



U.S. Department of Energy
**Energy Efficiency
and Renewable Energy**

Bringing you a prosperous future where energy
is clean, abundant, reliable, and affordable

ARRA Selection Briefing

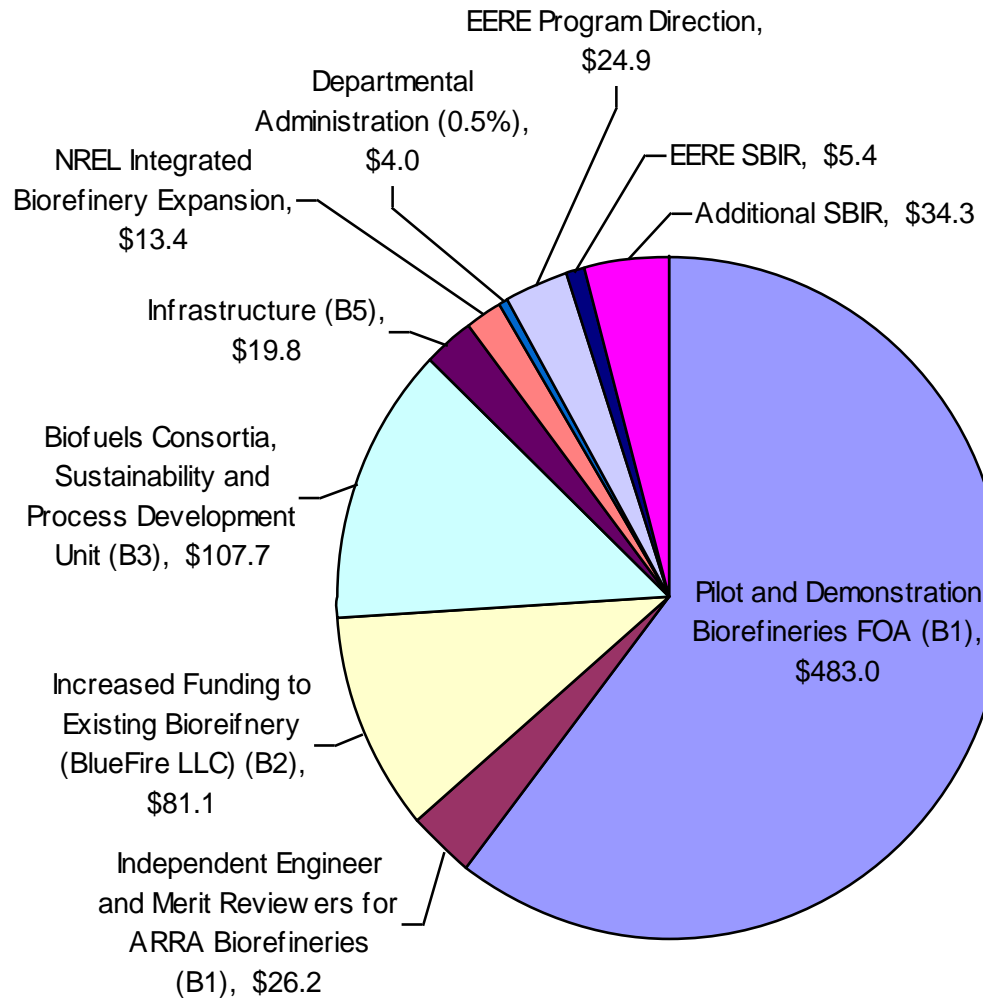
Demonstration of Integrated Biorefinery Operations DE-FOA-0000096

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Department of Energy



ARRA Funds in Millions of Dollars





Objective and Use of the ARRA Funding

- Issued a Funding Opportunity Announcement (FOA) focused on the design, construction, and operation of integrated biorefineries at the pilot (minimum 1 dry tonne per day) or demonstration scale (minimum 50 dry tonnes per day).
 - Six Topic Areas to promote flexibility on allowable feedstock, scale, and primary output.
 - Secretarial cost share waiver could be requested, if justified.
 - Number of awards: 18 recommended for \$483.0M
- Increase federal funding on integrated biorefinery projects that were selected & awarded within the last two years.
 - BlueFire construction phase to be awarded with \$81.1M
 - Enables additional appropriated funds for another 11 projects

