 18, 2015.



Sustainability Webinar: April 22, 2015

Climate Change and Air Quality



Analyzing biofuel pathways to quantify progress towards reducing [lifecycle greenhouse gases, regulated emissions, and fossil energy use](#).

Soil Quality



[Developing strategies and tools](#) for producing biomass feedstocks while maintaining or enhancing soil quality.

Land Use and Productivity



Advancing landscape design approaches that increase biomass production while maintaining or enhancing ecosystem services and food, feed, and fiber production.

Water Quantity and Quality



Assessing the [water resource use and water quality](#) of bioenergy production, and investigating opportunities for bioenergy crops [to improve water quality](#).

Biological Diversity



Investigating relationships between [bioenergy crops and biodiversity](#), and engaging with diverse experts to understand and promote practices that conserve wildlife and biodiversity.

Efforts also include evaluating [sustainability indicators](#) across the bioenergy supply chain, contributing to [global scientific dialogues](#) on bioenergy sustainability, and engaging with [international organizations](#) to understand and promote more sustainable outcomes.

Workshop: Bioenergy with Carbon Capture & Sequestration (BECCS)

- **Monday, May 18, 2015, Washington, DC**
Sponsored by Office of Fossil Energy (FE) and BETO
- Workshop focused on carbon-negative power systems and the use of biomass in power generation to achieve lower greenhouse gas emissions.
- BETO and FE are seeking inputs from experts in bioenergy, power generation, and algae from industry, academia, non-profit organizations, government, and national laboratories.
- Workshop incorporated discussion sessions to facilitate future research and development.
- Results from these discussion sessions will be compiled into a workshop report.
- Workshop report will be used to assist:
 - DOE leadership in identifying opportunities for technology development and deployment in the power industry, and
 - FE and BETO in strategic planning for future joint program activities.

BETO Webinar: A Changing Market for Biofuels and Bioproducts

May 27, 2015

12:30 PM to 1:30 PM EDT

<http://www.energy.gov/eere/bioenergy/events/webinar-changing-market-biofuels-and-bioproducts>

- Discussion topics will include:
 - Results of the BETO-funded report, the U.S. Billion-Ton Update, and how this and other research efforts are helping to enhance a secure and sustainable annual supply of biomass for the U.S. bioeconomy.
 - Oil price forecasts and their impact on the bioeconomy.

Waste-to-Energy (WTE) Updates and Upcoming Events

- ❑ WTE priority areas currently identified include the need to manage variable feedstocks, assess spatially resolved resources; improve microbial consortia for processing biosolids and other waste streams; and determine opportunities to improve biosolids treatment.
- ❑ In FY 2016, the WTE portion of the Conversion Technologies Subprogram will initiate projects to address these R&D targets.

Workshop Series (BETO-WETT collaboration)

- March 2015 (joint with Fuel Cell Technology Office): Anaerobic Membrane Bioreactors, Microbial Electrochemical Cells, and combinations thereof to produce hydrogen and higher hydrocarbons from wastewaters.
 - Report available on BETO/FCTO websites.
- April 2015 (together with EPA, NSF, and DOE Water-Energy Tech Team): Energy-Positive Water Resource Recovery.
- Mid-June 2015: Water Environment Federation Water-Energy Conference.
- June 22- 24, 2015: Bioenergy 2015, with sessions on Renewable Gaseous Fuels and Beyond Biogas: Challenges for Wet Waste-to-Energy.

