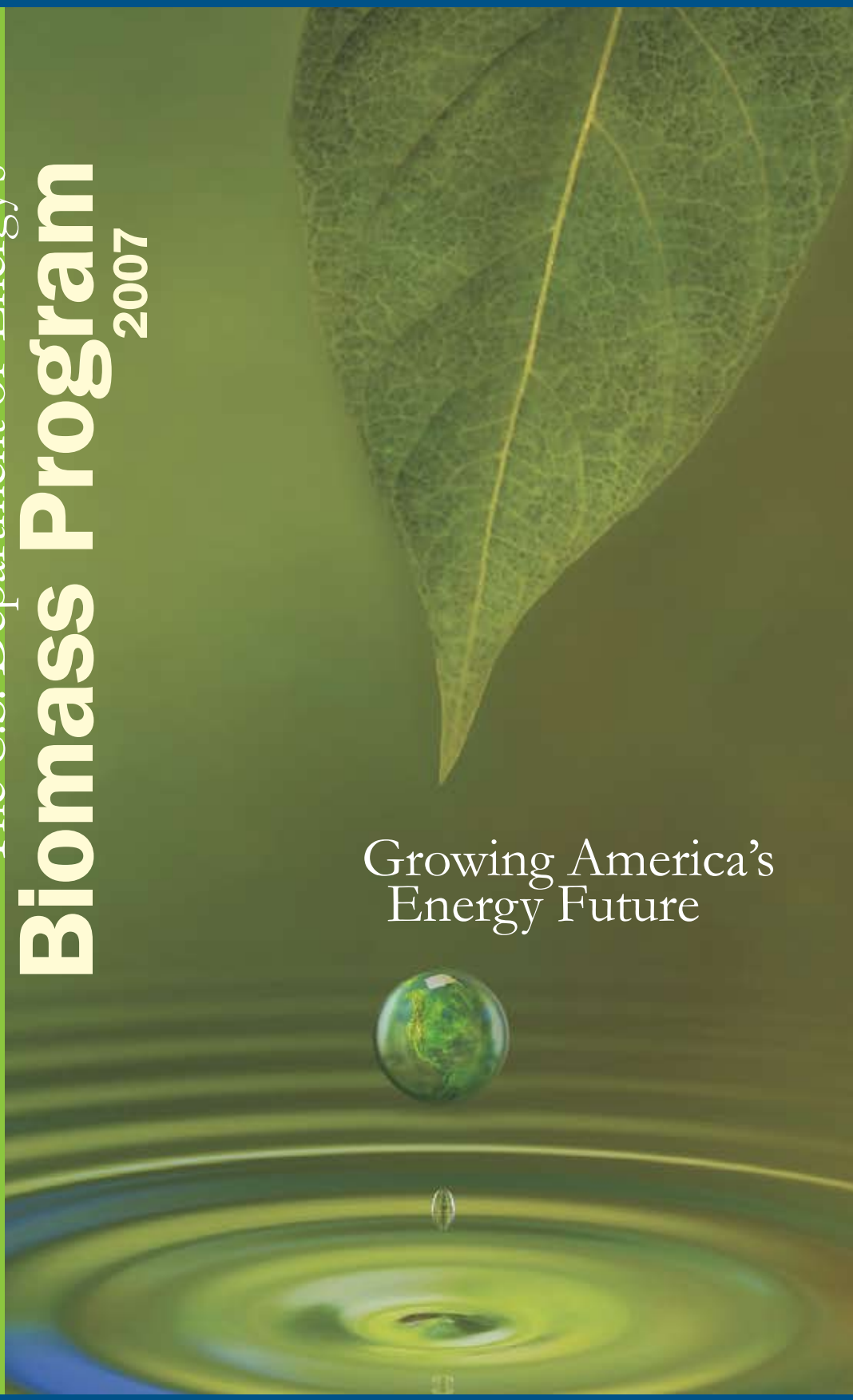
The U.S. Department of Energy's

Biomass Program

2007



Growing America's Energy Future

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) invests in a diverse portfolio of energy technologies to achieve a stronger economy, a cleaner environment, and greater energy independence for America.

