

U.S. Department of Energy, Biomass Program

Presentation to Biomass R&D
Technical Advisory Committee

September 2008
Valri Lightner, Biomass Program

Biomass Program Mission



Develop and transform our renewable and abundant biomass resources into cost-competitive, high-performance biofuels, bioproducts, and biopower.

Focus on targeted research, development, and demonstration

- Support through public and private partnerships
- Deploy in integrated biorefineries



Successive Generations of Biofuels



Corn Ethanol

- Commercially available (no DOE research ongoing)
- Reduced GHG emissions
- Capacity constrained



Cellulosic Ethanol

- Focus of current DOE research
- Potential to lower GHG emissions 86%
- Uses biomass from waste and non-agricultural land



Advanced Cellulosic Biofuels

- DOE scoping studies in progress
- Could minimize environmental footprint
- Energy content and fuel economy similar to petroleum-based fuels

Biomass Program Goals



Short Term: Foster breakthrough technologies needed to make cellulosic ethanol cost-competitive by 2012 (cost target: \$1.33/gal).

Mid Term: Help create an environment conducive to maximizing the sustainable production of biofuels by 2017, including cost-effective technology, sufficient infrastructure, appropriate policies, and supportive consumers (cost target: \$1.20/gal).

Long Term: Increase the supply of renewable fuels to 36 billion gallons by 2022 -- especially contributing to the 21 billion gallons of cellulosic and advanced biofuels (per Renewable Fuels Standard in the Energy Independence and Security Act of 2007)



Solicitations Leverage R&D Partnerships to Achieve Goals



Ethanolgen R&D (up to \$23M)

- Five selected research teams working to develop highly efficient fermentative microorganisms

Enzyme R&D (up to \$33.8M)

- Four selected research teams working on inexpensive enzyme systems for commercial biomass hydrolysis

Thermochemical R&D (up to \$16.7M)

- Integration of gasification and catalyst development
- Pyrolysis oil stabilization

Joint DOE-USDA Solicitation (\$5.2M of \$18M funded by DOE)

- Biomass R&D Initiative: 20 awards announced March 2008



2008 Technology Award



Microchannel Synthetic Fuels Technology

Microchannel process technology applied to Fischer- Tropsch process can convert a range of materials, including biomass and stranded natural gas, into ultra-clean transportation fuels. Modular units improve economic feasibility.

- Greatly reduces size and cost of synthetic fuel facilities for second-generation biofuels
- Reduces installation costs and facilitates deployment
- Improves heat transfer



**Presented annually to the
100 most innovative
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**Awarded to Velocys in cooperation with
Pacific Northwest National Laboratory
and Battelle**

Biorefinery Demonstrations Expedite Commercialization



Commercial-Scale Biorefineries (up to \$272 M)

- Four cost-shared, integrated biorefinery demonstrations to produce 98 million gallons of cellulosic ethanol in 5 years with variety of conversion technologies and cellulosic feedstocks



10%-Scale Biorefinery Validation (up to \$240 M)

- Cost-shared, integrated biorefinery demonstrations using cellulosic feedstocks to produce renewable fuels at one-tenth of commercial scale
- Nine projects now in progress

Commercial-Scale Biorefinery Demonstrations



DOE investments in cellulosic biofuels will accelerate commercialization and help create a biofuels market based on non-food feedstocks.

Performers	Feedstock Type	Conversion Technology	Status of Project
Abengoa	Agricultural Residue	Biochemical	Phase 1-Cooperative Agreement signed Sept. 2007
Bluefire	MSW	Biochemical	Phase 1-Cooperative Agreement signed Sept. 2007.
Poet	Corn cobs Corn Fiber	Biochemical	Phase 1-Cooperative Agreement signed Sept. 2007.
Range Fuels	Woody Waste	Gasification + Mixed Alcohol synthesis	Phase 2-Technology Investment Agreement – Signed Nov. 2007 Ground Breaking Nov. 2007

* Eventually including energy cane

UPDATE: Alico and Iogen dropped.