Peer Review 2015 Highlights

2015 PROJECT PEER REVIEW

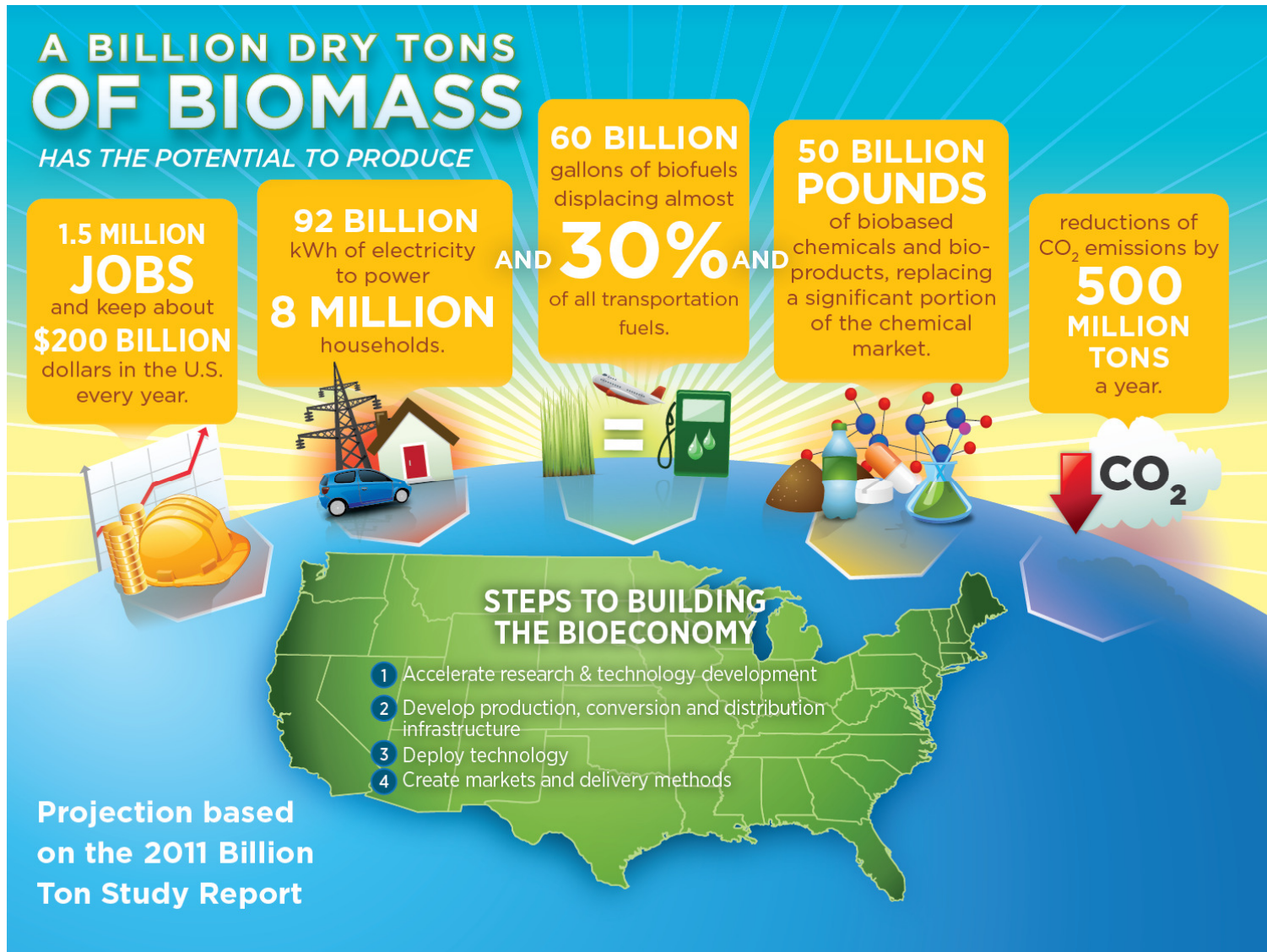
- Held during March 23-27, 2015 Hilton Mark Center Alexandria, Virginia
- 380 Attendees, \$400M in reviewed projects
- Presentations now available online at:
<http://www.energy.gov/eere/bioenergy/2015-project-peer-review>

- ❖ “The use of grants have been necessary to reduce the project capital investment; has provided project credibility which has acted as an attractant for private investment; and have provided a path for demonstrating technology proof of concept and market viability which is necessary for private industry to invest in future projects.”
- ❖ “The biggest strengths of the portfolio were the actual construction of facilities which were preparing to produce significant quantities of advanced biofuels.”
- ❖ “BETO should continue to fund IBR projects in the pilot, demo, and commercial stage with a larger number of pilot-scale, with fewer demonstration plants and even fewer commercial plants. All of these are important.”

Bioeconomy Update

- An initiative to sustainably reaching the full potential of biomass-derived products to expand the nation's economy, while providing energy security, economic, environmental, and social benefits.
 - Develop and provide innovative ways to expand the sustainable use of the nation's abundant biomass resources for biofuels, bioproducts, and biopower.
- Interagency collaboration continues among DOE, USDA, EPA, DOT, NSF, and other agencies for strategy development and formulation of a Bioeconomy initiative.
 - Federal Strategy Workshop held May 4-6, 2015, Washington, DC
 - Stakeholder Engagement
 - Workshops and Strategy Development
- By involving other agencies and stakeholders, as a collaborative effort, the initiative will strengthen the current federal commitment and coordination by leveraging existing resources across federal agencies.
 - Future public workshops are being planned for inputs from stakeholders.

