



**Biomass R&D Technical  
Advisory Committee (TAC)  
March 5, 2015**

**Elliott Levine  
Biomass R&D TAC Designated  
Federal Officer (DFO)**

**DOE Updates**

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# Welcome.. and Before We Start...

- Welcome!
- Apologies for having to do this meeting via Webinar.
- We also have omitted the customary meeting binder.
- Today, we will hear updates from DOE, USDA; discuss BETO's budget and new activities; get an overview of the Biomass Board, Operations Committees, and Interagency Working Group relationships; share feedback from the Board on the 2014 recommendations; and present the proposed path forward.
- **Webinar ground rules:**
  - If possible, please call in rather than using the computer audio feature (for better sound quality).
  - To reduce background noise throughout the webinar, please mute your phone when you are not speaking.
  - We will have all participants muted from the host end.
  - If TAC members would like to make a comment or ask a question, please use the Raise Your Hand feature.
  - No votes will be taken today.
  - Public comments will be accepted at 5:15-5:30 p.m. and if there are materials to be distributed, please e-mail them to me at [elliott.levine@ee.doe.gov](mailto:elliott.levine@ee.doe.gov)

# Purpose of TAC (1 of 2) – BRDI Components

- 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 TAC to make recommendations related to the BRD Initiative.

# Purpose of TAC (2 of 2) – Rest of the Responsibilities

- DOE and USDA General Counsel have advised that a broader biomass R&D scope is permissible.
- 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
  - Technical Biomass R&D Recommendations
- Recommendations are used to inform the Biomass R&D Board and provided to DOE and USDA Programs.
- A report of recommendations consented to frame the TAC Annual Report.
- Each recommendation is commented upon by both DOE and USDA.

