

Summary:
Biomass Research & Development
Technical Advisory Committee
Meeting
May 15-16, 2007

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Summary: Biomass Research & Development Technical Advisory Committee Meeting, May 15-16, 2007

Post Meeting Action Items:

1. Committee to provide a recommended (Federal) definition of cellulosic ethanol.
2. Revise the Roadmap to address the President's "Twenty in Ten" (20 in 10) goals
3. Provide recommendations from the Committee to the Board for achieving the 20 in 10.
4. Revisit the Committee's charge under the Biomass R&D Act of 2000 as revised by the Energy Policy Act of 2005

I. Purpose

On May 15-16, 2007, the Biomass Research and Development Technical Advisory Committee (Committee) held a meeting at the L'Enfant Plaza Hotel in Washington, DC. This meeting included discussions with members of the Biomass R&D Board.

The Committee was established by the Biomass R&D Act of 2000 (Biomass Act) and revised in the Energy Policy Act of 2005. The Biomass R&D Board was established under the same act to work with the Committee to coordinate interagency biomass R&D activities. The Committee is charged to: advise the Secretary of Energy and the Secretary of Agriculture on the direction of biomass research; facilitate consultations and partnerships; and evaluate and perform strategic planning.

This quarterly Committee meeting was the third of the 2007 fiscal year. The Committee came to the meeting to: hear presentations from the Biomass R&D Board, meet the new designated federal officer for the Department of Energy, and swear in six new Committee members, including the co-chairman of the Committee. Presentations were given from the Biomass Board to introduce new Board members to the Committee.

A list of attendees is provided in Attachment A. An agenda is provided in Attachment B.

II. Interagency Board

The Biomass R&D Board (Board) decided to expand the membership to other federal departments and to increase the profile of the Board. The Board had a meeting on May 10th, 2007 and included new member agencies such as the Departments of Treasury and Commerce. The Board is also considering expanding its DOE and USDA membership to include Gale Buchanan (USDA) and Ray Orbach (DOE). The Board is going to focus on advancing the President's "Twenty in Ten" goals:

- Increasing The Supply Of Renewable And Alternative Fuels By Setting A Mandatory Fuels Standard To Require 35 Billion Gallons Of Renewable And Alternative Fuels In 2017 – Nearly Five Times The 2012 Target Now In Law. In 2017, this will displace 15 percent of projected annual gasoline use.
- Reforming And Modernizing Corporate Average Fuel Economy (CAFE) Standards For Cars And Extending The Current Light Truck Rule. In 2017, this will reduce projected annual gasoline use by up to 8.5 billion gallons, a further five percent reduction that, in combination with increasing the supply of renewable and alternative fuels, will bring the total reduction in projected annual gasoline use to 20 percent.

The Board wants to implement the President's plan and work closer with the Committee to propel the United States towards the 20 in 10. The Board is currently focusing on identifying and overcoming roadblocks to achieving the President's goals.

A. Board Members Present

The Biomass Board was represented by Vice Admiral Thomas Barrett, Acting Deputy Secretary, U.S. Department of Transportation and Dr. Hratch Semerjian, Chief Scientist, National Institute of Standards and Technology (NIST), newly appointed members of the Board discussed expectations of the Committee. Executive Steering Committee members Douglas Faulkner (USDA) and John Mizroch (DOE) also were representing the Board in the absence of the DOE and USDA Board representatives.

The Department of Transportation uses the enterprise/free market approach to link transportation and distribution infrastructure issues with respect to biomass. Vice Admiral Barrett believes that as early as possible in the process, it is important to get as many players in the room who can contribute to solve the problems. Stakeholders and businesses can get the most important issues on the table and identify roadblocks. In particular there is an interest in linking transportation hubs such as pipelines which move more product than all other modes of transportation put together.

NIST can contribute through its many guest researchers from industry as well as work with other Federal agencies such as: USDA on DNA diagnostics and genomics; DOT on pipeline safety; and EPA on emission standards. Dr. Semerjian explained that these agencies need tools and standards and NIST can work with them to help develop the

standards. Standards need to be in place for trade purposes, testing, and to ensure performance.

The Board's Executive Steering Committee, headed by Douglas Faulkner, Deputy Under Secretary for Rural Development and John Mizroch, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, explained the recent efforts to rejuvenate the Board by appointing members at equivalent levels of the Board Co-chairs, Assistant Secretary Andy Karsner, and Under Secretary Thomas Dorr.

B. Board Committee Discussion

Activities of the reinvigorated Board include: monthly meetings and to create a national action plan (from the Board) of which the Committee's Roadmap will be a critical part. The Board is also interested in meeting with the Committee more than once a year. Since it is part of the Committee's responsibility to advise the Board, the Committee and the Board could meet more often. The Committee has a tremendous depth of expertise which will be critical to implementing the 20 in 10. The Board would welcome Committee input as it develops its action plan for 20 in 10.

The scope of this Committee, which focuses on biomass utilization, is part of the 20 in 10 which goes beyond biomass and includes other renewable and alternative fuels. Deployment of biofuels will require additional thinking about infrastructure, finance, refining.

The Committee recognized the importance of the 20 in 10 objective but stated that it should not let its focus stop at the ten year mark. Focus must also be placed on long term research and long term goals. For example the Billion Ton Study, an outlook of resource availability to 2030, is being updated and there is an enormous amount of research to be done. To support federal government analysis, the Board would like input from the Committee on available data that can be used and suggestions regarding analytical R&D that should be conducted to support the 20 in 10 goal and beyond. Further, the DOE Office of Science will announce this summer, the award of three bioenergy centers. These Centers will conduct basic science to provide the fundamental science that enables the production of cellulosic ethanol and other biofuels to be economically and environmentally viable.

The fuel additives and oxygenate markets will be saturated with ethanol in the next couple of years. To enable further expansion of ethanol of up to 30 billion gallons per year or more will require additional infrastructure and distribution avenues. This expansion is likely to include areas outside of the Midwest like NY and WA. Higher level blends and expansion of E85 infrastructure will be evaluated to develop infrastructure and distribution pathways that re positive for all users. The evaluation should include basic science and the impact on rural development. The U.S. cannot simply use the existing gasoline infrastructure.

III. U.S. Department of Energy: Overview

Jacques Beaudry-Losique from the Department of Energy (DOE) presented on the Energy Policy Act of 2005: §932 Integrated Cellulosic Biorefinery Solicitation, the Office of the Biomass Program's (OBP) budget, as well as greater cooperation with the Committee. OBP is looking for guidance from the Committee on all of these activities.

A. Energy Policy Act of 2005: §932 Integrated Cellulosic Biorefinery Solicitation

DOE selected six commercial biorefinery projects (three thermochemical and three biochemical) for over \$385 million in DOE funding over 4 years. Awards will be made by December of this year.

We need to ensure that once these plants are up and running there is transportation available to move the ethanol from the production facility to the location of demand. This will depend largely on the location of the plants, the nearest markets, and how many FFVs are available. DOE still sees the Midwest as the center of this biofuels-based economy. In two decades, around 2027, there will be a more distributed economy. The U.S. needs to develop a feedstock supply system for biorefineries and identify the federal and private roles related to feedstocks. Farmer programs are necessary to develop the diversity and volume of crops for this industry.

Discussion

DOE is currently evaluating the contribution of cellulosic ethanol towards the 2017 goal in addition to a cap of about 15 billion gallons/year of ethanol. Then DOE believes cellulosic will penetrate the liquid fuels market but production must meet the cost target which is about \$1.30/gal.

Committee member Jim Martin explained that it is important to clarify what constitutes cellulosic ethanol. The definition of cellulosic ethanol is nuanced and it is necessary to have a single federal definition. He went on to say that overlooking biodiesel right now would be a mistake. There is a lot of discussion currently on soy-based business and how soy can be used to produce up to 8 billion gallons of biodiesel. Jacques Beaudry-Losique, from DOE's Biomass Program agreed that biodiesel is an important issue but the total volumes will not make a big impact on the "Twenty in Ten".

B. The Office of the Biomass Program Budget

The DOE Office of the Biomass Program's budget is \$199 million in FY07 with no earmarks to date. In FY08 it is expected to be \$190 million. The U.S. needs the federal government to deploy R&D results to the marketplace. OBP feels that this is a high priority and need to be addressed urgently. There also must be a predictable policy framework in order for mid-long term planning to take place.

It will take about \$100 billion to bring about cellulosic economy by 2030. It cannot be accomplished without private sector investments. In the last year the entire EERE

program has been asked to focus on biofuels. If you look at the objective to bring cellulosic ethanol to the marketplace – there is enormous pressure given OBP’s limited resources. Over time when the biofuels goals are on their way to being achieved, then more aggressive activities in bioproducts and biopower will take place. The “Twenty in Ten” initiative is approximately 75% alternative fuels and 25% energy efficiency including CAFÉ standards and vehicle technologies.

IV. U.S. Department of Agriculture: Overview

Several presentations were given by USDA to update the Committee on its biomass activities. Harry Baumes (USDA) presented on the USDA response to Committee's Policy Gap Analysis and its utilization in the 2007 Farm Bill; Bill Hagy (USDA) presented on the 2007 USDA-DOE Joint Solicitation Projects update; and Helena Chum (NREL) presented on the USDA Energy Matrix.

A. Farm Bill

The Committee's Policy Gap Analysis (PGA) identified current biomass policies and assessed their effectiveness. It also helped shape some of the language proposed for the 2007 Farm Bill. Although the suggestion of a "Manhattan Project" for biofuels did not make it into the proposed language for the bill, much of the content of the PGA did.

The PGA identifies barriers which will be shared with the Board. In various ways, the Biomass R&D Technical Advisory Committee does have influence on decisions. This Committee's recommendations fell into three main categories (biofuels, bioproducts, and biopower).

In the biofuels area, one of the Committee's recommendations was to broaden the biofuels standard and analyze the incentives and mandates for federal fleet requirements. The Committee recommended multi-agency federal panels. The Board is now taking an active role in leading interagency biofuels collaboration.

There is a lot of work to accomplish in order to fully develop the bioproducts industry. The BioPreferred program will invest \$1.8 million over ten years. The Farm Bill is expanding USDA and university research by authorizing \$500 million in mandatory funding over 10 years for the creation of a Bioenergy and Bioproducts Research Initiative to increase the cost-effectiveness of bioenergy by facilitating collaboration between Federal and university scientific experts. Additionally the Farm Bill proposals include more than \$1.6 Billion in new renewable energy funding and targets programs to cellulosic ethanol projects. These proposals advance renewable energy and build upon Farm Bill energy programs. The Federal government has to look at the economics of the biomass industry. It is critical that markets create a balance with industry to push the bioeconomy forward.

B. Matrix Benefit Analysis of Section 9008 Projects

Helena Chum from the National Renewable Energy Laboratory presented the results of the Matrix Benefit Analysis of Section 9008 Projects. USDA commissioned NREL to review the status of Section 9008 research projects. The draft report has been shared with the Office of Management and Budget and other areas of USDA. The report is not yet public. The objective of the study is to identify the outcomes of those projects and then assess them. There are significant challenges in developing meaningful metrics. Beginning this task, USDA did not have many metrics so reasonable measures had to be

developed and integrated into a peer review. It was common to have 60 people on a project, an enormous number of collaborators. The collaboration and other partners provided cost share.

A copy of the full presentation is provided in Attachment D.

V. Woody BUG

John Stewart of the U.S. Department of Interior presented on the Woody Biomass Utilization Group (BUG) activities. The Woody BUG Committee would like to work closer with the Biomass R&D Technical Advisory Committee. Currently Woody BUG is working with the U.S. Forest Service (USFS) and focusing on forest health and management activities. In the wake of hurricane Katrina, a disaster debris strategy was started. There has been a lot of timber going into landfills and being burned. We need to address landfill diversions and greenhouse gas issues. USFS is working with a wide constituency and put together a proposal for management of hurricanes and tornados in the south and also will incorporate fire in the west.

VI. Technical Advisory Committee: Subcommittee Updates

Previously the Committee established three Subcommittees to carry out the work of the Committee throughout the year. The Subcommittees are: Policy, Analysis, and Communication, each chaired by one Committee member and supported by several other members. The Subcommittee chairs reported on the work of their respective subcommittees and future plans.

A. Policy Subcommittee

Earlier in the year, the Policy Subcommittee developed a Policy Gap Analysis which was submitted to the Departments of Agriculture and Energy. Looking ahead, there is an intense level of policy discussion and development stimulated by the 20 in 10. In terms of the Committee's policy gap analysis there were no recommendations relative to how U.S. markets should integrate fuel blends, and other user issues with fuel infrastructure. It is at those supply-distribution interfaces in the infrastructure, where the Committee should be making policy recommendations. The Committee should review existing policies and build on the work of other efforts. For example, there are action plans from 25x25 website which involve biomass policy analysis.

B. Communications Subcommittee

The Communications Subcommittee reviewed the charge of the Committee in the Biomass R&D Act of 2000 (rev. 2005). The Committee is charged to advise, and facilitate partnerships with the agencies. There is a lot of experience on the Committee to facilitate these partnerships. The Committee would also like an event for the release of its Roadmap. The Committee discussed other ideas it could communicate such as its Vision as well as recommendations about biofuels, however it needs to highlight the positive impact of current biofuels. Specific items that could be communicated include:

- The U.S. needs to recognize that rising costs of natural gas have hurt the chemicals industry which uses natural gas to power most production facilities.
- There is a negative public perception about the use of biofuels and biomass both in Europe and in the U.S. "Ag-flation" and "How biofuels can starve the poor" are key points of debate in the public forum. However there are many positive stories regarding biomass utilization and its social and environmental benefits that need to be communicated.
- The Committee's responsibility is to outreach to other organizations. There are numerous groups promoting renewable energy and the Committee should work more closely with them. Bob Dinneen, a Committee member and President of Renewable Fuels Association (RFA), offered to support outreach activities and to provide RFA news clips to the Committee.

RFA is responding to negative press where it can. For example, ABC recently did a negative story on ethanol but was not willing to talk to RFA.

Ethanol has been attacked over the last year and the facts have been spun several different ways. The response of the biomass community should be to address these attacks quickly as well as be proactive. It is critical to discuss what is appropriate for this Committee and to try to figure out how negative press can be addressed.

C. Analysis Subcommittee

This Subcommittee was asked to do a high level review of foundational documents for DOE. Ralph Cavalieri, the chair of this subcommittee, presented his most recent assessment of DOE's foundational documents.

D. Public Comment

There was no public comment during the meeting.

VII. Committee & SGE Briefing from General Counsel (Closed Session)

The Department of Energy's General Counsel held a closed session to provide the annual Special Government Employee briefing as well as answer questions from Committee members regarding their charge under the Biomass R&D Act of 2000 revised by the Energy Policy Act of 2005.

VIII. New Latin American Biofuels Presidential Initiative

Jonathan Shier, Latin America Division, White House National Security Council presented on the New Latin American Biofuels Presidential Initiative. Brazilian President Luiz Inácio Lula da Silva (Lula) approached President Bush about developing an agreement between the two countries on biofuels. The U.S. thought that was an interesting proposal and realized a big part of this initiative would involve R&D. The White House is pulling together Federal agencies to advance this agreement. Currently the Federal agencies involved are: DOE (EERE and Policy), USDA, EPA, DOC, and NIST.

The memorandum of understanding (MOA) on advancing biofuels between US and Brazil was released on March 9, 2007 and covers three areas:

1. Bilateral work to advance R&D on biofuels which builds on existing energy, agriculture, commerce, and environment agreements. It shines a new spotlight on existing channels.
2. Cooperation to promote biofuels production and consumption in the Latin America and Caribbean region (LAC)
3. Fostering global cooperation, establishing an international biofuels forum for best practices and standards on biofuels, and to bring consistency and compatibility.

The initiative has been joined by India and South Africa.

Bush is excited about this agreement because Latin American countries are among the least energy independent countries in the world. Some import 100% of their energy. Biofuels have turned around rural economies in the US. This could also be applied to developing countries.