Potential Impact of a Billion Ton Bioeconomy



The Bioeconomy Concept

Round Wood and Woody Energy Crops

Woody Residues



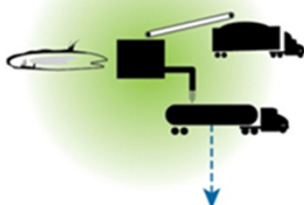
Solid Urban Residues and Municipal Solid Wastes



Herbaceous Residues and Energy Crops



Algae and Other Microcrops



Hydrolysis and Fermentation



Combustion



Gasification



Refining



Liquid Fuels



Chemicals



Ethanol



Electricity

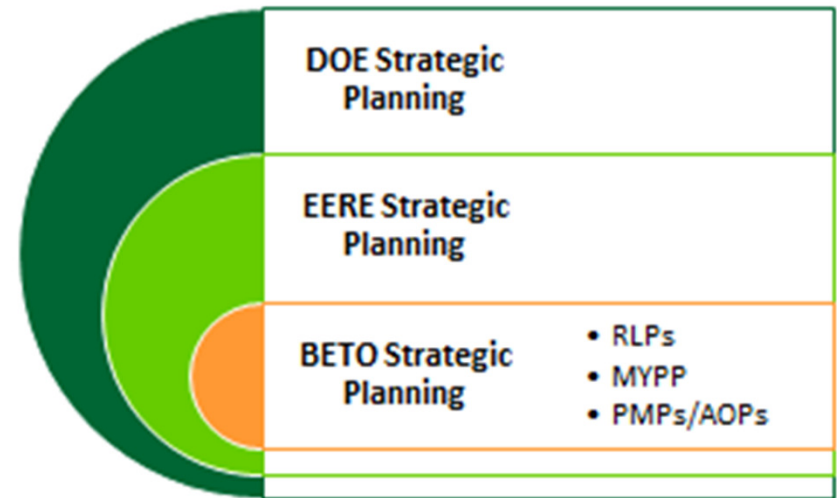


Heat & Steam

- Revenue and economic growth
- Broad spectrum of new jobs
- Rural development
- Advanced technologies and manufacturing
- Reduced emissions and Environmental Sustainability
- Export potential of technology and products
- Positive societal changes
- Investments and new infrastructure

BETO Strategic Planning

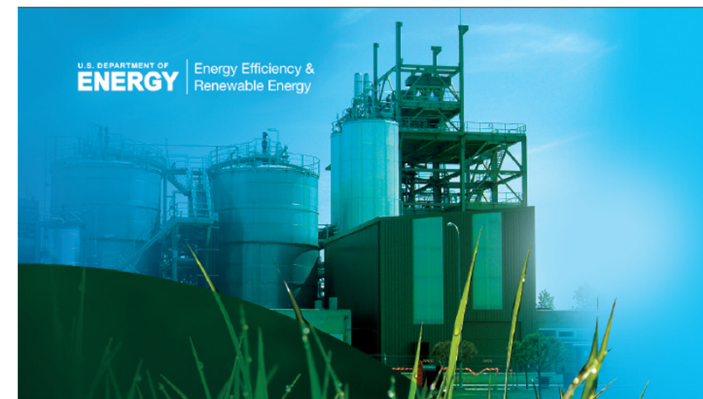
- **Continuous process**
- **Provides framework**
 - Alignment with EERE/DOE/Federal goals
 - Interactions with stakeholders
 - Inter- and intra-office collaborations/discussions across technology areas
 - Alignment of Office activities from project level to multi-year goal horizons
- **Purpose**
 - Align objectives and activities across multiple stakeholders and interests
 - Document goals, current state of technology, and strategic plans
 - Inform budget processes
 - Track progress
 - Integrate learning
- **Based on best practices for technology R&D planning and systems engineering**



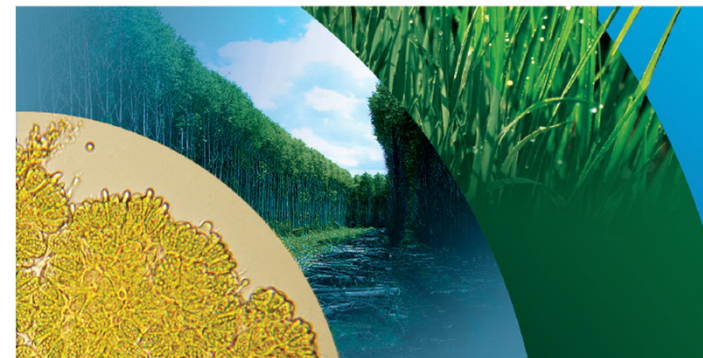
Publications

BETO Multi-Year Program Plan (MYPP)

- Updated version of the BETO's Multi-Year Program Plan was released in March 2015.
 - <http://www.energy.gov/eere/bioenergy/articles/update-released-beto-s-multi-year-program-plan>
 - Includes assessment of additional pathways.
- A new version of the Update to the Billion-Ton Study is under-development.



