U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Bioenergy Technologies Office – Peer Review 2013

May 20-23, 2013

Valerie Reed

Acting Director

Welcome

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

Bioenergy Technologies Office (BETO): Focus, Strategy, and Goals

Focus

Through targeted RDD&D activities, progress the sustainable, nationwide production of advanced biofuels that are compatible with today's transportation infrastructure and will displace a significant share of petroleum-derived fuels to reduce U.S. dependence on oil.

Office Strategy and Approach

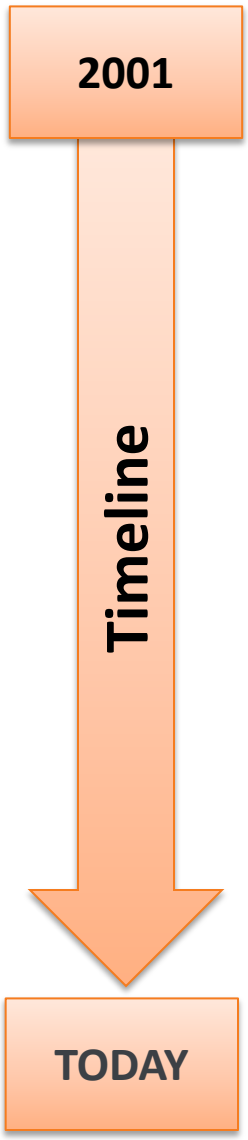
- After validating a cost target for a given pathway, BETO will assist partners in scaling-up technologies appropriately to ensure a smooth transition from the bench to commercial facility, helping to reduce barriers along the way.
- Deployment efforts will continue to focus on innovative technologies for new, viable pathways that are down-selected to those with the best chance of success, while continuing to leverage lessons learned from the Office's existing portfolio of pilot-, demonstration-, and commercial-scale biorefineries.
- Funding R&D activities designed to overcome these barriers will reduce technological and financial risks and facilitate a greater sense of confidence and stability that will allow private capital to flow to the emerging industry.

Performance Goals/Metrics

Goal: Reduce the cost of biofuels to be competitive with petroleum-based fuels (gasoline, diesel, and jet fuels) in the market, reducing U.S. need for imported petroleum and reducing emissions from the transportation sector.