Small-Scale (10% of Commercial Scale) Biorefinery Demonstrations



Performers	Feedstock Type	Conversion Technology
ICM Incorporated	Agricultural Residue	Integrated biochemical and thermochemical
Lignol Innovations	Wood Residue	Biochem-organosolv
Pacific Ethanol	Agricultural & Forest Residue	Biochemical
NewPage Corporation	Wood Waste	Thermochemical
Ecofin, LLC	Corncoobs	Biochemical (solid-state fermentation)
Mascoma	Switchgrass & hardwoods	Biochemical
RSE Pulp & Chemical	Wood chips (mixed hardwood)	Biochemical
Flambeau River	Wood Residue	Thermochemical
Verenium Biofuels	Bagasse, Agricultural & Wood Residue	Biochemical



NEW
NEW

Major DOE Biofuels Project Locations

Geographic, Feedstock, and Technology Diversity



Loan Guarantees



FY2007

- 143 pre-applications received
- Funds authorized February 2007
- 16 full applications requested
 - 6 for biomass
 - Others in fossil, industrial, solar, hydrogen, alternative fuel vehicles, electricity delivery, and reliability



FY2008

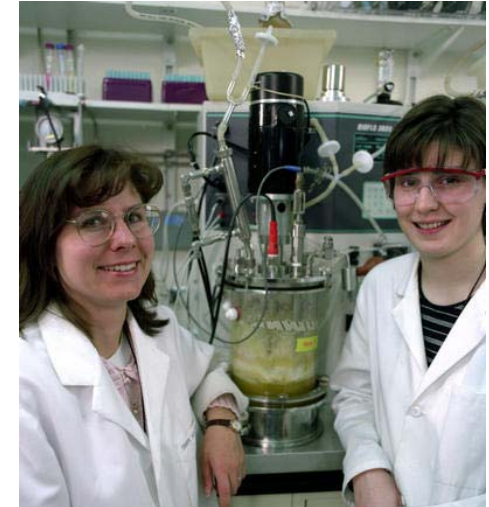
- Announced solicitation for \$30.5B on June 30, 2008
 - \$10B for renewable energy and electricity transmission
 - \$18.5B for nuclear power and \$2B for advanced nuclear fuel cycle
- Plan to issue solicitation for \$8B for fossil energy later in 2008

Upcoming & Pending Solicitations



In Progress

- Pyrolysis Solicitation for \$7M over 2 years (closed May 29); award pending
- University Solicitation for Conversion R&D for \$4M over 3 years (closed June 2); pending



FUTURE SOLICITATIONS

- R&D Lab Call
- Draft Funding Opportunity Announcement planned for September 2008 for public comment on future solicitation for *either* an Integrated Pilot-Scale or Demonstration-Scale Biorefinery
 - Soliciting input on project size (production volumes), biofuel type (ethanol, green gasoline, FT liquids, etc.), data requirements to justify scale
 - Anticipate the final FOA will be issued in October 2008
- Advanced Biofuels R&D (Winter), based on scoping study
- Annual USDA/DOE Joint Solicitation

USDA/DOE Joint Solicitation Planning



- The Food, Conservation, and Energy Act of 2008 (Farm Bill) Section 9008:
 - New technical areas for grants (with at least 15% of funding going to each area) include:
 - o Feedstocks Development
 - o Biofuels and Biobased Products Development
 - o Biofuels Development Analysis
- USDA has \$20M FY09 mandatory funds; DOE has plans for \$5M
- June 21 conference call with TAC: Gathered input on distribution of funds and evaluation criteria
- August 15 meeting: Results reported to Board
- Draft Funding Opportunity Announcement currently under review; release anticipated this Fall