Discussion:

What is the focus of the international biofuels forum with regard to standards?

The U.S. has suggested product quality standards for ethanol and biodiesel as have been applied to other commodities, specifically fuel additives. The forum needs to discuss ethanol blends.

Are there target countries and if so, why?

The goals of the U.S.-Latin American Initiative are to help countries expand consumption of biofuels. Greater consumption of locally-produced biofuels will help expand economies and reduce dependence on oil imports. The U.S. will interact at a broad policy level not at a technical level.

During the negotiations between the U.S. and Brazil, what was the overall goal of the Brazilians?

They would like to see an end to the U.S. tariff on ethanol imports. The U.S. made it clear that the tariff will be in place through 2009. General Motors, Cargill, and ADM are all involved in Brazil with flex fuel vehicles and biofuels production.

IX. Genomes to Life (GTL) Bioenergy Research Centers

David Thomassen from the U.S. Department of Energy's Office of Science presented on the Genomes to Life (GTL) Bioenergy Research Centers to be funded by the Department of Energy.

The Office of Science finds biotechnology solutions using the natural diversity of microbes and microbial communities. The GTL centers will use systems biology in a focused program of fundamental research on plants, microbes, and biological communities to:

- Develop biological solutions for intractable environmental problems
- Understand relationships between climate change and earth's microbial systems, and
- Support development of biofuels as a major secure energy source

GTL Overview:

Funding: \$375 million to be provided over five years to establish and operate three new Bioenergy Research Centers (proposals are under review).

Goals: transformational discoveries in basic science to make production of cellulosic ethanol, sunlight-to-fuels, and other biofuels truly cost-effective and economically viable

Method: advanced systems biology research on microbes and plants - to learn to exploit nature's own conversion methods, plus develop a new generation of optimized bioenergy crops

Discussion:

There is a large concern over genetically modified crops. How will the Centers respond to this?

Genetically modified crops or genetically modified organisms (GMO) may be one strategy but it isn't the only approach to producing biofuels, bioproducts, and biopower. Science and industry may modify enzymes, which is different than modification of plants but we need to fund research on some of these issues.

Is the Office of Science Federal Advisory Committee connected with private sector such as Monsanto?

Yes, they review some grants for us. Their folks are present at some of the workshops we hold. They have competing interests but that is appropriate.

Do you work with your European counterparts? Yes, and GMO's are a bigger issue in Europe than the U.S.

With an emphasis on the National Institute of Health and other budgets, funding and focus towards R&D for carbohydrate chemists has gone down. How do you view it from DOE's perspective?

The President's Initiative is supposed to double the R&D funding. This should include a fair amount for science. Our GTL program has gone from \$450 to \$550 million. The Office of Science budget is going up and the Farm Bill funding should also increase R&D funding.

X. Discussion on Updated Roadmap

The Committee discussed the update of the Roadmap for Bioenergy and Biobased Products in the United States. Regional meetings were held in the U.S. to update the Roadmap. Technical experts from each region were invited to participate and discuss: barriers to biomass technologies, R&D, and policy to overcome those barriers. A summary of the Roadmap update process was briefly discussed followed by a detailed discussion on the Roadmap, the National Biofuels Action Plan, and how the Departments of Energy and Agriculture will receive and endorse the Roadmap.

Major points of discussion:

- The Departments endorse the “Twenty in Ten” goal for biofuels, which is larger than the Committee’s Vision goal for biofuels. If the Departments are to endorse the Roadmap, it must address the “Twenty in Ten” goals.
- To update the Roadmap the Committee will:
 - Revisit the Introduction and remove the Vision goals table and integrate the “Twenty in Ten”
 - Add an Executive Summary
 - Add a section on the “Twenty in Ten”
- Develop top recommendations from the Committee to the Board for consideration in the National Biofuels Action Plan as well as legislation being debated by Congress.

A. Regional Roadmaps

The Central Roadmap Workshop discussed the barriers of geography, transportation and infrastructure. The majority of ethanol currently produced in the U.S. is geographically located in the central region. Unfortunately it is costly to move finished product to the major consumption areas on the west and east coasts of the United States. It is critical to upgrade and equip all modes of transportation including pipelines, waterways, and rail to move biopower, biofuel, and bioproducts.

The Western Roadmap Workshop revealed that the west has a highly distributed mix of feedstocks which are relatively inaccessible. The nature of western feedstocks such as urban waste and forest residues as well as the economics of material distribution, transportation, and densification reveal that the western U.S. needs a more flexible, distributed feedstock collection process.

The Eastern Roadmap Workshop captured barriers and needs for improved R&D, genetics, and processing capacity. Eastern feedstocks are available but they are mostly agriculture and woody residues which are not as readily convertible into finished products like corn to ethanol is in the central region of the U.S.

B. The National Biofuels Action Plan and the Roadmap

The Energy Policy Act of 2005 mandated the Secretaries update the Committee's Vision and Roadmap. In late 2005, the Secretaries requested the Committee undertake this task. At that time, all assumptions regarding goals that could be achieved were based on FY2006 and estimated FY2007 funding. Things have changed dramatically in the last few months with large increases in funding for biomass as well as more aggressive goals laid out by the White House than the Committee's Vision goals.

The Roadmap should support the National Biofuels Action (NBA) Plan and can be changed to direct biomass R&D efforts towards the 20 in 10. The Roadmap can assist the NBA Plan and the infrastructure section can be tied into the 20 in 10. The technical points in the Roadmap are all valid whether it's done in ten or twenty years. The timeframe only depends on the amount of funding available to overcome barriers and implement R&D strategies.

Although the Vision sets targets for biobased products and biopower as well as biofuels, the Federal focus is now on biofuels. The Vision goals for biofuels are not as aggressive as the 20 in 10 goals. The Departments requested the Committee to revise its Roadmap to incorporate the 20 in 10 goals.

Regardless of specific goals, the overarching challenges remain as do the recommended R&D and policy strategies. However, this Committee may want to reprioritize infrastructure recommendations to focus on the shorter term 20 in 10 goal. The Committee should add text or a section to the Roadmap to address this but not remove the existing R&D recommendations.

As the Committee discusses reworking the Roadmap, it must keep in mind that the current administration is focused on biofuels. The Committee focused on petroleum displacement, which is the ultimate goal.

If the Roadmap is timed right, the Farm Bill discussions can be influenced, especially in the R&D and commercial arena. There is a window of opportunity this summer, in which these recommendations can play a role. The energy, farm, and water bills are all in conference versions in Congress. The window to make recommendations is now.

C. Recommendations

DOE and USDA requested the Committee develop its top recommendations to enable the 20 in 10 goal. The Committee agreed to develop these recommendations which will help the Board develop its Action Plan.

The Roadmap Subcommittee will facilitate development of the Committee's recommendations to the Board. The Committee needs to provide recommendations that are focused on the near term in order to achieve the 20 in 10.

Committee members will submit five recommendations by Monday (5/21/07). These will be posted on the Committee's internal website. The Subcommittee will revise the

ideas and send them out to the Committee. A final set of ten recommendations will then be submitted to the Board no later than 30 days from this meeting.

The market and consumer issues need to be addressed in addition to the R&D.

It would be incredibly helpful if the Departments could lay out a price tag and provide a detailed framework to meet the 20 in 10 goal. Are there preconditions to meet the 20 in 10 goal? The Departments said that the 20 in 10 proposes a 15% displacement of gasoline which includes more than just biofuels.

When the White House created that number – they must have had an idea how much of that will be biomass and how much will be from coals to liquids.

Those targets have not been made specifically by the White House or the Departments.

DOE operates on a three legged stool comprised of R&D, policy, and markets. To the extent the Committee can incorporate this approach into the Roadmap; the Department would find the Roadmap much more beneficial.

USDA has released corn to ethanol numbers which the baseline is 12 billion gallons of ethanol by 2016.

The Committee would also like to request a special meeting or conference call with the Board in 30 days. It may be more appropriate for a smaller group of Committee members to meet with the Board. If the Committee could get some dialogue around the recommendations it would attest to how valuable they are to the Board.

Volunteers for the Committee’s Top Ten Recommendations on the “Twenty in Ten” working group:

Ralph Cavaliere
Tom Binder
Doug Hawkins
Jim Barber
Scott Faber
John McKenna
Ed White

The Committee welcomed Henson Moore, the new Committee Co-chair.

XI. Fiscal Year 2007 Recommendations to the Secretaries of Agriculture and Energy

A. Recommendations regarding the distribution and use of Initiative funds

A.1. The Departments approach biomaterials with greater balance, increasing the emphasis on biobased materials in tandem with biofuels.

A.2. R&D should be pursued to develop liquid transportation fuels from biomass, in addition to ethanol and biodiesel; especially technologies that improve the economics and/or net energy yield.

B. Recommendations regarding the independence and transparency of the annual joint solicitation awards/ Recommendations regarding the independent merit-based review of solicitation applications

B.1. Joint Solicitation Review panel selections should be clear and transparent.

C. Overall recommendations to the Secretaries

C.1. The Departments are asked to review Committee recommendations made over the past five years, and agency responses, given in the Secretaries' Annual Reports to Congress. The agencies should then report on actual agency responses to each of the Committee recommendations. This should include reporting on recommendations on which there has been no agency action, as well as a report on whether there has been a pattern in how the agencies have responded to Committee recommendations over the life of the Biomass R&D Initiative.

C.2. That the Departments continue to emphasize timeliness of Committee member appointments.

C.3. The Departments are encouraged to improve education for low and high concentration ethanol blends, biodiesel, renewable diesel, and other renewable fuels. Educational efforts should be designed to inform consumers concerning the environmental benefits of biofuels, jobs creation, national security, fuel quality, and petroleum displacement. Facts concerning food for fuel displacement should be included in educational efforts.

C.4. The Federal Government should analyze tax credits to incentivize biobased products; replicate the success of biobased fuels policy for biobased products; and assess extending policy drivers applied to biofuels to petroleum and natural gas displacement by whatever means.

C.5. Policies for the agricultural economics of biomass production should be given further study.

C.6. We recommend that the Secretaries direct staff and request funding for new research on protein utilization in the manufacture of biobased chemical products.

C.7. The Committee has revised the Roadmap which contains recommendations and is also putting together a short list of high priority recommendations which should be considered by the Secretaries.

C.8. Study the economic incentives necessary at the producer level to encourage a robust alternative energy crop industry as well as to ensure financing.

XII. 2007 Committee Work Plan

Committee member Mark Maher gave a brief presentation about the September meeting in Detroit, which General Motors will be sponsoring. If the Committee is interested on Sunday or Monday evening, a trip can be arranged to the GM proving grounds and see the testing that goes on. The Committee would be able to experience how GM motors react with ethanol as well as some of the hybrid vehicles.

Next the Committee held a brief discussion on the agenda items for the November 2007 meeting. Most important was the 2007 recommendations to the Secretaries. This will be an agenda item at the Detroit meeting and the Committee felt that at this meeting it should finalize its recommendations so that it can present them to the Board at the Washington, DC meeting in November.

Attachment A: Attendees

Committee Members Present

Thomas Ewing (co-chair)

Henson Moore (co-chair)

Robert Ames

David Anton

James Barber

William Berg

Thomas Binder

Ralph Cavaliere

Bob Dinneen

Scott Faber

Douglas Hawkins

John S. Hickman

Lou Honary

E. Alan Kennett

Mark Maher

Timothy Maker

Jim Martin

Scott Mason

Mary McBride

John McKenna

Ed McClellan

Jeffrey Serfass

Robert Sharp

J. Read Smith

Edwin White

Rodney Williamson

Committee Members Not Present

Arthur Butch Blazer

Larry Pearce

Mitch Peele

Charles Kinoshita

Eric Larson

Biomass R&D Board Representatives Present

Hratch Semerjian – NIST

Vice Admiral Thomas Barrett – DOT

John Mizroch – for DOE

Doug Faulkner – for USDA

Federal Employees Present

William Hagy – USDA

John Stewart – DOI

Jacques Beaudry-Losique – DOE

Helena Chum – NREL

Christina Hymer – DOE

Jonathan A. Shrier – National
Security Council, White House

David Thomassen – DOE

Total Attendees – 37

Designated Federal Officer – Valri Lightner

Attachment B: Agenda

Day 1	May 15, 2007
1:00 – 2:00 pm	<p>Welcome/Update from Biomass R&D Board - <i>Doug Faulkner, Deputy Under Secretary, U.S. Department of Agriculture (USDA) and John Mizroch, Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy, U.S. Department of Energy (DOE)</i></p> <ul style="list-style-type: none">• Introduce New Board Members to Committee<ul style="list-style-type: none">○ In attendance:<ul style="list-style-type: none">▪ Thomas Barrett, Acting Deputy Secretary, U.S. Department of Transportation▪ Dr. Hratch Semerjian, Chief Scientist, National Institute of Standards and Technology• Discuss Board Expectations of the Committee
2:00 – 2:30 pm	<p>Update on OBP/DOE activities - <i>Jacques Beaudry-Losique, Office of the Biomass Program, U.S. Department of Energy</i></p> <ul style="list-style-type: none">• Update on Energy Policy Act §932 Integrated Cellulosic Biorefinery Solicitation• Update on OBP Budget
2:30 – 3:00 pm	<p>Welcome/Update from USDA Liaison - <i>Bill Hagy, Rural Development, U.S. Department of Agriculture</i></p> <ul style="list-style-type: none">• Update on 2007 Farm Bill & Policy Gap Analysis status• Woody Biomass Utilization Group (BUG) – <i>John Stewart, U.S. Department of Interior</i>• 2007 USDA-DOE Joint Solicitation Projects update• Energy Matrix
3:00 – 3:15 pm	<i>Break</i>
3:15 – 3:45 pm	Continue USDA Update
3:45 – 4:30 pm	Matrix Benefit Analysis of Section 9008 Projects – <i>Helena Chum, Biorefinery Analysis and Exploratory Research Group Manager, National Renewable Energy Laboratory</i>
4:30 – 5:00 pm	<p>Subcommittee Updates</p> <ul style="list-style-type: none">• Policy – <i>Chair: Jim Barber, Metabolix International</i>• Communications – <i>Member: Jim Martin, Omnitech International</i>• Analysis – <i>Chair: Ralph Cavalieri, Washington State University</i>
5:00 – 5:15 pm	Public Comment/Adjourn (over)

7:30 – 8:00 am	<i>Breakfast</i>
8:00 – 8:30 am	Closed Session: Committee & SGE Briefing from General Counsel - <i>Christina Hymer, Assistant General Counsel for General Law, DOE</i>
8:30 – 9:00 am	Presentation: New Latin American Biofuels Presidential Initiative - <i>Jonathan A. Shrier, National Security Council, White House</i>
9:00 – 9:30 am	Presentation: Genomics: GTL Research and Bioenergy Research Centers - <i>David Thomassen, Chief Scientist, Office of Biological and Environmental Research</i>
9:30 – 10:30 am	Discussion: Updated Roadmap
10:30 – 10:45 am	<i>Break</i>
10:45 – 11:30 pm	Continue Discussion: Roadmap
11:30 – 12:30 pm	Discussion: Fiscal Year 2007 Recommendations to the Secretaries of Agriculture and Energy
12:30 – 1:00 pm	<i>Working Lunch (to be provided)</i>
1:00 pm – 2:30 pm	Continue Discussion: Fiscal Year 2007 Recommendations to the Secretaries
2:30 – 3:00 pm	Discussion: 2007 Committee Work Plan
3:00 – 3:15 pm	<i>Break</i>
3:15 – 3:45 pm	Continue Discussion: 2007 Committee Work Plan <ul style="list-style-type: none">• Activities for the Committee through next meeting
3:45 – 4:00 pm	Public Comment
4:00 – 4:15 pm	Closing Comments/Adjourn

Attachment C: 2007 Work Plan

December 1, 2006 – November 30, 2007 Biomass R&D Technical Advisory Committee Background

The Biomass Research and Development (R&D) Technical Advisory Committee (Committee) is chartered to provide advice to the Secretaries of Agriculture and Energy and their points-of-contact (POCs) within the regulations of the Federal Advisory Committee Act (FACA). Under Secretary for Rural Development Thomas C. Dorr, U.S. Department of Agriculture (USDA), and Assistant Secretary for Energy Efficiency and Renewable Energy Alexander “Andy” Karsner, Department of Energy (DOE) are the Departmental POCs for 2006-2007.

