

U.S. Department of Energy Biomass Program

Updates to Biomass R&D TAC

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TAC Housekeeping



- 2007/2008/2009 Recommendations Status
- Travel Reimbursement – Chrissy Fagerholm:
christina.fagerholm@ee.doe.gov
- Status of 2010 Nomination Process
- Next Meeting – June 2010 TBD
- SGE Financial Disclosure Forms

OBP Project Selections



\$564 Million for Advanced Biorefinery Projects (Dec. 4, 2009)

Funded by
Recovery Act

- 19 projects
 - \$483M for 14 pilot-scale and 4 demonstration-scale
 - \$81M for acceleration of construction of previously selected Bluefire project
- \$700M in private/non-Federal cost share
- Announcement corresponds with USDA RD announcement
 - Sapphire Energy loan guarantee up to \$54.5M via Biorefinery Assistance Program

OBP Project Selections



Ethanol Blends Infrastructure & Outreach (Jan. 13, 2010)

- \$1.4M for expanding fueling infrastructure for ethanol blends
- 6 projects in 8 states
- Collectively, 35 E85 pumps and 16 blender pumps

Funded by
Recovery Act



Algal and Advanced Biofuels (Jan. 13, 2010)

- \$78M for 2 consortia
 - \$44M for algal biofuels
 - \$33.8M for infrastructure compatible, biomass-based hydrocarbon fuels
- \$19M in private/non-Federal cost share

Funded by
Recovery Act





Technologies

Feedstocks

Processing & Conversion

Integrated Biorefineries

- Development
- Related Links

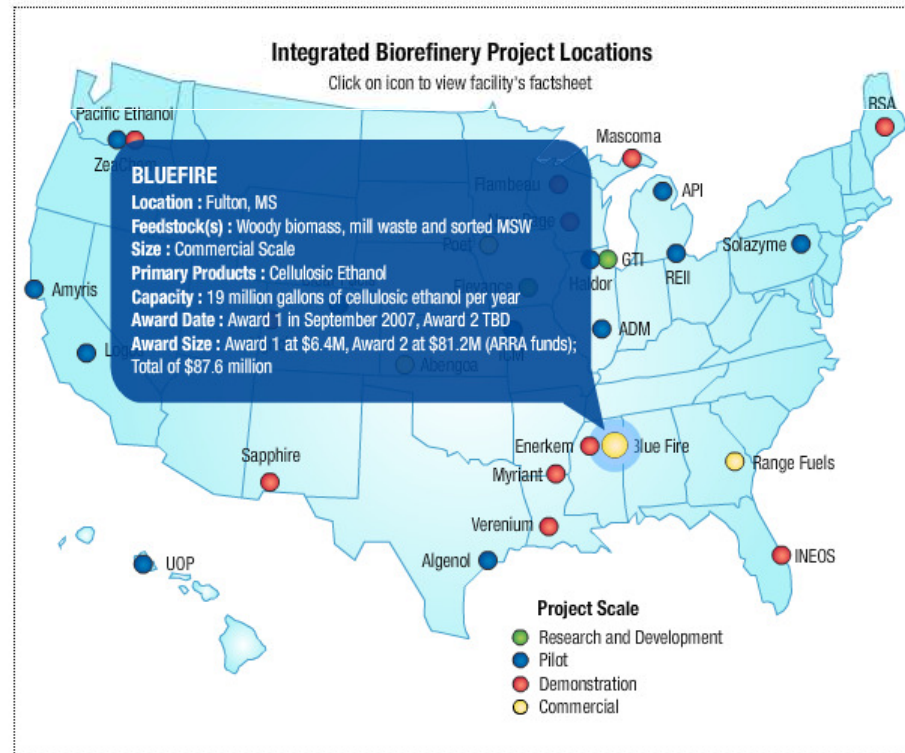
Infrastructure

Quick Links

- Biomass FAQs
- Program Overview
- Program Research
- Financial Opportunities
- Publications
- Contact Us

Integrated Biorefineries

Biorefineries are similar to petroleum refineries in concept; however, biorefineries use biological matter (as opposed to petroleum or other fossil sources) to produce fuels, chemicals, and heat and power.