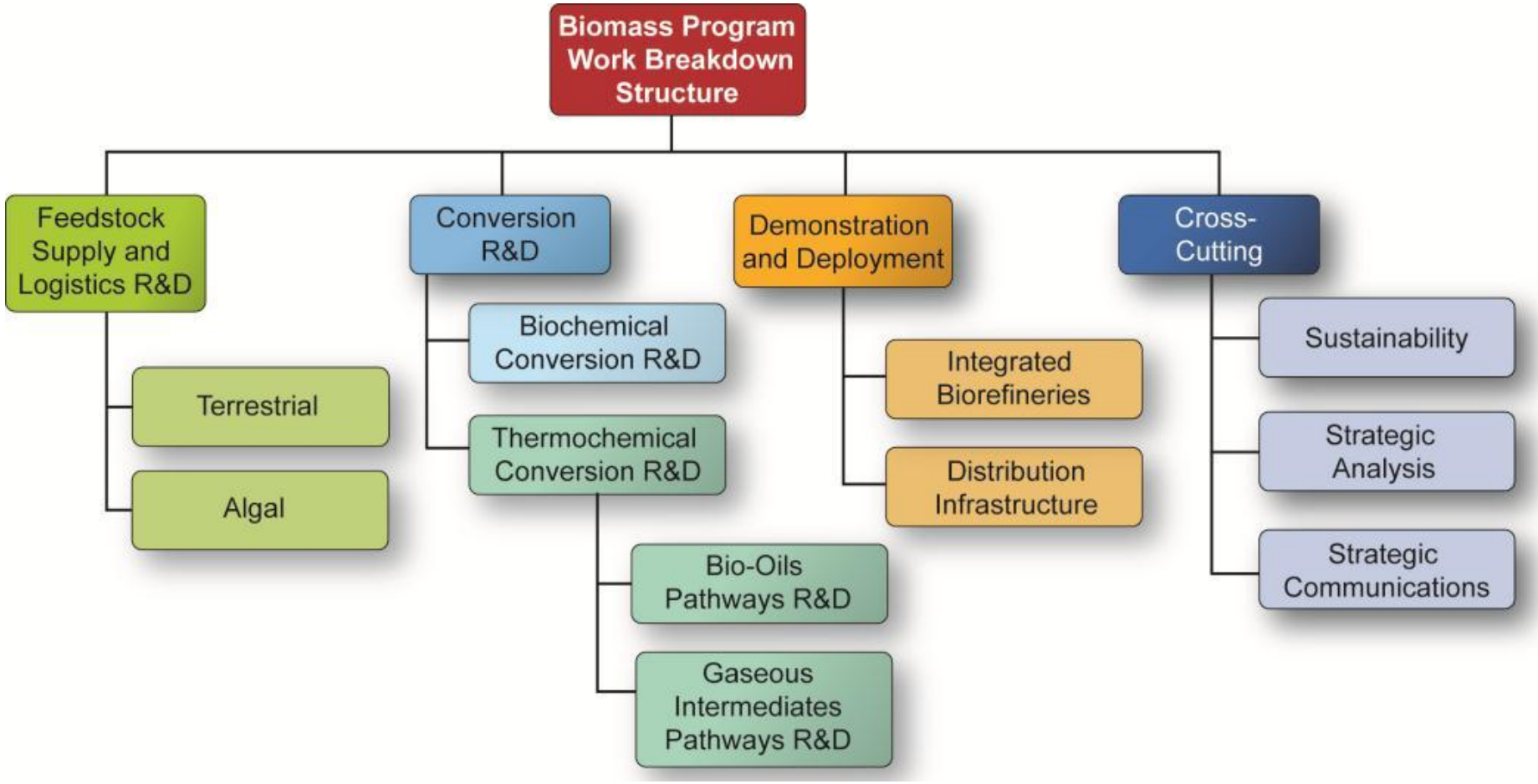
- By 2017, achieve a modeled cost of $3/gge for the pyrolysis pathway to drop-in renewable gasoline, diesel, and jet fuel.
- Develop additional pathways to enable utilization of a larger variety of biomass resources and conversion technologies that also aim to achieve $3/gge.

Programmatic Strategic Goals and Legislative Drivers



- 2001: Program pursues an integrated biorefinery strategy to address fuels, power and products from biomass;
- 2005's Energy Policy Act – Section 932: authorizes the Office to pursue deployment at commercial-scale to accelerate the industry;
- 2007's Energy Independence and Security Act (EISA) of 2007 sets aggressive initial goals in RFS;
- 2009: ARRA funding of $800 million directed to Program;
- 2009: Cost target for cellulosic ethanol set at **$2.00/gal**, for mature plant cost validated at pilot scale;
- 2011: Program sets target for hydrocarbon fuels at **$3/gge cost** mature cost, validated at pilot scale;
- 2012: BETO hits cellulosic ethanol R&D cost targets in support of Biochemical and Thermochemical design cases (mature plant modeled cost projections);
- 2013: New design cases are being developed for Biochemical and Thermochemical routes to gasoline, diesel, and jet fuel that will support the $3/gge programmatic cost target.

Bioenergy Technologies Office (BETO): Organization



BETO: Recent and Anticipated Accomplishments

Office Accomplishments

- In FY 2012, the Office demonstrated a biochemical and thermochemical conversion process in integrated systems at pilot scale for the conversion of biomass to ethanol and other industrial alcohols, validating that these fuels can be produced cost-competitively with gasoline. The data from the Office's efforts directed at alcohol fuels will be available to industry and others looking to commercialize any of these technology pathways. Specific technical accomplishments in FY 2012 include the following:

➢ Achieved a modeled total cost of cellulosic ethanol for mature technology of $2.05–$2.15/gallon of ethanol (less than $3.21/gge).