Background

- Supports existing integrated biorefinery deployment efforts and authorizing legislation
 - Solicitations for commercial and demonstration scale biorefineries, Energy Policy Act of 2005, Section 932
 - Energy Independence and Security Act of 2007, Section 207
 - American Reinvestment and Recovery Act of 2009, Title IV

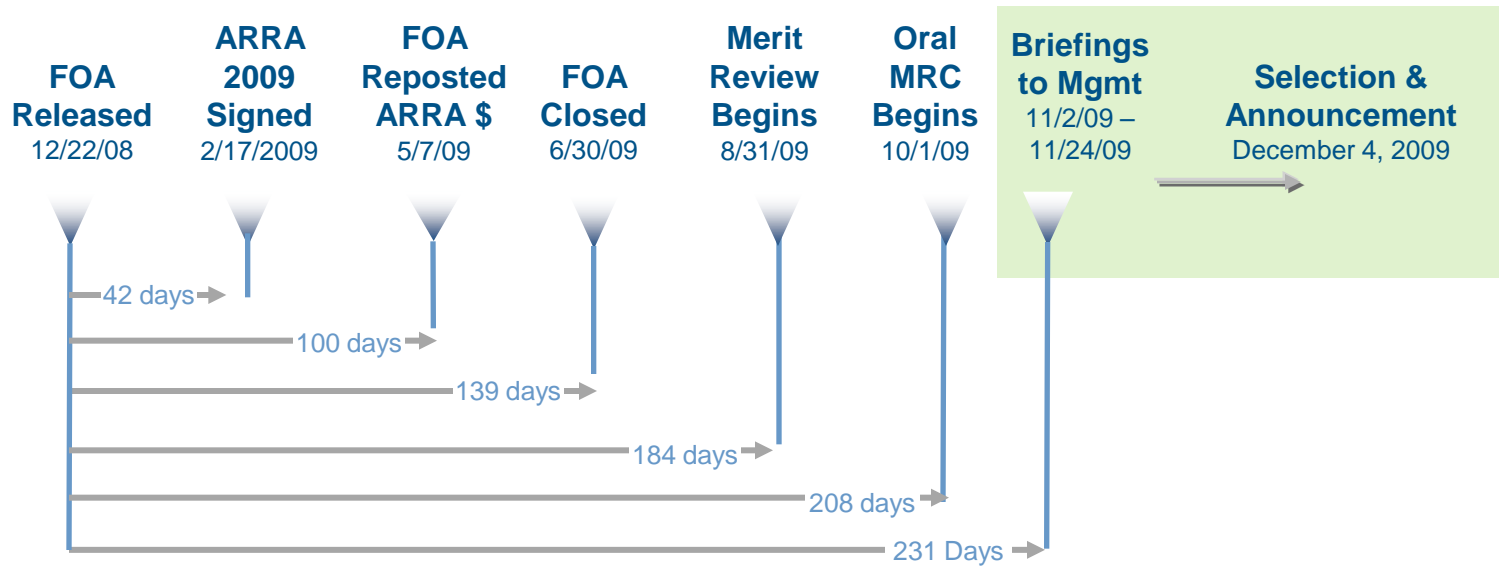


Topic Area	Minimum Scale (Feedstock Input)	Feedstock (Legislative Authority)	Product	GHG reduction	Award Ceiling	Cost Share %*
1	1 ton per day integrated pilot	Algae, lignocellulosic (LC) biomass (EPAAct 2005, Section 932)	Biofuel	50% algae 60% LC	\$25M	20%
2	1 ton per day integrated pilot	Algae, lignocellulosic biomass (EPAAct 2005, Section 932)	Bioproduct	n/a	\$25M	20%
3	50 ton per day integrated demonstration	Algae, lignocellulosic (LC) biomass (EPAAct 2005, Section 932)	Biofuel	50% algae 60% LC	\$50M	50%
4	50 ton per day integrated demonstration	Algae, lignocellulosic biomass (EPAAct 2005, Section 932)	Bioproduct	n/a	\$50M	50%
5	1 ton per day integrated pilot	Any renewable biomass except corn starch (EISA 2007, Section 207)	Biofuel	80%	\$25M	20%
6	50 ton per day integrated demonstration	Any renewable biomass except corn starch (EISA 2007, Section 207)	Biofuel	80%	\$50M	50%

* Secretarial cost share waiver could be requested. A justification was required.



