Annual Report to Congress on the Biomass Research and Development Initiative for FY 2006

Submitted Jointly by

U.S. Department of Agriculture

&

U.S. Department of Energy

Contents

Report to Congress on the National Biomass Research and Development Initiative for FY 2006

The National Biomass Research and Development Initiative (Biomass Initiative) was established by section 307(a) of the Biomass Research and Development Act of 2000 (Biomass Act) [7 U.S.C. 8101 note] (Public Law 106-224) (see Appendix 1) for cooperation and coordination in biomass research and development (R&D) between the U.S. Department of Agriculture (USDA) and U.S. Department of Energy (DOE).

Section 309(b) of the Biomass Act states ". . .for each fiscal year for which funds are made available to carry out this title, the Secretary of Energy and the Secretary of Agriculture shall jointly submit to Congress a detailed report." This document outlines the status and progress of the Biomass Initiative, according to the requirements of that section, for fiscal year (FY) 2006.

I. Purposes and Objectives of the Biomass Initiative

The Biomass Initiative facilitates R&D with the following purposes, according to Biomass Act section 307(c):

- Increased domestic energy security.
- Job creation and enhanced economic development of the rural economy.
- Enhancement of the environment and public health.
- Diversify markets for raw agricultural and forestry products.

Biomass Act section 307(b) provides detailed R&D objectives:

- Development of technologies and processes for abundant commercial production of biobased fuels at prices competitive with fossil fuels.
- Development of high-value biobased products to enhance the economic viability of biobased fuels and power, and establish them as substitutes for petroleum-based feedstocks and products.
- Development of a diversity of sustainable domestic sources of biomass for conversion to biobased fuels and biobased products.

During FY 2006, the Biomass Initiative sought to advance these purposes and fulfill these objectives through funding awarded in the annual competitive USDA – DOE joint solicitation. Additionally, agencies were able to achieve common goals and benefits through the exchange of expertise and coordination of common efforts.

II. Status and Progress of the Biomass Initiative

Major accomplishments of the Biomass Initiative during FY 2006 include:

- awards totaling $17.5 million from the USDA – DOE joint biomass solicitation;
- review of the current USDA – DOE biomass R&D portfolio;
- an update of the *Vision for Bioenergy and Bioproducts in the United States* goals by the Biomass Technical Advisory Committee;
- organization of three regional workshops for expert input in updating the *Roadmap for Biomass Technologies in the United States;*
- recommendations to the Secretaries of Agriculture and Energy regarding biomass R&D;
- review of the state of biomass analysis and policies; and
- increased interagency involvement in the development of research pathways to support the President's Advanced Energy Initiative.

To oversee research and development goals, the Biomass Act established both an external Federal Advisory Committee and an internal Federal interagency Board. The Biomass Research and Development Technical Advisory Committee (Committee), established in section 306, is a 30-member panel consisting of representatives from industry, academia, nonprofits, State, and tribal government. A full list of FY 2006 members is given in Appendix 2. Neil Rossmeissl of the DOE Office of the Biomass Program (OBP) acted as the Designated Federal Officer (DFO) for FY 2006. William Hagy of the USDA Rural Development Office acted as that Agency's point of contact.

Committee members discuss current biomass research activities and results and policies during quarterly public meetings. In compliance with the Federal Advisory Committee Act (FACA), the activities of the Committee during FY 2006 were public. Committee information, publications, and news are available for review on the Biomass Initiative Web site: http://www.biomass.govtools.us/.

The Committee has authored two research guidance documents originally published in 2002. The *Vision for Bioenergy and Bioproducts in the U.S. (Vision)* establishes far-reaching goals for the production of biofuels, bioproducts, and biopower. The *Roadmap for Biomass Technologies in the U.S.* (*Roadmap)* establishes recommended research pathways for these technologies. Applicants to the annual Biomass Initiative joint solicitation are required to review the *Roadmap* research pathways.

During FY 2006, the Committee was tasked with updating these publications per the requirements of section 941(f) of the Energy Policy Act of 2005. In consultation with the Interagency Biomass Research and Development Board (Board), a subcommittee was established to organize this effort. Both the updated *Vision* and *Roadmap* will be published in FY 2007. These documents are products of the Committee and are not necessarily endorsed by DOE or USDA. However, Federal agencies consider them in their planning.

The Committee established two other subcommittees during the fiscal year. The Analysis subcommittee provides strategic guidance to the Departments on the effectiveness of their analysis activities. The Policy subcommittee provides an independent assessment of State and Federal incentive policies for the production and use of biomass-derived power, fuels, and products. These subcommittees report to the full Committee on the status of their work during public meetings. The Committee also identified and addressed the need to review and evaluate state-level biomass efforts. Public committee meetings included presentations by and discussions with representatives of the National Conference of State Legislatures, the Western Governors' Association, the State of Indiana, the California Energy Commission, and the California Biomass Collaborative.

III. The General Status of Cooperation and R&D Efforts

Interagency collaboration for FY 2006 also included the extended reach of the Board. This panel, established under section 305 of the Biomass Act, collaborates on R&D with the following agencies: USDA, DOE, Department of Interior (DOI), Environmental Protection Agency (EPA), National Science Foundation (NSF), the Office of Science and Technology Policy (OSTP), Office of the Federal Environmental Executive (OFEE), and Department of Transportation (DOT). DOT membership was approved by majority vote in FY 2005, and the first representative was appointed during FY 2006.

Senior advisory-level representatives of each Agency meet to discuss all Federal biomass R&D efforts. The Board representatives for FY 2006 are listed in Table 1.

Table 1. Interagency Biomass R&D Board Membership

Co-Chairs	*Position*	*Agency*
Thomas C. Dorr	Under Secretary for Rural Development	USDA
Alexander A. Karsner	Assistant Secretary Energy Efficiency and Renewable Energy	DOE
Members	*Position*	*Agency*
Dr. Bruce Hamilton	Director Bioengineering and Environmental Systems Division	NSF
Dr. Ashok Kaveeshwar	Deputy Administrator and Acting Administrator Research and Innovative Technology Administration	DOT
In transition	**-**	EPA
Johnnie Burton	Acting Assistant Secretary Land and Minerals Management	DOI
Dr. Sharon Hays	Chief of Staff	OSTP
Dana Arnold	Chief of Staff	OFEE

At a Board meeting on June 15, 2006, members appointed points of contact from each Agency to participate in the development of a biomass posture plan for interagency coordination regarding biomass research, development, demonstration, and policy analysis. Information regarding all agencies' support for biofuels and biobased products R&D is to be used in both the posture plan and the annual Biomass R&D Portfolio Analysis document.

The Biomass R&D Portfolio Analysis has been provided to the Committee and the public since FY 2003. The document provides information on all current biomass R&D projects analyzed by the categories given in the Committee's *Roadmap*. These two reports are available on the Biomass Initiative Web site: http://www.biomass.govtools.us/publications.asp. The FY 2006 Biomass *Roadmap* R&D Portfolio will contain information on current biomass R&D projects across all agencies of the Board. This information will prove invaluable in the continued advancement of biomass technologies for energy security, development of rural economies and varied national markets, and improvement of our environment. When complete, it will also be posted on the Web site.

USDA and DOE have cooperated on numerous activities, including those described below. These are also referenced where appropriate in departmental responses to the Committee recommendations in section VI of this report.

- ***Vision* Update Workshop and Development of Updated *Vision D*ocument** - Revision of goals set for national biofuels, biopower, and bioproducts consumption.
- **Regional Biomass *Roadmap* Update Workshops** – Meetings organized to gather expert input on revision of recommended R&D focus to achieve updated *Vision* goals.
- **Regional Biomass Energy Feedstock Partnerships** – Collaboration between geographically-concentrated land- and sun-Grant universities, industry, state, and local feedstock organizations.
- **Organization for the October 2006 USDA – DOE Advancing Renewable Energy Conference in St. Louis, Missouri** – Co-organization of high-level alternative energy discussions with national industry.
- **DOE Office of Science Biomass to Biofuels Workshop** – Coordination with genetic researchers for focused pursuit of efficient biofuel production process.
- **USDA Federal Biobased Preferred Procurement Program** – Organization of first Federal program to define biobased products and establish priority government purchase.

The primary interagency collaboration under the Biomass Initiative remains the annual USDA – DOE joint solicitation for biomass R&D. In FY 2006, USDA's Rural Development Office and DOE's Office of Energy Efficiency and Renewable Energy coordinated efforts for the joint solicitation, awarding $12.7 million in USDA funding to 14 R&D projects under Section 9008 of the Farm Security and Rural Investment Act of 2002 (Farm Bill) and $4.7 million from DOE appropriations under Energy and Water Development to three R&D projects. Through these awards, the Biomass Initiative achieved a distribution and use of funds according to Biomass Act subsections 309(b)(1)(A) through (D).