  - Reduced modeled **conversion cost** through targeted R&D to $1.33/gallon of ethanol.
  - Reduced **feedstock logistics costs** for dry herbaceous biomass (i.e., field-dried corn stover) from harvest to biochemical conversion plant gate to $0.49/gallon of ethanol (equivalent to approximately $35/dry ton in 2007 dollars).

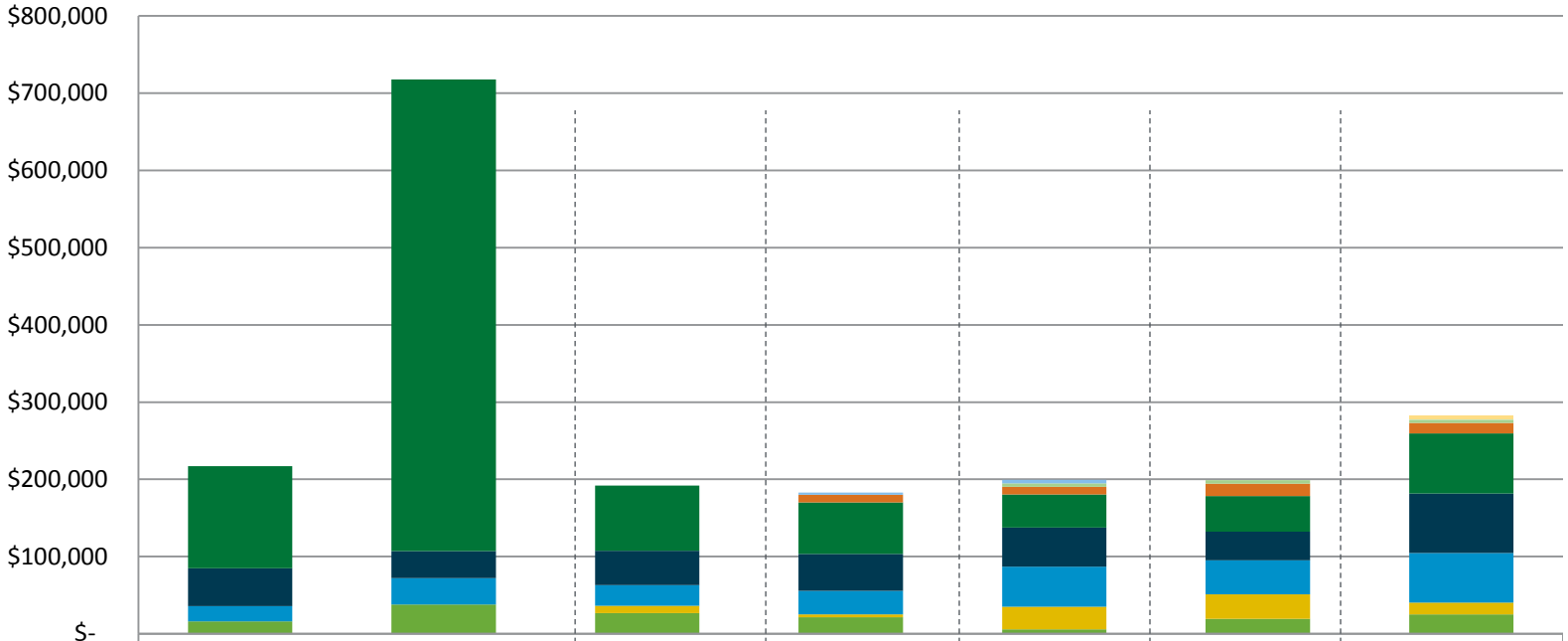
➢ Achieved a conversion cost of $3.95/gge (combined fuel) from a bio-oil pathway, which is on track to support the $3/gge program goal for 2017.