# Webinar: Agenda at a Glance

## Day 1: Technical Advisory Committee Meeting

March 5, 2015

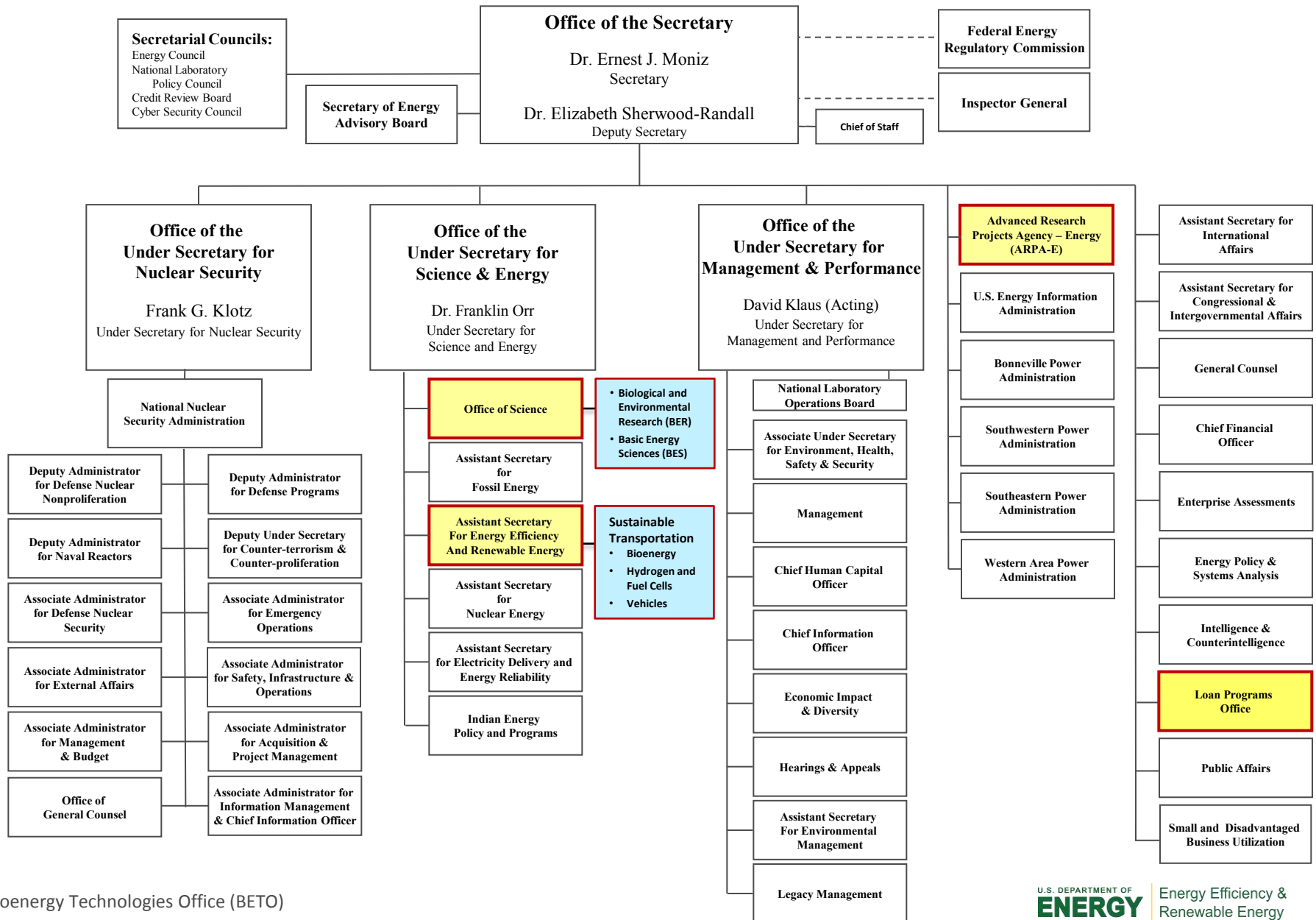
- |                       |  |
|-----------------------|--|
| 1:30 p.m. – 1:45 p.m. | <b>Welcome</b><br><i>Committee Co-Chair(s)</i>   |
| 1:45 p.m. – 2:15 p.m. | <b><u>Presentation:</u></b> Committee Business for 2015 and U.S. DOE Updates<br><i>Elliott Levine, DFO, U.S. Department of Energy</i>  |
| 2:15 p.m. – 2:45 p.m. | <b><u>Presentation:</u></b> USDA Update on Biomass R&D Activities<br><i>Todd Campbell, U.S. Department of Agriculture</i>  |
| 2:45 p.m. – 3:15 p.m. | <b><u>Presentation:</u></b> Overview of Biomass Research and Development Board, Operation Committee and Working Groups<br><i>Todd Campbell, U.S. Department of Agriculture</i><br><i>Alison Goss Eng, Bioenergy Technologies Office, U.S. Department of Energy</i> |
| 3:15 p.m. – 3:30 p.m. | <b><u>Presentation:</u></b> Biomass Research and Development Initiative (BRDI) Solicitation, Status, and Update<br><i>Daniel Cassidy, NIFA, U.S. Department of Agriculture</i>   |
| 3:30 p.m. – 4:15 p.m. | <b><u>Presentation:</u></b> Overview of DOE Bioenergy Technologies Office 2015 Budget, New Areas, and Activities<br><i>Jonathan Male, Bioenergy Technologies Office Director, U.S. Department of Energy</i>  |
| 4:15 p.m. – 4:45 p.m. | <b><u>Presentation:</u></b> 2014 Recommendations and Feedback from the Board<br><i>Kevin Kephart, Committee Co-Chair</i>   |
| 4:45 p.m. – 5:15 p.m. | <b><u>Presentation:</u></b> 2015 Committee Activities and Work Plan<br><i>Kevin Kephart, Committee Co-Chair</i>  |
| 5:15 p.m. – 5:30 p.m. | <b><u>Public Comment</u></b>   |
| 5:30 p.m.             | <b><u>Close Meeting</u></b>  |