IV. Selection Criteria

Biomass Act section 309(a)(3) establishes a set of criteria for assessment of projects to be funded under the annual biomass R&D joint solicitation. They include an energy accounting, an environmental impact assessment, and an economic assessment. Biomass Act section 307(e) sets additional considerations for all technical areas, including maximization of synergies with current technologies and practices, life-cycle analysis for maximization of benefits, and assessment of Federal land use and sustainable agriculture methods.

To address the Biomass Act, the text of the funding opportunity announcement (FOA) included a requirement for applicants to demonstrate energy, economic, and environmental benefits in their proposal. A complete list of evaluation criteria and weights follows:

- Technical Relevance and Merit – 30 percent
- Technical Approach/Work Plan – 25 percent
- Energy Efficiency/Displacement, Rural Economic Development, and Environmental Benefits – 25 percent
- Technical, Management, and Facility Capabilities – 20 percent

For the full technical criteria, see Appendix 3. These criteria, as well as recommended review of the research needs outlined in the *Roadmap for Biomass Technologies in the U.S.*, were listed in the text of the FY 2006 FOA. More than 300 applications were received in response to the competitive solicitation. The selection process included an independent technical review, followed by a programmatic review. In FY 2006, DOE was responsible for the joint solicitation process. Final selections were made by the agencies according to independent reviewers' assessment of projects combined with the results of the programmatic review.

V. Distribution of Funds

Section 307(d) of the Biomass Act calls for satisfaction of Biomass Initiative objectives through direction of research and development in four technical areas. These areas address a need for sustainable feedstocks supply, overcoming recalcitrance in cellulosic conversion, diversification of biobased products, and analysis for strategic research and policy guidance.

Sections 307(g) (2) and (3) require awards made in the years 2007 through 2010 be distributed by technical area, with each receiving a target percentage of total funding. In addition, funding will be divided by percentages within each technical area for applied fundamentals, innovation, and demonstration. For FY 2006, information on the percentage of funding given to each technical area is included for reference purposes only. Table 2 provides a summary of funding by area.

Table 2. Summary of FY 2006 Joint Solicitation Awards

Technical Area	Number of Awards	Federal Funding Totals	Actual Percentage	Target Percentage
Feedstocks	2	$2,385,910.00	14%	20%
Recalcitrance	3	$4,707,733.00	27%	45%
Products	7	$8,369,281.44	48%	30%
Analysis	5	$2,029,582.32	12%	5%
Totals	17	$17,492,506.76	100%	100%

* Target percentage from the Biomass Act not in effect till 2007. In 2006, DOE and USDA made awards consistent with their program needs and independent technical review, while also considering target percentage.

A. Feedstocks

Two awards were made to projects working to develop diverse sustainable feedstocks supply. Projects can combine approaches to provide advanced, dedicated energy crops, higher productivity, increase site range, lower chemical input requirements, easier processing, better growing methods, easier harvest, handling, transport, and storage, and strategies for integrating energy feedstocks into existing managed lands. This fulfills the Biomass Act's objectives under section 307(d)(2). These projects are funded by USDA Farm Bill Section 9008 appropriations. Feedstocks area awards total $2,385,910; 14 percent of total awards (Feedstocks will receive 20 percent of funding in the future).

1. **SUNY College of Environmental Science and Forestry** - Overcoming Barriers to Facilitate the Commercialization of Willow Biomass Crops as a Feedstock for Biofuels, Bioenergy, and Bioproducts – Federal Funding -$813,450 Total Project - $1,365,021.

   Domestication and deployment of fast-growing perennial plats as dedicated energy crops can provide a long-term, sustainable replacement for fossil fuels. Perennial woody and herbaceous crops will annually provide up to 377 million dry tons of biomass by 2030. Shrub willows, grown as short-rotation woody crops (SRWC), can serve as a dedicated and custom feedstock for bioproducts and bioenergy, promote rural development, and provide positive environmental benefits. This project will seek to increase willow yield through genetic improvement. In addition, reduction of planting density should reduce the cost of planting establishment. Work will combine these efforts with a push to expand harvesting timeframes for willow biomass crops, and provide a user-friendly model of willow production and conversion economics.

2. **Ceres, Inc.** - Biotechnological Improvement of Switchgrass – Federal Funding - $1,572,460 Total Project - $1,965,575

   The ultimate goal of this project is to double switchgrass yield from the current 7 tons per acre to 14 tons per acre by the year 2020; thus, greatly promoting the adoption of cellulosic ethanol as a source of fuel. Switchgrass yields are relatively high, and costs, pesticide requirements, and planting efforts are lower than corn. The rate of yield

improvement for switchgrass through traditional breeding methods is very slow. Biotechnological (transgenic) approaches such as the mis-expression of certain plant genes could result in rapid and dramatic improvement of traits desirable in energy crops. Ceres can use its innovative and proprietary biotechnological tools to make dramatic improvement of agronomic traits for switchgrass.

B. Recalcitrance

Three awards were made to projects developing technology and processes to increase recalcitrance conversion in cellulosic biomass, producing commercial-scale competitively priced biofuels. This fulfills the Biomass Act's objectives under section 307(d)(2). Conversion technologies used to address recalcitrance include pretreatment in combination with enzymatic or microbial hydrolysis, and thermochemical approaches such as gasification and pyrolysis. These projects are funded under energy and water development appropriations from DOE. The awards in this area total $4,707,733, or 27 percent of total funding (Recalcitrance will receive 45 percent of funding in the future).

1. **Edenspace Systems Corporation** - Energy Corn Consortium – Federal Funding - $1,926,970 Total Project - $5,514,054

   By 2009, the Consortium will introduce new corn varieties for production of cellulosic ethanol in existing grain ethanol facilities. This work will include identification and testing of improved enzymes for conversion of lignocellulose, sped-up development of corn feedstocks specifically bred for cellulosic ethanol production from stover, and continuous control for lowest-cost solutions using current ethanol production facilities, such as solutions for concurrent processing of various feedstocks. Project technology will also be applicable to crops such as switchgrass, and will provide high performance enzymes for such other processes as dilute-acid and ammonia fiber explosion pre-treatments, as well as applications in textile, paper, and other industries.

2. **Lucigen Corporation** - Novel Enzyme Products for the Conversion of Defatted Soybean Meal to Ethanol – Federal Funding $1,259,000, Total Project $1,576,200

   This work will seek to overcome the recalcitrance of cellulosic biomass with the development of enzymes capable of breaking down the carbohydrates in defatted soybean meal (DSM) into a fermentable substrate suitable for biobased alcohol production, thereby increasing fuel ethanol production by as much as two billion gallons. The project will clone, express, and characterize thermostable bacterial enzymes capable of degrading less than 70 percent of the carbohydrates in DSM into monosaccharides and disaccharides fermentable by yeast. The goal is to develop a product and process that does not require separation of soybean protein from carbohydrate, not require harsh pretreatment of the soybean meal, and retain the protein value of the meal. Because the feed value of the protein would be retained in the fermentation residue, this conversion to ethanol could increase the value of the soybean crop by over $4 billion.

3. **Center for Technology Transfer, Inc**. - Value Prior to Pulping – Federal Funding - $1,521,763 Total Project- $2,666,986

   This work seeks to produce fuel ethanol from hemicelluloses extracted from wood chips prior to paper production. The project will combine approaches, addressing the recalcitrance of woody biomass for conversion with enzymes, acids, and other additives for hemicellulose sugar extraction, as well as high-yield conversion of a complex mixture of pentose and hexose sugars and fermentation to produce ethanol and acetic acid as a coproduct.

C. Product Diversification

Seven projects received awards for research to develop high value biobased products; thus, increasing the economic viability of biobased fuels, power, and displacing petroleum-based products. This fulfills the Biomass Act's objectives under section 307(b)(2). End-use products include chemicals, animal feeds, and co-generated power. Work in this area varies, including catalytic processing, metabolic engineering, product recovery, power production, and integration of processes in existing biomass facilities for starch ethanol, paper mills, or power plants. These projects are funded by the USDA Farm Bill Section 9008 appropriations. The awards in this area total $8,369,281.44, 47 percent of total awards made (Product diversification will receive 30 percent of funding in the future).

1. **Drexel University** - Moisture Management in Polylactide and Polylactide Copolymers - – Federal Funding -$1,312,389 Total Project - $1,649,657

   This project seeks to improve the moisture barrier properties of polylactide or polylactic acid (PLA) using chemical modification, copolymerization, and composite approaches while maintaining thermal, mechanical, degradation, and optical properties of pure PLA. Cooperative work with industrial partner NatureWorks, LLC combines fundamental and applied research that will lead to both improvements in performance of bio-based polymers and improved fundamental knowledge about moisture transport in bio-based polymers. In turn, this will lead to a more efficient and environmentally benign production of bio-based polymeric products with enhanced properties and performance to compete with or displace petroleum-based polymers in the marketplace.