[\(Text-only version\)](#)

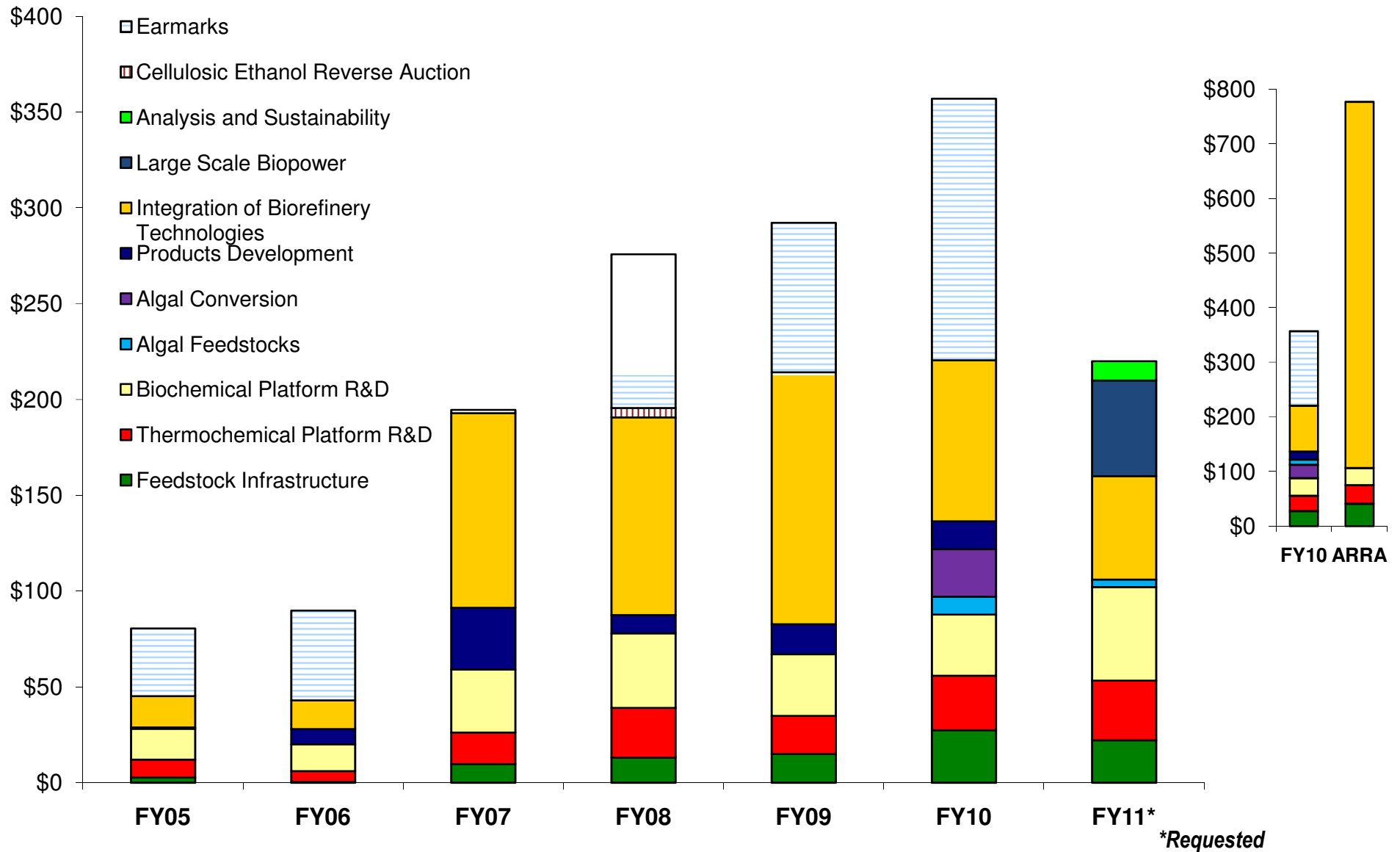
Potential Funding Opportunity



- OBP is considering the release of a Funding Opportunity Announcement (FOA) on Sustainable Feedstock Production in FY10
 - Watershed-scale trials
 - Landscape design
 - Optimization of environmental, economic, and social sustainability and productivity
 - Considering agricultural residues, perennial and annual herbaceous energy crops, woody energy crops, sorted MSW