Project Completions and Progress

- Of the 29 integrated biorefinery projects in BETO's initial portfolio, 5 projects have been completed, 5 were terminated for lack of technical progress or loss of cost-share, and 19 are currently active.
- One pre-commercial-scale (8 million gallons/year) biorefinery (INEOS) is expected to come online in 2013. It will be the first operating cellulosic ethanol production facility cost-shared with the Department of Energy in the United States.
- Two commercial-scale production facilities (POET and Abengoa) are currently under construction and due for completion in 2014.
- On track to validate 60 million gallons of annual advanced biofuel production capacity by FY 2014.

Historical Budget Information

BETO Budget History



	FY09	FY09 ARRA	FY10	FY11	FY12	FY13	FY14 Request
SBIR/STTR				$2,716	$4,281		
NREL Lab Facilities							$5,000
Biopower/Cookstoves					$4,829	$4,487	$4,000
Analysis/Sustainability				$10,000	$9,813	$15,830	$13,500
Int Biorefineries	$132,000	$611,000	$84,278	$66,695	$42,897	$46,248	$78,000
Biochem	$49,000	$35,000	$44,440	$47,765	$50,733	$37,075	$77,000
Thermochem	$20,000	$34,000	$26,830	$30,184	$51,685	$43,982	$64,000
Algae Feedstock	$-	$-	$9,250	$3,895	$29,067	$31,659	$15,500
Feedstock Infrastrucure	$16,000	$38,000	$26,962	$21,440	$5,971	$19,523	$25,000

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BETO Budget

(Dollars in Thousands)	FY 2012 Appropriated	FY 2013 Annualized CR	FY 2014 Request
Total, Feedstocks	**35,038**	**—**	**40,500**
Sustainable Production	967	—	8,500
Logistics	5,004	—	16,500
Algae & Advanced Feedstocks	29,067	—	15,500
Total, Conversion Technologies	**102,418**	**—**	**141,000**
Thermochemical	51,685	—	54,000
Biochemical	50,733	—	67,000
Incubator Program	0	—	20,000
Total, Integrated Biorefineries	**42,897**	**—**	**78,000**
Integrated Biorefineries	42,897	—	33,000
Defense Production Act	0	—	45,000
Total, Analysis and Sustainability	**9,813**	**—**	**13,500**
Systems Analysis	3,925	—	5,500
Crosscutting Sustainability	3,925	—	6,500
Systems Integration	1,963	—	1,500
Biopower	**4,829**	**—**	**4,000**
NREL Site Wide Facility Support	0	**—**	**5,000**
Total, Bioenergy Technologies Office	***194,995***	***198,804***	***282,000***

Recent Bioenergy Technologies Office Solicitations

Innovative Pilot and Demonstration Scale Production of Advanced Biofuels

An F/A-18 Green Hornet Fighter plane operating on a 50/50 biofuels blend. Photo courtesy of the U.S. Navy.

- On April 22nd, the Department of Energy announced the four projects selected for negotiation for the innovative pilot FOA for the production of advanced biofuels. Each project that was selected will be working to produce biofuels that meet military specifications for jet and diesel fuel.
  - **Frontline Bioenergy LLCM, Ames, Iowa**
    - Up to $4.2 million to produce FT liquids from woody biomass, municipal solid waste, and refuse derived fuel. These liquids will be upgraded to produce samples of biofuels that meet military specifications.
  - **Cobalt Technologies, Mountain View, California**
    - Up to $2.5 million to operate a pilot-scale integrated biorefinery to convert switchgrass to bio-jet fuel
  - **Mercurius Biorefining, Inc., Ferndale, Washington**
    - Up to $4.6 million to operate a pilot plant converting cellulosic biomass into drop-in bio-jet fuel and chemicals.
  - **BioProcess Algae, Shenandoah, Iowa**
    - Up to $6.4 million to produce hydrocarbon fuels meeting military specifications from an algae-based integrated biorefinery.

