



Biomass R&D Technical Advisory Committee (TAC)

November 20-21, 2014

Elliott Levine

DOE Updates

Q4 Binder Elements

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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 submission deadline for the November meeting: **December 12, 2014**

New Members

- A Federal Register Notice was released on 5/19/2014, soliciting nominations for new members.
- The solicitation closed 6/9/2014.
- <https://www.federalregister.gov/articles/2014/05/19/2014-11497/biomass-research-and-development-technical-advisory-committee>

2015 Proposed Meeting Dates

- Week of February 23-27, 2015
- Week of May 18-22, 2015
- Week of August 24-28, 2015
- Week of November 16-20, 2015

Agenda at a Glance - Day 1 of 2

Thursday, November 20th

Introduction and Welcome

- 8:00 am – 8:30 am: Breakfast *(to be provided for the Committee)*
- 8:30 am – 9:00 am: Welcome – *Committee Co-Chairs*

Presentations and Updates

- 9:00 am – 9:45 am: DOE Updates – *Elliott Levine (DOE)*
- 9:45 am – 10:15 am: USDA Updates – *Todd Campbell (USDA)*
- 10:15 am – 10:30 am: *Break*
- 10:30 am – 11:00 am: Presentation: Biomass Research and Development Initiative (BRDI) Update – *Daniel Cassidy (USDA)*
- 11:00 am – 11:45 am: 2014 Committee Recommendations – *Committee Co-Chairs*
- 11:45 am – 12:00 pm: Public Comment – *Dr. Brent H. Shanks, NSF Engineering Research Center for Biorenewable Chemicals (CBIRC), Iowa State University*

Lunch

- 12:00 pm – 1:00 pm: *(to be provided for the Committee)*
– *Reuben Sarkar, Deputy Assistant Secretary for Transportation, DOE/EERE*

Discussion

- 1:00 pm – 5:15 pm: 2014 Committee Recommendations – *Committee Co-Chairs*
- 5:15 pm – 5:30 pm: 2014 Vote: Committee Recommendations – *Committee*

Agenda at a Glance - Day 2 of 2

Friday, November 21st

Welcome

- 8:00 am – 8:30 am: Breakfast *(to be provided for the Committee)*

Discussion and Breakouts

- 8:30 am – 9:30 am: 2014 Recommendations to the Board Presentation – Committee *Co-Chairs*
- 9:30 am – 10:30 am: Sustainability Panel
 - Donna Perla, U.S. Environmental Protection Agency
 - Dr. Lynn Scarlett, The Nature Conservancy
 - Dr. Marina Moses, Director, American Academy of Microbiology
- 10:30 am – 11:00 am: DPA Update
 - Chris Tindal, Director for Operational Energy, U.S. Navy
 - Zia Haq, Bioenergy Technologies Office, DOE
- 11:00 am – 11:30 am: BioPreferred Program, Ron Buckhalt, U.S. Department of Agriculture
 - Ron Buckhalt, U.S. Department of Agriculture
- 11:30 am – 12:00 pm: Hydrogen and Fuel Cell Technical Advisory Committee, Sarah Studer, Fuel Cell Technologies Office, DOE

Public Comment: 12:00 pm – 12:15 pm

Closing Remarks and Thank You to Departing Members

- 12:15 am – 12:30 am: *Committee Co-Chairs*

Closed Lunch

- 12:30 pm – 1:30 pm: *(to be provided for the Committee)*

Committee Recommendations and Annual Report

- The 2014 TAC recommendations should be written to address the findings and needs of the Committee in the following areas:
 - Specific Committee Reporting Obligations – Conformity with BRDI Legislation
 - Information Requests from the Board
 - The Bioeconomy Activity
 - Subcommittee Recommendations
 - Sustainable Feedstocks Production and Logistics Recommendations
 - Conversion Recommendations
 - Products, Markets, and Systems Recommendations
- Recommendations are used to inform the Biomass R&D Board and provided to DOE and USDA Programs.
 - A report of recommendations consented to by the TAC to frame the TAC Annual Report to Congress.

TAC 2014 Work Timeline

Date	Committee Objectives
<p>Q1 2014 February 27-28, 2014 Place: Washington, 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 • Provide guidance on BRDI solicitation • Determine need and location of site visit
<p>Q2 2014 June 5-6, 2014 Place: Washington, DC</p>	<ul style="list-style-type: none"> • Subcommittees to: <ul style="list-style-type: none"> • Begin framing general subcommittee-related R&D recommendations outside of the listed areas with problem statement • Provide recommendations for R&D based on the topics presented such as the feedstocks panel • Provide R&D recommendations to BRDI based on the pathway selected by NIFA or others • Provide consideration to any applicable public comments • Review prior years' work to revisit any topics
<p>Q3 2014 August 19-20, 2014 Place: Kansas City, MO</p>	<ul style="list-style-type: none"> • Subcommittees to: <ul style="list-style-type: none"> • Prioritize challenges/problems • Flesh out recommendations • Draft recommendations
<p>Q4 2014 November 20-21, 2014 Place: Washington, DC</p>	<ul style="list-style-type: none"> • Finalize and approve 2014 recommendations • Discuss whether recommendations, other subjects or new ideas should be brought into 2015 • Discuss how to improve this process for the future • Discuss annual report and PPT needs and write-up schedule (time permitting)