The Committee was established by the Biomass R&D Act of 2000 [7 U.S.C. 7624 note] (as revised by the Energy Policy Act of 2005) to provide:

- Advice on the technical focus and direction of requests for proposals issued under the Biomass R&D Initiative, and
- Advice on the procedures for reviewing and evaluating the proposals.

The Committee shall also:

- Facilitate consultations and partnerships among Federal and State agencies, agricultural producers, industry, consumers, the research community, and other interested groups to carry out program activities relating to the Biomass R&D Initiative, and
- Evaluate and perform strategic planning on program activities relating to the Biomass R&D Initiative.

Additionally, the Committee shall have the following duties:

- Advise the POCs with respect to the Biomass R&D Initiative;
- Make recommendations in writing to the Biomass Research and Development Board to ensure that:
 - Funds authorized for the Biomass R&D Initiative are distributed and used in a manner that is consistent with the objectives, purposes, and considerations of the Biomass R&D Initiative;
 - Solicitations are open and competitive with awards made annually and that objectives and evaluation criteria of the solicitations are clearly stated and minimally prescriptive, with no areas of special interest;
 - The points-of-contact are funding proposals under this title that are selected on the basis of merit, as determined by an independent panel of scientific and technical peers predominantly from outside the Departments of Agriculture and Energy; and
 - Activities under the Biomass R&D Initiative are carried out in accordance with the Biomass Research and Development Act of 2000.

For each fiscal year for which funds are made available to carry out the Biomass R&D Initiative, the POCs provide a report to Congress, via the Secretaries of Agriculture and Energy, on whether funds appropriated for the Biomass R&D Initiative have been distributed and used in a manner that:

- Is consistent with the objectives, purposes, and additional considerations described in subsections (b) through (e) of section 307;
- Uses the criteria established under subsection (a)(3);
- Achieves the distribution of funds described in paragraphs (2) and (3) of section 307(g); and
- Takes into account any recommendations that have been made by the Advisory Committee.

1. Required 2007 Activities

Recommendations to Secretaries of Agriculture and Energy:

To be discussed at every public quarterly meeting throughout the fiscal year. At the last meeting of FY 2007, recommendations will be approved by majority vote for inclusion in the annual report to the Secretaries and Congress. The Biomass R&D Act of 2000 requires that the recommendations consider the following:

- Feedback on the results of the FY 2007 joint USDA – DOE biomass R&D solicitation.
- Recommendations for the FY 2008 joint solicitation.
- Recommendations on the progress of all R&D funded under the joint solicitation in achieving the goals of the Committee’s updated *Vision* document.

2. Recommended 2007 Activities

- Complete the update of the Committee’s *Roadmap* document. Submit both the *Vision* and *Roadmap* to the Secretaries of Agriculture and Energy in satisfaction of the Energy Policy Act of 2005 update requirement.
- Pursue the priorities of the Analysis and Policy subcommittees.
- Establish the goals and statement of work for a Communications subcommittee.
- Share Committee activities with other Federal Advisory Committees relevant to biomass.
- Communicate with the Biomass R&D Board (Board), both as a group and with individual agencies’ members, regarding Committee activities and priorities for biomass R&D. As required by the Biomass R&D Act of 2000, meet with the Board at least once during the year.

3. 2007 Deliverables

- Revised *Roadmap* document.
- Recommendations to the Secretaries of Agriculture and Energy on biomass R&D.
- Policy Gap Analysis and Recommendations
- Analysis Subcommittee Reports and Activities
- Committee Outreach Plan and Activities.

4 Timeline for Generation of Recommendations

In order to provide recommendations for the annual report to Congress for fiscal year 2007 before its due date of December 20, 2007, formal approval of recommendations must be prompt. During its March 2-3, 2006 meeting, the Committee agreed to collect recommendations during a specific session at quarterly public meetings throughout each fiscal year. Members also agreed to allow submission of recommendations up to the final due date via email at mmanella@bcs-hq.com. Submission via other means is possible by contacting Michael Manella at 410-997-7778*217. Two weeks after each public meeting, a list of all submitted recommendations will be provided to all Committee members. If members cannot access email, a hard copy of the list is provided via fax or regular mail. A timeline will be included in updated versions of this Work Plan, to provide all deadlines for submission of recommendations for the FY 2007 Annual Report.

5. Recommended Committee Meeting Schedule

In 2007, the full Committee will meet at least quarterly, as stated in its charter.

Date	Purpose
February 13-14, 2007 2 -Day Meeting Orlando, FL	<ul style="list-style-type: none"> ▪ Receive Status of the FY 2007 Joint Solicitation ▪ Discuss <i>Roadmap</i> Update first draft ▪ Review Policy Gap Analysis - discuss Committee comments and decide on recommendations to propose for inclusion in annual report ▪ Review Analysis Subcommittee Efforts ▪ Presentation on Cellulosic Ethanol Economic/Scenario Model ▪ Review Communications Subcommittee Statement of Work & Outreach Plan ▪ Discuss Local and State Biomass R&D Efforts, including any local projects funded under the biomass R&D joint solicitation ▪ Discuss FY 2007 Recommendations to the Secretaries
May 15(-16), 2007 1 or 2-Day Meeting L'Enfant Plaza Washington, DC	<ul style="list-style-type: none"> ▪ Discuss <i>Roadmap</i> DRAFT ▪ Discuss FY 2007 Recommendations to the Secretaries ▪ <i>SGE/New Member Orientation/New DFO/New Co-Chair</i> ▪ Receive an update on the FY 2007 joint solicitation ▪ Discuss Subcommittee Efforts ▪ Presentation from EXCO on Board Activities ▪ Presentation: Update on DOE/OBP Activities ▪ Presentation: Update on USDA Activities ▪ Presentation: Matrix Benefit Analysis of Section 9008 Projects ▪ Presentation from DOE OBP on Transition Modeling Efforts ▪ Presentation from Woody Biomass Utilization Group ▪ Presentation from BERAC (Biomass-related Advisory Committee) ▪ Presentation of USDA Analysis of Projects Funded by Farm Bill section 9008 ▪ Receive report on agency reactions to 2002-2006 recommendations
September 10-11, 2007 2-Day Meeting General Motors Detroit, MI Trip to proving grounds (Monday evening)	<ul style="list-style-type: none"> ▪ Review of National Biofuels Action Plan Discuss Interagency Biomass R&D Portfolio Analysis ▪ Approve FY 2007 Recommendations to Secretaries ▪ Discuss Policy, Analysis, and Communications Subcommittee Efforts ▪ Presentation from Wall Street/investment/financial bioenergy perspective ▪ Discuss Local and State Biomass R&D Efforts, including any local projects funded under the biomass R&D joint solicitation: Michigan Tech and/or Michigan State ▪ Presentation from Argonne National Lab on LCA for biofuels
November 28-29, 2007 2-Day Meeting Washington, DC	<ul style="list-style-type: none"> ▪ Review of National Biofuels Action Plan Discuss Interagency Biomass R&D Portfolio Analysis ▪ Receive an update on the status and awardees of the FY 2007 joint solicitation ▪ Presentation from USDA Agricultural Resource Service regarding financial analysis of feedstocks pricing ▪ Meet with the Biomass R&D Board to Discuss Recommendations, Research, and Policy ▪ Develop topics for the 2008 Work Plan ▪ Discuss Policy, Analysis, and Communications Subcommittee Efforts ▪ Discuss Local and State Biomass R&D Efforts, including any local projects funded under the biomass R&D joint solicitation

Attachment D: Presentations



U.S. Department of Energy Biomass Program

Growing a Robust Biofuels Economy



Jacques Beaudry-Losique
Program Manager

Technical Advisory Committee
May 15, 2007

1

US Commitment to Ambitious Biofuels Goals



- Cost-competitive cellulosic ethanol” by 2012
- **“20 in 10”**
 - Reduce U.S. gasoline* use by **20%** by 2017 through...
 - o **15%** reduction from new Alternative Fuels Standard at **35 billion** gallons/year
 - o **5%** reduction from enhanced efficiency standards (CAFÉ)
- **“30 in 30”**
 - Longer-term DOE biofuels goal
 - Ramp up the production of biofuels to **60 billion** gallons
 - Displace **30%** of U.S. gasoline consumption* by 2030

* light-duty vehicles only

2

Biomass R&D Initiative (BRDI)

Energy Efficiency &
Renewable Energy



- Multi-agency effort to coordinate and accelerate all Federal biobased products and bioenergy research and development.
- Mandated under the Biomass Research & Development Act of 2000, further revised by Energy Policy Act of 2005 (Sec 937).
- BRDI coordinating bodies
 - Biomass R&D Board, a cabinet level council co-chaired by DOE and USDA – also includes DOI, DOT, EPA, DOC.
 - **Commissioned National Biofuels Action (NBA) Plan by Fall 2007.**
 - OBP heavily engaged
 - Will need and require TAC input
 - Biomass R&D Technical Advisory Committee

BR&Di
BIOMASS RESEARCH & DEVELOPMENT INITIATIVE
www.brdisolutions.com

3

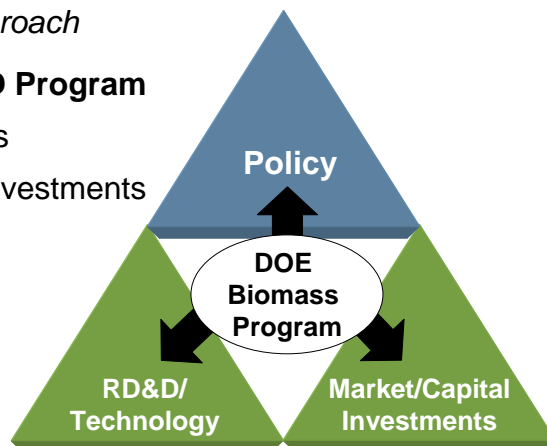
How Do We Achieve These Goals?

Energy Efficiency &
Renewable Energy



Three-pronged approach

- **Effective RD&D Program**
- Effective policies
- Private sector investments



4

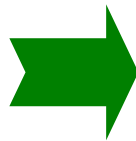
Biomass Program Mission

Energy Efficiency & Renewable Energy



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

- **Partnerships**
- **Policy**
- **Interagency Coordination**



Collaborative R&D

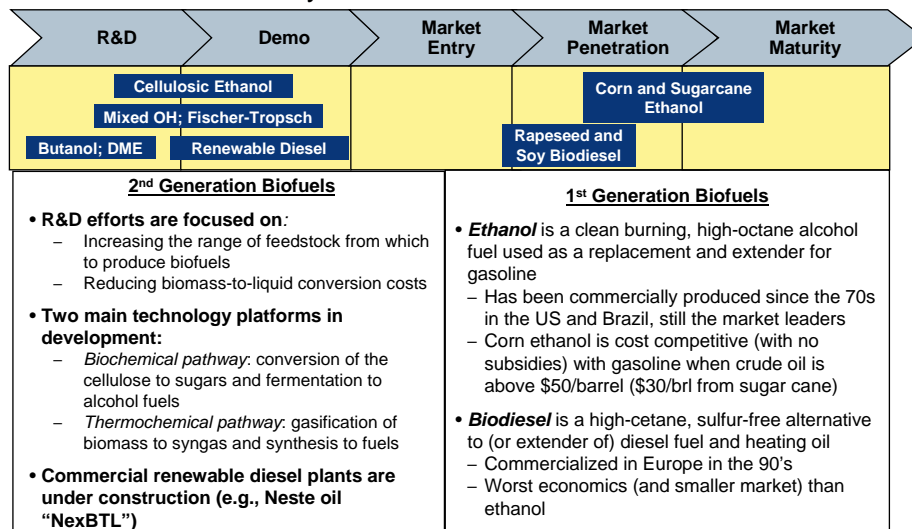
Integrated Biorefineries: Systems Integration and Demonstration

Core activities accelerate the technological advances needed to support a domestic bioindustry producing cellulosic ethanol and other biofuels in integrated biorefineries.

5

“First generation” biofuels are commercially developed technologies, but have high costs and limited scalability...

Energy Efficiency & Renewable Energy



Source: Navigant

Second generation” technologies aim to resolve these limitations

6

Targeted R,D &D: Overcoming Barriers

Energy Efficiency &
Renewable Energy



Barriers

- High cost of enzymatic conversion
- Inadequate technology for producing ethanol from sugars derived from cellulosic biomass
- Limitations of thermochemical conversion processes
- Demonstration/integration of technology in biorefineries
- Inadequate feedstock and distribution infrastructure

Solutions

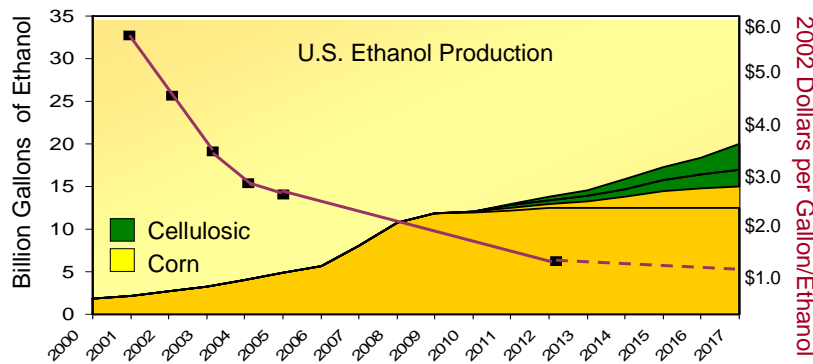
- R&D to improve effectiveness and reduce costs of enzymatic conversion
- R&D on advanced micro-organisms for fermentation of sugars
- Re-establish thermochemical conversion as a second path to success
- Fund loan guarantees, commercial biorefinery demonstrations, and 10% scale validation projects
- Form interagency infrastructure and feedstock teams

OBP organizes to deliver against barriers

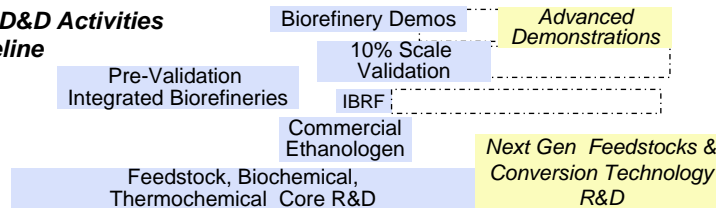
7

Cellulosic Ethanol Growth

Energy Efficiency &
Renewable Energy



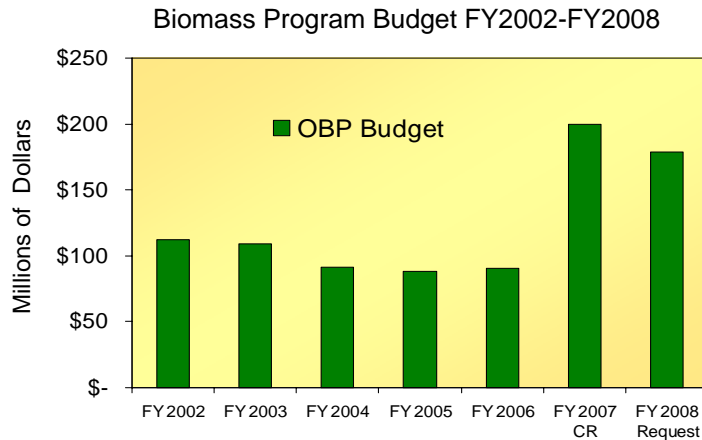
OBP RD&D Activities & Timeline



88

Impacts of the Advanced Energy Initiative

Energy Efficiency & Renewable Energy



The Advanced Energy Initiative is providing a boost in funding for critical biomass technologies in FY 2007.