# TAC 2015 Work Timeline

| Date  | Committee Objectives  |
|---|---|
| <b>Q1 2015</b><br>March 5, 2015<br><b>Webinar</b>   | <ul style="list-style-type: none"><li>• Receive presentation on the interactions between the Biomass Board, Operation Committees, and Interagency Working Groups.</li></ul>   |
| <b>Q2 2015</b><br>Week of May 18 <sup>th</sup><br><b>(2 ½ day meeting, if acceptable)</b> | <ul style="list-style-type: none"><li>• TAC along with the attending Operation Committees and Interagency Working Group guests would list and rank topics for the TAC to consider.</li><li>• Agree on TAC 2015 topic areas.</li><li>• Adjust the TAC sub-committee structures (if necessary) to best address one or more topics per future meeting.</li></ul> |
| <b>Q3 2015</b><br>Week of August 24 <sup>th</sup><br>(possible site visit)                | <ul style="list-style-type: none"><li>• Work in Subcommittees to develop recommendations on agreed upon topic areas.</li></ul>  |
| <b>Q4 2015</b><br>Week of November 16 <sup>th</sup><br>(1 ½ day meeting)                  | <ul style="list-style-type: none"><li>• Finalize and vote on 2015 recommendations.</li></ul>  |



# DOE Program Offices with Biomass Related Activities





# BETO Announcements and Updates



# Bioenergy Technologies Office Incubator Selections

On February 20, 2015, DOE is announced up to \$10 million for seven projects to support innovative technologies that are not represented in a significant way in the Bioenergy Technology Office's current project portfolio.

- **Metabolix, Inc.** of Cambridge, MA
- **The Pacific Northwest National Laboratory** of Richland, WA
- **The Ohio State University** of Columbus, OH
- **The University of California Riverside** of Riverside, CA
- **OPX Biotechnologies** of Boulder, CO
- **Kiverdi, Inc.** of Berkeley, CA
- **Gas Technology Institute** of Des Plaines, IL

➤ Jonathan Male will be providing additional information shortly.

# Biomass Research & Development Initiative (BRDI)

## BRDI FOA 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
- Concept Papers are solicited to address in three technical topic areas:
  1. Feedstocks Development
  2. Biofuels and Biobased Products Development
  3. Biofuels and Biobased Products Development Analysis

### Dates:

- Concept Paper Due Date: 03/27/2015, 5:00 p.m. EST
- Full Application Due Date: 7/27/2015, 5:00 p.m. EST



# Advanced Supply System Validation Workshop

## Held on February 3-4, 2015, Golden, Colorado

- The purpose was to bring together a diverse group of stakeholders to examine, discuss, and validate analysis assumptions used to move beyond current feedstock supply systems designed to support the agriculture and forestry industries.
- Participants discussed assumptions relating to volume and transportation logistics, biomass quality, and operational risks.
- The topics covered in the breakout sessions included the following:
  - Barriers to delivering one billion tons of biomass to biorefineries annually
  - Advanced supply system concepts, including depots
  - Business models for advanced supply systems
  - Siting and sizing considerations for depots
  - Open discussion of unresolved issues
- The outcome of the workshop will include a report summarizing the expert opinions shared during the workshop.
- Workshop report is currently being developed.

# 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 CO<sub>2</sub> 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