Demonstration of Integrated Biorefinery Operations



- Released December 2009 for up to \$200M from annual appropriations with 2 topic areas.
- Canceled and released May 2009 for up to \$480M from ARRA with 6 topic areas.

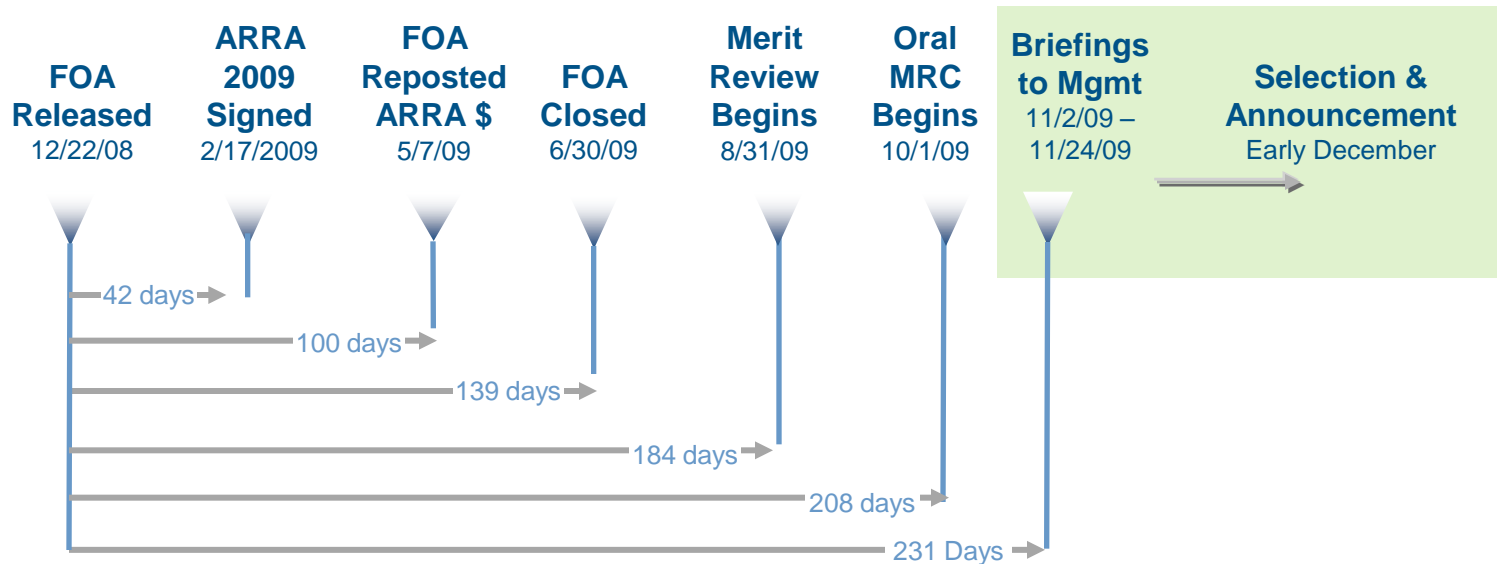


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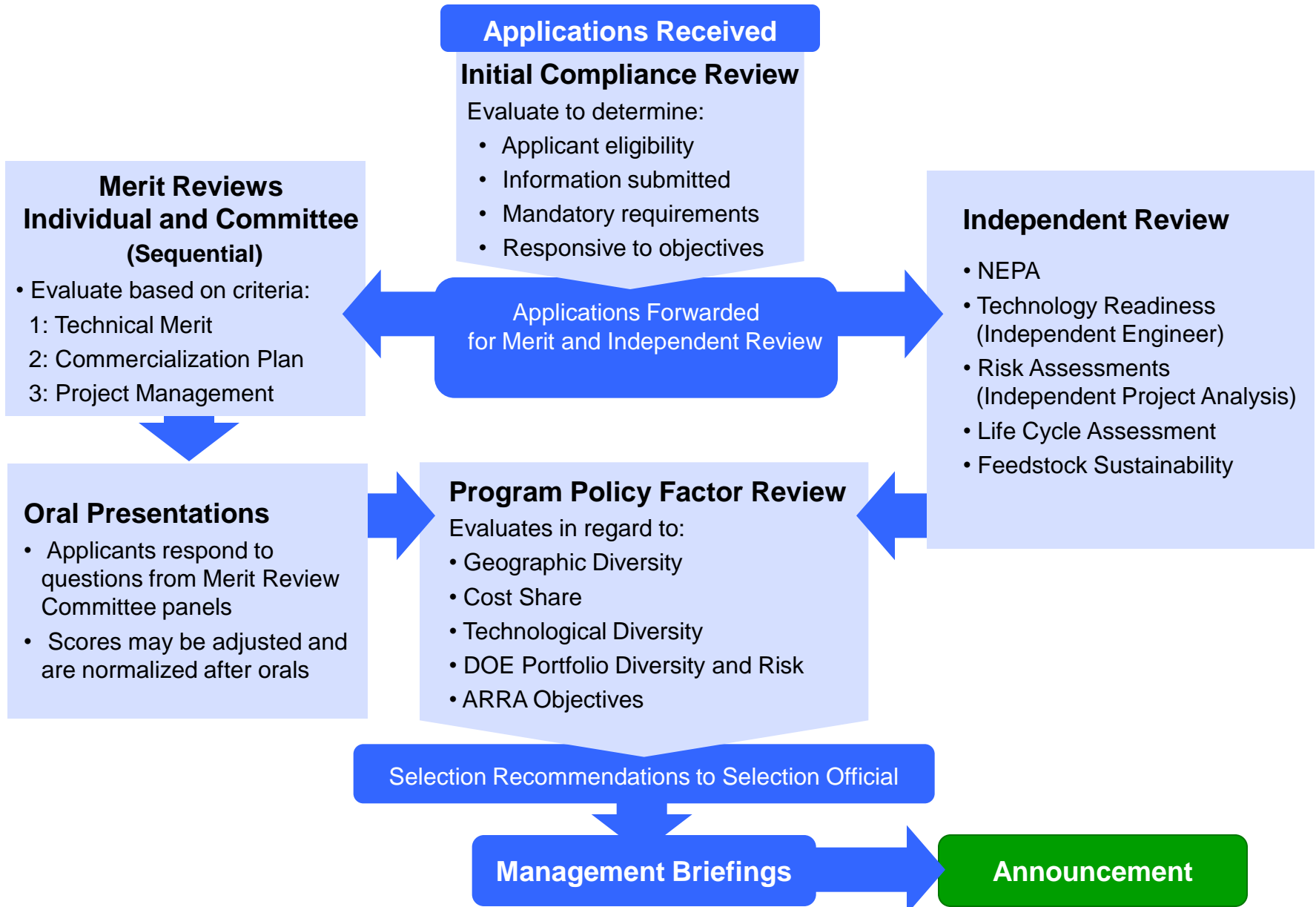
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Demonstration of Integrated Biorefinery Operations



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Topic Area	Selected for Award Negotiations	DOE Funding (\$M)	Total Project (\$M)
1: Pilot-Algae/LC-Fuel	11*	\$234	\$384
2: Pilot-Algae/LC-Prod	1*	\$2	\$3
3: Demo-Algae/LC-Fuel	3	\$150	\$376
4: Demo-Algae/LC-Prod	1	\$50	\$140
5: Pilot-Sugar-Fuel	2	\$47	\$61
6: Demo-Sugar-Fuel	0	\$0	\$0
Total:	18	\$483	\$963

*** 2 projects selected for R&D and preliminary engineering design phase only.**



Grantee	DOE Grant Amount	Non-Fed Amount	Project Location (City)	Project Location (State)	Description
Pilot Scale					
Algenol Biofuels Inc.	\$25,000,000	\$33,915,478	Freeport	TX	This project will make ethanol directly from carbon dioxide and seawater using algae. The facility will have the capacity to produce 100,000 gallons of fuel-grade ethanol per year.
American Process Inc.	\$17,944,902	\$10,148,508	Alpena	MI	This project will produce fuel and potassium acetate, a compound with many industrial applications, using processed wood generated by Decorative Panels International, an existing hardboard manufacturing facility in Alpena. The pilot plant will have the capacity to produce up to 890,000 gallons of ethanol and 690,000 gallons of potassium acetate per year starting in 2011.
Amyris Biotechnologies, Inc.	\$25,000,000	\$10,489,763	Emeryville	CA	This project will produce a diesel substitute through the fermentation of sweet sorghum. The pilot plant will also have the capacity to co-produce lubricants, polymers, and other petro-chemical substitutes.