9

Biomass Program Budget Overview

Energy Efficiency & Renewable Energy



Energy & Water Development Appropriation	FY06 Budget	FY 07 Budget	FY08 Request
Feedstock Infrastructure	479,000	9,967,000	10,000,000
Platforms Research & Development	15,140,000	50,530,000	59,400,000
Thermochemical Platform R&D	4,494,000	16,866,000	21,100,000
Bioconversion Platform R&D	10,646,000	33,664,000	38,300,000
Utilization of Platform Outputs	23,321,000	139,190,000	104,863,000
Integration of Biorefinery Technologies	11,073,000	104,403,000	96,863,000
Products Development	12,248,000	34,787,000	10,000,000
Cellulosic Ethanol Reverse Auction (EPACT Section 942)	-	-	5,000,000
Congressional Earmarks	51,778,000	0	TBD
Total	90,718,000	199,687,000	179,263,000

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FY 2006 Major Activities

Energy Efficiency &
Renewable Energy



- Significant Earmarks
 - Reevaluated portfolio
 - Cut back project funding levels and zeroed out projects
- First year of President's Advanced Energy Initiative
 - Developed RD&D strategy to meet the 2012 goal for making cellulosic ethanol cost competitive
- Initiated 2 Regional Feedstock Partnerships with USDA and the Sun Grant Initiative
- Hosted Two Workshops
 - "30 by 30" Industry workshop, August 2006
 - National Biofuels Action Plan Workshop, November 2006

11

FY 2007 Major Activities

Energy Efficiency &
Renewable Energy



- Core RD&D aimed at 2012 goal
- Competitive solicitations
 - EPA Section 932 Biorefinery Project selections
 - Ethanol project selections
 - 10 Percent Biorefineries
 - May 2007 - "USDA/DOE Joint Solicitation" under the Biomass Research and Development Initiative
 - June 2007 - Biochemical Platform R&D "Development of Improved Cellulases with Increased Activities"
 - June 2007 - Thermochemical Platform R&D "Integrated Syngas Cleanup & Fuels Synthesis Technology Development"
- Regional Feedstock Partnerships
- 20 in 10 Biofuels Infrastructure Analysis and Strategy
- Integrated Biorefinery Pilot Plant Users Facility at NREL
- Major Strategy/MYPP review in Progress

12

FY 2008 Major Activities

Energy Efficiency &
Renewable Energy



- Core RD&D activities aimed at 2012 goals
- Support for projects selected through competitive solicitations
- Select up to 10 10% validation scale solicitation projects
- Complete NBA Plan supporting 20 in 10 goals
- Biofuels Infrastructure RD&D coordinated with other DOE programs and other agencies
- Framework for implementing section 942 of EPACT 2005

13

Cellulosic Biorefinery Investments

Energy Efficiency &
Renewable Energy



Announced competitive selections on February 28 to provide up to \$385 million over four years for cost-shared integrated biorefineries in six states

- **Abengoa Bioenergy Biomass of Kansas**

Capacity to produce 11.4 million gallons of ethanol annually using ~700 tons per day of corn stover, wheat straw, milo stubble, switchgrass, and other feedstocks. (bio/thermo)

- **ALICO, Inc.**

Capacity to produce 13.9 million gallons of ethanol annually using ~770 tons per day of yard, wood, and vegetative wastes and eventually energy cane. (thermo/fermentation)

- **BlueFire Ethanol, Inc.**

Sited on an existing landfill, with capacity to produce 19 million gallons of ethanol annually using ~700 tons per day of sorted green waste and wood waste from landfills. (bio)



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Cellulosic Biorefinery Investments

Energy Efficiency & Renewable Energy



- **Poet**

Capacity to produce 125 million gallons of ethanol annually (~25% will be cellulosic ethanol) using ~850 tons per day of corn fiber, cobs, and stalks (bio)

- **Iogen Biorefinery Partners, LLC**

Capacity to produce 18 million gallons of ethanol annually using ~700 tons per day of agricultural residues including wheat straw, barley straw, corn stover, switchgrass, and rice straw (bio)

- **Range Fuels (formerly Kergy Inc.)**

Capacity to produce 40 million gallons of ethanol annually and 9 million gallons per year of methanol, using ~1,200 tons per day of wood residues and wood based energy crops (thermo)



15

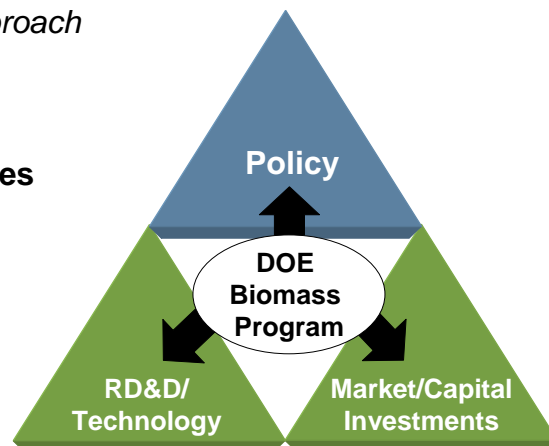
How Do We Achieve These Goals?

Energy Efficiency & Renewable Energy



Three-pronged approach

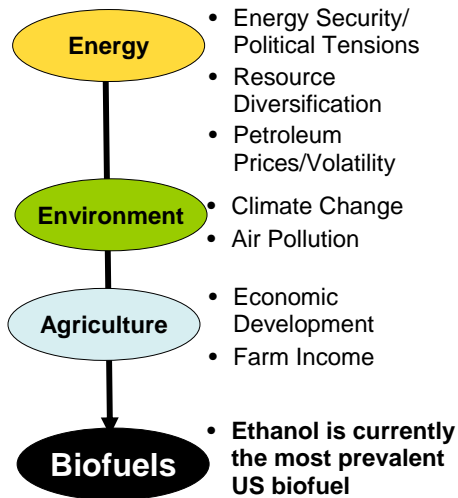
- Effective RD&D Program
- **Effective policies**
- Private sector investments



16

Policy Drivers & Incentives Supporting Biofuels

Energy Efficiency & Renewable Energy



Examples of Policies

United States

- Energy Policy Act of 2005 (federal policy)
- State tax credits, blend requirements...

Europe

- Tax credits: most common incentive
- EU set target for biofuels consumption (similar to RFS, but not a mandate)

Asia

- China, India, and Malaysia introducing policies to support biofuels
- Japan has tax credits in place

South America

- Brazil: Ethanol blending requirements in place and a requirement for biodiesel starting in 2008

Source: Navigant

Biofuels require a comprehensive & effective policy framework

17

Policies Accelerating Biofuels Production

Energy Efficiency & Renewable Energy



Energy Policy Act 2005 (EPAAct 2005)

- Section 932: **Commercial Integrated Biorefinery**
 - Secretary Bodman recently announced six awards
 - \$53 million in FY 2007 budget request
- Section 941: **Revisions to Biomass R&D Act of 2000**
 - *Vision* document released November 2006; updated *Roadmap* due May 2007
- Section 942: **Cellulosic Ethanol Reverse Auction**
 - Request For Information and Options papers completed
 - \$5 million requested for FY 2008
- Sections 1510, 1511, and Title XVII: **Loan Guarantees**
 - DOE issued guidelines for the first Loan Guarantees under Title XVII in August 2006
 - Loans for conversion of Municipal Solid Waste and cellulosic biomass to fuel ethanol and other commercial byproducts also considered under this offering

EPAAct 2005 goals are integrated into core technology priorities.

18

New Policies May Foster Market Expansion

Energy Efficiency & Renewable Energy



- National strategy for low level blends/
Regional strategy for E-85
- RFS with greater requirements for cellulosic ethanol
- Stronger incentives for all biofuels
 - Extension of ethanol subsidies to 2015
 - Payments to lignocellulosic biomass suppliers for residues and energy crops
- Tougher greenhouse gas regimes
- State support – individual state mandates/legislation



Ramp-up of ethanol production will require innovative and focused policies for infrastructure and feedstocks

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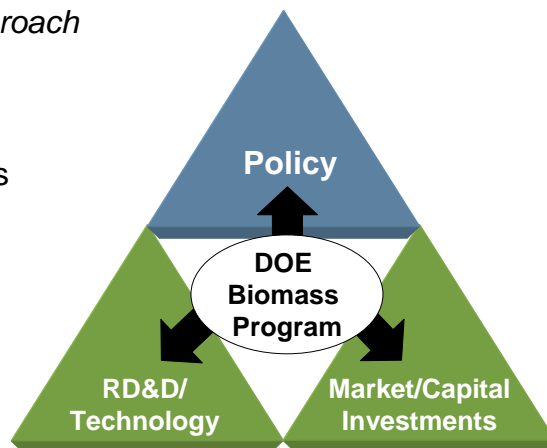
How Do We Achieve These Goals?

Energy Efficiency & Renewable Energy



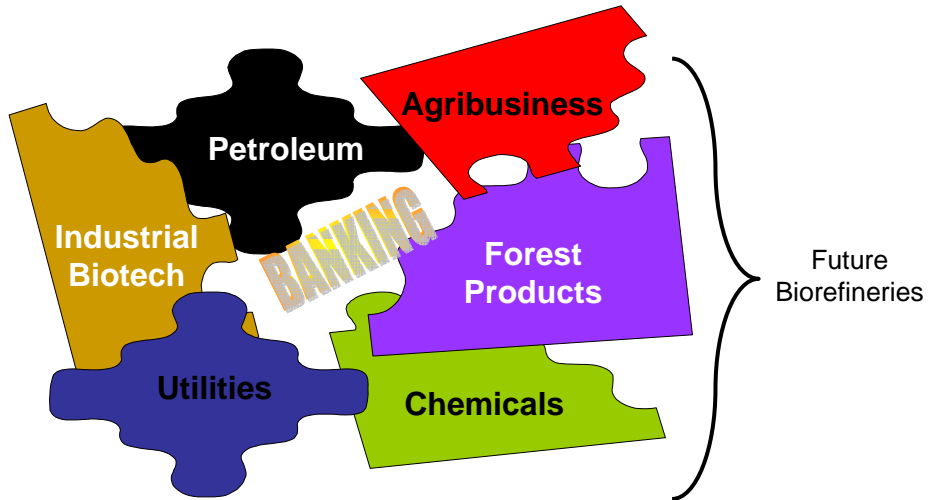
Three-pronged approach

- Effective RD&D Program
- Effective policies
- **Private sector investments**



20

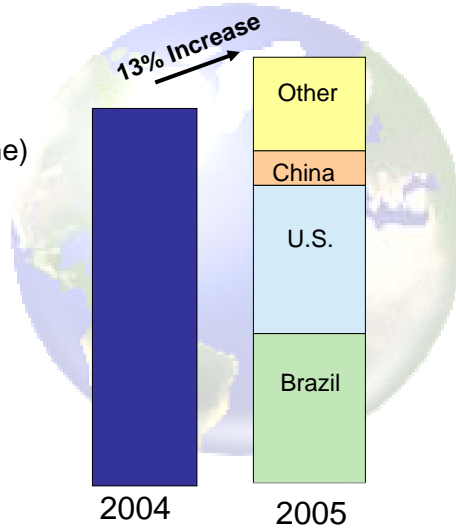
The future of biofuels will depend on the creation of new partnerships among several industries



Source: Navigant

Global Ethanol Status

- 2005 Production: 12,150 million gallons
 - o 35% -- U.S. (corn)
 - o 35% -- Brazil (sugarcane)
 - o 8% -- China (feedstock unknown)
 - o 22% -- Other Countries (wheat, barley, beet)
- 2004 Production: 10,770 million gallons



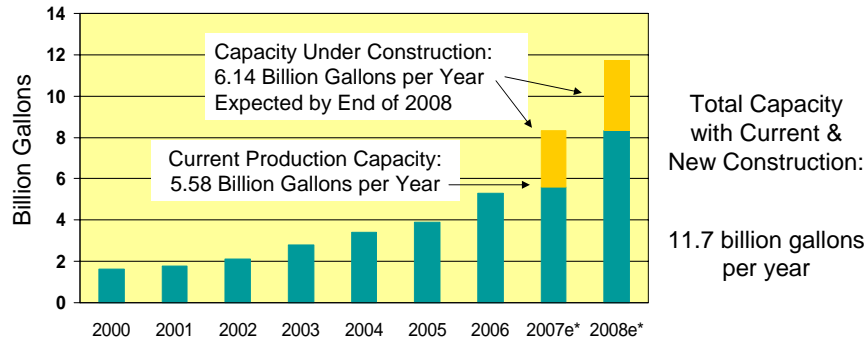
The market is placing bets on biofuels

US Markets Driven by High Prices and RFS: Building Capacity

Energy Efficiency & Renewable Energy



U.S. Ethanol Production Capacity



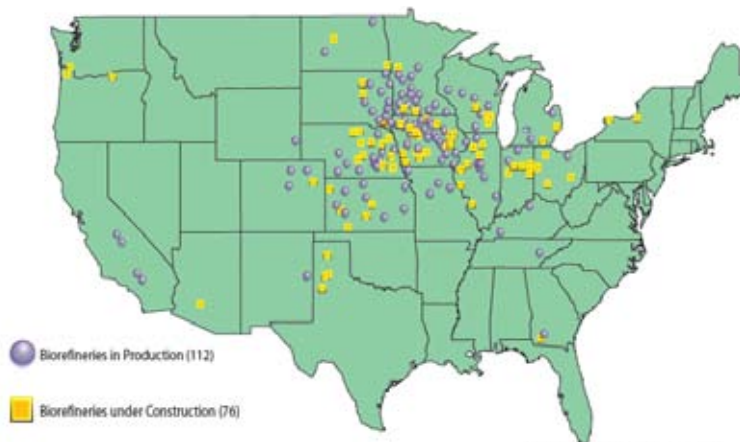
*Estimated as of February 7, 2007.
Source: Renewable Fuels Association.

While biofuels represent only 3% of US transportation fuels today, production is growing rapidly.

23

Ethanol Plants Focused on Midwest; "Destination" Plants Increasing

Energy Efficiency & Renewable Energy



Source: Renewable Fuels Association
1.29.07

One of the drivers for destination ethanol plants is to produce DDGS closer to market.