The Biomass Program is an integral component of EERE's efforts to diversify our energy supply. The program works with industrial partners, national laboratories, and other stakeholders to develop the technologies and systems needed to cost-effectively turn abundant, domestic biomass resources into clean, affordable biofuels.

"Biofuels will not only give us more control over our own energy supplies, they will allow us to tap our nation's scientific and agricultural resources to create and supply new domestic markets for renewable fuels."

Samuel W. Bodman
Secretary of Energy

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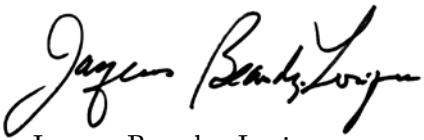
Our quality of life and robust economy require a secure, affordable, and sustainable energy supply. Biofuels made from abundant, renewable feedstocks can reduce U.S. dependence on oil, lower impacts on climate, and stimulate economic growth. Recognizing the potential for biofuels to address these issues, President Bush set a national goal in January 2007 to reduce U.S. gasoline use by 20 percent in the next 10 years via greater vehicle efficiency and use of alternative fuels. By the end of the year, Congress passed the *Energy Independence and Security Act of 2007*, which requires that renewable fuels collectively supply at least 36 billion gallons of U.S. motor fuel by 2022 and meet interim supply targets for specific advanced fuels.

These requirements call for unprecedented growth in our biofuels industry, which today produces about 6 billion gallons of ethanol annually. Success will depend on new systems and networks to efficiently produce, harvest, and transport large quantities of diverse feedstocks; advanced technologies to cost-effectively convert that biomass into fuels; and an expanded and improved distribution and end-use infrastructure to deliver these fuels to consumers across America.

The Biomass Program is actively working with public and private partners to meet these needs. With the corn ethanol market growing steadily, our researchers are unlocking the potential of *non-food* biomass sources, such as switchgrass and forest and agricultural residues. In this way, we are helping to ensure that cost-effective technologies will be ready to support production goals for advanced biofuels. At the same time, we are working with stakeholders to lay the foundation for widespread market uptake of biofuels and other biobased products.

Our efforts are accelerating the pace of technology development, stimulating the domestic biofuels industry, and bringing broad benefits to the nation. I invite you to learn more about this exciting program.



Jacques Beaudry-Losique
Biomass Program Manager
Energy Efficiency and Renewable Energy
U.S. Department of Energy

Biomass is the only clean, renewable energy source that can immediately help diversify U.S. liquid transportation fuels.

Program Goals

Research and develop technology to directly achieve the following:

By 2012, ethanol produced from cellulosic feedstocks is cost competitive.

Conduct research and development to enable the growing biofuels industry to achieve the following:

By 2015, U.S. transportation fuels contain at least 3 billion gallons of cellulosic biofuels.

By 2022, U.S. transportation fuels contain at least 16 billion gallons of cellulosic biofuels.

By 2030, biofuels displace at least 30 percent of U.S. gasoline use (2004 levels).

"Along with feeding the world, American farmers will be able to help power our transportation sector by growing the raw materials for biofuels."

Samuel W. Bodman
Secretary of Energy

Why Biofuels?

Biofuels offer a broad range of benefits to our nation, economy, and environment.

Secure, renewable vehicle fuels

Americans will enjoy a more secure and sustainable fuel supply that meets their driving needs while reducing U.S. dependence on oil.

Vibrant rural economies

Rural areas will receive a sustained economic boost as biorefineries create strong markets for diverse plant and agricultural materials.

Homegrown feedstocks

Biorefineries will increasingly use cellulosic biomass, such as stalks, wood chips, switchgrass, and other organic materials, to sustainably produce affordable, homegrown fuels—without affecting food crops.