BIOENERGY TECHNOLOGIES OFFICE
Multi-Year Program Plan
March 2015



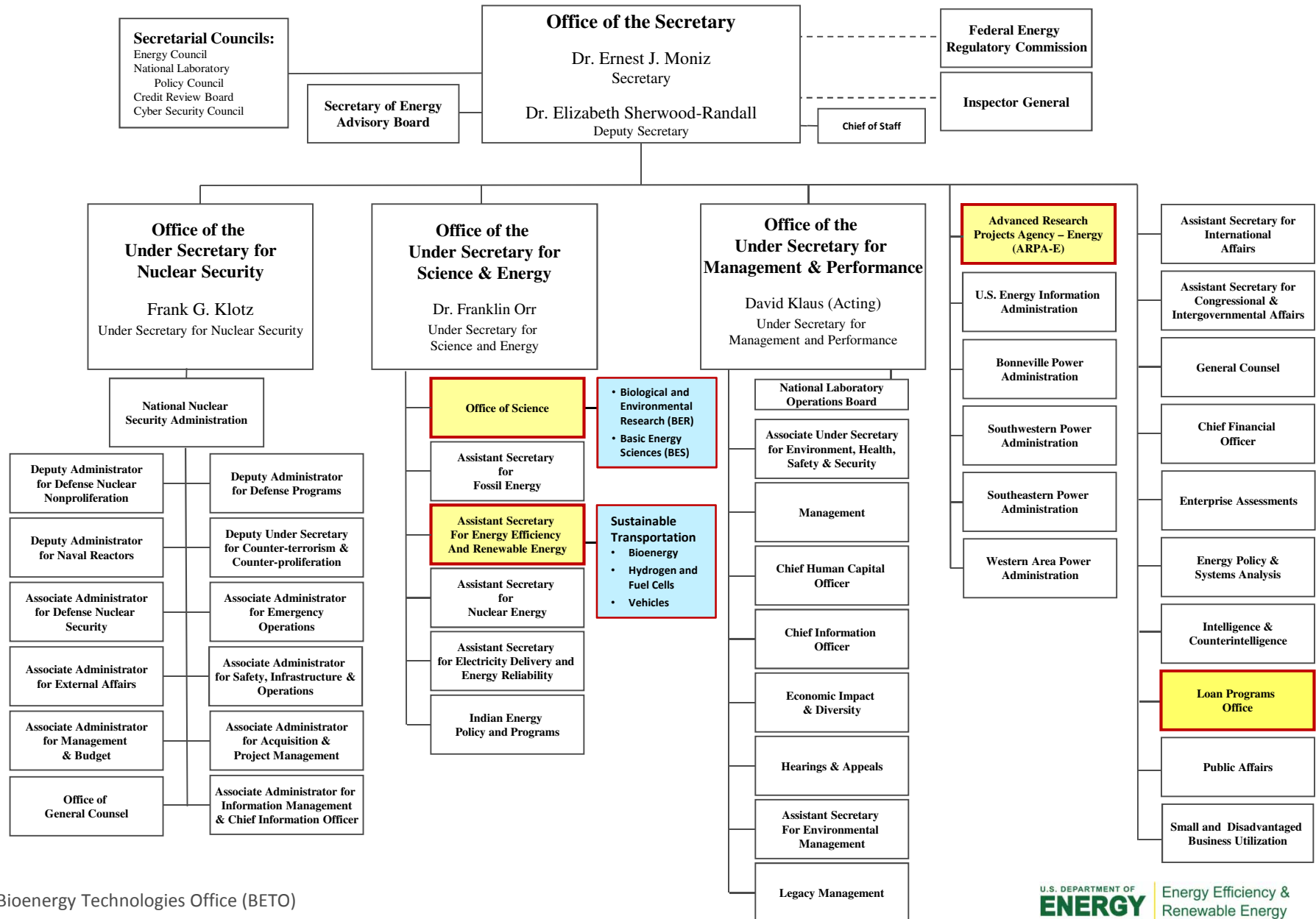
Bioenergy 2015: Opportunities in a Changing Energy Landscape

Join me June 23-24 at
BIOENERGY 2015



- Washington Convention Center, Washington, DC
- This year's event, co-hosted with the Clean Energy Research and Education Foundation (CEREF), will highlight the opportunities and challenges in our dynamic energy ecosystem.
- Discuss issues critical to the continued growth and success of the bioeconomy such as changing oil prices, the Renewable Fuel Standard, algae-based biofuels, sustainability, innovative technologies, and the bioenergy market.
- Bioenergy 2015 will be an opportune time to network with your peers and others in the bioenergy community.