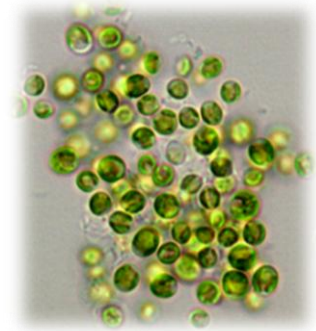


Photo credits NREL and Arizona State University



# 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.



# Upcoming BETO Events

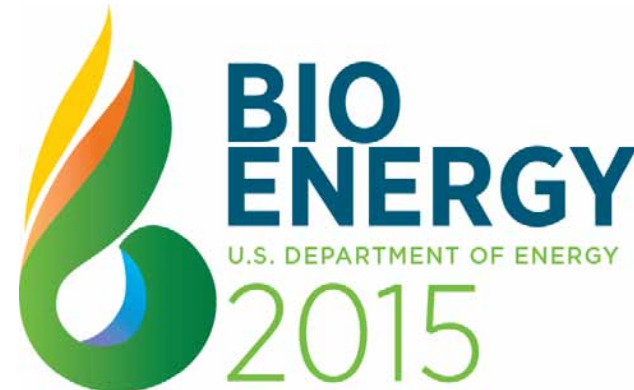
## 2015 Peer Review

- March 23-27, 2015  
Hilton Mark Center  
Alexandria, Virginia



## Bioenergy 2015

- June 23-24, 2015  
Washington Convention Center  
Washington, DC





# Upcoming Events

## Waste-to-Energy (WTE) Workshop Series

- WTE-Fuel Cells Workshop planned for March 18-19, 2015
- WERF workshop at WEF Water-Energy event in June 2015 \*  
<http://www.wef.org/WaterEnergy/>

## BETO Strategic Plan Development

- Kicked-off a Strategic Planning effort.
  - As the energy landscape is changing, it would be valuable to address the change and refine the BETO previous strategic plan.
- A strawman plan will be developed by May/June 2015.
- Bottoms up participation and stakeholder inputs will be sought from DOE (VTO, ARPA-E, Science), other federal partners (e.g., USDA, EPA), industry, national labs, academia, NGOs, etc.

\* WERF: Water Environment Research Foundation  
WEF: Water Environment Federation

## BETO Multi-Year Program Plan (MYPP)

- Updated version of the BETO's Multi-Year Program Plan was released in November 2014.
  - <http://www.energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-november-2014-update>
- New version is scheduled for release in April 2015 – will contain an assessment of additional pathways.
- A new version of the Update to the Billion-Ton Study is under-development.

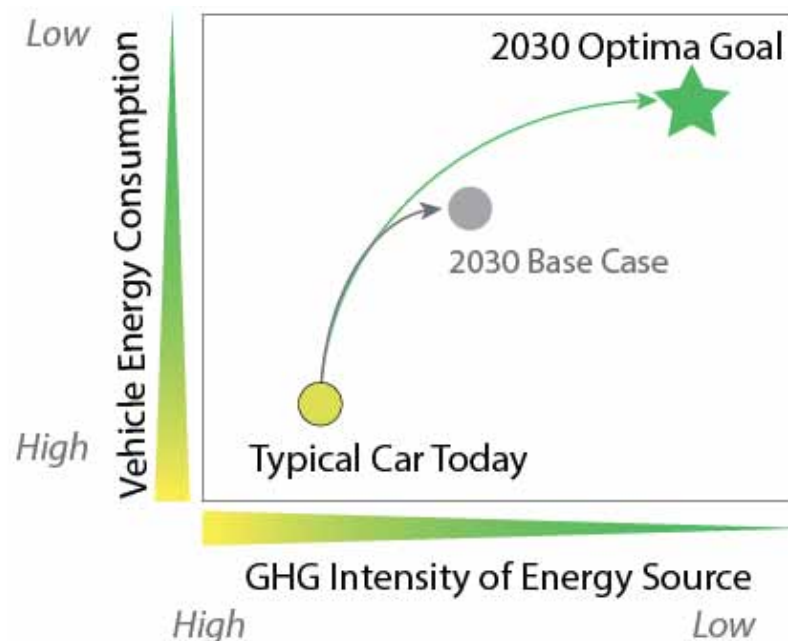
# Vehicle Technologies Office (VTO) Projects

## Recent/ongoing competitive fuels awards with biofuel component – late FY 2014 competitive award

- **Cummins Engine Co.** : E85/Diesel Premixed Compression Ignition (EDPCI) Technology Demonstration of a Dual-Fuel Class 8 Truck.
  - Advanced, low carbon engine combustion enabled using diesel and E85.
  - Utilizes Reactivity Controlled Compression Ignition (RCCI) approach.
  - Theoretical thermal efficiencies higher than conventional diesel.