Healthy, sustainable forests

Biorefineries using forest thinnings and wood wastes will enhance forest health while providing a boost to the forest products industry.

Reduced greenhouse gases

Biofuels made from cellulosic biomass can reduce greenhouse gas emissions by as much as 86 percent compared with conventional gasoline.

Who We Are

The Biomass Program supports research and diverse activities to accelerate progress in establishing a sustainable U.S. biofuels industry.

The Biomass Program sponsors cost-shared research, development, and demonstrations (RD&D) aimed at tapping the full potential of biomass as a sustainable energy resource. In partnership with industry and others, the program is developing advanced technologies and real-world solutions to dramatically reduce costs and spur the growth of a new bioindustry in America.

Significant expansion of biofuels production will require technological advances that address the bioindustry's top challenges: feedstock production, conversion of feedstocks to fuels, and distribution infrastructure. Through RD&D in these areas, we are developing technologies that will accelerate both the production and market uptake of biofuels and bioproducts.

Other fuels derived from cellulosic biomass, such as biobutanol, green gasoline, and renewable diesel, will likely be addressed in future program work. The production and use of these fuels are currently limited or still in the research and development (R&D) stage.

Our Vision

A viable, sustainable, U.S. biomass industry that produces renewable biofuels, bioproducts, and biopower; enhances U.S. energy security; reduces our dependence on oil; reduces greenhouse gas emissions; provides other environmental benefits; and creates economic opportunities across the nation.

Our Mission

Develop and transform our renewable and abundant biomass resources into cost-competitive, high-performance biofuels, bioproducts, and biopower. Achieve this through targeted research, development, and demonstration leading to technology deployment in integrated biorefineries—all with the support of public and private partnerships.

Today:

While corn ethanol is helping to reduce our nation's reliance on imported petroleum today, our future demand for biofuels will require use of diverse, non-food feedstocks that can be grown in abundance across the country.

Tomorrow:

Ethanol made from the cellulose in agricultural wastes, trees, grasses, and other sources makes sense for many reasons. Cellulosic ethanol offers more efficient energy conversion, lower greenhouse gas emissions, and reduced water use. For these reasons, the Biomass Program currently focuses the vast majority of its RD&D efforts on cellulosic ethanol.

What is cellulose?

Cellulose is the primary structural component of green plants and is not digestible by humans.

Sustainability

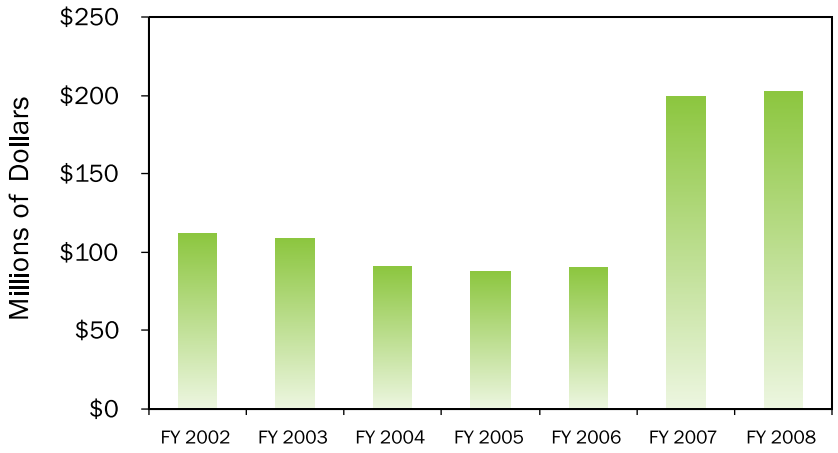
The Biomass Program is committed to developing the technologies, processes, and systems needed to sustainably convert a broad range of cellulosic feedstocks into clean, abundant biofuels. We aim to develop processes and products that reduce carbon emissions, protect human health and the environment, and add value throughout the biofuel life cycle—from biomass production to end use in vehicles. This commitment drives our efforts to accomplish the following objectives:

- Explore a range of non-food feedstocks.
- Improve understanding of regional factors tied to feedstock production (e.g., soil types, fertilizer requirements, climatic conditions, land use, and water issues).
- Develop technology to harvest biomass components efficiently while maintaining soil health.
- Foster forestry practices that enhance long-term forest vitality.
- Evaluate the economic, social, and environmental impacts of emerging technologies and infrastructure for the large-scale production and use of biofuels.