DOE Program Offices with Biomass Related Activities



Loan Programs Office (LPO)

LPO has three open Title XVII solicitations*: (1) Advanced Fossil Energy Projects, (2) [Renewable Energy and Efficient Energy Projects](#), and (3) Advanced Nuclear Energy Projects. LPO is proposing guidance that would clarify eligibility issues that have arisen as LPO has responded to questions and reviewed applications under the open Title XVII solicitations. The eligibility issues, as applied to areas for BETO interest, are as follows:

- **Mixed-Feedstock Inputs:** LPO has received applications for projects that use multiple feedstocks, such as a mix of biomass and fossil fuels. Currently, there is no guidance to direct applicants to the appropriate solicitation based on the feedstock inputs of the project.
- **Chemical or Other End-Product Outputs:** In addition to applications for projects that would produce electricity or fuels, LPO has received applications for projects, under both the Advanced Fossil Energy solicitation and the Renewable Energy solicitation that would produce chemicals or other end-product outputs. Title XVII does not provide guidance on what output from an eligible project is acceptable.



* <http://energy.gov/lpo/innovative-clean-energy-projects-title-xvii-loan-program>

Bioenergy related eligible project areas include:

Drop-in Biofuels:

- New bio-refineries that produce gasoline, diesel fuel, and/or jet fuel;
- Bio-crude refining processes; and
- Modifications to existing ethanol facilities to gasoline, diesel fuel, and/or jet fuel.

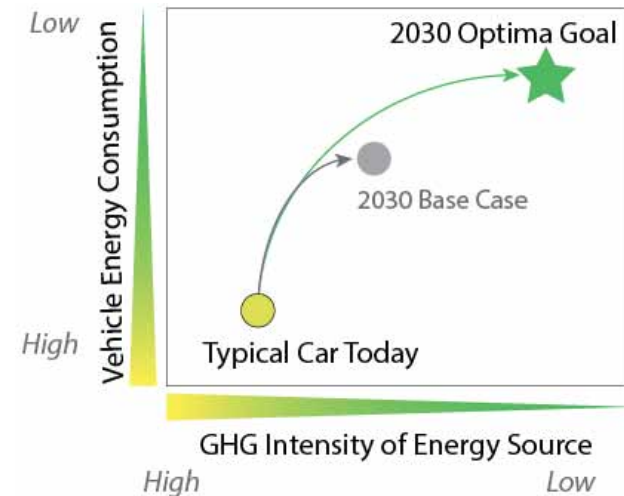
Waste-to-Energy:

- Methane from landfills or ranches via biodigesters to heat and power;
- Municipal solid waste to electricity;
- Crop waste to fuel and/or energy and bioproducts; and
- Forestry waste to fuel and/or energy potentially via cofiring.

Vehicle Technologies Office (VTO)

Optima: co-optimization of fuels and engines

- The nation requires new low carbon fuels and advanced engines that are *co-optimized*—designed in tandem to work for maximum performance and carbon efficiency.
- The Optima initiative will accelerate the widespread deployment of significantly improved fuels and vehicles (passenger to light truck to heavy-duty commercial vehicles) by 2030.
- Optima goals include:
 - Develop new fuels and vehicles with higher performance that can be produced affordably, sustainably, and at scale.
 - Identify and mitigate barriers to wide-scale deployment of new fuels and vehicles.
 - Through a coordinated DOE and national lab effort, maximize value to widest range of stakeholders.
- **Upcoming Workshop:** Stakeholders Listening Day, June 16-17, 2015, Golden, CO



Vehicle Technologies Office (VTO) – Optima

The Challenge: 80% reduction in transportation GHG emissions by 2050

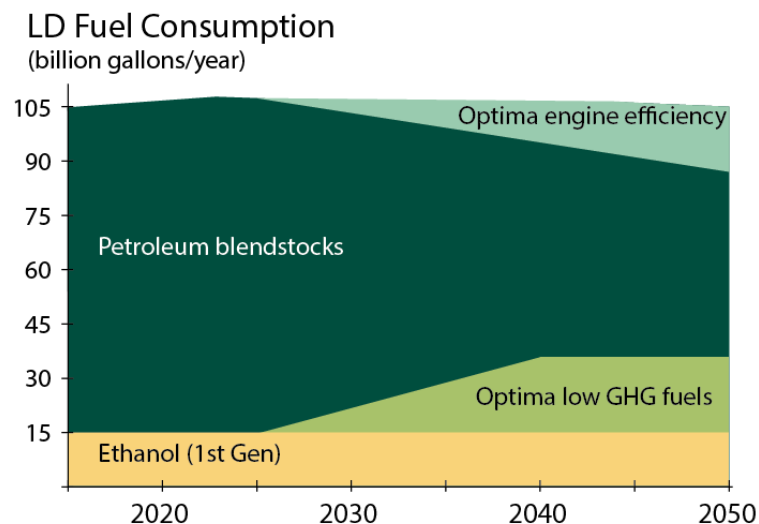
Status

- Optima included in President's FY16 budget at \$27M (\$17M VTO + \$10M BETO)
- Selected as lead Transportation “Big Idea” candidate from April 2015 Big Idea Summit.