# Optima (formerly NFVSO) Objectives

- Through co-optimization of fuels and engines, reduce per-vehicle petroleum consumption 30% vs. 2030 base case.
    - Additional 7-14% reduction in engine fuel consumption.
    - 20% reduction in fuel WTT emissions
    - Additional 9-14% fleet GHG reduction by 2040.
  - 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.
- Status and next steps will be discussed by Jonathan Male.



# 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.

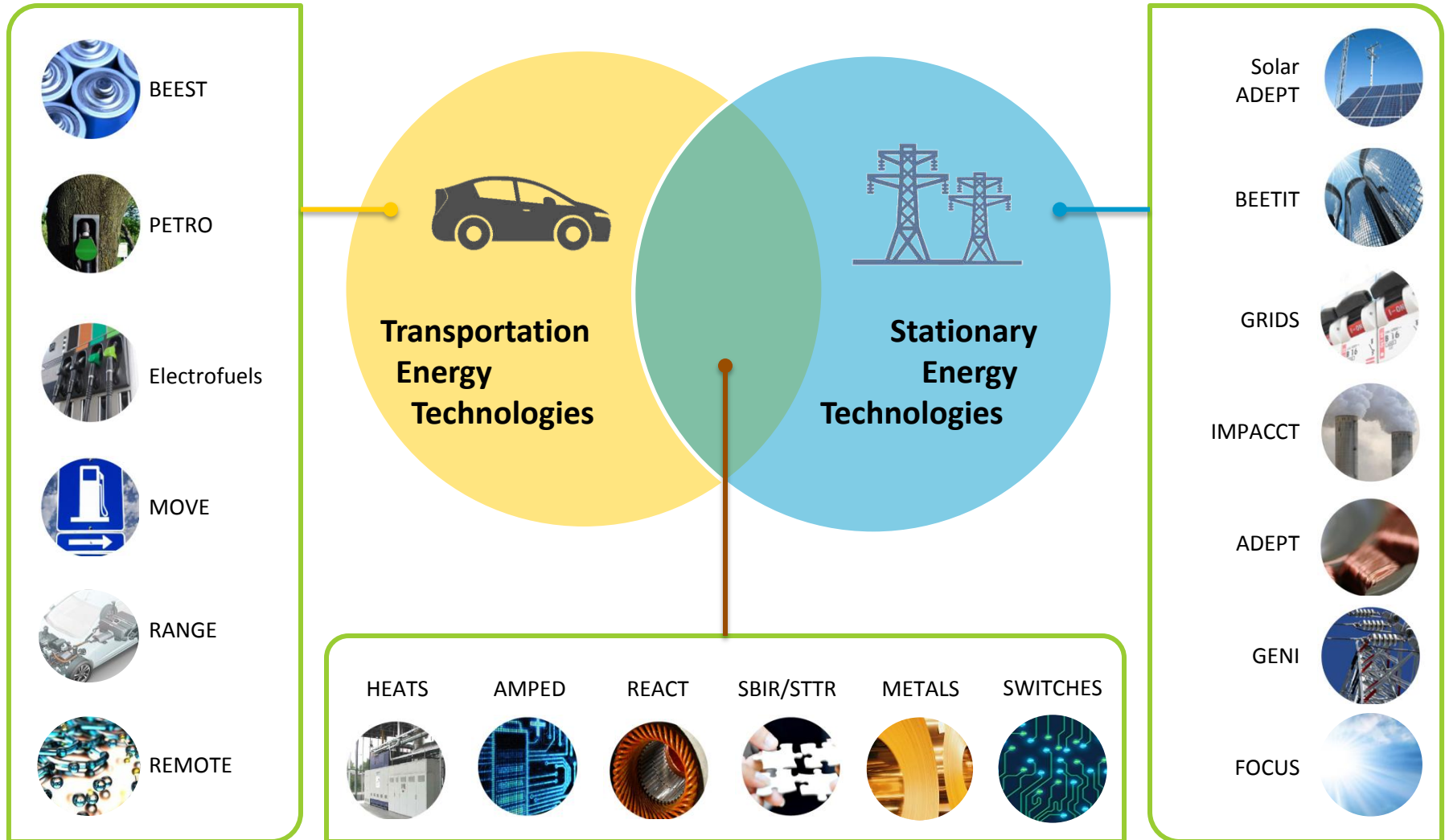
<http://science.energy.gov/bes/efrc/>

- 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



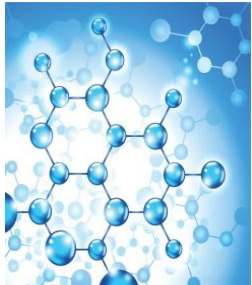
## Electrofuels [Status: All projects have closed]

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

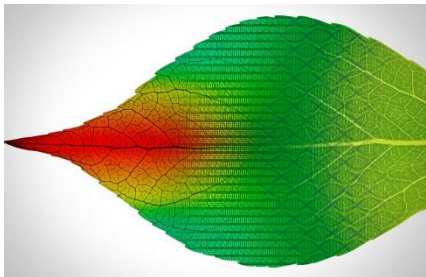


## **PETRO: Plants Engineered to Replace Oil [Status: 12 projects active]**

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](mailto:jonathan.burbaum@hq.doe.gov))  
SETA: David Lee ([david.lee2@hq.doe.gov](mailto: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](mailto:joe.cornelius@hq.doe.gov))  
SETA: David Lee ([david.lee2@hq.doe.gov](mailto:david.lee2@hq.doe.gov))

**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. |

# The Work of the Biomass R&D TAC can be Found Online



<http://www.biomassboard.gov/>

<http://www.biomassboard.gov/committee/committee.html>

- Find info on:
  - Previous work and recommendations;
  - Meeting summaries;
  - TAC membership list; and
  - Key “library” documents and referenced materials.