Strategic Approach

The keystone of our strategy is to work with industry and other stakeholders to identify and pursue priority RD&D pathways. In addition to cost-sharing projects with private-sector partners, we help position technologies for commercial success by conducting technology demonstrations that validate performance. Peer reviews led by industry experts ensure that the program's increased budget is invested wisely. In addition, we work actively with stakeholders to raise public awareness of the benefits of biofuels and foster their widespread use.

Biomass Program Budget for Fiscal Years 2002 to 2008



Biomass Research and Development Initiative (BRDI)

All federal biobased products and bioenergy R&D are coordinated under the Biomass Research and Development Initiative, a multi-agency effort mandated by the *Biomass R&D Act of 2000* and revised under the *Energy Policy Act of 2005* (Section 937). The following groups ensure effective planning and coordination:

- **Biomass R&D Board.** This cabinet-level council co-chaired by the U.S. Department of Energy (DOE) and the U.S. Department of Agriculture (USDA) coordinates federal activities to promote use of biobased fuels and products. Membership includes the Departments of the Interior, Transportation, Defense, Treasury, and Commerce; the Environmental Protection Agency; the National Science Foundation; the Office of Science & Technology Policy; and the Office of the Federal Environmental Executive. The group plans to complete a National Biofuels Action Plan by winter 2008.
- **Biomass R&D Technical Advisory Committee.** This group of 30 senior representatives from industry, academia, and state government provides guidance to the Biomass R&D Board on technical issues.

As one example of federal coordination under BRDI, DOE and USDA issue annual joint solicitations worth up to $18 million for R&D in biobased fuels and products.

Technology Pathways

We engage partners all along the biofuels supply chain to develop technologies that will efficiently and sustainably convert domestic biomass resources into clean, abundant transportation fuels.

Grow

The Biomass Program conducts extensive research on fast-growing trees and grasses in collaboration with the U.S. Department of Agriculture, which bears primary responsibility for research in this area. Objectives are to

- Increase biomass yield per acre
- Improve biomass characteristics

Agricultural Residues

A portion of the residues currently left in the field after harvest (stalks, leaves, straw, and husks) can be collected and used for biofuels.

Forest Resources

Biofuels-related thinning of overstocked and overstressed forests will reduce smoke and carbon emissions, protect wildlife habitat, improve tourism, contribute to local economies, and save state funds spent on forest fire suppression.

Energy Crops

Dedicated energy crops, including fast-growing trees and grasses, can be grown sustainably on land that will not support intensive food crops.

Industrial & Other Wastes

Food processing wastes, fats and greases, municipal solid wastes, and animal manure all hold potential as biomass feedstocks.

Harvest

The program is developing single-pass, multi-component, selective harvest equipment to gather much of the traditionally discarded plant biomass. This agricultural waste can be used to produce feed, fiber, energy, and value-added products, providing an additional revenue source to growers.

Store & Transport

The Biomass Program is evaluating the requirements and performance characteristics of bulk processing and storage systems. In addition, we are developing analytical tools for optimizing overall logistics of the infrastructure system.

Convert in Integrated Biorefineries

The Biomass Program supports RD&D of integrated biorefineries to sustainably convert a wide range of biomass feedstocks into biofuels, biopower, and bioproducts. Demonstration facilities are using both biochemical and thermochemical pathways for conversion.