Next Steps

- Stakeholder outreach (“Listening Day”)
- Visits to auto-, energy-companies and biofuel companies ongoing since December.
- Coordinate with complementary efforts (e.g., U.S. DRIVE)
- Develop detailed R&D plans.



Office of Science - Recent Biofuels Related Activities

Office of Biological & Environmental Research (BER)



Current Funding Opportunity Announcements (FOAs):

- Systems Biology Research to Advance Sustainable Bioenergy Crop Development
 - DOE Genomic Science Program FOA DE-FOA-0001207.
 - Systems biology research on biomass crops related to stress resilience/adaptation, resource use efficiency, and response to environmental variables.
 - Genome-enabled research on interactions between plants, microbial communities, and soil ecosystems relevant to sustainable biomass production.
- USDA/DOE Plant Feedstock Genomics for Bioenergy (Joint FOA)
 - DOE Genomic Science Program FOA DE-FOA-0001249.
 - Genomics-based research on biomass plant traits related to plant response to pathogens, with a long-term focus on crop improvement.

Reports and Strategic Planning Documents:

- DOE Genomic Science Program: 2014 Strategic Plan Update
<http://genomicscience.energy.gov/strategicplan/index.shtml>
- Lignocellulosic Biomass for Advanced Biofuels & Bioproducts: 2014 Workshop Report
<http://genomicscience.energy.gov/biofuels/lignocellulose/index.shtml>

Office of Science - Recent Biofuels Related Activities (1 of 2)

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, 2015).
- 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
 - Carbon Fixation, RuBisCO and Calvin-Benson Cycle
 - Processes and Mechanisms of Energy Capture and Conversion
 - Carbon Storage in Organic Molecules
 - Metabolism in Relation to Energy Storage and Use
 - Application of Physical Science Tools to Address Structure/Function and Mechanistic Studies
 - Active Site Protein Chemistry, Redox Reactions
 - Regulation of Energy-Relevant Biological Reactions
 - Biochemistry and Biophysics of Cell Architecture including Cell Wall
 - Biosynthesis, Structure, and Self-Organizing Processes
 - Assembly and Maintenance of Energy Transduction Systems

Office of Science - Recent Biofuels Related Activities (2 of 2)



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 all projects that are funded in BES:

Basic Energy Sciences Summary Report and FY 2014 Research Summaries.