DOE's BETO Announcements & Updates



Bioenergy Technologies – FY 2015 Budget Request

Subprograms (\$000's)		FY 2013 Enacted	FY 2014 Enacted	FY 2015 Request
Feedstocks		\$47,359	46,972	30,500
	Feedstock Production	\$4,847	4,997	4,000
	Feedstock Logistics	\$13,294	11,993	12,500
	Algae and Advance Feedstocks	\$29,128	29,982	14,000
Conversion		\$75,140	101,384	100,500
Demonstration and Market Transformation (formerly Demonstration and Deployment)		\$43,630	64,790	105,000
	Integrated Biorefineries	\$25,733	19,790	35,000
	Biofuels Compatibility/Infrastructure	\$6,500	-	10,000
	Defense Production Act (DPA)	-	45,000	60,000
	Other Projects (FY 2013)	\$11,397	-	-
Strategic Analysis and Cross-cutting Sustainability		\$14,939	12,146	11,000
	Strategic Analysis	\$9,000	6,080	5,500
	Cross-cutting Sustainability	\$3,939	6,066	5,500
	Systems Integration	\$2,000	-	-
Cookstoves		\$4,122	1,998	-
NREL Site-wide Facility Support		\$0	5,000	6,200
TOTAL		\$185,190	232,290	253,200

POET-DSM Grand Opening

POET-DSM's Project LIBERTY in Emmetsburg, Iowa celebrated its grand opening on September 3, 2014.

- The plant will produce 25 million gallons of cellulosic ethanol per year – enough to avoid approximately 210,000 tons of CO₂ emissions annually.
- Keynote speakers included USDA Secretary Tom Vilsack, Iowa Governor Terry Branstad, and his Majesty Willem-Alexander, King of the Netherlands, and DOE Assistant Secretary Dr. David Danielson.

Project Overview:

- Feedstock: Corn Stover
- Scale: 770 dry tons/day
- Capacity: 25 million gallons/year
- Product: Ethanol
- Coproduct: Power



Abengoa Grand Opening

Abengoa Bioenergy Biomass of Kansas (ABBK) celebrated its grand opening on October 17, 2014, in Hugoton, Kansas.

- The plant will produce 25 million gallons of cellulosic ethanol per year.
- Keynote Speakers included: Abengoa CEO Manuel Sanchez Ortega, DOE Secretary Moniz, Governor Sam Brownback, Senator Pat Roberts, Hugoton Mayor Jack Rowden.

Project Overview:

- Feedstock: Corn stover
- Scale: 930 dry tons/day
- Capacity: 25 million gallons/year
- Product: Ethanol
- Coproduct: Energy Cogen (21 MW)



FY14 Demonstration & Market Transformation (DMT) Example

Wood-to-Gasoline Pilot Biorefinery

An international team wrapped up integrated pilot testing at Gas Technology Institute (GTI) in Illinois, converting wood to *drop-in* gasoline blendstock.

- Andritz’s biomass gasifier and GTI’s CO₂ removal unit fed Topsoe’s TIGAS gasoline synthesis process.
- The integrated plant produced 10,000 gallons of gasoline blendstock – a product with 87% lower greenhouse gas impact than conventional gasoline – from waste wood.
- Fuel passed Tier 1 engine emissions testing for EPA registration and also completed 75,000-mile track testing of a 50:50 blend in four vehicles with no observable effects on engine operation.

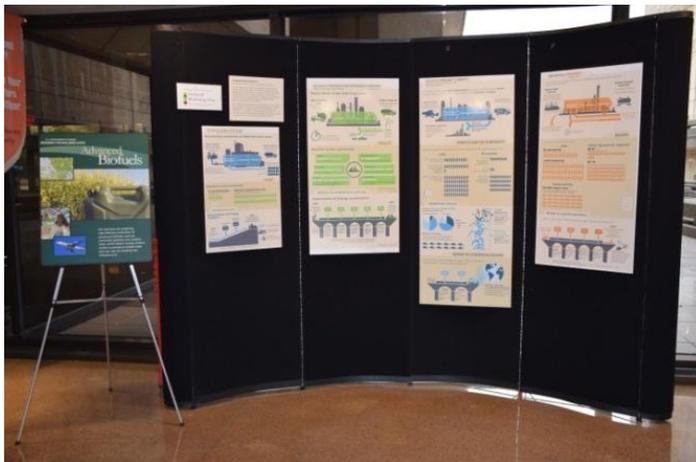
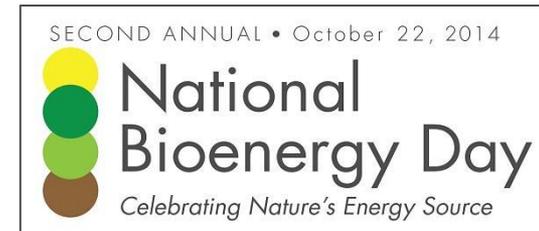
Project Overview:

- Feedstock: Woody Biomass
- Scale: 18 dry tons/day
- Capacity: 20 barrels/day
- Product: Gasoline Blend Stock
- Coproduct: LP Gas



National Bioenergy Day – October 22, 2014

- The sponsors include Biomass Power Association, U.S. Forest Service, U.S. Industrial Pellet Association, Biomass Thermal Energy Council, and Biomass Magazine.
- BETO exhibit booth was on display at DOE/HQ (Forrestal)
- Other displays included feedstock, biofuel, and bioproducts samples, as well as four infographics on DOE-supported biorefineries, and a feedstock preprocessing diorama.
- Bioenergy factoid posters were posted throughout DOE HQ.
- The booth was well attended by engaged visitors from many DOE offices.



Recent BETO Award Announcements

Algal Biofuels Research

- Following a 2013 FOA, DOE announced \$3.5M in additional funding to support the Department's goal of producing 2,500 gallons of algal biofuel feedstock per acre per year by 2018, an important milestone toward reducing the cost of algal biofuels to cost-competitive levels of 5,000 gallons per acre per year by 2022.
 - **Cellana, LLC**, in Kailua-Kona, Hawaii, was selected to receive \$3.5M to develop a fully integrated, high-yield algae feedstock production system by integrating the most advanced strain improvement, cultivation, and processing technologies into their operations at Kona Demonstration Facility.

Carbon, Hydrogen and Separation Efficiencies

- Following a 2013 FOA, DOE announced \$6.3M in additional funding to support lowering production costs by maximizing the renewable carbon and hydrogen from biomass that can be converted to fuels and improving the separation processes in bio-oil production to remove non-fuel components.
 - **SRI International** of Menlo Park, California will receive \$3.2M to produce a bio-crude oil from algal biomass that will maximize the amount of renewable carbon recovered for use in fuel and reduce the nitrogen content of the product in order to meet fuel quality standards.
 - **Research Triangle Institute (RTI)** of Research Triangle Park, North Carolina, will receive \$3.1M to maximize the biomass carbon and energy recovery in a low pressure process, therefore lowering production costs, to produce a bio-crude oil that can be efficiently upgraded into a finished biofuel.

Biological & Chemical Upgrading (BCU) Selection Announcement

On October 9th, DOE announced up to \$13.4 million for five projects to develop advanced biofuels and bioproducts that will help drive down the cost of producing gasoline, diesel, and jet fuel from biomass.

- **The University of Wisconsin** of Madison, Wisconsin will receive up to \$3.3 million to develop a process to produce high value chemicals from biomass, which can be used as plasticizers (an additive in certain plastics) and in the production of industrial chemicals and resins.
- **American Process, Inc.** of Atlanta, Georgia will receive up to \$3.1 million to develop and demonstrate processes to upgrade cellulosic sugars to solvents in their demonstration facility.
- **The National Renewable Energy Laboratory** of Golden, Colorado will receive up to \$2.5 million to develop a conversion process demonstrating the production of muconic acid from biogas. This acid can be converted into an array of bioproducts, including fuel, plasticizers, and lubricants.
- **Natureworks, LLC** of Minnetonka, Minnesota will receive up to \$2.5 million to develop a fermentation process, using biogas and bacteria, for the production of lactic acid. This process could be used for the commercialization of biomethane to fuels.
- **Vertimass LLC** of Irvine, California will receive up to \$2 million to commercialize technology to convert ethanol into diesel fuel, gasoline, and jet fuel blend stocks compatible with the current transportation fuel infrastructure.

New Funding Opportunity – Algal Feedstocks

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 without this FOA – to less than \$5 per gallon algal biofuel by 2019, through non-integrated bench and process development scale technology improvements.