Source: Navigant

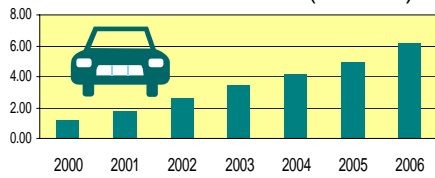
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U.S. Ethanol Infrastructure

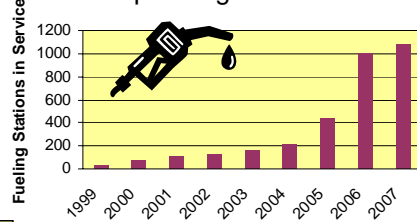
Energy Efficiency & Renewable Energy



FFV's in Service (millions)



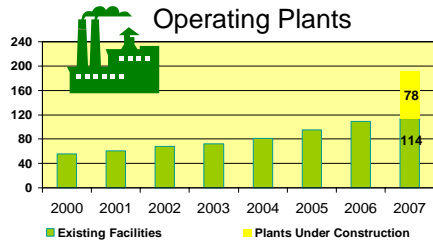
Operating E85 Stations



Source: Alternative Fuels Data Center, March 8, 2007

As of 3/8/07

Operating Plants



Existing Facilities Plants Under Construction

Source: Renewable Fuels Association

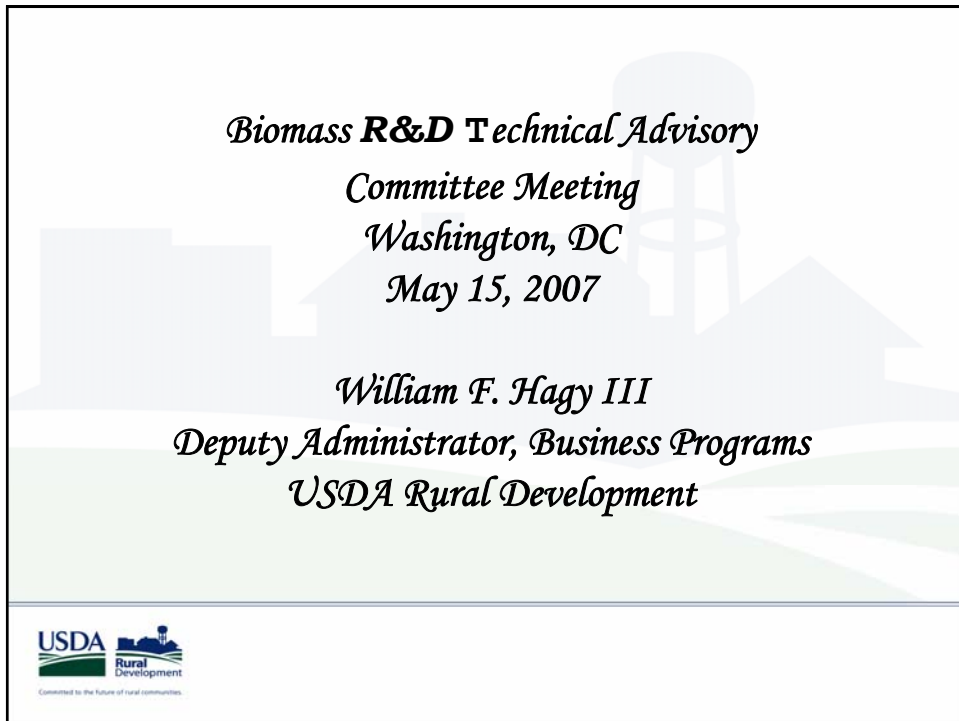
As of 2/25/07

Existing infrastructure lags behind projected biofuels production growth



*Biomass **R&D** Technical Advisory
Committee Meeting
Washington, DC
May 15, 2007*

*William F. Hagy III
Deputy Administrator, Business Programs
USDA Rural Development*



Update from USDA

- *Farm Bill*
- *FY 2007 USDA – DOE Joint Biomass R&D Solicitation*
- *Renewable Energy/Energy Efficiency Activities*
- *Woody Biomass Utilization Group (BUG)*
- *Policy Gap Analysis Report*



Farm Bill – Rural Development Title

- *Multi-Department Energy Grants Platform*
 - *Legislative language released – April 30, 2007*
 - *Amends Section 307 of Biomass R&D Act of 2000*
 - *Research and Development Grant*



Farm Bill – Rural Development Title

- *Multi-Department Energy Grants Platform (Continued)*
 - *Renewable Energy Systems and Energy Efficiency Grant (Section 9006)*
 - *Mandatory Funding*
 - *\$15 million annually - R&D Grant Program*
 - *\$50 million annually - Section 9006*
 - *Focus on cellulosic ethanol - R&D Grant Program*



Farm Bill – Rural Development Title

- *Multi-Department Energy Grants Platform (Continued)*
 - *Energy Loans*
 - *9006 Program – Direct/Guaranteed Loans*
 - *Cellulosic Ethanol Loan Guarantee*
 - *\$21 million annual mandatory funding for cellulosic ethanol loan guarantee*
 - *Intermediary Relending Program*



Farm Bill – Energy Title

- *Reauthorization of Federal Procurement of Bio-based Products*
- *Bio-diesel Fuel Education Program*
- *Revitalization of Cellulosic Bio-energy Program*



FY 2007 USDA/DOE Joint Biomass R&D Solicitation

- *Publication Date Projection*
- *30 day review for pre-applications*
- *Peer Review Process*
- *45 day Application Review*
- *Funding Available*
 - *USDA - \$14 Million*
 - *DOE - \$4 Million*



*USDA/DOE
Energy/Energy Efficiency Activity*

- *Energy Matrix*
- *Section 9006 – NOFA Published March 22, 2007*
- *Value-Added Producer Grant –NOSA Published April 16, 2007*



Matrix Benefit Analysis USDA Section 9008 Program

*Requested by William F. Hagy III
Deputy Administrator, Business Programs
USDA Rural Development*

*Helena L. Chum
Biorefinery Analysis and Exploratory Research
Group Manager and Senior Advisor
National Bioenergy Center
National Renewable Energy Laboratory*

Presented to the
Biomass R&D Technical Advisory Committee
May 14, 2007
Washington, DC

Outline

- Purpose
- Objectives
- System of Measurements
- Baseline Metrics for USDA Section 9008
- Tracking Measures to Assess Benefits

Study Purpose

- To evaluate the USDA Section 9008 program and awards from fiscal years 2002 to 2005 solicitations.
- To provide a general assessment of performance measures that could lend themselves to tracking of current and future benefits of the program

Objectives

- Document alignment with USDA strategic goals
- Document alignment with the guiding legislation
- Analyze processes and inputs
- Identify award outputs
- Evaluate outcomes by analyzing completed or nearly completed projects
- Assess potential impact of the program
- Suggest potential metrics for program implementation and offer recommendations.

Definition

Metrics – a **system of measurements** that includes the

- *Item being measured,*
- *Unit of measurement, and*
- *Value of the unit*

are a tool for

- *Measuring progress,*
- *Improving program performance, and*
- *Demonstrating program successes to*
 - Congress
 - Office of Management and Budget (OMB), and
 - Public

NRC, 2005, "Thinking Strategically, The Appropriate Use of Metrics for the Climate Change Program" ISBN 0-309-09659-6 (Book),
<http://www.nap.edu/catalog/11292.html>

Benefits Accrue Over Time

- To assess benefits follow the research outputs through to commercialization and their transformation into products and services used in our society
- Called **impact metrics**

Geisler, E. 2002, "The metrics of technology evaluation: where we stand and where we should go from here," *International Journal of Technology Management*, Vol. 24, No.4 pp. 341-374

Geisler, E. 2000. *The Metrics of Science and Technology*. Westport, CT: Quorum Books.

Qualities of Good Metrics

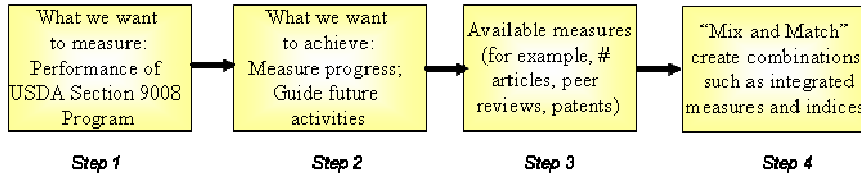
- Promote strategic analysis
- Serve to advance scientific progress or inquiry
- Promote continuous program improvement
 - Poor metrics can encourage actions to achieve high scores that could lead to unintended consequences
- Should be easily understood and broadly accepted by stakeholders
- Promote quality as a key objective
 - Quality is best assessed by independent, transparent peer review
- Assess process as well as progress
- Focus on multiple measures of progress
 - Single measures are often misguided

Challenges in Applying Metrics

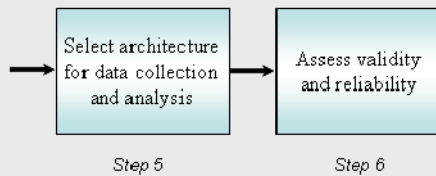
- Require significant human, financial, and computational resources to develop and apply meaningful metrics to a program
- Need to evolve to keep pace with scientific and technological progress and program objectives.
- Require good leadership if programs are to evolve toward successful outcomes.

Steps Used to Construct Metrics for Section 9008 Program

This study



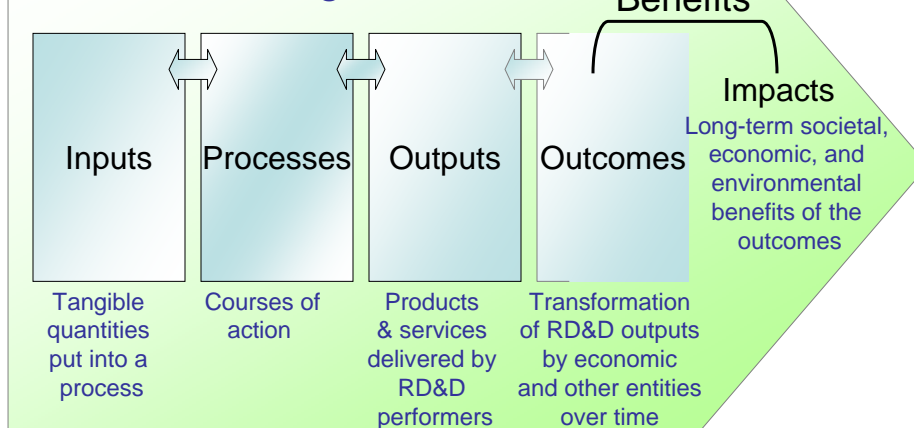
Future study

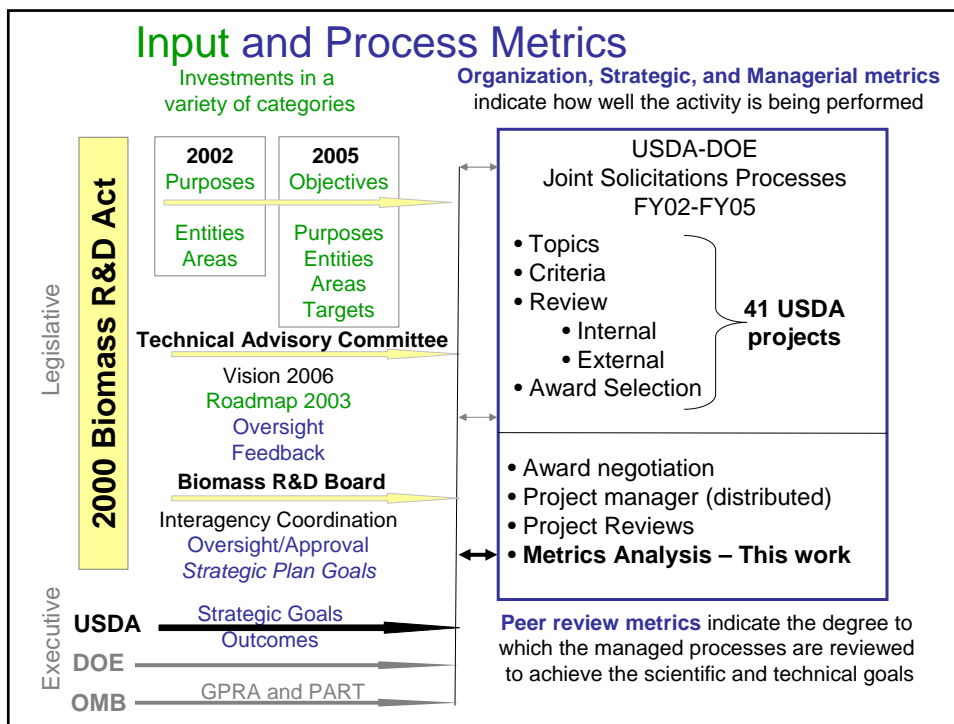


Geisler, E. 2002, "The metrics of technology evaluation: where we stand and where we should go from here," International Journal of Technology Management, Vol. 24, No.4 pp. 341-374

Section 9008 System of Measurements

To Achieve Program Goals





USDA Agencies, Offices, and Councils

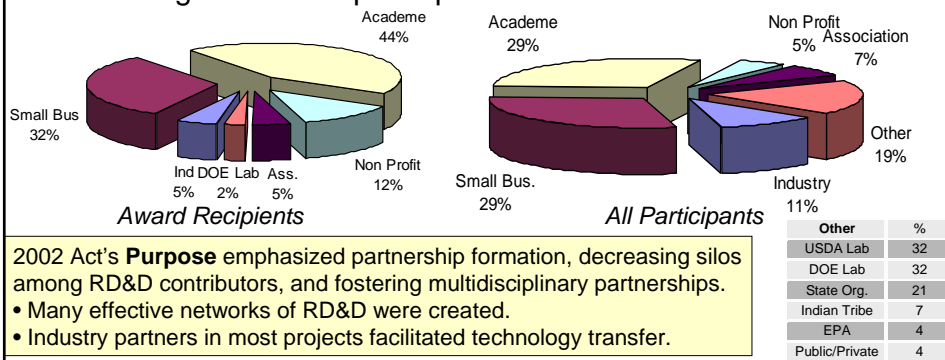
- Rural Development, **RD** – Current Manager
- Cooperative State Research Education and Extension Service, **CSREES** – Peer Review Process – External R&D arm
- Natural Resources Conservation Services, **NRCS** – Stewardship of Agricultural Lands – Initial Manager
- Agricultural Research Service, **ARS** – Internal R&D arm
- Forest Service, **FS** – Stewardship forest/grasslands and R&D
- Farm Service Agency, **FSA** – CCC funding and commercialization
- Office of Energy Policy and New Uses, **OEPNU** – Biobased Products FBP4 and biodiesel education program
- Intragency Collaboration and Coordination
 - USDA Biobased Products and Bioenergy Coordination Council, **BBCC**
 - **USDA Energy Council**
 - R&D
 - Commercialization
 - Outreach and Marketing
 - International

Alignment Strategic Goals/Outcomes/Measures:

- Increase use of renewable fuels and biobased products (bbp)
- Increase production of economically viable alternative energy
- Researched, demonstrated, promoted new bbp and energy technologies
- Enhanced capital formation to support sustainable business creation
- Provide new opportunities for ag producers and rural businesses

USDA Section 9008 Program

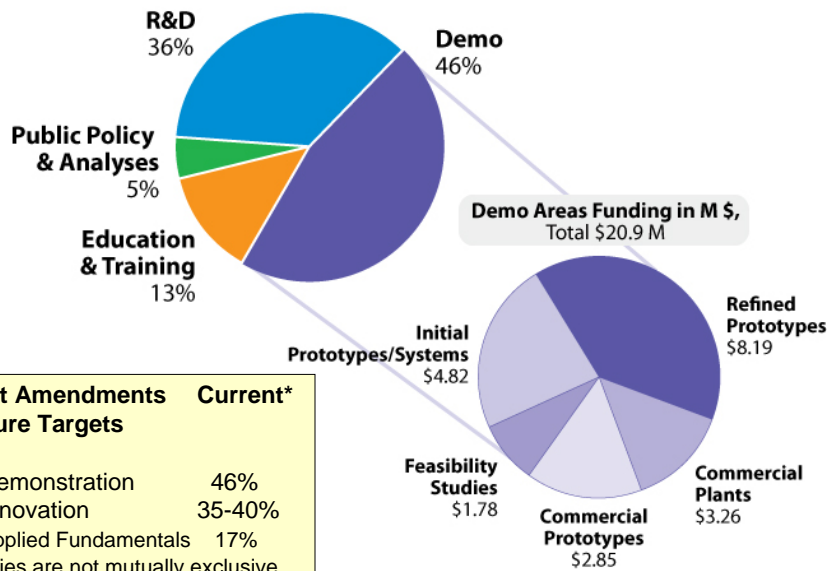
- 41 projects funded at \$46 Mi and \$36 Mi of non-federal cost share
- Project partnerships include 150 participating organizations in 36 states, DC, and a few international
- Integrated RD&D projects across multiple disciplines
- Average 5 partnering organizations/project
- Projects with 60 participants common. Has + and - impacts
- All Act eligible entities participated



2002 Act's **Purpose** emphasized partnership formation, decreasing silos among RD&D contributors, and fostering multidisciplinary partnerships.

- Many effective networks of RD&D were created.
- Industry partners in most projects facilitated technology transfer.