<http://science.energy.gov/bes/research/>

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/>

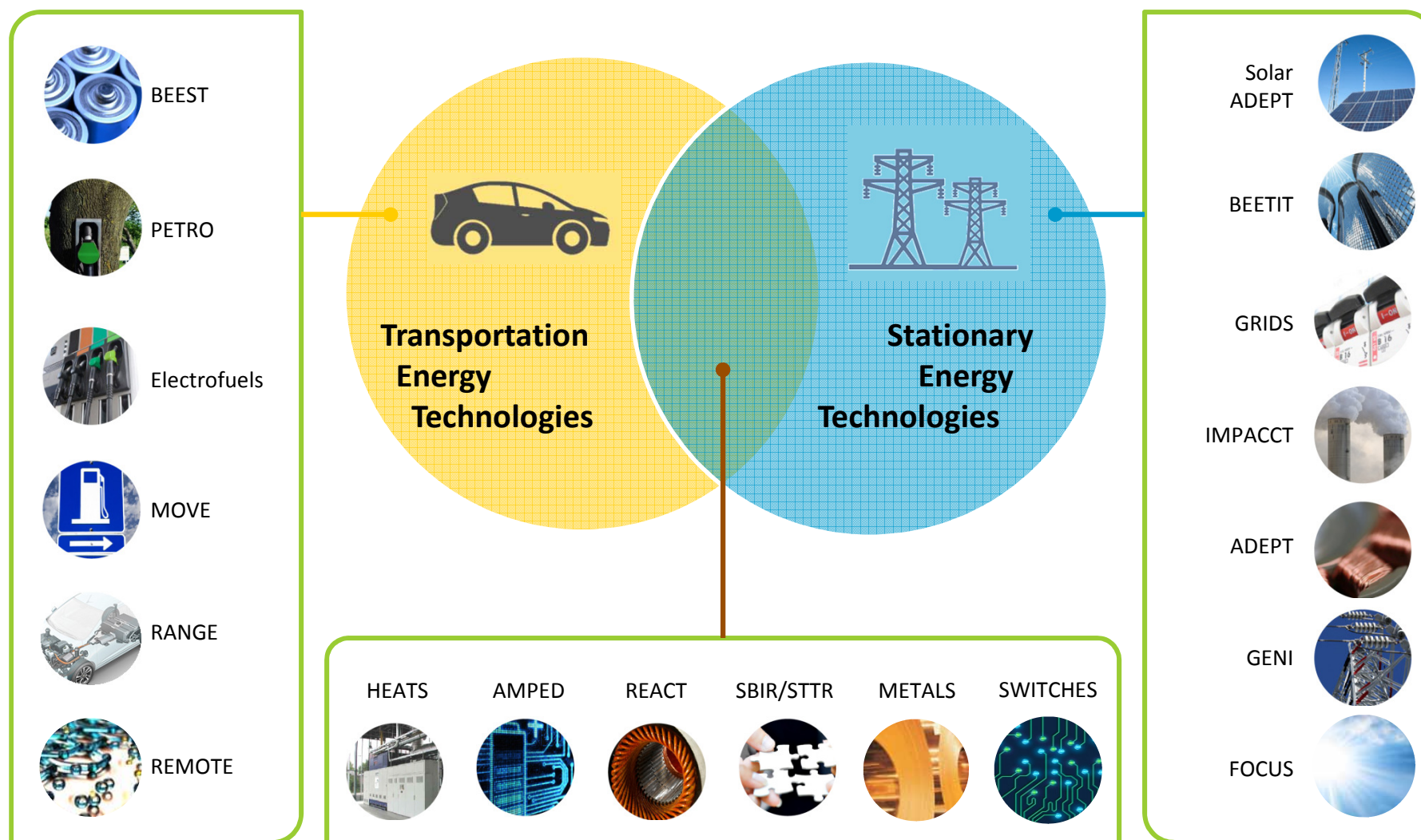
Open Recompensation of the Energy Frontier Research Center program resulted in 32 awards for FY 2014; 5 centers related to biosciences.

<http://science.energy.gov/bes/efrc/>

- Catalysis Center for Energy Innovation (CCEI); Dionisios Vlachos, University of Delaware
- 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
- 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

ARPA-E – Focused Programs

Advanced Research Projects Agency-Energy (ARPA-E) builds programs with ambitious performance metrics in mind so that the technologies developed will truly be techno-economically viable in the marketplace.



ARPA-E Developed Programs for Highly Efficient Bioconversion Processes for Fuels and More



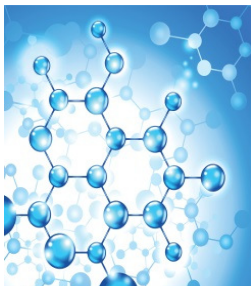
Electrofuels [Status: All projects have closed]

Targets the development of new chemoautotrophic biocatalysts for the production of fuels from inorganic energy feedstocks.

The program successfully developed and demonstrated the production of fuel molecules from H_2/CO_2 , $HCOOH$, and direct current/ CO_2 via engineered microorganisms and new bioprocesses. ARPA-E has identified ancillary technical challenges beyond microbial engineering that need to be addressed for techno-economic viability.

Program Director: Ramon Gonzalez (ramon.gonzalez@hq.doe.gov)

SETA: Chad Haynes (chad.haynes@hq.doe.gov)



REMOTE, Reducing Emissions using Methanotrophic Organisms for Transportation Energy [Status: 15 projects under active program management]

Targets the development of new methane bioconversion technologies for small scale, low CapEx gas-to-liquids (GTL) processing. Current GTL state-of-technology is challenged by high CapEx and technologically-complex processes. Bioconversion of methane is a viable option for GTL if technologies addressing energy efficient, carbon yield, and kinetics are developed with attention to cost.

The program objectives aim to develop new, more efficient biological routes to activate methane, engineer metabolic pathways to convert activated methane to liquid fuel with high energy density, and develop process intensification for methane bioconversion.

Program Director: Ramon Gonzalez (ramon.gonzalez@hq.doe.gov)

SETA: Chad Haynes (chad.haynes@hq.doe.gov)

ARPA-E Developed Programs for New Biofuel Feedstocks



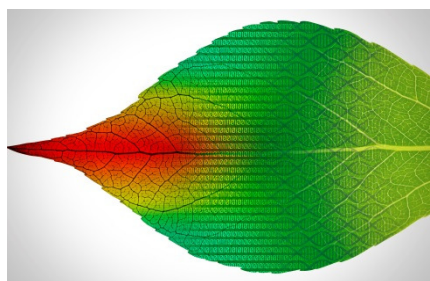
PETRO: Plants Engineered to Replace Oil [Status: 12 projects active]

Targets the production of fuel molecules, such as oils and hydrocarbons, directly in the plant feedstock through metabolic engineering.