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Archer Daniels Midland	\$24,834,592	\$10,946,609	Decatur	IL	This project will use acid to break down biomass which can be converted to liquid fuels or energy. The ADM facility will produce ethanol and ethyl acrylate, a compound used to make a variety of materials, and will also recover minerals and salts from the biomass that can then be returned to the soil.
Clearfuels Technology Inc	\$23,000,000	\$13,433,926	Commerce City	CO	This project will produce renewable diesel and jet fuel from woody biomass by integrating ClearFuels' and Rentech's conversion technologies. The facility will also evaluate the conversion of bagasse and biomass mixtures to fuels.
Elevance Renewable Sciences	\$2,500,000	\$625,000	Newton	IA	This project was selected to complete preliminary engineering design for a future facility that could produce jet fuel, renewable diesel substitutes, and high-value chemicals from plant oils and poultry fat.
Gas Technology Institute	\$2,500,000	\$625,000	Des Plaines	IL	This project was selected to complete preliminary engineering design for a novel process to produce green gasoline and diesel from woody biomass, agricultural residues, and algae.
HALDOR TOPSOE, INC.	\$25,000,000	\$9,701,468	Des Plaines	IL	This project will convert wood to green gasoline by fully integrating and optimizing a multi-step gasification process. The pilot plant will have the capacity to process 21 metric tons of feedstock per day.



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ICM, Inc.	\$25,000,000	\$6,268,136	St. Joseph	MO	This project will modify an existing corn-ethanol facility to produce cellulosic ethanol from switchgrass and energy sorghum using biochemical conversion processes.
Logos Technologies	\$20,445,849	\$5,113,962	Visalia	CA	This project will convert switchgrass and woody biomass into ethanol using a biochemical conversion processes.
Renewable Energy Institute International	\$19,980,930	\$5,116,072	Toledo	OH	This project will produce high-quality green diesel from agriculture and forest residues using advanced pyrolysis and steam reforming. The pilot plant will have the capacity to process 25 dry tons of feedstock per day.
Solazyme, Inc.	\$21,765,738	\$3,857,111	Riverside	PA	This project will validate the projected economics of a commercial scale biorefinery producing multiple advanced biofuels. This project will produce algae oil that can be converted to oil-based fuels.
UOP LLC	\$25,000,000	\$6,685,340	Kapolei	HI	This project will integrate existing technology from Ensyn and UOP to produce infrastructure compatible gasoline, diesel, and jet fuel from agricultural residue, woody biomass, dedicated energy crops, and algae.
ZeaChem Inc.	\$25,000,000	\$48,400,000	Boardman	OR	This project will use purpose-grown hybrid poplar trees to produce fuel-grade ethanol using hybrid cellulosic ethanol technology. Additional feedstocks such as agricultural residues and energy crops will also be evaluated in the pilot plant.



Grantee	DOE Grant Amount	Non-Fed Amount	Project Location (City)	Project Location (State)	Description
Demonstration Scale					
BioEnergy International, LLC	\$50,000,000	\$89,589,188	Lake Providence	LA	This project will biologically produce succinic acid from grain sorghum. The process being developed displaces petroleum based feedstocks and uses less energy per ton of succinic acid produced than its petroleum counterpart.
Enerkem Corporation	\$50,000,000	\$90,470,217	Pontotoc	MS	This project will be sited at an existing landfill and use feedstocks such as woody biomass and biomass removed from municipal solid waste to produce ethanol and other green chemicals through gasification and catalytic processes.
INEOS New Planet BioEnergy, LLC	\$50,000,000	\$50,000,000	Vero Beach	FL	This project will produce ethanol and electricity from wood and vegetative residues and construction and demolition materials. The facility will combine biomass gasification and fermentation, and will have the capacity to produce 8 million gallons of ethanol and 2 megawatts of electricity per year by the end of 2011.
Sapphire Energy, Inc	\$50,000,000	\$85,064,206	Columbus	NM	This project will cultivate algae in ponds that will ultimately be converted into green fuels, such as jet fuel and diesel, using the Dynamic Fuels refining process.