Biochemical Conversion

Pretreatment

Cellulose is broken down via:

- Pre-hydrolysis
- Enzymatic hydrolysis

Sugars

Fermentation

Organisms are added to convert sugars to alcohols

Dilute Alcohol

Distillation

- Separations
- Dehydration

Lignin

Power Generation for Processing

Thermochemical Conversion

Feedstock handling & processing

Gasification

Heat decomposes cellulose; steam is applied to oxygenate

Clean & Condition

Raw Syngas

Fuel Synthesis

Pyrolysis

Cellulose is heated in the absence of oxygen

Clean & stabilize via filtration

Raw Bio-oil

Fuel Synthesis

Deliver

- Ethanol
- Other biofuels
- Ethanol, mixed alcohols, or other fuels
- Power via combustion
- Gasoline, diesel, and other products via conversion

Delivery Infrastructure

Fueling Stations

Pumps

Vehicles

Other Infrastructure

Technology Pathways

Public-private partnerships are key to ensuring the growth of a thriving domestic biofuels industry.

Grow:

Feedstock Production & Logistics

Integrated biorefineries will require access to a large, sustainable supply of high-quality biomass feedstocks at a reasonable cost. Meeting these long-term biomass supply needs will require fundamental changes in our agricultural harvesting systems and other biomass collection and delivery infrastructure. The program is working with a variety of public and private interests to help local decision makers optimize the siting of future biorefineries and development of appropriate supply networks. The program is also working with partners to quantify costs, performance benefits, and tradeoffs along the entire feedstock delivery chain.

Opportunity. Our program partners are exploring sustainable agricultural methods and other technologies capable of handling large volumes of new feedstocks. A more robust feedstock supply infrastructure across the nation will stimulate rural economic development. Our feedstock partnerships are expected to accelerate resource readiness as the cellulosic fuels industry emerges.

The single-pass harvester, which is being developed with DOE and USDA funding, enables farmers to harvest corn stover (stalks, cobs, and leaves) and grain with one pass through a field (Image courtesy of Iowa State University).

State and Regional Partnerships

To address biomass resource availability and improve storage of delivered biomass in different parts of the country, DOE continues to support the work of the **Regional Biomass Energy Feedstock Partnerships** in tandem with USDA and land grant colleges. These partnerships are helping to identify regional biomass supply, growth, and biorefinery development opportunities.

Regional partnerships will help answer the following questions for each region:

- Which feedstocks should we grow?
- How much feedstock can be produced and what will be the costs?
- What are the opportunities and constraints?

Convert:
In Integrated Biorefineries

The most economical way to produce biofuels is in an integrated biorefinery, where the biomass can be used to produce multiple outputs—fuels, high-value bioproducts, and power. Key challenges are to effectively integrate complex feedstock and conversion systems and develop new, value-added co-products. Performance in a single, integrated system depends upon upstream and downstream processes, and our researchers are exploring various combinations of methods to optimize costs and production.

The program is exploring new technologies to cost-effectively break the complex structure of cellulose into components that are more easily converted into ethanol and other bioproducts. Our research pursues two distinct yet promising conversion pathways: one using organisms (biochemical) and one using heat (thermochemical). Both are being demonstrated at sites around the country.

Biochemical Conversion

Enzymes break the cellulose into sugars, which can then be fermented to produce alcohol fuels, including ethanol.

Pretreatment. Current pretreatment methods are costly and impose severe conditions to break down the hemicellulose and lignin in order to expose the cellulose for processing. New enzymes are now enabling milder pretreatment and increasing yield by as much as 12 percent. The program is pursuing innovative processes that use these enzymes to further reduce costs and increase sugar yields.

Enzymatic Hydrolysis. Enzymatic hydrolysis breaks down cellulose into its component sugars. A key challenge is to reduce the per-gallon cost of producing and using the cellulase enzymes from 30-50 cents today to less than 5 cents. Program research has already helped to reduce enzyme production costs thirty-fold since 2000.

Fermentation. During fermentation, microorganisms (primarily fungi and bacteria) convert the sugars to ethanol. The efficiency of this process can be compromised by compounds that form during pretreatment and by rising concentrations of ethanol and solids.