Bioenergy Technologies Office Solicitations

Carbon, Hydrogen and Separation Efficiencies in Bio-Oil Conversion Pathways (CHASE Bio-Oil Pathways)

On December 14th, 2012, BETO released a solicitation for up to $12 million to focus on three barriers repeatedly identified at CTAB and in the RFI:

- Carbon efficiency: developing selective fractionation and separation systems in bio-oil processing;
- Hydrogen efficiency: improving H2 production, use, and transfer in biomass liquefaction and bio-oil upgrading; and
- Separations efficiency: developing technologies for use and mitigation of the aqueous fraction of bio-oil.

The solicitation closed on February 20, 2013 and is in the final stages of the review process, expected to be announced in the Summer of 2013.

Bioenergy Technologies Office Solicitations

Advanced Biomass Feedstock Logistics Systems II

On January 28, 2013, this solicitation was released up to $6 million to support developing and demonstrating strategies, equipment, and rapid analytical methods to manage feedstock quality within economic constraints throughout the feedstock supply chain. The main effort must be directed toward full-scale demonstration of integrated feedstock supply chain systems that can deliver:

- Large volumes of high quality feedstocks
- At an affordable price
- Over long distances

The solicitation closed on March 22, 2013, and is currently under review. Awards are currently expected to be made later on in 2013.

Advancements in Algae Biofuel Yield (ABY)

On January 16, 2013, BETO released a solicitation for up to $10 million for the Advancements in Algal Biomass Yield, to demonstrate, at a process development unit scale of one acre cultivation equivalent, algal biofuel intermediate yield of 2,500 gallons of biofuel feedstock (or equivalent dry weight basis) per acre per year by 2018. This target is an important milestone in reducing the cost of algal biofuels to be cost-competitive. Research focuses on the following three main priority areas:

- Improvements in Algal Biomass Productivity;
- Improvements in Preprocessing Technologies; and
- Technical Advances that Enable Integration of Algal Biomass Unit Operations

The solicitation closed on April 1, 2013, and is currently under review. Awards are expected to be made later on in 2013.

Bioenergy Technologies Office (BETO)

FY 2014 Priorities

- **Feedstock Logistics**: Reduce the feedstock logistics cost target for delivery to plant from $55/dry-matter ton to $53/dry-matter ton for loblolly pine.
- **Algae and Advanced Feedstocks**: Reduce the modeled mature plant cost of open pond algal oil by $2.35 to $14.31/gasoline gallon equivalent (gge) by improving overall algal biomass productivity toward the $3.00/gge in 2022 goal.
- **Biochemical Conversion**: Define priority pathways for hydrocarbon fuel development and initiate two new programs beyond fuels: waste-to-energy and use of lignin and lignocellulosic sugars to produce carbon fibers.
- **Thermochemical Conversion**: Reduce the modeled conversion cost from $3.18/gge to $2.70/gge for producing gasoline/diesel from biomass by way of pyrolysis or direct liquefaction technologies followed by catalytic upgrading.
- **Incubator Program**: Support innovation by providing small businesses with increased access to BETO's funded capital and user facilities.
- **Integrated Biorefineries**: Advance portfolio of innovative pilot-scale and demonstration-scale biorefineries for biofuel and bioproduct manufacturing.
- **Analysis and Sustainability**: Conduct cross-cutting and systems-level analyses to inform program planning, decision-making, and R&D investments. Evaluate sustainability metrics and promote best practices regarding productivity, land use, water, emissions, and social sustainability.
- **Biopower/Cookstoves**: Emphasize R&D and validation of cookstoves. Improve combustion and heat transfer processes through a competitive process.

Why Are We Here?

Why Hold a Peer Review

- Transparent, non-biased evaluation of technical, scientific and business aspects of the Office, project results, and management
- Obtain independent expert assessments of each project in the Office's portfolio
- Obtain overall recommendations on the focus and scope of each technology area and the strategic outlook of the Office.