- **Challenges:** Algae Program funded work has highlighted barriers to broad commercialization must be overcome with both higher yields in scalable cultivation systems and higher value of the algal biomass.
- **FOA Objectives:** 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, alongside fuel components, to increase the overall value of the biomass; and
 2. Single investigator or small team technology development projects focused on developing crop protection and CO₂ utilization technologies to increase yields.
- **Addition to Portfolio:** This FOA builds on the existing advances towards productivity goals, but is unique from all prior efforts in that the FOA outcome will be a **finished fuel rather than a biofuel intermediate**. This FOA is the first from the Algae Program to explicitly fund bioproducts R&D in addition to biofuels.
- **Concept Papers due: 10/30/2014**
- **Full Applications due: 12/15/2014**



Photo credits NREL and Arizona State University

Biomass Research & Development Initiative (BRDI)

BRDI Notice of Intent—Opened on October 21, 2014

- This opportunity will address USDA and DOE programmatic objectives, administrative roles, and areas of interest in implementing Biomass Research and Development Initiative grants.
- For FY 2015, BRDI will require that funded projects address only one of the following three legislatively mandated technical areas:
 1. Feedstocks Development
 2. Biofuels and Biobased Products Development
 3. Biofuels Development Analysis

Dates:

- NOI: 10/22/2014
- FOA Announcement: 11/21/2014 (TBD)
- Close Date: 12/22/2014 (TBD)

Full solicitation information is available on Grants.gov



Landscape Design Announcement

Landscape Design Funding Opportunity Announcement—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
- Previous DOE projects have shown the potential for improved sustainability by strategically placing bioenergy feedstock production within a landscape.

Concept Papers Due: 11/21/2014

Full Applications Due: 1/12/2015



SBIR and STTR Programs

SBIR/STTR Phase I Release 1 Funding Opportunity Announcement (FOA)

- FOA issue date: August 11, 2014
- Application due date: October 14, 2014
- Award notification date: Early January 2015
- Maximum award amount: Phase I: \$150,000; Phase II: \$1,000,000
- Grant applications are sought in the following Bioenergy topical areas:
 - Hydrocarbon Fuels or Chemicals from Biomass-Derived Intermediates
 - Hydrocarbon Fuels and Products from Aqueous Biomass Intermediate Streams

SBIR/STTR Phase I Release 2 Funding Opportunity Announcement

- FOA issue date: November 24, 2014
- Application due date: December 15, 2014
- Award notification date: Late April 2015
- Maximum award amount: Phase I: \$150,000; Phase II: \$1,000,000
- Grant applications are sought in the following Bioenergy topical areas:
 - Design and Fabrication of Solids Handling for Biomass Conversion Systems
 - Low-Cost Coatings for Advanced Thermal Processes in Metal Combustors
 - Solid-Liquid Separations for Algal Systems

Biomass Feedstock National User Facility at Idaho National Laboratory

Feedstock Preprocessing



Biomass Analytical Library

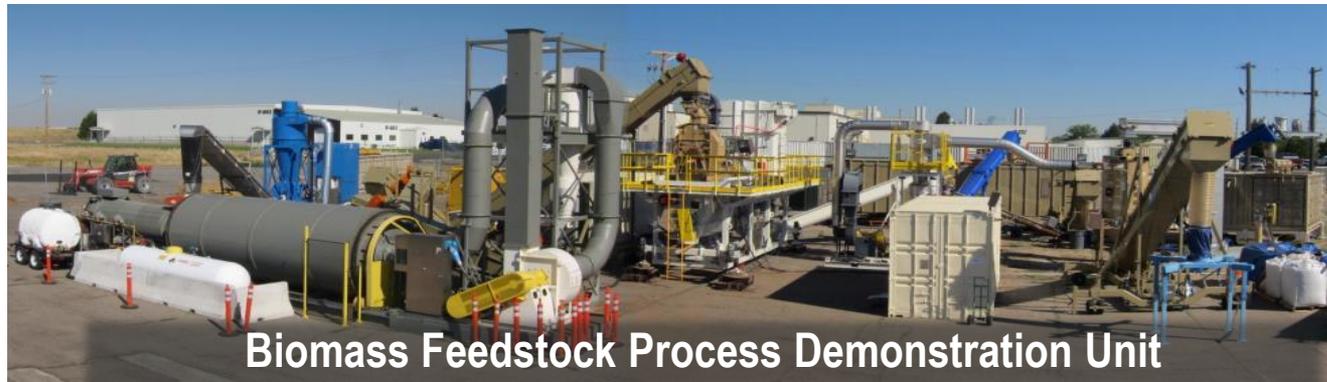


Feedstock Process Demonstration Unit

- Produce feedstock – any feedstock, and specification, any scale.
- Develop and test preprocessing unit operations.
- Develop and test fully integrated, fully instrumented, full-scale preprocessing systems.

Biomass Analytical Library

- Characterize biomass physical and chemical properties.
- Access feedstock properties database, nearly 70,000 samples.
- Analyze and model feedstock supply and logistics designs.



Biomass Feedstock Process Demonstration Unit

A unique capability of the Feedstock PDU is to test and develop fully integrated and instrumented industrial-scale preprocessing systems.