The program successfully generated a variety of crop feedstocks that accumulate at least 1% of the fuel molecule by DW, and has demonstrated a number of promising plants in small scale field trials. In parallel, multiple traits have been observed to increase photosynthetic efficiency. PETRO has also applied novel agronomic approaches to increase yields of the bioenergy crops under development.

Program Director: Jonathan Burbaum (jonathan.burbaum@hq.doe.gov)

SETA: David Lee (david.lee2@hq.doe.gov)



TERRA: Transportation Energy Resources from Renewable Agriculture [Status: Applications under review]

Targets the development of (1) high throughput field sensing platforms for bioenergy crops and (2) analytic tools to mine the phenotyping data from the field and correlate phenotypes with genetic loci.

The program is currently reviewing full applications, and expects to award approximately \$30M of funding in May, 2015.

Program Director: Joe Cornelius (joe.cornelius@hq.doe.gov)

SETA: David Lee (david.lee2@hq.doe.gov)

PETRO Program Technical Advancement

PETRO projects have observed very promising technical results, but need to identify new funding or deployment opportunities now.

Research Stage	Deployment Stage
Synthetic carbon fixation pathways.	Cold tolerant sugarcane, and oil producing cane.
Plant metabolic flux modeling.	Terpene production in tobacco and high density production in the field.
Photorespiratory channeling to increase specific metabolite yields in crop plants.	Young pine trees over accumulating terpenes with efficient tapping methods.
Increased photosynthetic activity through altered light harvesting antenna complex.	Camelina with improved oil content for fuel use and terpene accumulation, and phenomic chambers capable of predicting field performance.
Producing carboxysomes in plant cells to enhance photosynthesis.	Traits to increase carbon flux to terpene and lipid production, stress tolerance, accelerate flowering, seed yield, and biomass production.

References and Useful Links

References:

1. Bioenergy Technologies Office Multi-Year Program Plan http://www.energy.gov/sites/prod/files/2015/04/f22/mypp_beto_march2015.pdf
2. Bioenergy KDF <https://www.bioenergykdf.net/>
3. Bioenergy KDF Facebook <https://www.facebook.com/BioenergyKDF>
4. Bioenergy KDF YouTube <http://www.youtube.com/user/BioenergyKDFChannel>
5. Biomass R&D Board <http://www.biomassboard.gov/>
6. Board Resources Library http://www.biomassboard.gov/committee/tac_library.html
7. Committee Resources Library <http://www.biomassboard.gov/committee/committee.html>
8. Scientific Research Access News Release <http://www.energy.gov/articles/us-department-energy-increases-access-results-doe-funded-scientific-research>
9. I-75 Clean Fuels Corridor <http://www.cleanfuelscorridor.com>
10. Research for Sustainable Bioenergy Workshop Report <http://genomicscience.energy.gov/sustainability/>
11. Water Environment Federation <http://www.wef.org/WaterEnergy/>
12. **Hydrogen, Hydrocarbons, and Bioproduct Precursors from Wastewaters Workshop**
<http://www.energy.gov/eere/fuelcells/hydrogen-hydrocarbons-and-bioproduct-precursors-wastewaters-workshop>

Useful Links:

1. BETO Web page <http://www.energy.gov/eere/bioenergy/bioenergy-technologies-office>
2. BETO's Meetings Web page <http://www.energy.gov/eere/bioenergy/meetings>
3. BETO News and Announcements <http://www.energy.gov/eere/bioenergy/listings/bioenergy-news>
4. BETO Publications: <http://www1.eere.energy.gov/library/default.aspx?page=1>
5. The Targeted Algal Biofuels and Bioproducts (TABB) FOA <https://eere-exchange.energy.gov/>
6. Waste-to-Energy Workshop Notes <http://www.energy.gov/eere/bioenergy/waste-energy-roadmapping-workshop>
7. [ARPA-E TERRA funding opportunity announcement](#)
8. Peer Review 2015 <http://www.energy.gov/eere/bioenergy/2015-project-peer-review>
9. DOE/EERE, Sustainable Transportation Office Web page <http://www.energy.gov/eere/transportation>
10. ARPA-E Web page <http://arpa-e.energy.gov/>
11. Office of Science Web page <http://science.energy.gov/>
12. Loans Programs Office Web page <http://www.energy.gov/lpo/loan-programs-office>