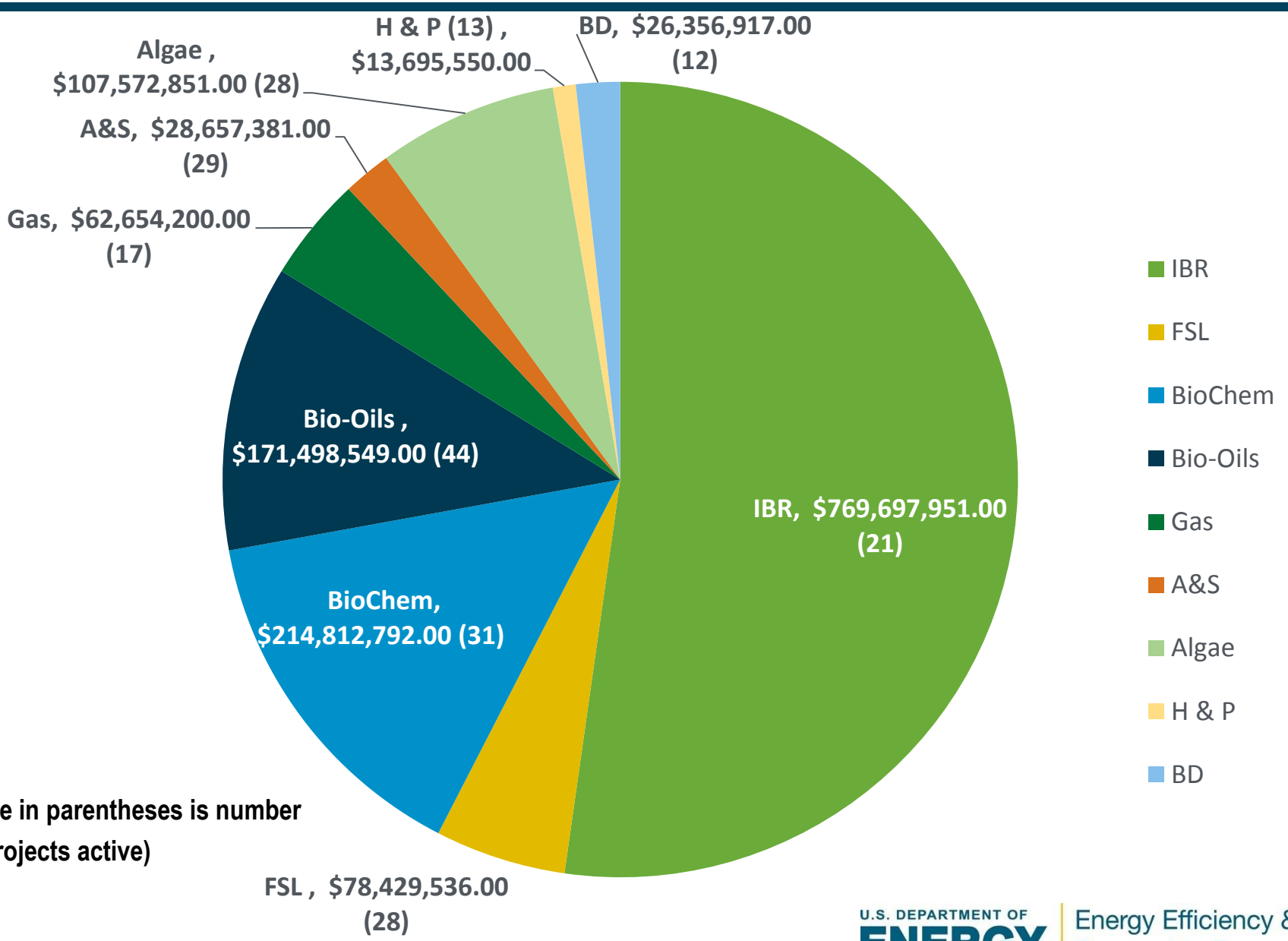
Objectives

- Evaluate the Office's approach
- Will our structure accomplish the goals and objectives of the BETO, EERE and DOE?
- Is the Portfolio balanced?
  - Right mix of R&D, demonstration, and deployment
  - Balance across the supply chain
- Have we identified the right technical and market barriers, and are they being appropriately addressed by the portfolio?