Office of Science

The U.S. Department of Energy's Office of Science conducts basic research that complements the Biomass Program's applied RD&D. The office is investing up to $400 million in three Bioenergy Research Centers to accelerate basic research on cellulosic biofuels and unleash scientific breakthroughs that can help propel the growth of the new bioenergy industry.

Nearly $34 Million for Enzyme Research

To reduce the cost of pretreating cellulose for processing, DOE awarded nearly $34 million for research on systems to hydrolyze and break down pretreated cellulosic material into simple sugars.

Cellulase enzymes break down the cellulose of plant cell walls into simple sugars that can then be fermented by microbes to produce fuels—primarily ethanol—as well as chemicals, plastics, and many other products.

DOE researchers have metabolically engineered a bacterium that offers a high ethanol yield and tolerates high ethanol concentrations. The program is also investing in several industrial microorganisms to lower their cost and further improve their performance.

Thermochemical Conversion

Applying heat and chemicals to biomass can produce valuable gases and other products that can then be converted into alcohol fuels, like ethanol.

Gasification. Heat and oxygen break down biomass into a synthesis gas (syngas), which can then be converted to ethanol, mixed alcohols, and other products. Producing a clean (low in tar) syngas is difficult and costly; subsequent conversion to fuels and alcohols tends to afford low yields. New processes have demonstrated high levels of conversion efficiency with improved process economics. Cost-effective options for gas cleanup and high-yield fuel catalysts are under further development.

Pyrolysis. The program is exploring additional thermochemical processing routes to biofuels, such as pyrolysis, which produces bio-oils that could potentially feed directly into petroleum refining processes.

Progress Toward Cost Goal

Program research has helped to cut the cost of cellulosic ethanol from almost $6.00 per gallon in 2001 to about $2.40 per gallon in 2007. Further progress is expected as a result of many new R&D efforts.

Biorefinery Demonstrations

Demonstration of new technology reduces risk and accelerates acceptance in the marketplace.

Small-scale Demonstrations. The Biomass Program is providing up to $200 million over five years to support the demonstration of cellulosic biorefineries at one-tenth of commercial scale. These small-scale biorefineries will convert cellulosic biomass into liquid transportation fuels, such as ethanol, as well as biobased chemicals and products. Demonstrating breakthrough technologies at this scale will help reduce technical and business risk, and thereby accelerate advances to commercial scale.

Five Ethanol Conversion Projects Launched in 2007

DOE awarded a total of $23 million to the following companies to develop highly efficient fermentative organisms that can speed conversion of biomass to ethanol:

- Cargill Incorporated
- Verenium Corporation (formerly Celunol)
- E.I. Dupont de Nemours & Company
- Mascoma Corporation
- Purdue University

Biomass Gasification R&D Awards in 2007

Four cost-shared, cellulosic biofuel projects will receive up to $7.7 million in DOE funding over the next three years to investigate the process steps in biomass gasification. The following organizations received awards:

- Emery Energy Company
- Iowa State University
- Research Triangle Institute
- Southern Research Institute

Commercial-scale Demonstrations. DOE is investing up to $385 million in funds over the next five years for the demonstration of six integrated biorefinery concepts across the nation. These biorefineries will operate at a commercial scale and use various cellulosic feedstocks and conversion technologies.