2. **Virent Energy Systems, Inc**. - High-Value Chemical Production from Biodiesel-Derived Glycerol - – Federal Funding - $2,000,000 Total Project – $2,685,630

   The process for biodiesel production is relatively simple, but deriving value from co-produced glycerol remains a challenge. This project will convert crude glycerol to propylene glycol, a high-value chemical, using patented aqueous-phase reforming (APR) technology. The goal is to complete research of this application and prove its

technical and economic feasibility. Work will include development and testing of conversion system prototypes up to commercial-scale.

3. **The Pennsylvania State University** - Lignin Conversion to Value-Added Materials - Federal Funding -$579,340 Total Project - $756,300

   This project seeks to produce high value salable products from hardwood lignin. Work includes process technology for conversion of hardwood feedstocks into fuel ethanol, and conversion of co-produced lignin into higher-value chemicals or fuel components. Depolymerization, using methanol with base as a catalyst, could produce a high-octane gasoline additive and chemical production of phenol from toluene. PSU will work with partners, SWAN Biomass Company and Axion Analytical Laboratories, to find the most commercially viable pathway.

4. **Iowa Corn Promotion Board** - Adding Value to Commercial Polymers through the Incorporation of Biomass Derived Chemistries – Federal Funding -$1,762,157.44 Total Project - $2,878,685

   This project builds on past polymer research conducted with various industrial and Federal partners, including the Pacific Northwest National Laboratory, New Jersey Institute of Technology, and Mid-Atlantic Technology, Research, and Innovation Center. Work will define the cost performance of isosorbide-derived compounds that improve the performance characteristics of thermoplastic and thermosetting polymer systems. Prior inventions and concepts include isosorbide-based chain modifiers, monomers, and crosslinking agents. This work will seek to develop a process that can be scaled to at least 500,000 lbs. per year. Process modeling and economic studies will be performed to provide direction to the project. A pilot plant will assist in demonstration and larger-scale production for commercial-scale engineering and economic data.

5. **Louisiana State University Agricultural Center** - Thermoplastics Composites Reinforced with Natural Fibers and Inorganic Nanoparticles – Federal Funding - $791,865 Total Project-$998,541

   This project combines natural wood fibers with recycled plastics to make biocomposites, providing a practical use for biomass. This research will use the latest technology in composite development and interface analysis to combat the predominant challenges of incompatibility and composite brittleness. Technical development will focus on new coupling agents and forms for commingled plastics, composite strengthening through nanoparticles, and advanced extrusion technology. Enhanced manufacturing capability should result, leading to improved energy efficiency, rural development, and environmental benefits.

6. **Ceres, Inc.** - A Plant-based Production System for Methacrylate – Federal Funding - $1,523,530 Total Project - $1,904,412

This project seeks to utilize the metabolic pathways that already exist in plants to genetically engineer methacrylate production into a cellulosic ethanol biomass crop such as switchgrass. Methacrylate as a coproduct will generate additional revenue from the biorefinery; thus, further enhancing the economics and efficiency of the biomass crop and biorefinery operations, as well as increasing possible petroleum displacement. Ceres will collaborate with industry partner Rohm & Haas, one of the world's leaders in methyl methacrylate production, ensuring technical suitability for downstream processes.

7. **Argonne National Laboratory** - Enhancing Animal Feed Values in Corn Dry Mills with Biobased Solvents – Federal Funding - $400,000 Total Project - $500,000

   Corn dry-grind mills are the technology of choice for expanding U.S. ethanol production. In these mills, distiller's grains and solubles (DGS) are coproduced and sold as animal feed, primarily to ruminants. If immediate markets are not available, the material is dried to produce dried DGS (DDGS), an expensive and energy-intensive process. This project will use renewable biobased solvents derived from corn and soybeans to extract and concentrate the protein content in DGS. The goal is to produce a high nutritional animal feed that is suitable for a wide range of animals, with value based on protein and oil content. This work will aid rural development, reduce energy waste in ethanol production, and develop additional markets for the ethanol coproduct. In addition, the project should enable production of "captured" cellulosic sugars from the corn fiber in residues, making them available for fermentation.

D. Analysis

Five awards were made to analysis projects to provide strategy guidance. This technical area includes work to increase technology synergy, conduct life-cycle and environmental analyses, and assess potential for biomass opportunities on Federal land and with land management programs. This fulfills the Biomass Act's objectives under section 307(d)(4). These projects are funded by USDA Farm Bill Section 9008 appropriations. Awards for analysis total $2,029,582.32, 11 percent of all awards (Analysis will receive 5 percent of future funding).

1. **Western Governors' Association (WGA)**- Strategic Development of Biomass in the Western States – Federal Funding -$290,246.32 Total Project - $377,902

   The WGA seeks to continue work begun with strategic analysis of clean energy in the Western States. The next step is to examine the implementation of proposed policy measures conducive to biomass development to enable continued and progressive additions of new bioenergy resources and technologies in the next decade. Data gathered will influence collective and individual governor's policy. Planned analysis includes augmentation of supply resource database and feedstock transportation functions, completion of the conversion technology database, spatial analysis and

supply curve development, resource/technology development scenarios and policy interactions, and cost/benefits analysis.

2. **Southern Illinois University** - Technical Area 4; Expansion of Ethanol Production: Evaluation of Costs and Benefits to Rural Communities in the Upper Mississippi River Basin – Federal Funding - $676,722 Total Funding - $845,903

   The project will simultaneously assess the impacts of corn-based ethanol production on crop prices, cropping patterns, water quality, and regional economic indicators for a major region of U.S. agricultural production, within an explicit spatial framework. Work will include development of economic models, spatial models, energy displacement accounting, and a soil and water assessment tool model. Data will be mapped to estimate the economic and environmental impacts of potential future growth of ethanol production in the region.

3. **Clarkson University** - Analysis for Strategic Guidance Demonstrating the Value of Waste Biomass Feedstocks for Fuel Ethanol Production from Energy Policy Perspectives – Federal Funding -$250,001 Total Project – $314,940

   This project will develop an analysis framework to compare the benefits of various ethanol feedstocks based on national energy policy perspectives. The framework will focus on both dedicated feedstocks and waste materials, and metrics will be developed for assessment using three national energy policy perspectives: increased energy security, energy resource conservation, and sustainable development of energy resources and systems. Work will aid decisionmakers in understanding tradeoffs between developing different ethanol supply systems.

4. **Michigan State University** - Life Cycle Assessment to Improve the Sustainability and Competitive Position of Biobased Chemicals – Federal Funding -$376,616 Total Project - $506,541

   This project will build locally oriented (county-level) life-cycle inventory databases for biomass production and biorefinery systems up to platform chemicals, determine effects of faring locations and practices on the environmental performance of biobased chemical production systems, identify the most important environmentally-sensitive areas within the system boundaries for future improvements, evaluate the environmental impacts of potential or proposed improvements in crop production and biorefinery systems, and estimate the eco-efficiencies of biobased chemical production systems. Information will be collected for corn and soybean agriculture in approximately 40 counties in 9 Corn Belt states: Iowa, Illinois, Indiana, Michigan, Minnesota, Nebraska, Ohio, South Dakota, and North Dakota. Also, data on platform chemical production in wet/dry milling plants and soybean crushing plants will be collected.

5. **North Carolina State University** - Strategic Positioning of Biofuels in the Economic Context of Agriculture, Crude Oil, and Auto Manufacturing. – Federal Funding - $435,997 Total Project - $545,896

   This project will concentrate on evaluation of the major participants in biofuel commercialization, and development of constructive interaction strategies. The major participants are government, agriculture, the petroleum industry, and automobile manufacturers. To minimize confusion and promote efficient interaction, a formalized methodology of examination and strategy or policy development must be created. Work will involve research of participants' goals, actions, collaborations, and responses, and creation of a model for effective interaction. This project will utilize review panels consisting of representative members from agriculture, industry, business, and government, who will in turn review the progress of this research effort by offering detailed recommendations, insights, and perspectives.

VI. Annual Recommendations from the Biomass R&D Technical Advisory Committee to the Secretaries of Agriculture and Energy, and Departmental Responses

Section 309(b)(1)(D) requires that funds be distributed in a manner that takes into account annual recommendations made by the Committee.

Full lists of specific annual recommendations, with responses from USDA and DOE regarding their action plans, can be found in section IV of each annual report since 2002. These are posted publicly on the Committee Web site: http://www.biomass.govtools.us/publications.asp .

Sections 306(c)(2) and 309(b)(1)(D) of the Biomass Act require the Committee to provide annual recommendations on biomass R&D efforts to the Secretaries of Agriculture and Energy. These recommendations assess the general status of cooperation and R&D efforts at both agencies, with respect to biobased fuels and products, in compliance with Biomass Act section 309(b)(2).