Biomass Program Budget



Other DOE Announcements



Jan 21, 2010: Secretary Chu Announces \$20.5M for
Community Renewable Energy Deployment Projects

<http://www.energy.gov/news/8536.htm>

- **City of Montpelier (Montpelier, VT)**
 - Installation of a 41 MMBtu combined heat and power district energy system
 - Fueled with locally-sourced renewable and sustainably-harvested wood chips
- **Forest County Potawatomi Tribe (Forest County, WI)**
 - Provide heating, cooling and electricity for the Tribe's governmental buildings, displacing natural gas and propane
 - Includes a 1.25 MW biomass combined heat and power facility that will provide heating, cooling and electricity
 - Includes a biogas digester and 150 kW generation facility
- **University of California at Davis (Davis, CA)**
 - Waste-to-Renewable Energy (WTRE) system
 - Generation of power from a renewable biogas fed fuel cell

Other DOE Announcements



Jan 27, 2010: Microbes Produce Fuels Directly from Biomass

<http://newscenter.lbl.gov/news-releases/2010/01/27/microbes-produce-biofuels/>

- Collaboration led by researchers with the U.S. Department of Energy's Joint BioEnergy Institute (JBEI)
- Development of a microbe that can produce an advanced biofuel directly from biomass
- JBEI researchers engineered a strain of *Escherichia coli* (*E. coli*) bacteria to produce biodiesel fuel and other important chemicals derived from fatty acids

Recommendation Topic Areas



- Feedstocks
 - USDA, DOE, EPA, and other Federal agencies participate in Feedstock Production and Feedstock Logistics IWGs.
 - USDA ARS, NRCS, and NIFA have active research for various feedstocks to reduce the water, nutrient, and management requirements (such as tillage, weed control, etc.) in the production of cellulosic feedstocks as well as some starch and oil crops.
 - Between FY07 -10, DOE funding has increased in the feedstock area. Feedstock production efforts take place within the Regional Feedstock Partnership with Sun Grant universities, Land Grant universities, and USDA ARS. Feedstock logistics efforts have expanded to include 5 industrial scale projects, as well as development of a Deployable Process Demonstration Unit.

Recommendation Topic Areas



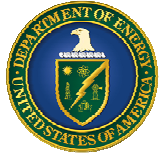
- Conversion
 - DOE OBP Thermochemical R&D funding has increased over the last 2 years. Additionally, multiple projects selected under various Integrated Biorefinery solicitations are using thermochemical technologies.
 - DOE OBP funded a syngas to fuels/syngas clean up solicitation in 2007.
 - DOE OBP publishes annual SOT reports that are used to evaluate (and sometimes change) annual conversion cost targets.

Recommendation Topic Areas



- Bioproducts
 - DOE & USDA have provided funds that support R&D on co-product development in biorefineries that could be used manufacture chemicals and other value-added products.
 - USDA runs the BioPreferred Program that aims to increase the purchase and use of biobased products within the Federal Government.
 - In Dec. 2009, DOE hosted a workshop to develop a report that will inform strategic planning in the area of biobased products.
 - DOE selected one ARRA-funded IBR project in the bioproducts area (Myriant Technologies).

Recommendation Topic Areas



- Sustainability/LCA
 - EISA requires new biofuel production facilities to achieve a 20% reduction in GHG emissions, based on a 2005 baseline that DOE, USDA, and EPA will work together to establish.
 - USDA, DOE, EPA, and other agencies have participated on Sustainability and Environment, Health, and Safety IWGs.
 - Several agencies participate in multiple domestic and international groups who are working to develop environmental sustainability indicators and criteria for biomass feedstock production.
 - DOE funds ANL to conduct LCA via the GREET model, as well as work with Purdue University on GTAP (Global Trade & Ag Project).
 - In FY11, DOE OBP established a new funding area to specifically address R&D related to analysis and sustainability.