# References and Useful Links

## References:

1. Bioenergy Technologies Office Multi-Year Program Plan <http://www.energy.gov/eere/bioenergy/downloads/bioenergy-technologies-office-multi-year-program-plan-july-2014-update>
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](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 Research and Development Initiative (BRDI) FOA <http://www.grants.gov/web/grants/view-opportunity.html?oppld=268>
10. I-75 Clean Fuels Corridor <http://www.cleanfuelscorridor.com>
11. Research for Sustainable Bioenergy Workshop Report <http://genomicscience.energy.gov/sustainability/>
12. Water Environment Federation <http://www.wef.org/WaterEnergy/>

## Useful Links:

1. BETO Web page <http://www.energy.gov/eere/bioenergy/bioenergy-technologies-office>
2. BETO's Meetings Web page <http://www1.eere.energy.gov/bioenergy/meetings.html>
3. BETO News and Announcements <http://www1.eere.energy.gov/bioenergy/news.html>
4. Upcoming Solicitations [http://www1.eere.energy.gov/biomass/biomass\\_solicitations.html](http://www1.eere.energy.gov/biomass/biomass_solicitations.html)
5. The [Targeted Algal Biofuels and Bioproducts \(TABB\) FOA](#)
6. [Waste-to-Energy Workshop Notes](#)
7. FOA for [Landscape Design for Sustainable Bioenergy Systems](#)
8. [ARPA-E TERRA funding opportunity announcement](#)
9. Peer Review 2015 <http://www.energy.gov/eere/bioenergy/2015-project-peer-review>
10. DOE/EERE, Sustainable Transportation Office <http://www.energy.gov/eere/transportation>
11. ARPA-E Web page <http://arpa-e.energy.gov/>
12. Office of Science Web page <http://science.energy.gov/>