Recommendations are submitted in the following categories, according to section 306(c)(2) of the Biomass Act:

A. Recommendations regarding the distribution and use of Initiative funds.
B. Recommendations on the solicitation and proposal review process.
C. Overall recommendations to the Secretaries.

Section 309(b)(3) of the Biomass Act states that the annual report should include ". . .the plans of the Secretary of Energy and the Secretary of Agriculture for addressing concerns raised in the report, including concerns raised by the Advisory Committee." These responses are a part of this segment of the annual report.

The following are the recommendations approved August 10, 2006, during the last public quarterly Committee meeting of the fiscal year. *Responses from USDA and DOE are provided after each recommendation in italics.*

A. Recommendations Regarding the Distribution and Use of Biomass Initiative Funds

1. In order to fully support the vision of the integrated biorefinery, the thermochemical platform should receive continued funding, and those thermochemical technologies should become an integral part of the Biofuels Initiative.

   The DOE Office of the Biomass Program (OBP) continues to fund the thermochemical platform as part of its entire Biofuels Initiative (BFI). In addition, OBP has begun planning for a thermochemical roadmap meeting in the second quarter of FY 2007, to establish the role of thermochemical technologies in the BFI. FY 2006 thermochemical platform R&D funding totaled $5,628,000. DOE's FY 2007 request includes $16,455,000 for thermochemical R&D.

   USDA supports the continued research and application of new technology for thermochemical processes in integrated biorefinery. USDA funds thermochemical conversion research in four agency programs; the Agricultural Research Service (ARS), Cooperative State Research, Education, and Extension Service (CSREES), Rural Development, and the Forest Service (FS).

   ARS has four locations doing work on thermochemical technologies. All of them involve working relationships with local stakeholders interested in thermochemically converting their agricultural wastes (both plant- and animal-based) to energy and/or fuels. Research focuses on: pyrolysis and dry gasification of energy crops and crop residues ($323,000); direct combustion and gasification (wet and dry) of manures; conversion to liquid fuels ($500,000); dry gasification of grass straw ($216,000); and hybrid (coal & biomass) gasification ($50,000). ARS' FY'08 bioenergy initiative asks to accelerate our thermochemical program.

   CSREES, through its affiliation with the land grant institutions, supports research on thermochemical technologies that focus on: Gasification of agricultural residues, wastes ($500,000); and linking gasification with fermentation to produce ethanol and chemicals ($1.2 million). It is anticipated that more resources will be directed to thermochemical conversion technologies through formula-funded programs at land grant universities. The National Research Initiative and Small Business Innovation Research Programs will continue to support biomass conversion technologies.

The Farm Bill section 9008 Biomass Research and Development supports research, development, and demonstration of biobased products, biofuels, and biopower. This section is administered by USDA's Rural Development mission area. Thermochemical technology is one area supported by 9008 funds ($1.4 million).

2. The Biomass Program and the Fossil Energy Program at DOE should report to the Committee on how their efforts in the areas of thermochemical conversion and in carbon capture and storage are interacting with each other, what synergies and benefits they see in expanding the coordination and collaboration from current levels, and what future coordination and collaboration are being planned.

   The DOE program supporting most carbon sequestration R&D is Fossil Energy. The DFO has requested that representatives from the Fossil Energy Program provide the Committee an overview of their R&D portfolio for a discussion on collaboration.

3. R&D should be pursued to develop liquid transportation fuels from biomass, in addition to ethanol and biodiesel.

   DOE is pursuing the development of liquid transportation fuels within the Office of FreedomCAR and Vehicle Technologies Program, as well as the production of renewable energy carriers by the Office of the Hydrogen Program. OBP has targeted its biofuels approach to take advantage of existing ethanol markets and infrastructure. This approach is part of an integrated biorefinery concept, which seeks to maximize the variety of feedstocks which can be efficiently converted to a variety of biofuels and bioproducts. The current focus on commercialization of cellulosic ethanol should generally advance technology for conversion of varied cellulose feedstocks within the same plant. The December 2005 DOE Office of Science Biomass to Biofuels Workshop resulted in a report on the current status of cellulosic ethanol fuel development technologies. A recommendation is included, stating that 15 percent of funding should be focused on alternatives to ethanol. The report is available online: http://genomicsgtl.energy.gov/biofuels/b2bworkshop.shtml

4. Fund R&D to develop technologies capable of processing multiple and mixed feedstocks into biofuels and bioproducts (to the extent possible).

   The two feedstock proposals funded under the FY 2006 joint solicitation will receive a combined $2.4 million for work with willow and switchgrass. The Integrated Biorefinery platform within OBP also concentrates R&D to identify multiple feedstocks for multiple end-uses within one conversion location. In FY 2006, DOE and USDA have also begun participation in the

Regional Biomass Energy Feedstock Partnerships, a project to facilitate development of biomass resources in certain geographic focus areas. By definition, the feedstocks variety addressed by these regional partnerships is very wide. Other members of the partnerships are: state energy offices, sun-grant universities, land-grant universities, extension service organizations, other academia, industry, environmental organizations, state farm bureaus, and foresters. The combined efforts of USDA and DOE in partnership with all other feedstocks research organizations will provide for efficiently structured processing R&D with significant resource support.

FS R&D is initiating new research specifically addressing the conversion of multiple feedstocks including agricultural and forestry materials. In future, the issue of handling systems will be evaluated by ARS. Gasification technology is optimized to efficiently convert a variety of agriculture and forestry residues to syngas.

5. Research should endeavor to provide technologies of scale that can be practiced on a local basis in dispersed geographies utilizing readily available feedstocks. Such technologies will help to reduce the concentration of plant emissions in an area, reduce the transportation requirements for inbound feedstocks and outbound finished products, and provide the economic benefits of resulting jobs to more locations.

Analysis projects funded under the FY 2006 solicitation are receiving a total of $2 million to examine and publish data for increased technology synergy, efficient production life-spans, environmentally friendly production of biobased fuels and products, adequate feedstocks supply, and ideal crop and plant locations. Part of the benefit in developing regional biomass energy feedstock partnerships is the opportunity to identify necessary actions to increase industry interest in each region's biomass potential. The intent is to site plants based on feedstock availability. Infrastructure needs are also considered in the Biomass Posture Plan, a document being developed by all Federal agencies involved in biomass production and distribution. The Biomass Posture Plan will map out the agencies' roles and responsibilities regarding biomass research, development, demonstration, and policy analysis.

USDA's Rural Development provides financial assistance through grants, loans, and loan guarantees which support technology deployment. As noted above (item 1), a portion of 9008 Support research, development, and demonstration of biobased products, biofuels, and biopower. The Rural Development Loan Program (REDL) funds economic and community development, technical assistance, construction, capital improvements, purchase of machinery and equipment, and working capital loans. The Business and Industry Guaranteed Loan Program provides that loan proceeds may be used for working capital, machinery and equipment, buildings and

real estate, and certain types of debt refinancing. The primary purpose is to create and maintain employment and improve the economic climate in rural communities.

Because transportation costs restrict the distance for transporting biomass to the biorefinery, conversion technologies by ARS are focused on efficient, smaller scale operations.

6. To reach the billion-ton feedstock goal, support R&D capable of handling and converting a wide variety of feedstocks. This should include research directed at overcoming logistical hurdles and addressing issues of harvesting, handling, densifying, transporting, preparing, and storing feedstocks headed for the biorefinery.

   OBP's Feedstock Platform emphasizes the focus of its R&D to "develop…harvesting, storage, and transportation technologies that will reduce the cost of sustainable delivery of biomass to a biorefinery and on ensuring effective coordination between DOE and USDA biomass research efforts." Information on projects undertaken in the past few years can be found on the OBP Web site: http://www1.eere.energy.gov/biomass/project_factsheets.html#feedstocks *Feedstocks R&D project technologies for FY 2006, included feedstock infrastructure, multicomponent harvest, and supply system logistics. USDA has focused on research and technology commercialization efforts to overcome the logistical barriers for economical production, recovery, and use of various agricultural and forestry feedstocks from different regions. Infrastructure collaboration in the Biomass Posture Plan will help streamline Federal efforts for feedstock transportation and storage. In addition, the Regional Biomass Energy Feedstock Partnerships described above include land-grant and sun-grant university members whose primary R&D goal is to streamline feedstocks pre-processing, handling, transportation, and storage.*

B. Recommendations on the Solicitation and Proposal Review Process

1. The 2007 USDA – DOE joint solicitation should be issued in a timely manner by October 1, 2006.

   The FY 2005 joint solicitation was issued December 17, 2004. The joint solicitation process was accelerated for FY 2006, starting with a pre-application solicitation issue on November 1, 2005. Administration of the solicitation alternates between agencies. For FY 2007, USDA takes over these duties from DOE, and is making every effort to issue the funding opportunity announcement (FOA) in a timely manner.