Performers	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Amount**	Status
Bluefire	Fulton, MS	\$87.6M	Sorted MSW Woody Biomass	Biochemical- Concentrated Acid Hydrolysis	19M gals ethanol/yr	Bluefire relocated its site from CA to MS. An EA has commenced for NEPA to be completed by March 2010.
Poet	Emmetsburg, IA	\$100M	Corn Cob	Biochemical	25M gals ethanol/yr	POET recently held a “field day” to highlight its feedstock commercialization effort with farmers and equipment manufacturers.
Range Fuels	Soperton, GA	\$76.2M	Woody Biomass	Gasification + Mixed Alcohol synthesis	21M gals per yr split 50/50 with ethanol and methanol	Initiated construction Dec 2007, estimated commissioning first modular unit soon.
Abengoa	Hugoton, KS	\$100M	Agricultural Residues	Biochemical and Combustion	13-15 M gals ethanol/yr and 92 MW of green power (20 MW internal use and 72 MW to the regional grid)	Record of Decision on EIS expect Summer 2010.

*Award amounts still under negotiation, based on contingencies, and go/no go decisions

**Amounts by fuel are based on estimates. Co-gen of steam/heat and power and not included.

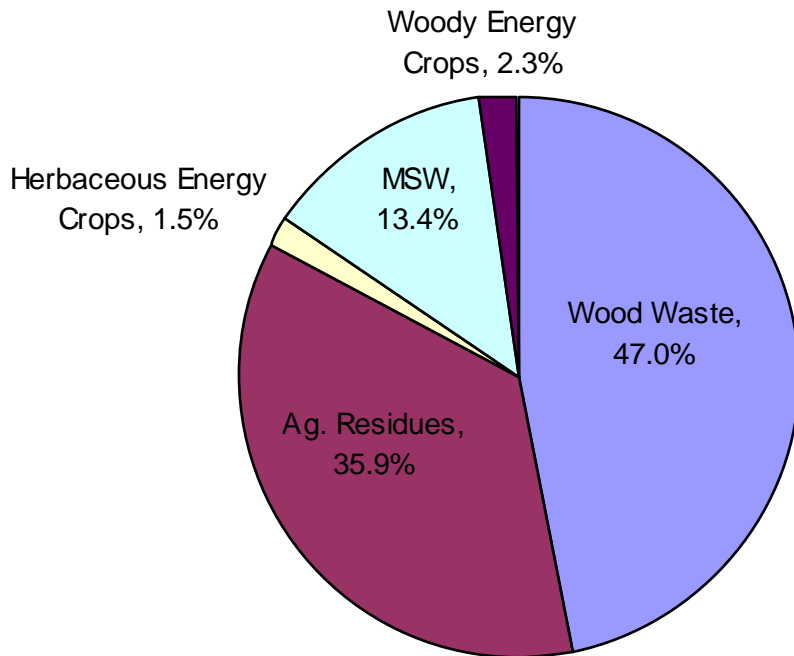


Demonstration-Scale Biorefineries Selected in FY2008

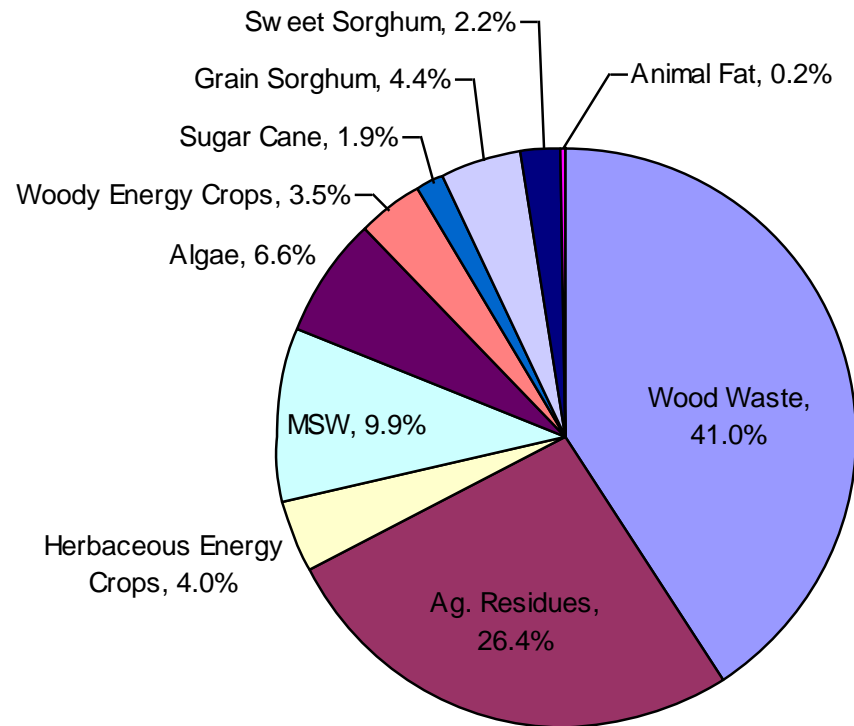
Performers	Location	DOE Award*	Feedstock Type	Conversion Technology	Fuel / Amount	Status