Intermediate Blends Testing: An Alternative Approach to Market Penetration

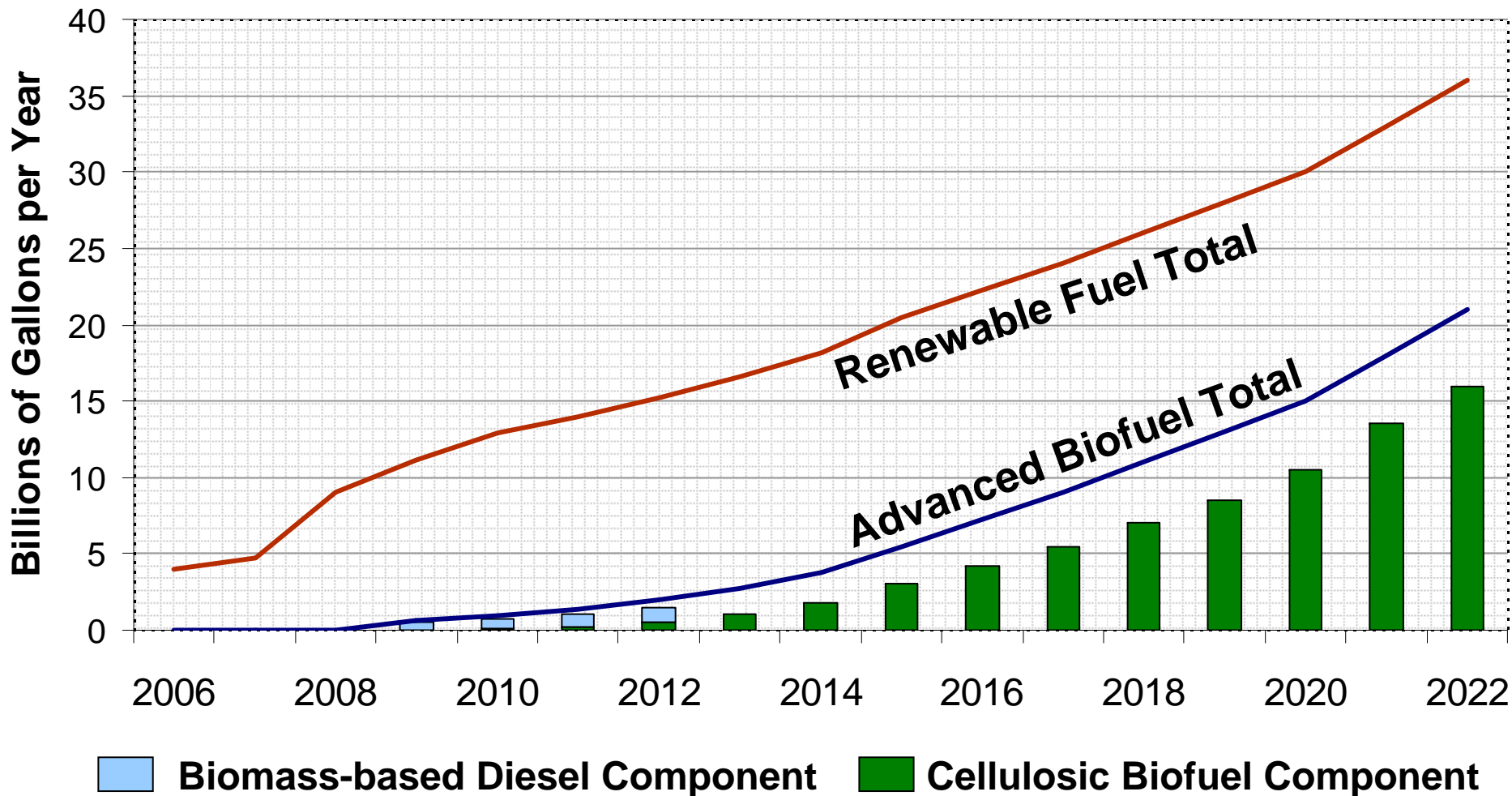


- E10 market will be saturated within a few years – once ethanol supply reaches 13-14 billion gallons.
- DOE and EPA working together to assess feasibility of intermediate blends to enable greater use of ethanol in fulfilling new RFS
- DOE studying intermediate ethanol blends (allocated \$2.1 million in FY07 and \$12.5 million in FY08).
- The DOE test program is evaluating --
 - Vehicle exhaust and evaporative emissions
 - Catalyst durability and aging
 - Cold-start operation and drivability
 - Fuel-system and catalyst materials compatibility
- DOE is also evaluating impacts of higher ethanol blends on small engines
 - Testing leaf blowers, line trimmers, pressure washers, and small generators
 - Expanded test plan for marine engines, all-terrain vehicles, and motorcycles in summer 2008 with input from industry.



Interim Report currently under technical review for fall release

Meeting Minimum Legislated RFS Targets



* EISA; Title II; Subtitle A; Section 202

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