2. Budgeted funding for the Initiative should be subject to fewer congressionally directed projects, and provide a greater proportion of discretionary amounts to

pursue projects that are measured by documented milestones and which reflect the Committee's *Vision* and *Roadmap*. For example, a separate targeted program and/or solicitation should be developed in consultation with appropriate Congressional staff, focusing on drawing in State research and demonstration funding in a true partnership fashion. Around the nation, governors and legislators are making decisions about increasing funding for biofuels and bioproducts research, demonstration, and infrastructure efforts. States are providing not only funding but tax incentives, education, and outreach to the public. Leveraging these public interest funds and efforts in a manner that recognizes the important role of the States would greatly expand available resources for sector biofuels and bioproducts development efforts. Moreover, properly structured and communicated, it would greatly aid efforts in reducing the overall proportion of congressionally directed funding.

The Department of Energy has experienced decreases in available appropriations due to Congressionally directed projects. In many cases, this has resulted in stretching out the R&D activities and delaying the time for scheduled milestones.

OBP has also experienced decreases in discretionary funding for all R&D platforms. Congressionally directed projects comprised 58 percent of OBP R&D in FY 2006. OBP will be initiating activities to better inform and educate Congress of the specific technical objectives of the program plans, and the importance of full funding for those objectives to meet AEI goals. OBP will continue to focus on the most efficient achievement of current research goals with the resources made available.

3. Support ongoing review and analysis of awards made to determine the impact of funded programs.

   OBP R&D platforms conduct regular annual stage gate reviews. In turn, the entire OBP R&D portfolio is subjected to an independent peer review biennially. The next Biomass Program Peer Review should occur in late 2007 or early 2008. During the first quarter of FY 2007, the Biomass Initiative will conduct a portfolio review of all USDA and DOE biomass R&D. This report analyzes current R&D by technology area and compares achievements to the Committee's recommended R&D pathways as outlined in the Roadmap. *Involvement of other agencies in biomass work should increase in FY 2007 due to the development of the Biomass Posture Plan for the BFI, with a corresponding increase in data on current biomass efforts Federal-wide. Information will be made available on the Biomass Initiative Web site as analysis is completed:* http://www.biomass.govtools.us

C. Overall Recommendations to the Secretaries

1. Opportunities for workforce development in biomass-related disciplines should be pursued.

   DOE and USDA will continue to pursue biomass R&D opportunities in collaboration with private interests, providing opportunities for workforce development. The joint solicitation offers an annual opportunity for industry to pursue Federal biomass research funding. DOE's Regional Biomass Energy Feedstock Partnerships previously described involve industry and academic participants, and are working to identify communications strategies for outreach. These include not only current biomass employment opportunities, but also publicity efforts focused on education options for school-age children. Land-grant and sun-grant universities play a significant role in educating the future workforce.

2. Outreach to the general public should be expanded to better communicate the benefits of biomass technologies.

   The FY 2006 joint solicitation awards were announced at the October 10-12, 2006 USDA – DOE Advancing Renewable Energy Conference in St. Louis, Missouri, in an effort to broadcast recent accomplishments at a major national event. OBP is collaborating with other DOE programs on current consumer awareness programs and ethanol and E85 infrastructure. In addition, the FY 2007 OBP Communications Plan, currently in development, should feature more public outreach than in previous years.

   The National Biodiesel Education Program was established by the 2002 Farm Bill, which authorized funding of $1 million per year from FY 2003 through FY 2007 for education grants. The primary objective of the Program is to educate the public and government and private entities that operate vehicle fleets about the benefits of biodiesel use. The Program is implemented by USDA through two competitive grants -- one run by the National Biodiesel Board and the other by the University of Idaho. Program funds have been used for organizing national conferences, conducting technical workshops, and developing partnerships with stakeholders, such as engine manufacturers, health organizations, environmental groups, the National Energy Education Development (NEED) Program, and State Department of Transportation Offices. Education materials have been developed, including Technotes, a biodiesel technical bulletin published quarterly by University of Idaho. In addition, public radio and television programs demonstrating the benefits of biodiesel have been broadcasted nationally.

3. Fuel tax abatement has been extremely successful in promoting biofuels. Similar incentives should be developed to promote biobased products. An

evaluation should be conducted to identify policy initiatives that will support the growth of biobased products.

During FY 2006, USDA has advanced its Federal Biobased Preferred Procurement Program (FB4P, known in FY 2007 as the BioPreferred Program) in compliance with the requirements of the Farm Bill, identifying more products for inclusion. FB4P enhances biobased product markets and provides for industry standards, including the establishment of minimum biobased content percentages. USDA offers its program as a model to other agencies. More information about the program can be found online: http://www.usda.gov/procurement/business/biobased.htm

DOE has continued Products Development R&D in FY 2006 with $7,490,000 in funding. The FY 2007 budget request for this area is $33,931,000. OBP will take this recommendation into consideration as it pursues Products Development goals in the next year.

4. That Congress provides full funding for the integrated biorefinery solicitation under section 932 of the Energy Policy Act of 2005 - FOA # DE-PS36-06GO96016.

   In FY 2006, DOE issued the solicitation according to the requirements of the Energy Policy Act of 2005. DOE requested funds to support the solicitation in its FY 2007 Budget.

5. The Committee encourages the agencies of the Board to provide solicitations that support biomass R&D so that a greater number of university faculty members are directly involved in biomass R&D projects. This will advance the influence of the biomass community, facilitate the increase of the biomass workforce, and will encourage cooperation with industry and Federal scientists.

   The Departments recognize that university faculties are critical for advancing biomass R&D, influencing not only technological advancement, but also workforce development, and corresponding industry and Federal policies. As early as FY 2004, OBP issued a FOA for university R&D in support of its conversion technologies portfolio. The solicitation required a consortium of universities to collaborate on R&D, in partnership with national laboratories. The solicitation progressed through project selection, but awards could not be made because Congressionally directed projects limited the availability of funds. The joint solicitation also offers an annual opportunity for university faculty to pursue Federal biomass research funding.

   Land-grant and sun-grant university members of the Regional Biomass Energy Feedstock Partnerships (previously described) conduct research directly funded with Farm Bill resources. In the first quarter of FY 2007, the

agencies of the Interagency Biomass Board have been asked to assign experts to work with USDA and DOE on the development of the interagency Biomass Posture Plan, a document that will outline the combined Federal effort to advance biomass technologies. The document development process is conducted under the advisement of Committee recommendations, so that the final Federal-wide strategy should consider university faculty.

USDA's CSREES works directly with the faculties of land grant institutions including 1862, 1890, and 1994 colleges in support of broad research agendas. CSREES provides funding for about 100 projects that include an energy-related objective, and for projects to develop biobased products that can replace petroleum-based products and/or are manufactured with alternatives to petroleum and natural gas. This work is carried out under the research agenda of the Agency. FS and ARS each have laboratories located on many college or university campuses and collaborate on renewable energy work..

6. Increased support should be given for international peer exchange among policy makers and researchers on biofuels and biobased products issues. Supporting a global market for biofuels and biobased products would greatly advance U.S. efforts by facilitating the exchange of complementary cross-border policies, development of joint research projects, and increased understanding of the potential of biofuels and biobased products.

   OBP is an ongoing partner in International Energy Agency (IEA) activities, including several major bioenergy tasks. More information about the IEA's bioenergy efforts is online: http://www.ieabioenergy.com/

   Some examples of other DOE collaborations with other nations are:
   - *The U.S. – Brazil 2003 Memorandum of Understanding, to strengthen bilateral cooperation on energy modernization and new technologies for both countries.*
   - *The July 2005 International Biorefinery Workshop in Washington, D.C. was co-sponsored with the European Commission Directorate General for Research. The Workshop was convened for information-sharing about efforts to streamline biofuel and bioproduct operations, and to help launch the Secretary of Energy's focus on biofuels. About 20 countries were represented, including speakers from South America, Asia, Europe, and North America. Participants expressed a wish to take turns hosting similar workshops in the future.*
   - *The China Resources Alcohol Corporation (CRAC), which is beginning a 3-year cooperation agreement with Novozymes' U.S. office on cellulosic ethanol research.*
   - *The United States and Sweden signed a Science and Technology Agreement in allowing government agencies of both countries to collaborate on research.*

DOE recognizes there is much to learn from other nations in terms of successful policies and market-based mechanisms to promote biofuels. Fostering the infrastructure to distribute and market biofuels is critical to the promotion of biofuels. Similarly, it is hoped that DOE research in producing cellulosic ethanol can benefit other nations and broaden the range of biofuels available worldwide.

USDA is also a partner in the feedstock production tasks of the IEA and uses this venue for international collaboration and coordination, and is a member of the Working Group on Renewable Energy. USDA also supports collaboration and information exchange on renewable through other formal organizations such as FAO and IUFRO (International Union of Forest Research Organizations).