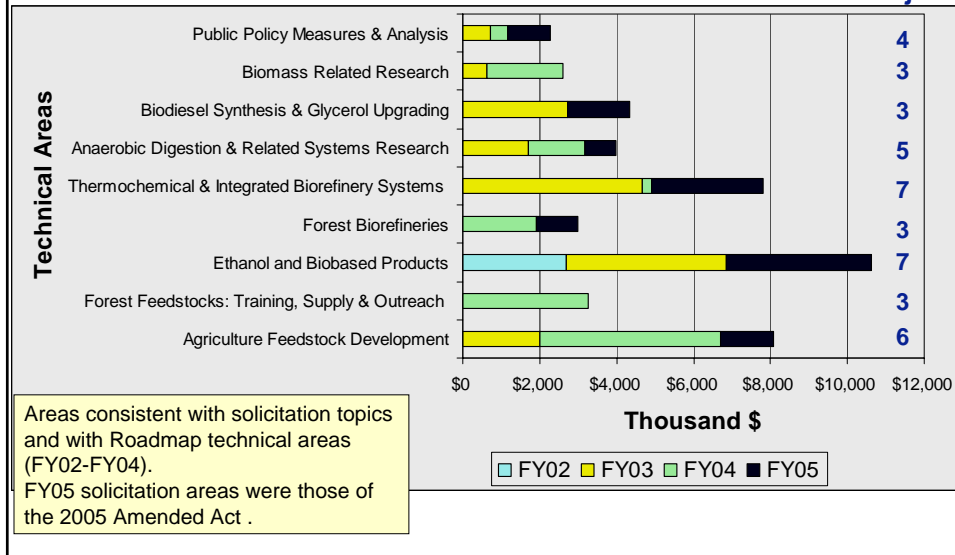
Funding Proportion by Stage of Development Total: \$46 Million



Project Portfolio by Solicitation Technical Topical Areas

\$45.98 M funds 41 projects

Projects



2003 TAC Roadmap Categories

Technical Area	USDA Section 9008 FY02-FY 05 Funding Thousand \$
Feedstock Production	\$7,823 (17%)
a. Biotechnology and Plant Physiology	a. \$2,840
b. Agronomic Practices	b. \$2,614
c. Feedstock Handling	c. \$2,369
Processing and Conversion	\$20,395 (44.5%)
a. Thermochemical Conversion Pathways	a. \$4,034
b. Bioconversion	b. \$10,953
c. Products	c. \$5,408
Product Uses and Distribution	\$7,582 (16.5%)
a. End-Products and Distribution Systems	a. \$483
b. Biorefineries – Pilots, Demos, and Commercial [includes integrated thermal/bioconversion]	b. \$7,099 [\$2,000]
Public Policy Measures to Support Biomass Development	\$10,179 (22%)
a. Economic Analysis	a. \$1,006
b. Life Cycle Assessment	b. \$674
c. Procurement and Markets	c. \$2,080
d. Regulatory Measures	d. \$340
e. Incentives	e. \$778
f. Biomass Resource Supply	f. \$2,478
g. Education, Outreach, and Training	g. \$1,395
h. Financial Assistance	h. \$-
i. Environmental Impact, Emissions Reductions	i. \$1,428

Technical Area Distribution

Areas	2005 Amended Act, %	Based on Solicitation Topics and Project Areas, %	Based on 2003 Biomass R&D TAC Roadmap Categories, %
Feedstock Corn, stover, DDG 37% Animal residues 22% Wood & residues 21% Switchgrass 13%	20	18-20	17 (R&D) 25 (with biomass resource supply)
Conversion (Overcoming Recalcitrance)	45	45-50	45
Product Diversification	30	25-30	16 (5%-10% in conversion)
Strategic Guidance	5	4-6	

USDA Technical Area Distribution is consistent with the legislation

USDA Section 9008 Projects

Solicitation FY, Managing Organization	Awards Announced	#	Grants Started	Grants Reviewed
2002 - DOE	10/2002	2	1/2003	DOE Stage Gate; 8/2005
2003 - USDA	9/2003	15	9/2003 – 1/2004	3-5/2005 (USDA)*
2004 - DOE	9/2004	13	12/2004-1/2005	5-6/2006 (USDA)* 3 feedstocks projects - DOE Stage Gate 3/2005
2005 - USDA	10/2005	11	--	Not reviewed yet

*Led by Professor M. Hanna from Industrial Agricultural Products Center at the University of Nebraska who selected members of the Multistate Committee S-1007: Science and Engineering for a Biobased Industry and Economy knowledgeable and available on the topics

Metrics in Research Programs

Peer Review Metric

- The item measured = **scientific outcomes**
- The unit of measurement = **subjective assessment**
- Inherent value = **performance and productivity** of scientists, engineers, and involved organizations.

NRC, 2003, "The Measure of STAR: Review of the U.S. Environmental Protection Agency's Science to Achieve Results (STAR) Research Grants Program , http://books.nap.edu/openbook.php?record_id=10701

Peer Review Metrics

Level	Focus	Type	Mechanism
1	Solicitation Process (and Program)	a) Biomass R&D TAC b) Biomass R&D Board	a) External statutory FACA b) Interagency federal government (statutory)
2	Solicitation Proposals	a) Internal agency review for fit b) External peer review for quality	a) USDA b) Industry, academia, labs, and government experts
3	Individual Project	a) Peer Review (all) b) Stage Gate (select)	a) On site with two independent experts from academia b) External Panel Review

Section 9008 program management processes include multi-level reviews to achieve the scientific and technical goals of the program:

- Overall solicitation process
- Individual solicitations
- Individual projects
- Feedback loops built into all these processes through TAC and Board

Proposed Output Metrics	Baseline of 20 projects Weight Average of 3 Years After Award
<ul style="list-style-type: none"> • <u>Direct Measure of R&D Quality</u> <ul style="list-style-type: none"> • Bibliometric measures coupled with quality assessments • Special honors or awards 	<p>Examples: 1 most downloaded; 1 most cited pub Production of peer reviewed and broadly accepted results and knowledge base increase. 40 publications. - None</p>
<ul style="list-style-type: none"> • <u>Resource Development</u> <ul style="list-style-type: none"> • Human • Infrastructure 	<p>81 faculty, industry, other led subprojects 39 graduate students, 12 students, 5 postdocs In academia, industry, research organizations</p>
<ul style="list-style-type: none"> • <u>Business Development</u> foster creativity and innovation <ul style="list-style-type: none"> • Patents (Pat.) and licenses • Growth of new and of existing businesses • Development of Products/Processes/Systems 	<p>Partnerships in all projects 1 Pat. Issues; 19 Pat. Filed; 2 licenses granted</p> <p>40 companies (75% small) can capitalize on IP</p> <p>10-12 processes; 17-25 products; 3 systems under investigation</p>
<ul style="list-style-type: none"> • <u>Quality Education and Information Transfer Products</u> <ul style="list-style-type: none"> • Quality and impact • Special honors or awards 	<p>Multilevel outreach Biomass Encyclopedia Network Bioenergy tool; Policy development information; social/env. issues None</p>

Outputs Moving to Outcomes

- Early Outcomes from Direct RD&D Outputs result from the increased understanding of scientific and technical areas
 - Number of licenses granted while conducting RD&D – **2**
 - Number of projects that obtained financing for commercial plants – **1** from **USDA RUS** and **1** from **private equity**
 - Number of advanced technology developments near commercialization – **1** **bioavailable cattle feed**

Intermediate Outcome Metrics from demos or advances from prior R&D by economic entities

- Number of improved processes/products under commercialization
- Number of integrated biorefinery systems developed and tested moving to commercialization
- Number of new products developed
- Number of licenses granted post RD&D at various times
- Number of companies/cooperatives/ventures created
- Number of technology packages resulting from the RD&D in operation – 1 for advanced cogeneration of heat and power from biomass residues in a dry mill in Minnesota

Final Outcomes

- Number and amount of biobased products directly incorporated into manufactured products
- Existing biorefineries commercializing process improvements and products from the RD&D
- New commercial biorefineries

Impact Metrics

- Indices for economic/financial outputs per dollar of program investment (total or by technical area that generated the impacts)
 - Energy security index: Value of fossil fuels substituted with renewable fuels – a surrogate for imported fuels substitution
 - Economic development index: Value of biobased products generated also a surrogate for diversification in agriculture and forestry
 - Economic development index: Number of jobs created in rural America and industry from the application of the program outputs
 - Energy diversification index: Value of the biomass energy as thermal or combined heat and power, or power generated also a surrogate for rural development
- Environmental quality and sustainability indices:
 - A climate change mitigation index: tons of fossil carbon emissions (and other green house gases) mitigated per dollar of program investment
 - A sustainability index could be generated for biomass feedstock, water use, fertilizer use, soil carbon measurements and soil fertility, and land/water stewardship with appropriate development of life cycle based measures
 - A green engineering index could take into account energy efficiency, plant water closure level, and overall emissions from the biorefineries thus providing energy, water, and emissions indices for the plants incorporating RD&D outputs of the research

Long-term societal, economic, and environmental benefits of the outcomes of the Program

Proposed Measures for Tracking

Measures	Measure Amount	Index Measure/ Million \$	Comments
USDA Funding, Million \$	\$22.4		
Cost Share, Million \$	\$22.7	1:1	50 % cost share
# Proj. FY02 (2), FY03 (15), FY04 (4)	20	0.9	One FY03 project continued in FY04. Counted as 1
Cumulative # Publications	40	1.8	Easy to track but best associated with quality index
Cumulative # Patents (applied and issued)	20	0.9	Upper limit. Later separate applied and issued patents. Index is 0.04 for issued patent.
Cumulative # technologies under commercialization	2	0.08	One 1 st commercial (Project # 14, FY03) and one commercial prototype (Project # 14 FY03)
Cumulative # Processes, products, systems under development	36	1.6	Difficult to track. Expert judgment on the overall portfolio.
Cumulative # Licenses	2	0.08	Easy to track
Cumulative # Companies involved with IP generation	40	1.8	Requires detailed analysis of projects
Cumulative # Projects financed	2	0.08	Easy to track. USDA RUS Loan (Project # 3 FY03). Equity financing (Project # 14 FY03)
Cumulative # Feasibility studies	5	0.2	Decrease investment risk. Downselection tool
Cumulative # Outstanding training/ education courses/policy analysis	3	0.12	Not just numbers; counts only if quality is built into it.
Cumulative # of students to Post-docs	56	2.5	Human resource development dimension of training of professionals. Easy to track
Cumulative # of project investigators and lead collaborators	81	3.6	Human resource dimension of complexity of projects with multiple investigators at different organizations.

A Benchmark for Technology Development – DOC-NIST's Advanced Technology Program (ATP)

Measures	1990-2000 Cumulative			Average 1999-2002		
	ATP	Target	Measure/ Million \$	ATP	Target	Measure/ Million \$
DOC/NIST Funding, Million \$	\$ 1,640			\$150		
Cost Share, Million \$	\$ 1,629		0.99	\$150		1.0
Cumulative # pubs generated by ATP funded research	565	680	0.34	150	100	1.0
Cumulative # patents generated by ATP funded research	693	770	0.42	100	100	0.67
Cumulative # technologies under commercialization	166	170	0.10	25	35	0.17

National Institute for Standards and Technology (NIST)

Comparison

	ATP Development only 1990-present	RD&D - USDA Section 9008
Cumulative # Publications/Mi\$	0.34 mid program 1.0 early 2000	1.8 includes earlier R&D phases
Cumulative # Patents/Mi\$	0.42 mid program 0.67 early 2000	0.04 issued 0.9 applied
Cumulative # Techn. Under Development/Mi\$	0.10 mid program 0.17 early 2000	0.08 0.24 estimated based on 36 tech under development and the ratio 9:1 from prototypes to successful commercialization*

*Stevens, G.A.; Burley, J. 1997. "3,000 Raw Ideas = 1 Commercial Success". Research Technology Management, Vol. 40(3) pp. 16-17

First Integrated Dry Mill Biorefinery Outcomes/Impacts Sebesta, Blomberg and Associates

Technological Growth Existing Business

- 1st integrated dry mill with biomass cogeneration.
- Reduced cost volatility by replacing NG with biomass energy
- NG savings/yr 735,000 MiBTU/yr
- Pay back of cogen facility 3-6 yrs depending on NG price
- Increased diversity of products from plant

Foundation

- Infrastructure creation for biomass residue for energy
- Partnership development model can be replicated
- Outreach papers – 5

Energy & Environment

- 1 MW green power operational. Green electricity sold to grid
- Reduced water use in plant by 50%
- Reduced VOC emissions to compliance or better

Jobs

- 20 jobs added in the infrastructure of biomass residues with Woodline Mfg.
- Sebesta already requested to analyze 6 other dry mills and other industries
- Primenergy and other gasification companies contacted

Advanced Anaerobic Digestion Technology Utah State University-Andigen

Technological Growth Existing Business (Dairies) and New (Andigen and its licensees)

- 1st Commercial Plant (USDA funded – 4 tanks) spurred sales of 7 tanks.
- Two licenses developed – ID and Central CA

Foundation

- Technology modularity, automation, and remote control will facilitate penetration of technology at farmer level. Patents and improving testing in UT
- Partnership and dissemination through NRCS – Texas, Montana, Oregon, Utah farmers and USDA staff visits
- Outreach papers – 5; 4 research students trained

Energy & Environment

- Penetration in ID will replace 10% of NG residential heating with green natural gas or 2 Trillion Btu/yr (250,000 homes)
- 15-yr contract with InterMountain Gas for purchase of compressed BioMethane in ID
- Reduced emissions, odor control, which will enable increased rural economic development in Magic Valley, ID
- Electricity production in UT Dairy will be sold to grid at 4.7 cents/kWh to Pacificor (took 1 yr for agreement and 7 mo for permitting).
- Potential additional products in fertilizers

Jobs

- 6 employees at Andigen; spurring job creation in Idaho (Intrepid) and California (AgriMass EnviroEnergy)
- Andigen already receiving proposals from potential licensees to other states and countries

Biomass R&D for Fuels, Chemicals & Improved Cattle Feed

1. Dry Mill Improvement – fractionation of the germ, pericarp, and endosperm
2. Bioavailable cattle feed from corn processing by products and pretreated agriculture residues



Pellet extrusion



Pellets

Offset cracked, rolled and flaked corn feed with these products liberates corn for increased ethanol production. Potential increase is 40% of today's 4.4 billion gallons at full market penetration.

Prime, Location: Archer Daniels Midland Co., Decatur & Champaign, IL; Decatur, IN
Participating Orgs: USDA ARS, EERC; Univ Illinois; ADM Animal Nutrition
Funding: \$1.4 M ; Cost share: \$600,000
PoP: Jan 04 to Dec 06 *P.I.: Charles Abbas; abbas@admworld.com*



Fuels, Chemicals, and Improved Cattle Feed ADM

Technological Growth Existing Business

- Increased production of ethanol and biodiesel from improved fractionation
- Increased diversity of products from dry mill plants.

Foundation

- Farmer/cooperatives could establish animal feed pellets production on site.
- Partnership model can be replicated in many places
- 2 PhD students, 2 post docs, interdisciplinary areas of research in three organizations involved.