Waste-to-Energy Workshop

Held on November 5th in Arlington, Virginia

- 84 participants from industry, associations, National Labs, government (EPA, USDA, DOE), and wastewater treatment plants
- Keynote talks provided by Jonathan Male, BETO Director; and Patricia Scanlan, Director of Residuals Treatment Technologies, Black & Veatch
- Breakout Groups:
 - Anaerobic Digestion of Wastewater Residuals and Biosolids
 - Anaerobic Digestion of Foodstuffs and Other Organic MSW
 - Hydrothermal Liquefaction of Wet Organic Waste Streams
 - Other Conversion Processes of Wet Organic Waste Streams
- Workshop Report is targeted for release in January 2015
- Toured DC Water's Blue Plains Wastewater Treatment Plant



Recent/ongoing competitive fuels awards with biofuel component

FY 2012 awards (finishing FY 2014/FY 2015)

- **University of Wisconsin:** Reactivity Controlled Compression Ignition (RCCI) development
 - Achieves diesel-like efficiency with cheaper fuels (e.g., E85, E10, etc.)
- **MIT:** Ethanol-enhanced combustion
 - Uses small volume of E85 as supplementary fuel to eliminate knock at high load
- **NREL:** Evaluation of various oxygenates as potential drop-in fuel components
 - Approximately a dozen oxygenates evaluated.
 - Studies examining oxygenates present in partially hydrotreated biomass pyrolysis oils.
 - Gasoline and diesel range oxygenates evaluated.

Recent/ongoing competitive fuels awards with biofuel component – Continued

FY 2014 competitive awards (starting FY 2014 and FY 2015)

- **University of Michigan:** Alternative fuel ignition property exploitation for improved efficiency
 - Spark ignition: ethanol and other gasoline-like fuels.
 - Compression ignition: Dimethyl -ether (DME) – RFS-eligible if from biogas.
- **ORNL:** Matching realistic, near-term engines with future gasoline formulations
 - Opportunity for co-optimization of fuels and engines.
 - Exploit properties of biofuels, and other components, to reduce knock and improve research octane number.
- **Southwest Research:** Reforming oxygenates to enhance combustion
 - Use one cylinder of engine as a reformer to feed “syngas” to other cylinders.
 - Possible significant benefit from oxygenated fuels vs. conventional.

FY 2014 competitive awards – Continued

- **Argonne National Lab:** New fuel quality metrics: Gasoline Compression Ignition (GCI)
 - Experimental/developing combustion regime.
 - Current metrics – octane and cetane – do not adequately describe behavior.
 - GCI has potential for diesel efficiency from gasoline-like fuels.
- Potential use with biogas, which counts as a cellulosic biofuel under RFS
 - Argonne: Dual-fuel natural gas direct injection with gasoline port fuel injection – potential real-time optimization of fuel mixture for engine operating condition to greatly improve fuel economy.
 - Clean Air Power: Dual-fuel heavy-duty natural gas-diesel engine system development – enables use of either fuel; cheaper natural gas when available, but still full functional on diesel.

New Fuels-Vehicle Systems Optima (NFVSO)

Opportunity:

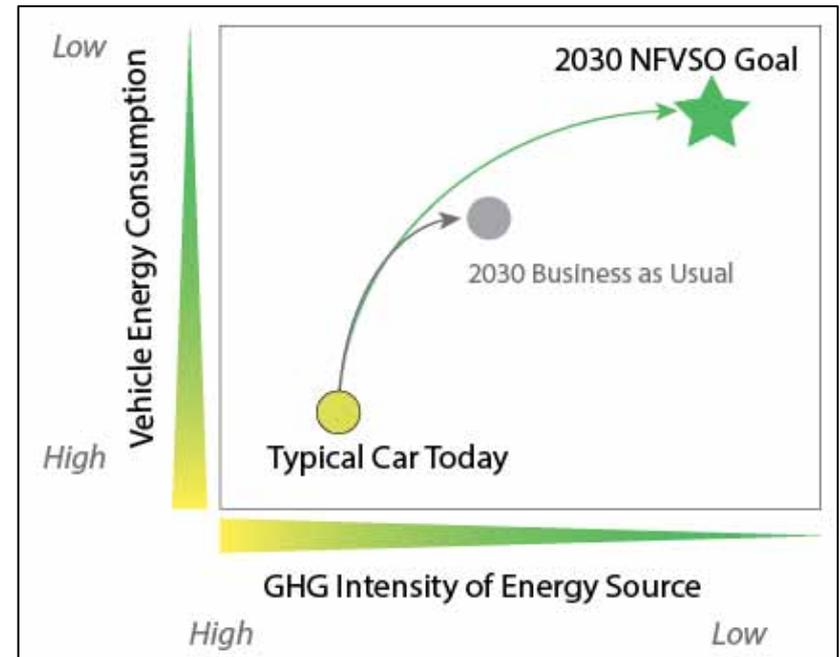
- Initiate stakeholder- and consumer value-driven R&D program enabling widespread deployment of sustainable, resilient, affordable, and domestically-sourced low carbon fuels by 2030.