Some examples of other USDA collaborations include:

- *USDA is a member of joint EU-EU Scientific Cooperation on Biofuels working group that is sponsored by the State Department.*
- *USDA is invited to join the Global Bio-Energy Policy Forum.*
- *There is a large number of bi-lateral research cooperation with different countries supported by different USDA Agencies.*
- *USDA supports exchange of technical information among international bio-fuels producers and consumers through the Cochran program.*
- *USDA supports and encourages its overseas representatives' participation in and attendance at international bio-fuels discussions.*
- *USDA supports increased international bio-fuels production and consumption information availability through reporting by its overseas representatives.*
- *USDA participates with the Organization for Economic Cooperation and Development on biobased product initiative. USDA participates in the Methane to Markets (M2M), an international initiative. The Partnership promotes collaboration between developed countries, developing countries, and countries with economies in transition,- together with strong participation from the private sector.*
- USDA participates in the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC sets an overall framework for intergovernmental efforts to address the challenges posed by climate change.

7. Study and test the existing infrastructure to identify methods in which it can be modified or improved to transport and distribute biobased fuels, products, and energy.

The recently formed E85 Infrastructure Team combines efforts to streamline the distribution and marketing of E85 from several programs under the aegis

of the DOE Office of Energy Efficiency and Renewable Energy: OBP, Federal Emergency Management Program, FreedomCAR, and Clean Cities. Also, the applied efforts of Federal Agencies to address infrastructure needs will be outlined in the Posture Plan document, for release in the first quarter of FY 2007. Funds provided to the analysis projects in the FY 2006 joint solicitation should assist the awardees to address critical issues, such as increased technology synergy, adequate feedstocks supply, and ideal crop and plant location.

Appendix 1: Biomass Research and Development Act
Revised by the Energy Policy Act of 2005

TITLE III—BIOMASS RESEARCH AND DEVELOPMENT ACT OF 2000
SEC. 301. [7 U.S.C. 7624 note] SHORT TITLE.
This title may be cited as the ‘‘Biomass Research and Development Act of 2000’’.
SEC. 302. [7 U.S.C. 7624 note] FINDINGS.
Congress finds that—

(1) conversion of biomass into biobased industrial products offers outstanding potential for benefit to the national interest through—
  (A) improved strategic security and balance of payments;
  (B) healthier rural economies;
  (C) improved environmental quality;
  (D) near-zero net greenhouse gas emissions;
  (E) technology export; and
  (F) sustainable resource supply;

(2) the key technical challenges to be overcome in order for biobased industrial products to be cost-competitive are finding new technology and reducing the cost of technology for converting biomass into desired biobased industrial products;

(3) biobased fuels, such as ethanol, have the clear potential to be sustainable, low cost, and high performance fuels that are compatible with both current and future transportation systems and provide near-zero net greenhouse gas emissions;

(4) biobased chemicals have the clear potential for environmentally benign product life cycles;

(5) biobased power can—
  (A) provide environmental benefits;
  (B) promote rural economic development; and
  (C) diversify energy resource options;

(6) many biomass feedstocks suitable for industrial processing show the clear potential for sustainable production, in some cases resulting in improved soil fertility and carbon sequestration;

(7)(A) grain processing mills are biorefineries that produce a diversity of useful food, chemical, feed, and fuel products; and

(B) technologies that result in further diversification of the range of value-added biobased industrial products can meet a key need for the grain processing industry;

(8)(A) cellulosic feedstocks are attractive because of their low-cost and widespread availability; and

(B) research resulting in cost-effective technology to overcome the recalcitrance of cellulosic biomass would allow biorefineries to produce fuels and bulk chemicals on a very large scale, with a commensurately large realization of the benefit described in paragraph (1);

(9) research into the fundamentals to understand important mechanisms of biomass conversion can be expected to accelerate the application and advancement of biomass processing technology by—
  (A) increasing the confidence and speed with which new technologies can be scaled up; and
  (B) giving rise to processing innovations based on new knowledge;

(10) the added utility of biobased industrial products developed through improvements in processing technology would encourage the design of feedstocks that would meet future needs more effectively;

(11) the creation of value-added biobased industrial products would create new jobs in construction, manufacturing, and distribution, as well as new higher-valued exports of products and technology;
(12)(A) because of the relatively short-term time horizon characteristic of private sector investments, and because many benefits of biomass processing are in the national interest, it is appropriate for the Federal Government to provide precommercial investment in fundamental research and research- driven innovation in the biomass processing area; and
(B) such an investment would provide a valuable complement to ongoing and past governmental support in the biomass processing area; and
(13) several prominent studies, including studies by the President's Committee of Advisors on Science and Technology and the National Research Council—
(A) support the potential for large research-driven advances in technologies for production of biobased industrial products as well as associated benefits; and
(B) document the need for a focused, integrated, and innovation-driven research effort to provide the appropriate progress in a timely manner.

SEC. 303. [7 U.S.C. 7624 note] DEFINITIONS.

In this title:

(1) ADVISORY COMMITTEE.—The term ''Advisory Committee'' means the Biomass Research and Development Technical Advisory Committee established by section 306.
(2) BIOBASED FUEL.—The term 'biobased fuel' means any transportation fuel produced from biomass.
(3) BIOBASED PRODUCT.—The term 'biobased product' means an industrial product (including chemicals, materials, and polymers) produced from biomass, or a commercial or industrial product (including animal feed and electric power) derived in connection with the conversion of biomass to fuel.
(4) BIOMASS.—The term ''biomass'' means any organic matter that is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood wastes and residues, plants (including aquatic plants), grasses, residues fibers, and animal wastes, municipal wastes, and other waste materials.
(5) BOARD.—The term ''Board'' means the Biomass Research and Development Board established by section 305.
(6) DEMONSTRATION.—The term 'demonstration' means demonstration of technology in a pilot plant or semi-works scale facility.
(7) INITIATIVE.—The term ''Initiative'' means the Biomass Research and Development Initiative established under section 307.
(8) INSTITUTION OF HIGHER EDUCATION.—The term ''institution of higher education'' has the meaning given the term in section 102(a) of the Higher Education Act of 1965 (20 U.S.C. 1002(a)).
(9) NATIONAL LABORATORY.—The term 'National Laboratory' has the meaning given that term in section 2 of the Energy Policy Act of 2005.
(10) POINT OF CONTACT.—The term ''point of contact'' means a point of contact designated under section 304(d).

SEC. 304. [7 U.S.C. 7624 note] COOPERATION AND COORDINATION IN BIOMASS RESEARCH AND DEVELOPMENT.

(a) IN GENERAL.—The Secretary of Agriculture and the Secretary of Energy shall cooperate with respect to, and coordinate, policies and procedures that promote research and development leading to the production of biobased fuels and biobased products.
(b) POINTS OF CONTACT.—

(1) IN GENERAL.—To coordinate research and development programs and activities relating to biobased industrial products that are carried out by their respective Departments—

(A) the Secretary of Agriculture shall designate, as the point of contact for the Department of Agriculture, an officer of the Department of Agriculture appointed by the President to a position in the Department before the date of the designation, by and with the advice and consent of the Senate; and

(B) the Secretary of Energy shall designate, as the point of contact for the Department of Energy, an officer of the Department of Energy appointed by the President to a position in the Department before the date of the designation, by and with the advice and consent of the Senate.

(2) DUTIES.—The points of contact shall jointly—

(A) assist in arranging interlaboratory and site-specific supplemental agreements for research and development projects relating to biobased fuels and biobased products;

(B) serve as co-chairpersons of the Board;

(C) administer the Initiative; and

(D) respond in writing to each recommendation of the Advisory Committee made under section 306(c).

SEC. 305. [**7 U.S.C. 7624 note**] **BIOMASS RESEARCH AND DEVELOPMENT BOARD.**

(a) ESTABLISHMENT.—There is established the Biomass Research and Development Board, which shall supersede the Interagency Council on Biobased Products and Bioenergy established by Executive Order No. 13134, to coordinate programs within and among departments and agencies of the Federal Government for the purpose of promoting the use of biobased fuels and biobased products by—

(1) maximizing the benefits deriving from Federal grants and assistance; and

(2) bringing coherence to Federal strategic planning.

(b) MEMBERSHIP.—The Board shall consist of—

(1) the point of contact of the Department of Energy designated under section 304(b)(1)(B), who shall serve as co-chairperson of the Board;

(2) the point of contact of the Department of Agriculture designated under section 304(b)(1)(A), who shall serve as co-chairperson of the Board;

(3) a senior officer of each of the Department of the Interior, the Environmental Protection Agency, the National Science Foundation, and the Office of Science and Technology Policy, each of whom shall—

(A) be appointed by the head of the respective Agency; and

(B) have a rank that is equivalent to the rank of the points of contact; and

(4) at the option of the Secretary of Agriculture and the Secretary of Energy, other members appointed by the Secretaries after consultation with the members described in paragraphs (1) through (3)).