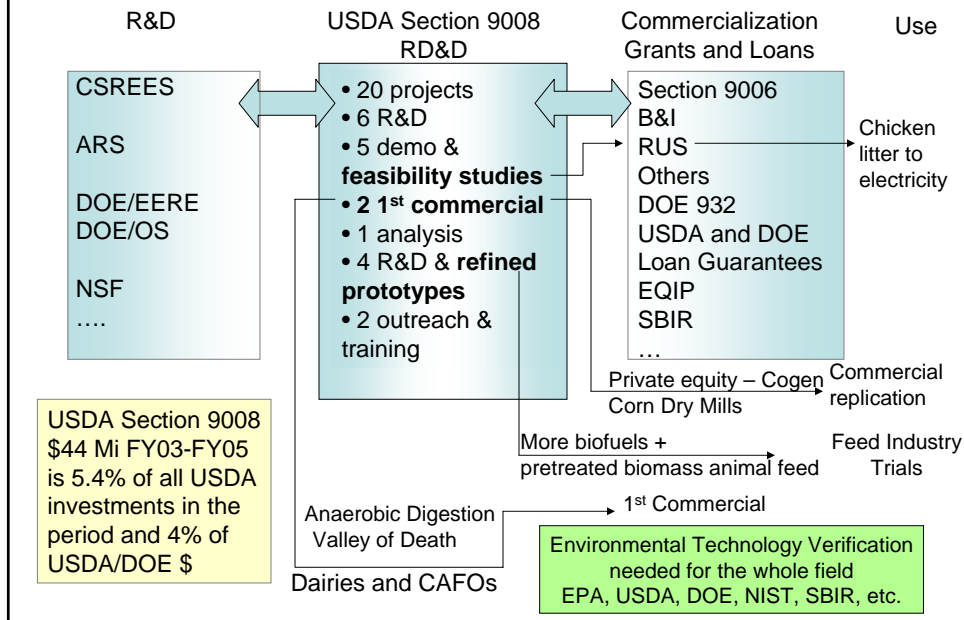
Energy & Environment

- Energy savings/yr about 1,500 Billion BTU per dry mill implementing technology. 60 dry grind mills could use the technology.
- Penetration 70-100 % of technologies can produce additional 1.2-1.7 Billion gal of ethanol from corn (40% of 4.4 billion gal)
- 130 million additional gal biodiesel production possible

Jobs

- Model for feed development with farmers could lead to creation of many businesses for feed manufacturing and distribution close to where the need for the feed is.

Summing Up



USDA Funding Section 9008 Projects

#	FY	Title	Submitter	Funding	Cost Share*
Agriculture Feedstock Development					
3	FY03	Advanced Biorefinery Feedstocks	MetaboliX, Inc., Cambridge, MA	\$ 2,000,000	\$ 1,833,835
19	FY04	Integrated Size Reduction and Separation to Pre-Fractionate Biomass	University of Tennessee, Knoxville, TN	\$ 717,319	\$ 307,180
21	FY04	Integrated Feedstock Supply Systems for Corn Stover Biomass	Iowa State University, Ames, IA	\$ 1,999,724	\$ 738,439
20	FY04	Biomass Opportunity for Imperial, Nebraska Region: What is the Value?	Imperial Young Farmers & Ranch, Imperial, NE	\$ 2,000,000	\$ 1,113,280
31	FY05	Increasing the Potential for the Utilization of Cellulose from Straw for Biofuel and Bioproduct Production	University of Idaho, Moscow, ID	\$ 693,285	\$ 184,277
32	FY05	Development of Low-Lignin Switchgrass for Improved Ethanol Production	The Samuel Roberts Noble Foundation, Ardmore, OK	\$ 670,166	\$ 204,415
				\$ 8,080,494	\$ 4,381,426
Forest Feedstocks - Management Training, Supply, and Outreach					
28	FY04	Sustainable Forestry for Bioenergy and Biobased Products	Southern Forest Research Partnership Inc., Athens, GA	\$ 1,801,453	\$ 541,448
27	FY04	Development of Existing Biomass Resources through Education of Key Supply Bottlenecks	University of Minnesota, Brainerd, MN	\$ 397,711	\$ 116,386
26	FY04	Technology Transfer and Education Programs for the Southern U.S.	University of Florida, School of Forest Resources & Conservation	\$ 1,075,001	\$ 368,704
Subtotal				\$ 3,274,165	\$ 1,026,538

#	FY	Title	Submitter	Funding	Cost Share
Ethanol and Biobased Products					
2	FY02	Continuous Isosorbide Production from Sorbitol Using Solid Acid Catalysis	Iowa Corn Promotion Board, Johnston, IA	\$ 700,000	\$ 1,615,756
1	FY02	Value-Added Products from Hemicellulose Utilization in Dry Mill Ethanol Plants	Iowa Corn Promotion Board, Johnston, IA	\$ 2,000,000	\$ 2,970,319
11	FY03	Grain Value Process: Pre-Commercialization Trials	Grain Value, LLC, St. Paul, MN (Small Business)	\$ 1,763,160	\$ 1,210,800
10	FY03	Biomass Research and Development for the Production of Fuels, Chemicals, and Improved Cattle Feed.	Archer Daniels Midland Co., Decatur and Champaign, IN	\$ 1,400,000	\$ 600,000
13	FY03	Biopolymers and Other Value-Added Products from Distillers' Dried Grains	Iowa State University, Ames, IA	\$ 1,000,000	\$ 250,757
33	FY05	Implementation of a Scale-Up Pilot Plant Demonstration Facility toward the Commercialization of Florida Biomass Feedstocks for Ethanol Production	The Tampa Bay Area Ethanol Consortium, Bartow, FL	\$ 1,920,000	\$ 480,000
38	FY05	Environmental Enhancement through Corn Stover Utilization	Iowa State University, Ames, IA	\$ 1,853,996	\$ 500,349
				\$ 10,637,156	\$ 4,657,662
Forest Biorefineries					
24	FY04	Hayfork Biomass Utilization and Value Added Model for Rural Development	Watershed Research and Training Center, Hayfork, CA	\$ 503,400	\$ 152,000
25	FY04	Development of a Wood Preservative System from Wood BioOil Fractions	Mississippi State University, Forest Products Department, Starkville, MS	\$ 1,409,011	\$ 353,000
37	FY05	Carbon Fiber from Biomass Lignins	Oak Ridge National Laboratory, Oak Ridge, TN	\$ 1,083,770	\$ 450,000
				\$ 2,996,181	\$ 955,000

#	FY	Title	Submitter	Funding	Cost Share
Thermochemical, Integrated Biorefinery Systems, and Training					
17	FY03	Biomass Cogeneration Demonstration Plant at Central Minnesota Ethanol Cooperative	Sebesta, Blomberg & Associates, Inc., Roseville, MN	\$2,000,000	\$ 13,000,000
5	FY03	Animal Waste Management-Chicken Litter to Energy	Earth Resources, Inc., Carnesville, GA	\$ 1,136,936	\$ 800,000
14	FY03	Biomass-Fired District Energy: A Source of Economic Development and Energy Security	Local Energy, Tesuque, NM	\$1,286,768	\$ 455,500
18	FY03	Feasibility of an Integral System for Improving the Economic and Environmental Performance of Poultry and Ethanol Production in North Alabama	T.R. Miles, Technical Consultants, Inc., Portland, OR	\$ 254,274	\$ 64,449
30	FY04	Small-scale, Biomass Fired Gas Turbine Plants Suitable for Distributed and Mobile Power Generation	Electric Power Research Institute, Palo Alto, CA	\$ 241,933	\$ 80,645
35	FY05	Biomass Gasification: A Comprehensive Demonstration of a Community-Scale Biomass Energy System	University of Minnesota, Morris, MN	\$ 1,896,493	\$ 2,345,597
39	FY05	Biopower Demonstration and Educational Outreach	University of Montana, College of Technology, Missoula, MT	\$ 990,500	\$ 443,500
				\$7,806,904	\$ 14,319,949

#	FY	Title	Submitter	Funding	Cost Share
Anaerobic Digestion & Related Research					
4	FY03	R&D of Anaerobic System on a Large Dairy Farm	Utah State University, Logan, UT	\$ 761,385	\$ 400,000
15	FY03	Steps Towards a Biorefinery Industry in Vermont	Vermont's Alternative Energy Corporation, Williston, VT	\$746,912	\$ 224,074
8	FY03	Design and Demonstration of a Commercial Prototype for Onsite Production of High Purity Hydrogen from Farm Animal Wastes - Phase I - proof of concept	New Energy Solutions, Inc., Pittsfield, MA	\$ 204,603	\$ 111,888
9	FY04	Design and Demonstration of a Commercial Prototype for Onsite Production of High Purity Hydrogen from Farm Animal Wastes - Phase II and III	New Energy Solutions, Inc., Pittsfield, MA (small business)	\$ 1,456,931	\$ 438,112
34	FY05	Environmental and Economic Performance of an Integrated, Digester-Cogeneration-Value-Added Process	Clarkson University, Potsdam, NY	\$ 805,938	\$ 960,315
				\$ 3,975,769	\$ 1,174,074
Biodiesel Catalytic Synthesis & Glycerol Catalytic Upgrading					
7	FY03	Heterogeneous Catalyst Development for Biodiesel Synthesis	Clemson University, Clemson, SC	\$894,203	\$ 230,836
6	FY03	New Technologies for the Production of Methyl Esters	West Central Cooperative, Ralston, IA	\$1,826,648	\$ 550,000
36	FY05	Conversion of BioDiesel Derived Glycerol to Glycidol, Glycerol Carbonate and C-3 Oxygenates by Catalytic and Biocatalytic Pathways	North Carolina State University Department of Chemical & Biomolecular Engineering, Raleigh, NC	\$ 1,606,265	\$ 411,795
				\$ 4,327,116	\$ 1,192,631

#	FY	Title	Submitter	Funding	Cost Share
Specific Process Component Research					
12	FY03	Coupled Processes for Bioenergy Production: Biological Hydrogen Production Links with Microbial Fuel Cells	Pennsylvania State University, University Park, PA	\$ 614,913	\$ 175,965
23	FY04	BioSep: A New Ethanol Recovery Technology for Small-Scale Rural Production of Ethanol from Biomass	Membrane Technology and Research, Inc., Menlo Park, CA	\$ 1,032,045	\$ 600,000
22	FY04	Fuel Cell Systems Operating on 100% Bio-Liquid Fuels	Technology Management Inc., Cleveland, OH	\$ 965,161	\$ 241,290
				\$ 2,612,119	\$ 1,017,255
Public Policy Measures to Support Biomass Deployment - Outreach					
16	FY03	Biomass for Tomorrow's Energy and Greenhouse Gas Management Needs: An Economic, Engineering and Environmental Appraisal of Opportunities & Policies	Texas Agricultural Experiment Station, Texas A&M, College Station, TX	\$716,338	\$ 182,050
29	FY04	Development of Workable Incentive Systems for Biobased Products, Biofuels and Biopower	North Carolina State University, Raleigh, NC	\$ 450,000	\$ 115,333
40	FY05	Incentives for Biomass Commercialization: Pioneering Markets for Biomass Using Renewable Energy Certificates, Emission Reduction Credits and Incentive Programs for Ammonia, PM10 and PM2.5 Reductions	Environmental Resources Trust, Washington, DC	\$ 449,993	\$ 191,078
41	FY05	Bioenergy: Optimum Incentives and Sustainability of Non-Industrial Private Forests in the U.S. South	University of Florida, Gainesville, FL	\$ 656,525	\$ 164,494
				\$ 2,272,856	\$ 470,905
* Cost share as submitted for FY05				\$ 2,272,856	\$ 470,905

Biomass R&D Technical Advisory Committee's

Policy Subcommittee Update

1

Policy Subcommittee Members

- James Barber - Chair
- Bob Dinneen
- Mark Maher
- Scott Mason
- Larry Pearce

2

Policy Gap Analysis

- Was developed in the fall of 2006.
- Submitted to the Committee for review in 2006.
- Revised and accepted by the Committee in February 2007.
- Submitted on March 23, 2007 to USDA for consideration in the 2007 Farm Bill discussions.

3

- Open discussion with the Committee.

4

Outreach Subcommittee

Report to the Committee
May 2007

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Charge to the FACA

- To advise the Secretary of Energy, the Secretary of Agriculture, and the points of contact concerning
 - the technical focus and direction of requests for proposals issued under the Initiative; and
 - procedures for reviewing and evaluating the proposals;
- **To facilitate consultations and partnerships among Federal and State agencies, agricultural producers, industry, consumers, the research community, and other interested groups to carry out program activities relating to the Initiative; and**
- To evaluate and perform strategic planning on program activities relating to the Initiative.

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Subcommittee Opinion

The FACA is in a unique position to facilitate interaction and support public outreach by the agencies due to its credibility as a group of third party experts.

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Outreach Plan

- Limited media events to announce work products
 - Vision and Roadmap
- Grassroots efforts
 - Speakers bureau of FACA members
 - PowerPoint presentation
 - Convert to video

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- The Federal Technical Advisory Committee for Biomass Research and Development
 - has published a new Vision which sets goals for biofuels, bioproducts and bioenergy.
 - has gathered input from industry leaders, farm groups, state governments, university researchers and everyday people and is developing a Roadmap to reach those goals.
 - is focused on the long-term overall national shift from a petroleum economy to bio-renewable economy.

Today's biofuels, ethanol and biodiesel, are already playing a growing role in reducing our dependence on foreign supplies of petroleum for gasoline, diesel fuel and heating oil, while providing good jobs here in the US.

- The subsidies on these fuels create new demand for crops and have reduced the deficiency payments paid to farmers when crop price are low. Ethanol and biodiesel are actually reducing the payments made to farmers more than they cost in tax payer support!

(Can we substantiate this?)

- New research to make fuels from non-food biomass shows real promise and should become a reality by 2012. In the mean time the country needs to figure out how to transport and store these new raw materials and finished products. We need big investments in new infrastructure to handle the new energy products and that means jobs all over the country.

The rising cost of petroleum and natural gas have hurt the chemical industry, especially plastics, in the US. Plastics made from corn, soybeans, sugars and other biobased materials are already coming into the market. We need an accelerated program to develop new chemical products from natural materials we can produce year in and year out here at home.

By capturing carbon dioxide from the atmosphere and converting it into carbohydrates, plants lock up greenhouse gases. Chemicals made from those carbohydrates have been shown in most cases to be better for the environment.

In 2001 burning and gasification of biomass in the US to make steam and electricity accounted for 3.2 quadrillion BTU of energy or over 3% of our power generation needs. Almost as much as wind, solar and hydroelectric combined!

Burning biomass alone or in combination with coal reduces emissions of greenhouse gases and smog forming compounds compared to coal alone.

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The Vision of the Federal Technical Advisory Committee for Biomass Research and Development is that to utilize biomass most effectively will require a balance of fuels, chemical products and power generation from the same sources in what has come to be called a biorefinery.

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Analysis Subcommittee

May 15, 2007
Biomass Technical Advisory
Committee Meeting

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Analysis Subcommittee

- Purpose: To conduct high level assessment of “foundational documents” used by agencies in decision making and program guidance and to provide comment via the Biomass Technical Advisory Committee as input to agency and/or industry programs on their past, present, and future analytical project documents.

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- The committee was asked to provide high level assessment of the documents and its members decided to focus their comments on each document's:
 - (1) key assumptions;
 - (2) analysis methods;
 - (3) data quality;
 - (4) whether the conclusions were supported by the analysis; and
 - (5) the quality of independent reviews prior to publication.

- Ralph Cavalieri, Washington State University
- Douglas Hawkins, Rohm and Haas
- John Hickman, John Deere
- Charles Kinoshita, University of Hawaii at Manoa
- Eric Larson, Princeton University
- John McKenna, Hamilton Clark & Co.
- Edwin White, SUNY - ESF

- Federal liaisons:
 - Harry S. Baumes, USDA, Associate Director
Office of Energy Policy and New Uses
 - Valri Lightner, Department of Energy,
Biomass Program, EE-2E
- BCS liaison:
 - Leslie Pezzullo

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- US-DOE reports reviewed to date:
 - The potential of thermochemical ethanol via mixed alcohols
production
 - Preliminary Screening - Technical and Economic Assessment of
Synthesis Gas to Fuels and Chemicals with Emphasis on the
Potential for Biomass-Derived Syngas
 - Development of a Multi-Criteria Assessment Model for Ranking
Biomass (corn stover) Collection and Transportation Systems
 - Costs of Wet Corn Stover Harvest, Large-Pile Storage, and
Transport
 - Roadmap for Agriculture Biomass Feedstock Supply in the
United States
 - Lignocellulosic Biomass to Ethanol Process Design and
Economics Utilizing Co-Current Dilute Acid Prehydrolysis and
Enzymatic Hydrolysis for Corn Stover
 - Updated: Development of Two Process Assessment Cases:
2003 State of Technology and 2002 Experimental Parameters

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- Summary of review of these documents (November 13, 2006 report):

“General consensus on the documents reviewed was that many of the analyses were well-done, but based on out-dated, unclear, or questionable assumptions. It remains uncertain what review, if any, was conducted prior to publication for several of the documents. In one case, one of the authors provided a “peer review”, a highly irregular procedure. The subcommittee would like to assist in the development of a review process for biomass R&D analytical documents, to facilitate delivery of an end product with a high degree of objectivity and quality.”