Lignol Innovations	Grand Junction, CO	\$30M	Woody Biomass	Biochemical-Organisolve	2.5M gals ethanol/yr	Suncor partner withdrew from project. Project currently seeking new partners/location.
Mascoma	Upper Peninsula, MI	\$32M	Woody Biomass	Biochemical – Consolidated Bioprocessing	20 M gals ethanol/yr & cogeneration of heat/power for internal use	Modifying and operating pilot plant..
NewPage	Wisconsin Rapids, WI	\$40M	Woody Biomass	Thermochemical-Fischer-Tropsch	5.5M gals FT Liquids/yr	Piloting underway, cost shared with Flambeau.
Pacific Ethanol	Boardman, OR	\$30M	Wheat Straw, Stover, Poplar Residuals	Biochemical-Biogasol	2.7M gals ethanol/yr	Parent company filed for reorganization, but the LLC continues to work on project planning.
RSA	Old Town, ME	\$33.9M	Hemicellulose from Wood	Biochemical-Pentose Extraction	2.2M gals of Ethanol or Butanol	Bankruptcy then acquired by Patriarch Partners. NREL conducting technology validation.
Verenium Biofuels Corp.	Jennings, LA	\$14.9M	Energy Cane and Sugar Cane Bagasse	Biochemical Process	1.5M gals ethanol/yr	Demonstration facility built. Feedstock and operational testing ongoing.
Flambeau River Biofuels LLC	Park Falls, WI	up to \$80M	Woody Biomass	Thermochem to Fischer-Tropsch	9M gals FT Liquids/yr and 50M lbs of FT wax	Piloting underway, cost shared with NewPage.