(c) DUTIES.—The Board shall—

(1) coordinate research and development activities relating to biobased fuels and biobased products—

(A) between the Department of Agriculture and the Department of Energy; and

(B) with other departments and agencies of the Federal Government;

(2) provide recommendations to the points of contact concerning administration of this title;

(3) ensure that—

(A) solicitations are open and competitive with awards made annually; and

(B) objectives and evaluation criteria of the solicitations are clearly stated and minimally prescriptive, with no areas of special interest; and

(4) ensure that the panel of scientific and technical peers assembled under section 307(g)(1)(C) to review proposals is composed predominantly of independent experts selected from outside the Departments of Agriculture and Energy.

(d) FUNDING.—Each Agency represented on the Board is encouraged to provide funds for any purpose under this title.

(e) MEETINGS.—The Board shall meet at least quarterly to enable the Board to carry out the duties of the Board under subsection (c).

SEC. 306. [**7 U.S.C. 7624 note**] **BIOMASS RESEARCH AND DEVELOPMENT TECHNICAL ADVISORY COMMITTEE.**

(a) ESTABLISHMENT.—There is established the Biomass Research and Development Technical Advisory Committee, which shall supersede the Advisory Committee on Biobased Products and Bioenergy established by Executive Order No. 13134—

(1) to advise the Secretary of Energy, the Secretary of Agriculture, and the points of contact concerning—

(A) the technical focus and direction of requests for proposals issued under the Initiative; and

(B) procedures for reviewing and evaluating the proposals;

(2) 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

(3) to evaluate and perform strategic planning on program activities relating to the Initiative.

(b) MEMBERSHIP.—

(1) IN GENERAL.—The Advisory Committee shall consist of—

(A) an individual affiliated with the biofuels industry;

(B) an individual affiliated with the biobased industrial and commercial products industry;

(C) an individual affiliated with an institution of higher education who has expertise in biobased fuels and biobased products;

(D) two prominent engineers or scientists from government or academia who have expertise in biobased fuels and biobased products;

(E) an individual affiliated with a commodity trade association;

(F) an individual affiliated with an environmental or conservation organization;

(G) two individuals associated with State government who have expertise in biobased fuels and biobased products;

(H) an individual with expertise in energy and environmental analysis;

(I) an individual with expertise in the economics of biobased fuels and biobased products;

(J) an individual with expertise in agricultural economics; and

(K) at the option of the points of contact, other members.

(2) APPOINTMENT.—The members of the Advisory Committee shall be appointed by the points of contact.

(c) DUTIES.—The Advisory Committee shall—

(1) advise the points of contact with respect to the Initiative; and
(2) evaluate whether, and make recommendations in writing to the Board to ensure that—
(A) funds authorized for the Initiative are distributed and used in a manner that is consistent with the objectives, purposes, and considerations of the Initiative;
(B) 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;
(C) 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 Department of Agriculture and Energy; and
(D) activities under this title are carried out in accordance with this title.

SEC. 307. [7 U.S.C. 7624 note] BIOMASS RESEARCH AND DEVELOPMENT INITIATIVE.

(a) IN GENERAL.—The Secretary of Agriculture and the Secretary of Energy, acting through their respective points of contact and in consultation with the Board, shall establish and carry out a Biomass Research and Development Initiative under which competitively awarded grants, contracts, and financial assistance are provided to, or entered into with, eligible entities to carry research on, and development and demonstration of, biobased fuels and biobased products, and the methods, practices and technologies, biotechnology, for their production.
(b) OBJECTIVES.—The objectives of the Initiative are to develop—
(1) technologies and processes necessary for abundant commercial production of biobased fuels at prices competitive with fossil fuels;
(2) high-value biobased products—
(A) to enhance the economic viability of biobased fuels and power; and
(B) as substitutes for petroleum-based feedstocks and products; and
(3) a diversity of sustainable domestic sources of biomass for conversion to biobased fuels and biobased products.
(c) PURPOSES.—The purposes of the Initiative are—
(1) to increase the energy security of the United States;
(2) to create jobs and enhance the economic development of the rural economy;
(3) to enhance the environment and public health; and
(4) to diversify markets for raw agricultural and forestry products.
(d) TECHNICAL AREAS.—To advance the objectives and purposes of the Initiative, the Secretary of Agriculture and the Secretary of Energy, in consultation with the Administrator of the Environmental Protection Agency and heads of other appropriate departments and agencies (referred to in this section as the Secretaries'), shall direct research and development toward—
(1) feedstock production through the development of crops and cropping systems relevant to production of raw materials for conversion to biobased fuels and biobased products, including—
(A) development of advanced and dedicated crops with desired features, including enhanced productivity, broader site range, low requirements for chemical inputs, and enhanced processing;
(B) advanced crop production methods to achieve the features described in subparagraph (A);
(C) feedstock harvest, handling, transport, and storage; and

(D) strategies for integrating feedstock production into existing managed land;

(2) overcoming recalcitrance of cellulosic biomass through developing technologies for converting cellulosic biomass into intermediates that can subsequently be converted into biobased fuels and biobased products, including—

(A) pretreatment in combination with enzymatic or microbial hydrolysis; and

(B) thermochemical approaches, including gasification and pyrolysis;

(3) product diversification through technologies relevant to production of a range of biobased products (including chemicals, animal feeds, and cogenerated power) that eventually can increase the feasibility of fuel production in a biorefinery, including—

(A) catalytic processing, including thermochemical fuel production;

(B) metabolic engineering, enzyme engineering, and fermentation systems for biological production of desired products or cogeneration of power;

(C) product recovery;

(D) power production technologies; and

(E) integration into existing biomass processing facilities, including starch ethanol plants, paper mills, and power plants; and

(4) analysis that provides strategic guidance for the application of biomass technologies in accordance with realization of improved sustainability and environmental quality, cost-effectiveness, security, and rural economic development, usually featuring system-wide approaches.

(e) ADDITIONAL CONSIDERATIONS.—Within the technical areas described in subsection (d), and in addition to advancing the purposes described in subsection (c) and the objectives described in subsection (b), the Secretaries shall support research and development—

(1) to create continuously expanding opportunities for participants in existing biofuels production by seeking synergies and continuity with current technologies and practices, such as the use of dried distillers grains as a bridge feedstock;

(2) to maximize the environmental, economic, and social benefits of production of biobased fuels and biobased products on a large scale through life-cycle economic and environmental analysis and other means; and

(3) to assess the potential of Federal land and land management programs as feedstock resources for biobased fuels and biobased products, consistent with the integrity of soil and water resources and with other environmental considerations.

(f) ELIGIBLE ENTITIES.—To be eligible for a grant, contract, or assistance under this section, an applicant shall be—

(1) an institution of higher education;

(2) a National Laboratory;

(3) a Federal research agency;

(4) a State research agency;

(5) a private sector entity;

(6) a nonprofit organization; or

(7) a consortium of two of more entities described in paragraphs (1) through (6).

(g) ADMINISTRATION.—

(1) IN GENERAL.—After consultation with the Board, the points of contact shall—

(A) publish annually one or more joint requests for proposals for grants, contracts, and assistance under this section;

(B) require that grants, contracts, and assistance under this section be awarded competitively on the basis of merit after the establishment of procedures that provide for scientific peer review by an independent panel of scientific and technical peers; and

(C) give some preference to applications that—

(i) involve a consortia of experts from multiple institutions;

(ii) encourage the integration of disciplines and application of the best technical resources; and

(iii) increase the geographic diversity of demonstration projects.

(2) DISTRIBUTION OF FUNDING BY TECHNICAL AREA.—Of the funds authorized to be appropriated for activities described in this section, funds shall be distributed for each of fiscal years 2007 through 2010 so as to achieve an approximate distribution of—

(A) 20 percent of the funds to carry out activities for feedstock production under subsection (d)(1);

(B) 45 percent of the funds to carry out activities for overcoming recalcitrance of cellulosic biomass under subsection (d)(2);

(C) 30 percent of the funds to carry out activities for product diversification under subsection (d)(3); and

(D) 5 percent of the funds to carry out activities for strategic guidance under subsection (d)(4).

(3) DISTRIBUTION OF FUNDING WITHIN EACH TECHNICAL AREA.—Within each technical area described in paragraphs (1) through (3) of subsection (d), funds shall be distributed for each of fiscal years 2007 through 2010 so as to achieve an approximate distribution of—

(A) 15 percent of the funds for applied fundamentals;

(B) 35 percent of the funds for innovation; and

(C) 50 percent of the funds for demonstration.

(4) MATCHING FUNDS.—

(A) IN GENERAL.—A minimum of 20 percent funding match shall be required for demonstration projects under this title.

(B) COMMERCIAL APPLICATIONS.—A minimum of 50 percent funding match shall be required for commercial application projects under this title.