	Feedstocks	Conversion	Annual Output
Abengoa Bioenergy	Corn stover, wheat straw, milo stubble, switchgrass, other	Biochemical and thermochemical routes	11.4 million gallons of ethanol plus energy to power the facility, with excess to adjacent grind mill
ALICO Inc.	Yard, wood, and vegetative wastes (energy cane in future)	Gasification and fermentation	13.9 million gallons of ethanol plus power, hydrogen, and ammonia
BlueFire Ethanol	Sorted green waste and wood waste from landfills	Mixed conversion with concentrated acid hydrolysis/fermentation	19 million gallons of ethanol
POET	Corn fiber, cobs, and stalks	Advanced corn fractionation and lignocellulosic conversion	125 million gallons of ethanol
Iogen Biorefinery Partners, LLC	Agricultural residue (straw, stover, and switchgrass)	Enzymatic hydrolysis	18 million gallons of ethanol
Range Fuels, Inc.	Wood residues and wood-based energy crops	Thermochemical conversion with catalytic upgrade	40 million gallons of ethanol and 9 million gallons of methanol

Deliver:

Success will ultimately be defined not only through improved biofuels production but also through enhanced delivery and expanded use of the fuels.

Expanding the Distribution Infrastructure

Increases in biofuels use, as legislated by Congress, will require more efficient strategies for transport, storage, and delivery. Large volumes of ethanol will continue to be produced in the Midwest, even as diverse cellulosic feedstocks are developed across the nation. To move large volumes of biofuels into major markets, we need an efficient distribution infrastructure that can reach consumers across the country. The Biomass Program is working with state and local government leaders, industry, and others to identify options that can best meet this challenge.

Developing New Strategies for End Use

To date, ethanol production has been largely absorbed by the market for E10—that is, gasoline blended with up to 10 percent ethanol. However, given projected ethanol production and new renewable fuel standards, the E10 market will become saturated in the next few years. Although flexible fuel vehicles (FFVs) can run on E85, this market takes up less than one percent of ethanol used today due to the limited number of FFVs and E85 fueling stations available. Given the legislative mandate to use 36 billion gallons of biofuels annually by 2022, we need to find ways to move these fuels into consumer use either through significant expansion of E85 infrastructure or through an intermediate ethanol blend, such as E15 or E20.

Recognizing that intermediate blends could ease the transition to more extensive use of E85, the Biomass Program is evaluating the potential emissions and performance impacts that may be associated with using these blends in new and existing vehicles. Through an extensive testing program designed in close collaboration with other DOE offices and federal agencies, we are assessing whether intermediate blends are viable and can provide another end-use alternative.

Technology Highlights

We are proud of the cutting-edge technologies and scientific advances emerging from the Biomass Program. These technical accomplishments are helping the nation make real progress toward oil independence and greater energy security.

Pretreatment Technology

The Biomass Program's research through national laboratories, universities, and private partners is leading to breakthroughs in understanding the role of lignin and the chemical and physical changes that occur during pretreatment processes. New discoveries will help achieve the conversion efficiency targets and cost goals necessary to making cellulosic ethanol cost competitive by 2012.

Integrated Biorefinery Research Facility

The National Renewable Energy Laboratory's (NREL's) Alternative Fuels User Facility is scheduled for expansion into an Integrated Biorefinery Research Facility that will greatly enhance NREL's capabilities to work simultaneously on multiple projects. It will also extend access to outside research partners for development and testing of new cellulosic technologies.

Range Fuels Biorefinery Demonstration Project

Range Fuels, Inc. broke ground on November 6, 2007, for a biorefinery that will become the first to make commercial levels of cellulosic ethanol. It will initially make 20 million gallons per year of ethanol from sawdust, pine trees, and wood bits left over from cutting down lumber.

Biomass Refining Consortium for Applied Fundamentals and Innovation (CAFI)

The Biomass Program participates in this consortium of national laboratory and academic researchers, each exploring a distinct pretreatment process. Consortium members share and compare performance and cost data across a range of lignocellulosic feedstocks, thereby avoiding duplication of effort and allowing research to progress more quickly and efficiently. CAFI provides consistent testing benchmarks as well as feedstock and conversion metrics, further expediting progress toward efficiency and cost goals.

Program Achievements

The prestigious R&D 100 Awards honor promising new technologies, products, and processes. The award is widely recognized as a mark of excellence for the most innovative and commercially viable scientific ideas that emerge each year.