Peer Review Statistics

- 223 projects
- 9 key technology areas
  - Integrated Biorefineries
  - Feedstock Production and Logistics
  - Algae
  - Biochemical Conversion
  - Bio-Oils
  - Gasification
  - Analysis and Sustainability
  - Heat and Power
  - Biodiesel
- $1.47 billion portfolio

Value Per Technology Area



Value in parentheses is number of projects active)

Strategic Partnering

The Office partners with industry, national labs, academia, and non-profit organizations to overcome challenges in effectively deploying biofuels, biopower, and bioproducts.

DOE Internal Collaboration

- ARPA-E
- Office of Science
- Other Energy Efficiency and Renewable Energy Program Offices

Federal Collaboration

- Biomass Research & Development Board
- Offices and programs within the following:
  - Department of Defense
  - Department of the Interior
  - Department of Transportation
  - Environmental Protection Agency
  - National Aeronautics and Space Administration
  - National Science Foundation
  - Office of Science and Technology Policy)
  - U.S. Department of Agriculture

Project Performers

- National Laboratories
- Industry, Academia, and Non-Profits
- State and Local Entities

Non-Federal Coordination and Collaboration

- Biomass R&D Technical Advisory Committee
- State, Local, and International Agencies and Research Institutions
- Trade and Professional Associations
- Nongovernmental Organizations
- Investment and Financial Communities

Useful Links

Bioenergy Technologies Office Links:

1. BETO Multi-Year Program Plan, November 2012 Update
   http://www1.eere.energy.gov/biomass/pdfs/mypp_november_2012.pdf
2. Innovative Pilot Award Announcements
   http://energy.gov/articles/energy-department-announces-new-innovative-projects-develop-advanced-drop-biofuels-military
3. BETO Funding Opportunities
   http://www1.eere.energy.gov/biomass/biomass_solicitations.html
4. 2013 Peer Review
   http://www1.eere.energy.gov/biomass/peer_review2013.html
5. Biomass 2013
   http://www1.eere.energy.gov/biomass/biomass_2013.html
6. Carbon Fiber Workshop
   http://www1.eere.energy.gov/biomass/carbon_fiber_workshop.html
7. Natural Gas-Biomass to Liquids Workshop
   http://www1.eere.energy.gov/biomass/gbtl_workshop.html
8. Biochemical Biorefinery Study
   http://onlinelibrary.wiley.com/doi/10.1002/bbb.1391/full

BETO Program Managers

BIOENERGY TECHNOLOGIES OFFICE PROGRAM MANAGERS	
John Ferrell	Program Manager, Feedstocks Acting Program Manager, Algae
Kevin Craig	Program Manager, Thermochemical Acting Program Manager, Biochemical
Brian Duff	Program Manager , Demonstration & Deployment
Alison Goss Eng	Operations Supervisor
Zia Haq	Lead Analyst

Please see Peer Review Booklet for a full list of Technology Managers and Program Staff

Steering Committee

PEER REVIEW STEERING COMMITTEE	
Jim Dooley	Forest Concepts, LLC.
Steve Kelley	North Carolina State University
Bob Miller	Consultant, retired Air Products
Mark Yancey	Neatech, LLC
George Parks	Consultant, retired ConocoPhillips
Bob Mantz	Army Research Laboratory
Kelly Ibsen	Lynx Engineering, LLC.