Recommendation Topic Areas



- Infrastructure/Advanced Fuels
 - DOE provided \$1.6M in ARRA funding for 8 projects addressing E85 and blender pumps.
 - DOE's current ethanol blends test program is focused on assessing the impacts of E15 and E20 on vehicles and small engines, as well as infrastructure for materials compatibility.
 - DOE provided \$78M in ARRA funds for algal and advanced hydrocarbon biofuels development.
 - DOE FY10 appropriations included \$35M for algae. DOE requested \$3.9M in FY11 for algae R&D.
 - Three IBR ARRA-funded projects include algae: Sapphire, Algenol, and Solazymes.

Back-Up Slides



Commercial-Scale Biorefineries

Fuel Product: Ethanol



Performer	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Capacity**	Status
Abengoa	Hugoton, KS	\$100M	Corn Cobs	Biochemical Process	15M gals Ethanol/yr and 75 MW Power	Phase 1 Award for engineering design and environmental permitting NEPA EIS process initiated.
Poet	Emmetsburg, IA	\$100M	Corn Cobs	Biochemical Process	25M gals of Lignocellulosic Ethanol/yr	Phase 2 TIA Award issued, engineering and construction in progress.
BlueFire Ethanol, Inc.	Fulton, MS	\$87.6M	Wood Waste and Sorted MSW	Biochemical-Concentrated Acid Hydrolysis	19M gals Ethanol/yr	Phase 1 Award for engineering design and environmental permitting.
Range Fuels, Inc.	Soperton, GA	\$76.2M	Wood Waste	Gasification + Mixed Alcohol Synthesis	20M gals/ Ethanol yr and Mixed Alcohols	Phase 2 TIA Award issued, engineering and construction in progress.

*Award amounts still under negotiation.

**Fuel capacities are based on performers estimates.

Demonstration-Scale Biorefineries

Fuel Product: Ethanol



Performer	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Capacity**	Status
RSA	Old Town, ME	\$33.9M	Hemicellulose from Wood	Biochemical-Pentose Extraction	1.5MM gals/year of Ethanol and 2.2MM gals/yr of Butanol	Phase 1 Award for engineering design and environmental permitting under negotiation.
Lignol Innovations	Grand Junction, CO	\$30M	Woody Biomass	Biochemical-Organisolve	2.5M gals Ethanol/yr	Phase 1 Award for engineering design and environmental permitting.
Verenium Biofuels Corporation	Jennings, LA	\$14.9M	Sugar Cane Bagasse, Energy Cane, Sorghum	Biochemical-Enzymatic Hydrolysis	1.4M gals of Cellulosic Ethanol/yr	Phase 1 Award for engineering design and environmental permitting.
Pacific Ethanol	Boardman, OR	\$30M	Wheat Straw, Stover, Poplar Residuals	Biochemical-Biogasol	2.7M gals Ethanol/yr	Phase 1 Award for engineering design and environmental permitting.
Mascoma Corporation	Kinross, MI	\$32M	Woody Biomass	Biochemical Process	24M gals of Denatured Ethanol/yr	Phase 1 Award for engineering design and environmental permitting.
Enerkem Corporation	Pontotoc, MS	\$50M	Waste Processing from Woody Biomass and Biomass	Thermochemical + Gasification		Phase 1 Award for engineering design and environmental permitting.

*Award amounts still under negotiation.

**Fuel capacities are based on performers estimates.

Pilot-Scale Biorefineries

Fuel Product: Ethanol



Performer	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Capacity**	Status
American Process Inc.	Alpena, MI	\$17.9M	Woody Biomass and Wood Waste	Biochemical Process	890,000 gals Ethanol/yr and 690,000 gals Potassium Acetate/year	Phase 1 award.
Zechem, Inc.	Boardman, OR	\$25M	Woody Biomass	Biochemical + Gasification		Phase 1 award.
ICM, Inc.	St. Joseph, MO	\$25M	Corn Fiber, Switchgrass, and Energy Sorghum	Biochemical Process + Enzymatic Hydrolysis	345,000 gals Ethanol/yr Fuel or Product	Phase 1 award.
Archer Daniels Midland	Decatur, IL	\$24.8M	Corn Stover and Agricultural Residues	Enzymatic Hydrolysis + Catalytic Conversion	300M gals Ethanol/yr and 250M lbs of Ethyl Acrylate/yr	Phase 1 award.
Logos Technologies	Visalia, CA	\$20.4	Corn Stover, Switchgrass, and Woodchips	Biochemical Process + Enzymatic Hydrolysis	50,000 gals Ethanol/yr	Phase 1 award.
Algenol Biofuels, Inc.	Freeport, TX	\$25M	Co ₂ , Algae and Seawater	Closed Bioreactor	>100,000 gals Ethanol/year	Phase 1 award

*Award amounts still under negotiation.