Objective:

- Reduce fleet averaged per-vehicle petroleum consumption 30% vs. 2030 business-as-usual.

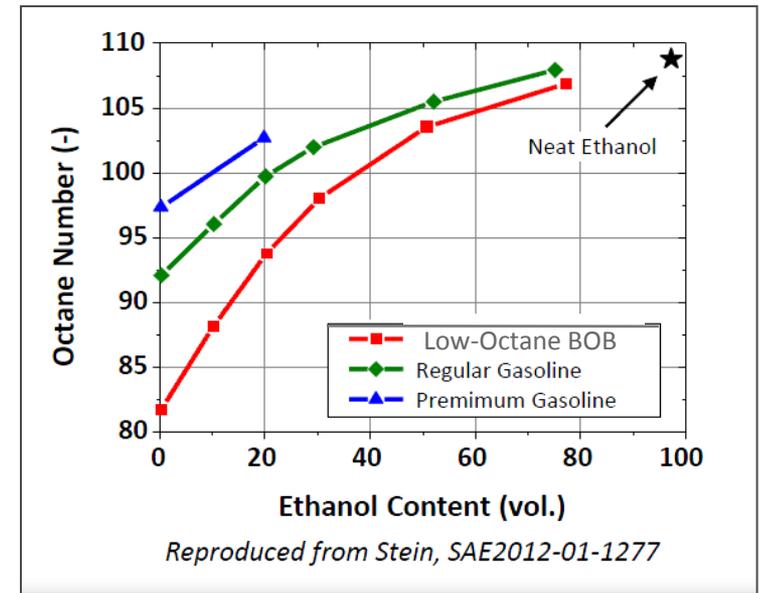
Program Benefits:

- Co-optimization of fuels/vehicle R&D will yield better solutions and reduce the time to market for scalable options in both sectors.
 - Enable highest efficiency engines by eliminating constraints of current fuels.
 - Enable fuels optimized for engine performance, sustainability, cost, and scalability.
- Effort will bolster U.S. industrial leadership in vehicle and bioenergy technologies and provide technical basis for cooperative national transportation energy strategy.
- Provide significant reduction in GHG emissions from the transportation sector.



Renewable Super Premium 3-Lab Study: Motivation for High-Octane, Mid-Level Ethanol Blends

- Higher octane allows for greater engine design, which can improve efficiency.
 - Higher octane fuels are better able to resist engine “knock”. (Knocking can destroy an engine so engines are designed and tuned to avoid it)
- Ethanol is a very effective octane booster.
- 2/3rd of octane benefit from first 1/3rd of ethanol volume percent (see chart).
- Efficiency gains have been demonstrated in research studies at ORNL, Ford, and others.



- Optimum blend likely 20-40% ethanol → **Renewable Super Premium**
 - Energy density penalty is *linear* with ethanol concentration. While power and efficiency gains are *non-linear*.
 - Optimizing between octane boost and tank mileage lost by managing the tradeoff between efficiency, cost, and fuel economy for dedicated vehicles.
- Also legal to use in 17M legacy Flex-Fuel Vehicles (bridge between supply and demand).
- **Opportunity to consume significant quantities of additional ethanol (move past blend wall) and improve fuel economy at attractive costs.**

BETO Renewable Super Premium Project – Outline and Goals

- BETO is supporting a preliminary screening study:
 - Address key barriers and develop technical information for “Renewable Super Premium,”
- 3-Lab collaboration (ANL, NREL, and ORNL) addressing multiple facets:
 - Infrastructure compatibility (NREL & ORNL) → *Can retail service stations dispense RSP?*
 - Market analysis (NREL & ORNL) → *Will OEMS be willing to produce and will consumers purchase dedicated RSP vehicles? Will this pathway consume significant quantities of additional ethanol?*
 - Well-to-wheels green house gas (GHG) analysis (ANL) → *Does RSP offer attractive GHG benefits? Can RSP be produced at an attractive cost to the refiners and consumers?*
 - Quantification of RSP knock resistance properties (NREL) → *Does RSP offer unique anti-knock properties not captured with conventional measurements? Can these benefits be quantified?*
 - Fuel economy and performance impacts of RSP in a dedicated commercial vehicle (ORNL) → *Can the engine studies be replicated in a dedicated vehicle? What are the likely fuel economy and performance benefit of RSP?*
 - Effect of RSP on legacy FFVs (ORNL) → *Is there any performance improvement in today’s FFVs using RSP?*
- Preliminary assessment to be completed early FY 2016 (began FY 2014).