Agenda – Day 1

Day 1: MONDAY, MAY 20, 2013		
TIME	**Title**	**Presenter**
8:30 a.m.–8:40 a.m.	EERE Welcome	Steve Chalk, Deputy Assistant Secretary for Renewable Energy, DOE
8:40 a.m.–9:10 a.m.	Introduction to the Bioenergy Technologies Office	Valerie Reed, Acting Office Director, DOE
9:10 a.m.–9:35 a.m.	Overview: Analysis & Sustainability	Alison Goss Eng, Operations Lead, DOE
9:35 a.m.–10:15 a.m.	Overview: Terrestrial Feedstocks & Algae	John Ferrell, Program Manager, Feedstocks, DOE
10:15 a.m.–10:30 a.m.	BREAK	
10:30 a.m.–11:30 a.m.	Overview: Conversion R&D	Kevin Craig, Program Manager, Conversion, DOE
11:30 a.m.–12:00 p.m.	Overview: Integrated Biorefineries	Brian Duff, Program Manager, Demonstration and Deployment, DOE
12:00 p.m.–1:00 p.m.	LUNCH	
1:00 p.m.–3:00 p.m.	Breakout Sessions – See Technology Area Agendas for Details	
3:00 p.m.–3:30 p.m.	BREAK	
3:30 p.m.–6:00 p.m.	Breakout Sessions – See Technology Area Agendas for Details	

Agenda – Day 2-4

Day 2: TUESDAY, MAY 21, 2013

TIME	Title	Presenter/Panel
8:30 a.m.–9:10 a.m.	Breaking Barriers: How the Cellulosic Ethanol Cost Goal Was Achieved	Presenter: Adam Bratis, NREL Panelists: Leslie Pezzullo, DOE; Jonathan Male, PNNL; J. Richard Hess, INL
9:10 a.m.-10:15 a.m.	Breakout Sessions – See Technology Area Agendas for Details	
10:15 a.m.–10:30 a.m.	BREAK	
10:30 a.m.-12:00 p.m.	Breakout Sessions – See Technology Area Agendas for Details	
12:00 p.m.–1:00 p.m.	LUNCH	
1:00 p.m.–3:00 p.m.	Breakout Sessions – See Technology Area Agendas for Details	
3:00 p.m.–3:30 p.m.	BREAK	
3:30 p.m.–6:00 p.m.	Breakout Sessions – See Technology Area Agendas for Details	

Housekeeping

- ***Internet*** – Complimentary internet is available to all attendees in meeting space and in guestrooms. Attendees in the meeting space can access the internet by logging on to the "**PSAV**" network and entering the password "**bioenergy**".

- ***Food and Beverage:***
  - Breakfast will be provided for all conference attendees from 7:30-8:30 AM in the main event foyer.
  - General Breaks will be provided for all conference attendees from around 10:15-10:45 AM, and from around 3:00-3:30 PM in the main event foyer.
  - Lunch will only be provided for Reviewers and Steering Committee Members. Information about local restaurants and eateries will be provided at registration.

- ***Shuttle*** – Morning and evening shuttle busses will transport attendees between the Pentagon City Mall Metro stop and the Hilton Alexandria Mark Center. These shuttles have been scheduled exclusively for the BETO Peer Review. The Peer Review event shuttles are white and will have a sign that says "**Bioenergy – Hilton Alexandria Mark Center**" in the window of the bus. → Please see insert in your peer review booklet for full schedule

Program Management Review

Bioenergy Technologies Office Program Management Review

July 30, 2013 : Renaissance Hotel, Washington D.C.

- Results from the Project Peer Review will be highlighted and the overall focus and proposed future direction for the Office will be reviewed.
- The BETO Program Management Review will take place immediately before the start of Biomass 2013.

Biomass 2013

BIOMASS 2013:

HOW THE ADVANCED BIOINDUSTRY IS RESHAPING AMERICAN ENERGY

- Wednesday, July 31 – Thursday, August 1, Washington D.C. Convention Center
- This year's agenda will include a focus on celebrating successes, current trends and frontiers, as well as highlighting sustainability and IBR projects.
- Information is now available and will be continually updated on the BETO Biomass 2013 website.