**Fuel capacities are based on performers estimates.

Pilot, Demonstration and Commercial -Scale Biorefineries

Fuel Product: Diesel Replacement



Performer	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Capacity**	Status
Flambeau River Biofuels LLC	Park Falls, WI	up to \$80M	Forest Residues and Wood Waste	Thermochemical to Fischer-Tropsch	6M gals FT Liquids/yr and 50M lbs of FT Wax	Commercial Phase 1 Award for engineering design and environmental permitting.
NewPage	Wisconsin Rapids, WI	Up to \$50M	Woody Biomass	Thermochemical to Fischer-Tropsch	5.5M gals FT Liquids/yr	Demonstration Phase 1 Award for engineering design and environmental permitting.
INEOS New Planet BioEnergy, LLC	Vero Beach, FL	\$50M	Agricultural Residues	Biochemical-Thermochemical Process	8M gals Ethanol/yr and 2 MW Power	Demonstration Phase 1 Award for engineering design and environmental permitting.
Sapphire Energy, Inc.	Columbus, NM	\$50M	CO ₂ and Algae	Dynamic Fuels, LLC refining process	1M gals/year of Jet Fuel and Diesel	Demonstration Phase 1 Award for engineering design and environmental permitting.
Amyris Biotechnologies, Inc.	Emeryville, CA	\$25M	Sweet Sorghum	Biochemical Process		Pilot Phase 1 Award for engineering design and environmental permitting.
REII	Toledo, OH	\$19.9	Agricultural and Forest Residues	Thermochemical and Catalytic Conversion	Synthetic Diesel Fuel	Pilot Phase 1 Award for engineering design and environmental permitting.

*Award amounts still under negotiation.

**Fuel capacities are based on performers estimates

Pilot-Scale Biorefineries

Fuel Product: Gasoline, Jet, Diesel



Performer	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Capacity**	Status
Haldor Topsoe, Inc.	Des Plaines, IL	\$25M	Wood Waste	Thermochemical Process	345,000 gals/year (approximate) Product: Green Gasoline	Phase 1 Award for engineering design and environmental permitting.
Clearfuels Technology, Inc.	Commerce City, CO	\$23M	Wood Waste and Bagasse	High Efficiency Hydrothermal Reformer technology + Fischer-Tropsch Synthetic Gas-to-Liquids technology	420 gals/day of Renewable Diesel and Jet Fuel	Phase 1 Award for engineering design and environmental permitting.
Solazyme, Inc.	Riverside, PA	\$21.7	Sugar Fed Algae, Sucrose (from cane), Municipal Green Waste, Switchgrass	Biochemical Conversion Process	300K gals/yr of Purified Algal Oil Product: Biodiesel and Renewable Diesel	Phase 1 Award for engineering design and environmental permitting.
UOP, LLC	Kapolei, HI	\$25M	Agricultural Residues and Wastes, Woody Biomass	Integrated Pyrolysis + Hydro-conversion	4 barrels/day Product: Green Gasoline, Diesel and Jet Fuel	Phase 1 Award for engineering design and environmental permitting.

*Award amounts still under negotiation.

**Fuel capacities are based on performers estimates.

Demonstration-Scale Biorefineries

Fuel Product: Succinic Acid



Performers	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Amount	Status
Myriant Technologies, Inc. [^]	Lake Providence, LA	\$50M	Sorghum and Lignocellulosic	Biochemical-Integrated Biocatalytic Processes	30M lb/year of Succinic Acid and Ammonium Sulfate Fertilizer	Phase 1 Award for engineering design and environmental permitting.

*Award amounts still under negotiation.

**Fuel capacities are based on performers estimates.

[^] Formerly BioEnergy International, LLC.