New Funding Opportunity Announcements:

- Systems Biology Research to Advance Sustainable Bioenergy Crop Development: DE-FOA-0001207
- Bioimaging Technology Development: DE-FOA-0001192
- DOE Joint Genome Institute (JGI): Community Sequencing Program (open submission)
- USDA/DOE Joint Plant Feedstocks Genomics for Bioenergy: Posting November 2014
- Small Business Innovative Research (SBIR): DE-FOA-0001164

Reports and Announcements:

- Systems Biology for Sustainable Bioenergy: Workshop Report
www.genomicscience.energy.gov/sustainability/
- DOE Genomics Science Program: 2014 Strategic Plan Update
www.genomicscience.energy.gov/strategicplan/index.shtml
- DOE Bioenergy Research Centers
www.genomicscience.energy.gov/centers/brcbrochure/
- Microbial Systems Biology for Biofuels Production: FY 2014 Awards Announcement
www.genomicscience.energy.gov/biofuels/systemsbiology/microbialbiofuelsawardsflyer
- Plant Feedstock Genomics for Bioenergy: FY 2014 Awards Announcement
www.genomicscience.energy.gov/research/DOEUSDA/2014awards.shtml

Funding opportunity for fundamental biological research proposals focusing on:

- Biosystems-level research to better understand the molecular and physiological mechanisms that control bioenergy crop vigor, resource use efficiency, and resilience/adaptability to abiotic stress, as well as interactions with the surrounding environment, in order to increase biomass productivity under changing or suboptimal conditions.
- Biosystems-level investigations into the role(s) of microbes and microbial communities in the complex and multi-scaled interactions of the plant-soil-environment:
 - Contribution(s) to bioenergy feedstock plant performance, adaptation, and resilience in the face of a broad range of changing environmental conditions and abiotic stressors (e.g., climate), and the impacts of introducing bioenergy cropping systems on the local ecosystem.

Preapplications due November 14th, Full proposals due January 16th

http://science.energy.gov/~media/grants/pdf/foas/2015/SC_FOA_0001207.pdf

ARPA-E PETRO Program Update: Projects have moved ARPA-E technologies to field demonstration



Tobacco

- Conventional varieties planted over two acres to optimize biomass yields.
- Grown under high density with multiple harvests, and expect 20 tons/hectare.

Camelina

- Transgenic lines with planted at multiple sites under APHIS permits.
- Engineered lines showed oil yields >30% over non-transgenic camelina.

Switchgrass

- Transgenic lines planted under APHIS permit.
- Lines engineered to modify their cell walls and improve biomass saccharification.

Pine

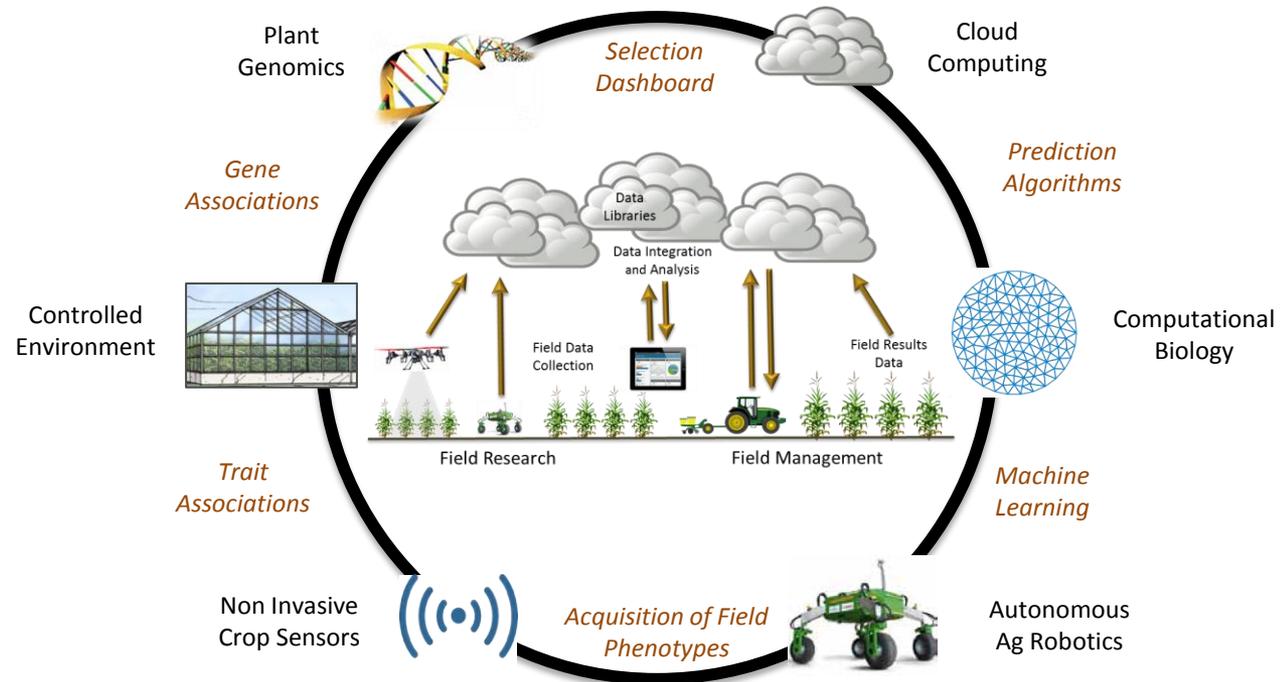
- Existing stands were tapped to extract terpene rich resin.
- Developed strategies to double the yields of oleoresins over control trees.