Feedstock Diversity Before Recovery Solicitation

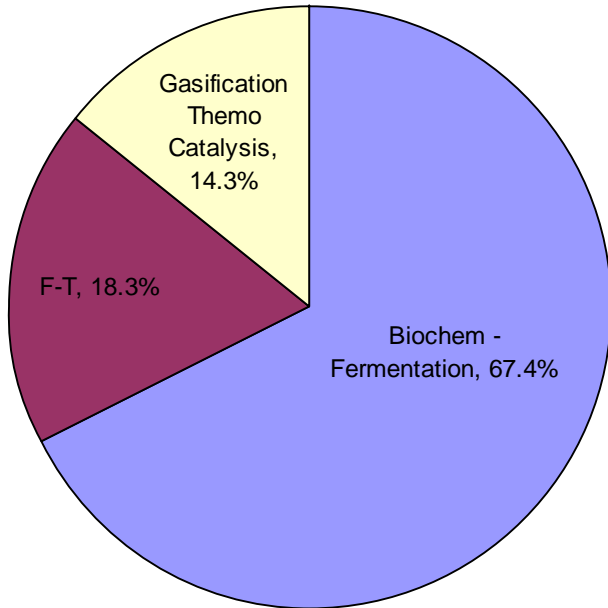


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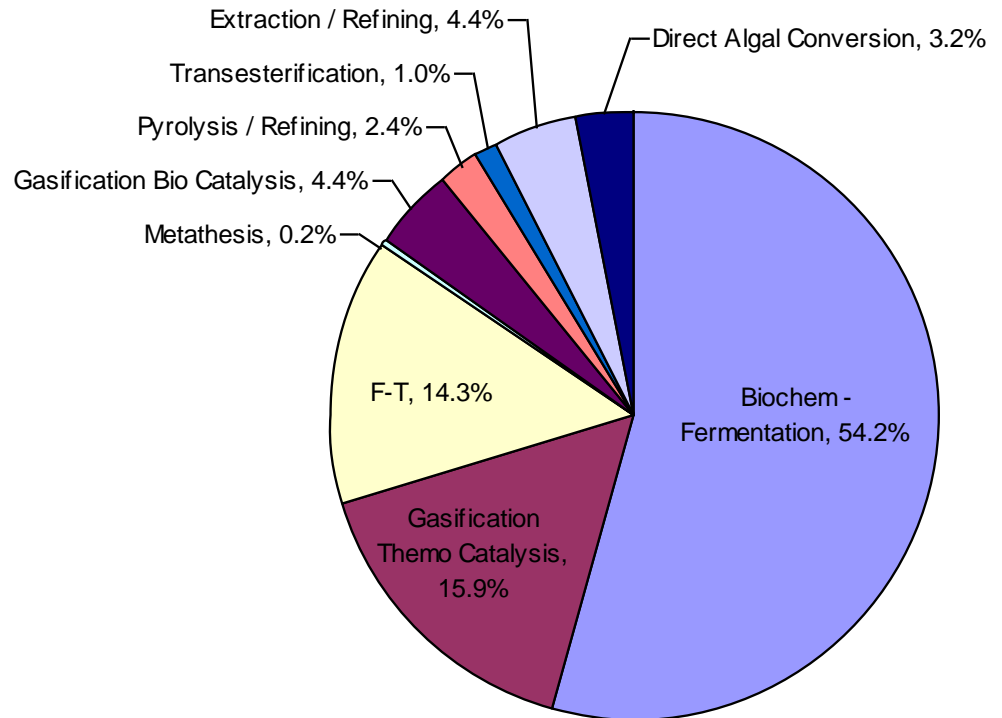




Conversion Technologies Before Recovery Solicitation

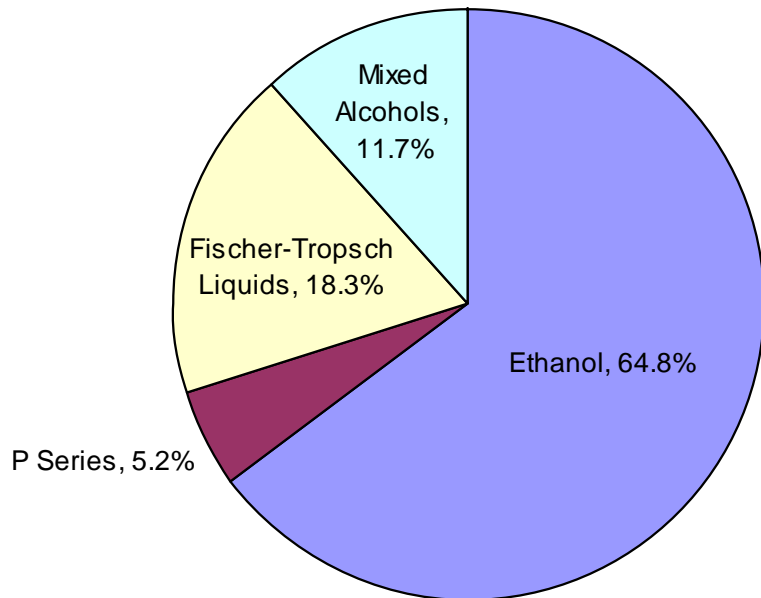


Conversion Technologies After Recovery Solicitation





Products Before Recovery Solicitation



Products After Recovery Solicitation