(5) TECHNOLOGY AND INFORMATION TRANSFER TO AGRICULTURAL USERS.—The Administrator of the Cooperative State Research, Education, and Extension Service and the Chief of the Natural Resources Conservation Service shall ensure that applicable research results and technologies from the Initiative are adapted, made available, and disseminated through those services, as appropriate.

SEC. 308. [7 U.S.C. 7624 note] ADMINISTRATIVE SUPPORT AND FUNDS.

(a) IN GENERAL.—To the extent administrative support and funds are not provided by other agencies under subsection (b), the Secretary of Energy and the Secretary of Agriculture may provide such administrative support and funds of the Department of Energy and the Department of Agriculture to the Board and the Advisory Committee as are necessary to enable the Board and the Advisory Committee to carry out their duties under this title.

(b) OTHER AGENCIES.—The heads of the agencies referred to in section 305(b)(3), and the other members appointed under section 305(b)(4), may, and are encouraged to, provide administrative support and funds of their respective agencies to the Board and the Advisory Committee.

(c) LIMITATION.—Not more than 4 percent of the amount appropriated for each fiscal year under section 307(f) may be used to pay the administrative costs of carrying out this title.

SEC. 309. [**7 U.S.C. 7624 note**] **REPORTS.**

(a) INITIAL REPORT.—Not later than 180 days after the date of the enactment of this Act, the Secretary of Energy and the Secretary of Agriculture shall jointly submit to Congress a report that—

(1) identifies the points of contact, the members of the Board, and the members of the Advisory Committee;

(2) describes the status of current biobased industrial product research and development efforts in both the Federal Government and private sector;

(3) includes a section prepared by the Board that establishes a set of criteria to assess the potential of biobased industrial products, which shall include for both biomass production and transformation into biobased industrial products—

(A) an energy accounting;

(B) an environmental impact assessment; and

(C) an economic assessment; and

(4) describes the research and development goals of the Initiative, including how funds will be allocated in order to accomplish those goals.

(b) ANNUAL REPORTS.—For each fiscal year for which funds are made available to carry out this title, the Secretary of Energy and the Secretary of Agriculture shall jointly submit to Congress a detailed report on—

(1) the status and progress of the Initiative, including a report from the Advisory Committee on whether funds appropriated for the Initiative have been distributed and used in a manner that—

(A) is consistent with the objectives, purposes, and additional considerations described in subsections (b) through (e) of section 307;

(B)uses the set of criteria established under subsection (a)(3);

(C) achieves the distribution of funds described in paragraphs (2) and (3) of section 307(g); and

(D) takes into account any recommendations that have been made by the Advisory Committee;

(2) the general status of cooperation and research and development efforts carried out at each Agency with respect to biobased fuels and biobased products, including a report from the Advisory Committee on whether the points of contact are funding proposals that are selected under section 307(c)(2)(C); and

(3) the plans of the Secretary of Energy and the Secretary of Agriculture for addressing concerns raised in the report, including concerns raised by the Advisory Committee.

(c) UPDATES.—The Secretary and the Secretary of Energy shall update the Vision and Roadmap documents prepared for Federal biomass research and development activities.

SEC. 310. [7 U.S.C. 7624 note] FUNDING.

(a) FUNDING.—Of funds of the Commodity Credit Corporation, the Secretary shall make available to carry out this title—

(1) $5,000,000 for fiscal year 2002; and

(2) $14,000,000 for each of fiscal years 2003 through 2007; to remain available until expended.

(b) AUTHORIZATION OF APPROPRIATIONS.—In addition to amounts transferred under subsection (a), there are authorized to be appropriated to carry out this title $200,000,000 for each fiscal year 2006 through 2015.

Appendix 2

Biomass Research and Development Technical Advisory Committee
Membership for Fiscal Year 2006

Chair	Affiliation	Term Ending
Thomas W. Ewing	Davis and Harman, LLP	November 2007

Vice Chair	Affiliation	Term Ending
F. Terry Jaffoni	Clean Transportation Fuels	November 2006

Members	Affiliation	Term Ending
David Anton	DuPont	November 2008
James Barber	Metabolix	November 2007
Thomas Binder	Archer Daniels Midland	November 2008
Arthur Blazer	New Mexico State Forestry	November 2007
Jerrel Branson	BioCrude, LLC	November 2006
Ralph Cavalieri	Washington State University	November 2006
Bob Dinneen	Renewable Fuels Association	November 2007
Carolyn Fritz	Allylix, Inc.	November 2006
Douglas Hawkins	Rohm & Haas	November 2007
John S. Hickman	Deere & Company	November 2007
Lou Honary	University of Northern Iowa	November 2008
Jack Huttner	Genencor International, Inc.	November 2006
E. Alan Kennett	Gay & Robinson Sugar	November 2008
Charles Kinoshita	University of Hawaii	November 2007
Eric Larson	Princeton University	November 2007
Mark Maher	General Motors	November 2008
Jim Martin	Omni Tech International	November 2007
Scott Mason	Conoco Phillips	November 2007
John McKenna	Hamilton Clark & Co.	November 2008
Ed McClellan	Alston & Bird, LLP	November 2008
Larry Pearce	Governors' Ethanol Coalition	November 2007
Mitchell Peele	North Carolina Farm Bureau	November 2008
Delmar R. Raymond	Weyerhaeuser, Inc. (Retired)	November 2006
Jeffrey Serfass	Technology Transition Corporation	November 2008
Robert Sharp	Mobile Forest Products	November 2008
J. Read Smith	Agricultural Energy Work Group	November 2008
Edwin White	State University of New York	November 2007
Rodney Williamson	Iowa Corn Promotion Board	November 2008

Total – 30 members

Appendix 3
Joint Solicitation Review Criteria

Criterion 1: Technical Relevance and Merit Weight: 30 percent
The technical merit of the application will be evaluated based on the extent to which the project, if successfully carried out, will address research, development, and demonstration activities for the biomass Technical Topic Areas as described in this Announcement. Specific considerations for this criterion are as follows:

- Clarity and relevance of the project objectives.
- Novelty, innovation, uniqueness, and originality of the project objectives.
- Technical merit of the proposed research, development, or demonstration.
- Extent to which the proposed work will demonstrate the current state of knowledge and/or technology.
- Extent to which the proposed work will complement or advance the current knowledge or technology for the stated objectives.

Criterion 2: Technical Approach/Work Plan Weight: 25 percent
The technical approach will be evaluated based on the clarity and technical strength of the approach to achieve the project objectives, including the plan for each task and subtask, milestones and deliverables. Specific considerations for this criterion are as follows:

- Technical feasibility of the proposed work.
- Adequacy and completeness of the proposed tasks.
- Clarity and completeness of the description of each activity necessary to complete the project.
- Likelihood of achieving project objectives through realistic milestones and logical task structure.
- Reasonableness of the schedule.
- Performance measures and milestones for evaluating progress with regard to key subtasks and/or deliverables.
- Identification and appropriateness of key decision points for mitigating potential problems.
- Process for monitoring and evaluating the project's progress and performance.

Criterion 3: Energy Efficiency/Displacement, Rural Economic Development, and Environmental Benefits Weight: 25 percent

The overall projected benefits will be evaluated in terms of: improvements in energy efficiency and economics of the biomass technology, oil displacement, rural economic development, and environmental benefits. Specific considerations for this criterion are as follows:

- Estimated benefits in comparison to existing technology or system (e.g., crude oil displacement or energy efficiency gains in product production).
- Comparison of the cost to produce the targeted product(s), fuel(s), and power, versus existing best commercial technology.
- Anticipated energy and/or economic benefits, including those related to enterprise and community self-sufficiency, rural economic development, job creation, and reduction in imports.
- Potential for the proposed work to provide sufficient benefits in terms of cost reduction, risk reduction, or performance improvement to justify the cost of the system being investigated.
- Potential for near-term implementation of the proposed system or technology.
- Incorporation of activities and technologies that are protective of the environment.
- Extent to which public safety, environmental concerns, and land sustainability issues in rural areas are addressed.

Criterion 4: Technical, Management, and Facility Capabilities
Weight: 20 percent

Technical and management qualifications of all participating organizations and key personnel, including subcontractors and consultants, will be evaluated with respect to their ability to carry out the proposed effort. The adequacy and appropriateness of the facilities planned for this work will also be considered. Specific considerations for this criterion are as follows:

- Credentials, capabilities, experience (technical and managerial), performance record, and availability of the applicant and participants to comprehensively address all aspects of the proposed project.
- Soundness of the project management concept with respect to proposed tasks and organizational structure to achieve project objectives.
- Type, quality, availability, and appropriateness of facilities, equipment, and materials utilized to carry out the proposed work.
- Level of participation by project participants as evidenced by letter(s) of commitment.
- Extent of beneficial collaboration across industry and academia.
- Current or recent government contracts, grants, cooperative agreements, or other work by the applicant and/or participants in this or related fields.