Plants Engineered to Replace Oil (PETRO)

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

ARPA-E TERRA Program Update: New Bioenergy Crop Phenotyping FOA Released October 2014

- The TERRA funding opportunity announcement (FOA) was released on 10/1/2014 with the goal of increasing the rate of genetic improvement of bioenergy crops, and is taking a systems approach to integrate genetics, data analytics, and high performance/automated field sensor platforms.
- Concept papers are due 11/17/2014 and awards expected to be made in Summer, 2015.
- The program anticipates providing \$30M, with average awards ranging from \$1-5M.

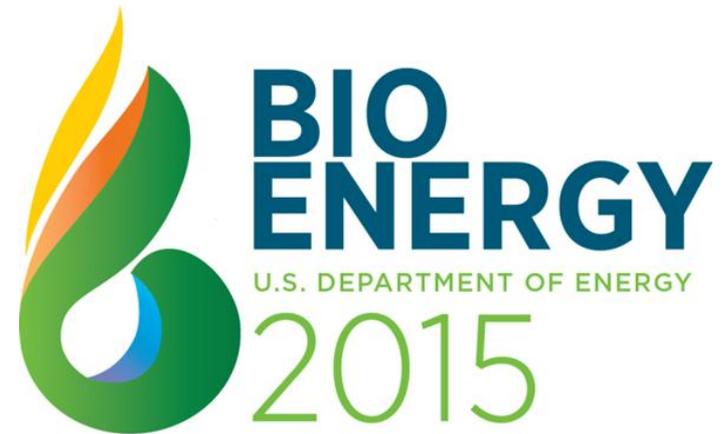


Transportation Energy Resources from Renewable Agriculture (TERRA)
Program Director: Dr. Joe Cornelius (joe.cornelius@hq.doe.gov)

Upcoming Events

Bioenergy 2015

- Bioenergy 2015 will convene key representatives from across the bioenergy supply chain, including industry, federal agencies, universities, and Congress.
- Focus on what is needed to sustain the growth and success of the advanced bioenergy industry now, and into the future.
- Tentatively scheduled for June 23-24, 2015, Washington DC Convention Center.



Peer Review 2015

- Peer Review of BETO projects scheduled for March 23-25, 2015, Alexandria, VA
 - In 2013, 219 projects were reviewed, representing \$1.6 billion in DOE funding.
- Program areas include: Feedstock Production and Logistics, Algae, Biochemical Conversion, Thermochemical Conversion, Feedstock Production and Logistics, Analysis and Sustainability, and Demonstration and Market Transformation.
- BETO is currently evaluating candidates to serve on one of 6 review panels.

References and Useful Links

References:

1. BETO's Meetings Web page <http://www1.eere.energy.gov/bioenergy/meetings.html>
2. Bioenergy Technologies Office Multi-Year Program Plan <http://www.energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-july-2014-update>
3. Bioenergy KDF <https://www.bioenergykdf.net/>
4. Bioenergy KDF Facebook <https://www.facebook.com/BioenergyKDF>
5. Bioenergy KDF YouTube <http://www.youtube.com/user/BioenergyKDFChannel>
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. Biomass 2014 Website <http://www.energy.gov/eere/bioenergy/biomass-2014-growing-future-bioeconom>
10. Plant Feedstocks Genomics for Bioenergy FOA http://science.energy.gov/~media/grants/pdf/foas/2014/SC_FOA_0001034.pdf
11. Systems Biology of Bioenergy-Relevant Microbes to Enable Production of Next-Generation Biofuels FOA http://science.energy.gov/~media/grants/pdf/foas/2014/SC_FOA_0001060.pdf
12. I-75 Clean Fuels Corridor <http://www.cleanfuelscorridor.com>
13. Research for Sustainable Bioenergy Workshop Report <http://genomicscience.energy.gov/sustainability/>

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. Biomass R&D Board <http://www.biomassboard.gov/>
4. The [Targeted Algal Biofuels and Bioproducts \(TABB\) FOA](#)
5. [Waste-to-Energy Workshop Notes](#)
6. FOA for [Landscape Design for Sustainable Bioenergy Systems](#)
7. [Notice of Intent \(NOI\) for the Biomass Research and Development Initiative \(BRDi\) FOA](#)
8. [ARPA-E TERRA funding opportunity announcement](#)