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- Next steps
 - Examine list of 96 USDA documents recently compiled and provided to the subcommittee.
 - With input from USDA and US-DOE, select 5-10 that are “foundational” for decision making and program direction
 - Determine review teams and collect assessments prior to meeting later in 2007

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Office of Science
U.S. Department of Energy



Genomics: GTL Research and Bioenergy Research Centers

May 16, 2007

Biomass R&D Technical Advisory Committee Meeting

David Thomassen, Ph.D.

Chief Scientist

Office of Biological and Environmental Research

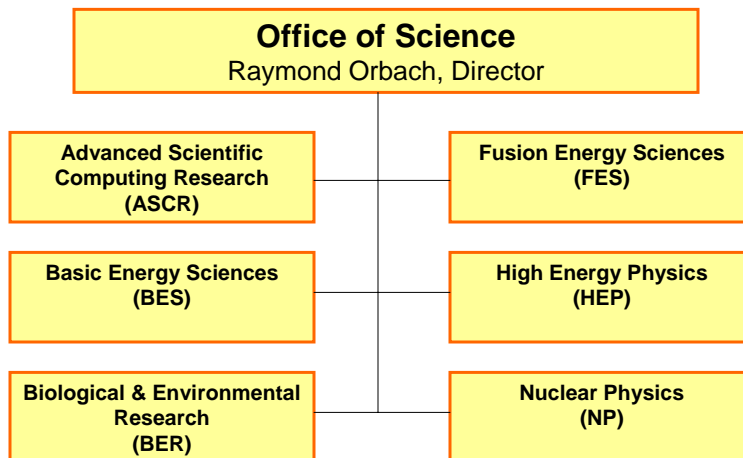
DOE Office of Science

U.S. Department of Energy



Office of Science

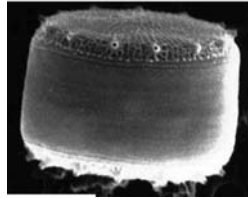
Office of Science





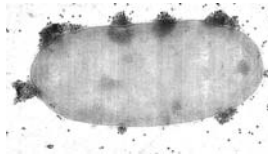
We can find biotechnology solutions using the natural diversity of microbes and microbial communities

Thalassiosira pseudonana



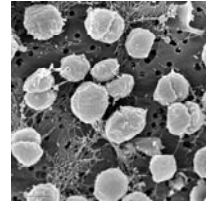
Ocean carbon pumping

Microbulbifer 2-40



Biomass conversion

Methanococcus jannaschii



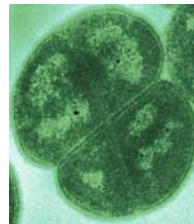
Methane production

Rhodospseudomonas palustris



Hydrogen production / Carbon sequestration

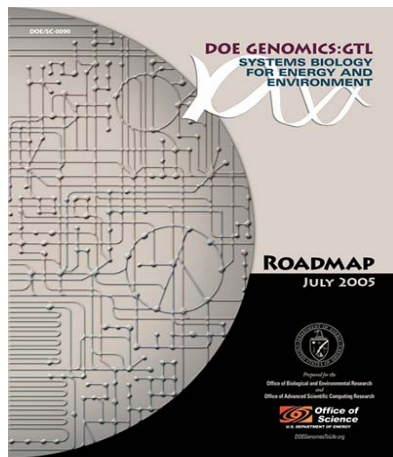
Deinococcus radiodurans



Radiation resistance - bioremediation



Genomics:GTL



A systems biology focused program supporting fundamental research on plants, microbes, and biological communities.

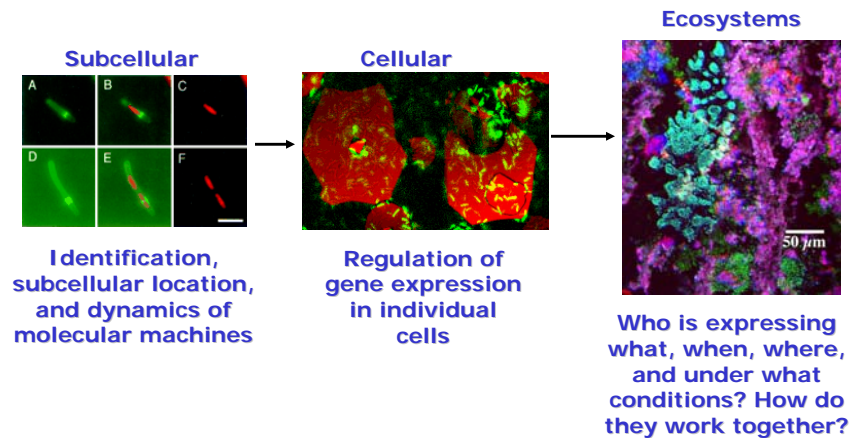
Mission Science Goals

- Develop biological solutions for intractable environmental problems
- Understand relationships between climate change and earth's microbial systems
- Support development of biofuels as a major secure energy source

<http://genomicsgtl.energy.gov>

Genomics:GTL – A Systems Biology Research Program

From Molecules to Cells to Ecosystems



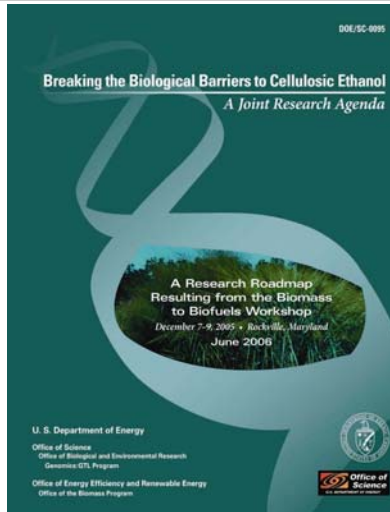
Genomics: GTL – A Vision of Systems Biology Research

In 10-15 years we would like to be able to start with a microbe or microbial community of interest and **in a matter of days or weeks:**

- Generate an annotated DNA sequence
- Produce proteins and molecular tags for most/all proteins
- Identify the majority of multi protein complexes
- Generate a working regulatory network model
- Identify the biochemical capabilities
- Design reengineering or control strategies in silico



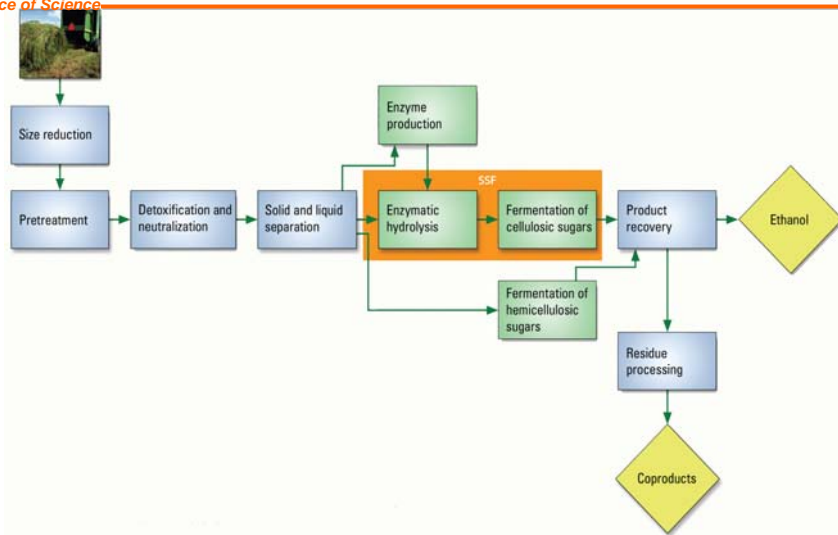
A Path Forward for Energy from Biomass



A joint SC / EERE workshop



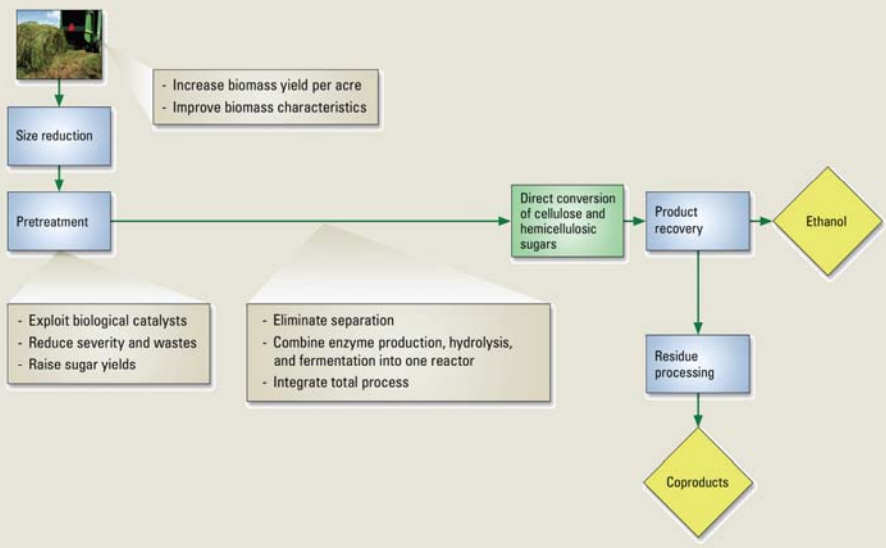
Steps in cellulosic ethanol production



From: Breaking the Biological Barriers to Cellulosic Ethanol



Science can improve the process



From: Breaking the Biological Barriers to Cellulosic Ethanol



GTL Bioenergy Research Centers

Funding: \$375 million to be provided over five years to establish and operate three new Bioenergy Research Centers (under review)

Goals: transformational discoveries in basic science to make production of cellulosic ethanol, sunlight-to-fuels, and other biofuels truly cost-effective and economically viable

Method: advanced systems biology research on microbes and plants - to learn to exploit nature's own conversion methods, plus develop a new generation of optimized bioenergy crops

- Understand metabolic pathways in microbial bioconversion processes
- Analyze plant cell wall structure and assembly
- Fine-tune microorganisms and plants to each other
- Pursue both microbial and bio-mimetic conversion methods





DOE Joint Genome Institute

- DOE user facility for mission relevant genome sequencing
- 154 finished Prokaryote genomes, 25 finished Eukaryote genomes (many in progress):
 - Poplar, switchgrass, soybean, brachypodium, white rot fungus, termite hindgut microbes
- 3.6 billion bases per month



<http://www.jgi.doe.gov>



JGI and Bioenergy

Improved Feedstocks

Cellulosic Materials

- Poplar
- Maize/Corn Stover
- Switchgrass
- Brachypodium
- Sorghum



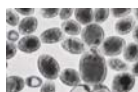
Saccharification

Sugars

Fermentation

Improved cellulose & lignin degradation

- Termite hindgut microbiota
- White Rot Fungus
- Clostridium thermocellum
- Saccharophagus degradans
- Acidothermus cellulolyticus



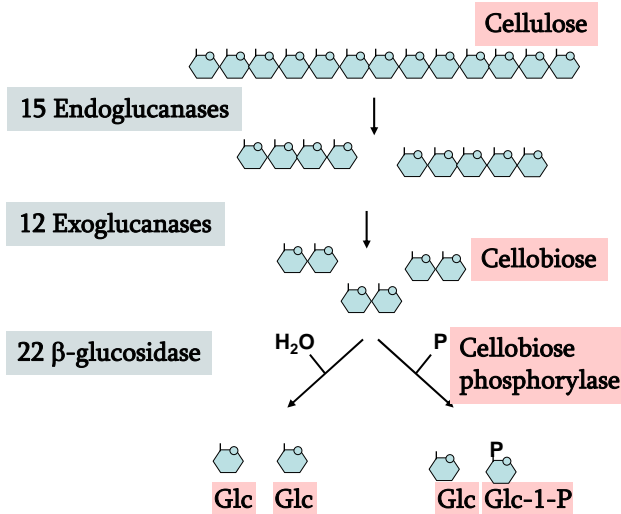
- Saccharomyces cerevisiae
- Zymomonas mobilis
- Thermoanaerobacter ethanolicus
- Pichia stipitis

Ethanol producing organisms

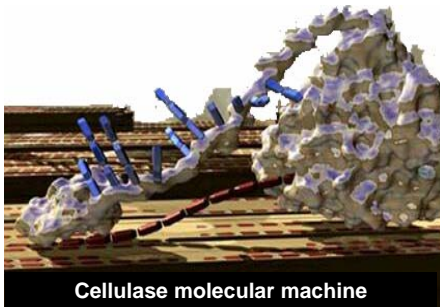




New Cellulase Genes from Termite Gut



Understanding Molecular Machines & Putting Them to Work



Cellulase molecular machine

- Natural forms of cellulase machines are too inefficient for commercial ethanol production.
- Fundamental knowledge of plant and microbial processes gained in GTL can be applied to develop more efficient methods.

Research objectives include: altering cellulose structure, identifying new sources of cellulases, understanding cellulosome structure and function, structural studies, directed evolution studies, enzyme mixture studies

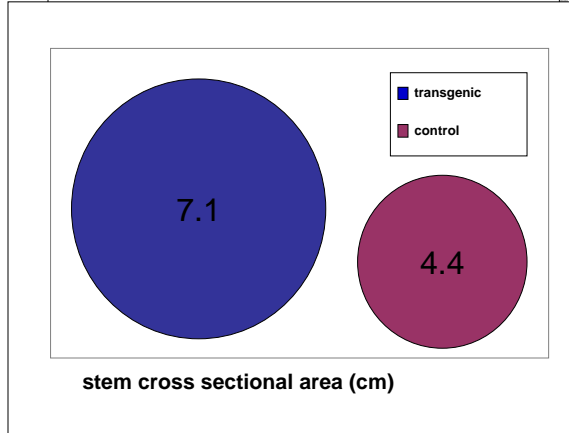


Auxin Regulation of Poplar Shape

90-day-old *Populus* cuttings



Enhanced radial growth of IAA16.3 transgenic trees



Plant Feedstock Genomics for Bioenergy



- DOE/USDA Joint Research Program
- Supports research on plants for improvement of:
 - Biomass Characteristics
 - Biomass Yield
 - Degradability of Lignocellulose
- Need for broader USDA role, e.g., agronomics

<http://genomicsgtl.energy.gov/research/DOEUSDA/index.shtml>



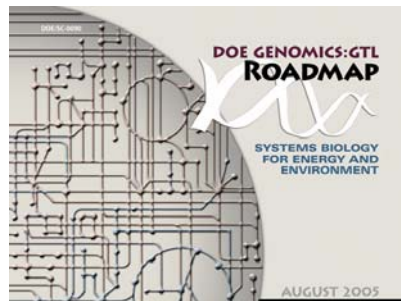
Other FY07 Genomics:GTL Solicitations

- **New Analytical and Imaging Technologies for Lignocellulosic Material Degradation, and for Multiplexed Screening for Plant Phenotypes**
- **Quantitative Microbial Biochemistry and Metabolic Engineering for Biological Hydrogen Production**
- **New Genomic Strategies and Technologies for Studying Complex Microbial Communities and Validating Genomic Annotations**
- **Ethical, Legal, and Societal Implications (ELSI) of Research on Alternative Bioenergy Technologies, Synthetic Genomics, or Nanotechnologies**



EERE is a principal customer

- **Identify and exploit opportunities for coordination and collaboration**
- **Help inform research and funding decisions**
- **Overcome traditional barriers between fundamental and applied research**



<http://genomicsgtl.energy.gov/>