2006: Separative Bioreactors

This innovative technology provides a more efficient way to produce organic acids from biomass, reducing the cost of production by nearly half compared to conventional methods. These bioderived organic acids can then be produced as high-value products in biorefineries and provide alternatives to chemicals produced from petroleum.

Project Partners: Argonne National Laboratory and Archer Daniels Midland Company

2004: Enzymatic Hydrolysis of Biomass Cellulose to Sugars

This novel biorefining process inexpensively breaks down plant cellulose to sugars, which can then be converted into fuels, chemicals, plastics, fibers, pharmaceuticals, and other products. The process has dropped the cost of enzyme hydrolysis 20-fold, making future production of bioproducts from cellulose far more cost-competitive with petroleum.

Project Partners: Genencor International, Novozymes Biotech Inc., National Renewable Energy Laboratory

2000: Real-Time Biomass Analysis

A new, highly functional measurement technology allows rapid and inexpensive characterization of the chemical and mechanical properties of a wide variety of biomass materials in multiple forms (native, processed, finished). The cost of the new technique is up to 50 times lower than that of conventional chemical methods.

Project Partner: National Renewable Energy Laboratory (NREL)

This program provides national recognition of outstanding chemical technologies that incorporate the principles of green chemistry into chemical design, manufacture, and use.

Sustainable Plastics

Under a cost-shared grant from DOE, Metabolix, Inc. began working on producing PHA (polyhydroxyalkanoates) natural plastics directly from green plants such as switchgrass, tobacco, and alfalfa. In 2005, Metabolix was awarded the Presidential Green Chemistry Challenge Award for this broad family of natural plastics that offer a sustainable alternative to petrochemical plastics. These versatile materials can be converted into molded plastics, coatings, films, fibers, and other products, combining the functionality of traditional plastics with biodegradability in a wide range of environments.

"PHA natural plastics offer the global marketplace an alternative to traditional petroleum-derived plastics, and ADM is proud to use the farmers' harvest to create new products for the emerging market for ag-based chemical and industrial products."

G. Allen Andreas, Chairman, Chief Executive and President of Archer Daniels Midland

Moving Ahead

The U.S. biofuels effort has achieved major advances in the past few years, and the Biomass Program looks forward to working with its diverse partners in taking the next key steps:

Invest in next-generation technology that will accelerate the use of cellulosic biomass for biofuels: advanced fermentation, gasification, pyrolysis, and innovative concepts.

Explore new fuels and feedstocks to evaluate the many options available, ensure the optimal use of domestic resources, and provide a strong foundation for the future biofuels industry.

Strengthen our planning and analysis to identify technology opportunities with the greatest potential to expand the use of biofuels, bioproducts, and biopower and to better understand the technical and market challenges.

Expand outreach and partnership opportunities to leverage resources, strengthen our alliances, and launch a robust market transformation strategy.

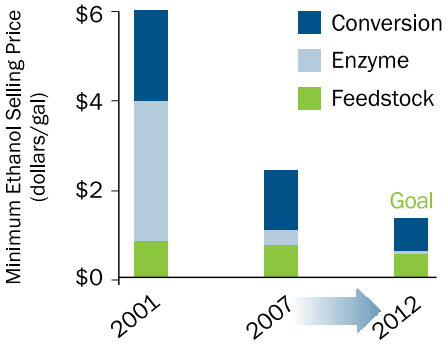
Reduce costs at all points along the supply chain to meet aggressive targets and make cellulosic ethanol cost competitive by 2012.

Emphasize commercialization throughout the RD&D life cycle, working with partners to develop robust strategies that can foster market success.

"The more we can rely on renewable fuels like ethanol and biodiesel to meet our energy needs—the less we will have to depend on oil imported from unstable and sometimes hostile parts of the world—and the less carbon we will be adding to the environment."

Samuel W. Bodman
Secretary of Energy

Cellulosic Ethanol Costs



A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

For more information contact:
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Visit the DOE website at
www.biofuels.energy.gov