

**Summary:**

**Biomass Research & Development  
Technical Advisory Committee Meeting  
and  
Joint Meeting with Biomass Research and  
Development Board**

**November 28-29, 2006**

**August 7, 2007**

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# Meeting Summary

**November 28, 2006**

## **A. Welcome to the Public and Interagency Biomass R&D Board Members and Overview of Combined Agenda**

Committee Chairman Tom Ewing called the meeting to order, and welcomed all members of both the Biomass Research and Development (R&D) Board (Board) and the Biomass R&D Technical Advisory Committee (Committee). Chairman Ewing explained that while Congressman for Illinois, he had the opportunity to sponsor the legislation that established both groups, and felt it a privilege to have been Committee Chairman since his nomination in 2001. Chairman Ewing asked the members of the Board and Committee to introduce themselves (Addendum A), recognizing that many of the members are new. The Committee's primary task is to discuss current biomass and renewable fuels technologies and goals to make recommendations to the Secretaries of Agriculture and Energy. Recent interest in this area has increased significantly, and Chairman Ewing asked the Board to continue work to emphasize the importance of renewable technologies to the economy, energy independence, and energy security.

## **B. Joint Meeting with Biomass Research & Development Board**

Committee Chairman Tom Ewing began the joint meeting by requesting the Board members to consider the briefing materials provided to them, including the Committee's recommendations to the Secretaries of Agriculture and Energy for Fiscal Year 2006 (Attachment A). The Committee has been working on these along with its recently completed update of the *Vision for Bioenergy and Bioproducts in the U.S. (Vision)* (Attachment B), and would appreciate feedback on the recommendations. Other key documents developed by subcommittees are the draft Policy Gap Analysis (Attachment C), and comments on analysis documents (Attachment D).

Board co-chair U.S. Department of Agriculture (USDA) Under Secretary for Rural Development Tom Dorr began the discussion. He felt the Committee's groundwork has been fruitful, and commended the members on their work with difficult issues. Several major concerns have steered their bioenergy efforts: The Farm Bill of 2002 contained the first energy title, while the Energy Policy Act of 2005 (EPAct) dealt with biomass directly. Hurricane Katrina manifested unanticipated energy and agriculture issues. The biofuels goals from the 2006 State of the Union Address and the biofuels discussion at the October 2006 Advancing Renewable Energy Conference in St. Louis have both shaped the Agency's recent approach to biomass technologies.

U.S. Department of Energy (DOE) Board co-chair Assistant Secretary for Energy Efficiency and Renewable Energy (EERE) Andy Karsner reaffirmed his gratitude to the Committee. In previous collaboration with advisory groups, he has found joint meetings to be important bellwethers for future direction. DOE's R&D portfolio is very broad, including transportation, vehicle technologies, and fundamental biofuels conversion

work. EERE will continue to support the Committee's advisory efforts. Assistant Secretary Karsner thanked *Vision* and *Roadmap* Subcommittee regional chairmen Tom Binder, Ralph Cavalieri, and Doug Hawkins. He also noted the Committee's alignment with the 25 x '25 renewable technologies group, including Committee member Read Smith and Chairman Tom Ewing. Assistant Secretary Karsner felt that updating metrics for national production and consumption of biofuels and other renewable technologies is an important focus.

Dr. Bruce Hamilton of the National Science Foundation (NSF) explained that his agency's role is to fund basic research, primarily at universities, but including small businesses. NSF still funds basic biofuels research, and will continue to provide information for collaboration with USDA and DOE on crosscutting federal efforts.

Mike Catanzaro of the Environmental Protection Agency (EPA) thanked the co-chairs, and expressed EPA's wish to fulfill its key biofuels responsibility with correct and thorough implementation of the Renewable Fuels Standard (RFS). A proposal was issued in September 2006, and awards should be finalized early in 2007. EPA also works with USDA, DOE, and the private sector in various areas.

Ed Pinero of the Office of the Federal Environmental Executive (OFEE) stated that his office's commitment to stewardship of environmental issues includes a focus on federal leverage and buying power, and the importance of biobased procurement programs. He pledged that OFEE will promote necessary policy measures in this area.

Diane Jones of the Office of Science and Technology Policy (OSTP) stated that her office, which examines all government science, is happy to collaborate with other agencies. In addition, President Bush's Advanced Energy Initiative is an exciting opportunity to explore new energy sources. OSTP recently addressed environmental questions regarding biofuels production, and appreciates the Committee's work to advance the field.

Chairman Ewing stated that the Committee published the original *Vision* in 2002, establishing production and market share goals for biofuels, biopower, and biobased products. The *Roadmap*, which followed a year later, established the R&D needs and pathways to achieve *Vision* goals. The Board had the opportunity to review the updated *Vision* during 2006. The *Roadmap* update process is ongoing. Chairman Ewing asked Tom Binder to provide an overview of this effort.

*Vision* and *Roadmap* subcommittee chairman Tom Binder stated that the Committee began work on the *Vision* update in November 2005 and received USDA and DOE endorsement of the revised document in August 2006. It was felt that in order to measure progress towards the original *Vision* goals they needed to remain unchanged; definitions were modified, however, to more accurately capture the specific categories of the goals. Electricity generation from biomass has remained almost static since 2002, due to the low price of coal generation. For biofuels and bioproducts, high petroleum prices have rendered renewable technologies comparable. Increased bioproducts applications are

necessary to support energy security, as rising domestic natural gas prices are driving chemical manufacturing operations overseas.

Dr. Binder gave a presentation regarding the document update process (Attachment D). The updated goals include interim metrics and adding a 2015 goal. The updated biofuels goal is measured in gasoline-equivalent gallons. Throughout 2006, *Roadmap* workshop participants at three regional meetings provided input on the best methods to achieving the aggressive targets in the updated *Vision*. Some participants advocated a central R&D approach to mimic the Manhattan Project. Others, including Dr. Binder, believe that industry can be empowered to develop a holistic approach to increase biopower and biobased products and production of biofuels. Basic research would provide both immediate and long-term results for industrial applications. Infrastructure development would help move fuels efficiently to production sites and end-users. Training for engineers, materials scientists, and chemists is necessary to continue the refining work already begun to parallel petroleum operations.

USDA Under Secretary Dorr asked what progress has been made on increased education and training since the Committee last discussed it at the November 2005 joint meeting. USDA's Cooperative State Research, Education, and Extension Service (CSREES) supports related efforts for the agency. Under Secretary Dorr reported Committee recommendations directly to CSREES. Tom Binder responded that major progress is lacking. Research professors require increased funding to take on doctoral and graduate students. Basic protein, lipids, carbohydrate, biomass, and lignocellulosics programs are small, and cannot train enough organic chemists to supply industry needs. Biorefineries operate on a smaller scale than centralized petroleum refineries to take advantage of regional feedstocks supplies. Ed White added that students are not aware of renewable energy degree opportunities. Purdue and Iowa have programs that are slowly gaining momentum, but a national initiative in this area would be a catalyst for technology and industry growth.

Dr. Bruce Hamilton agreed that the small programs in existence should be expanded. The NSF Integrative Graduate Education and Research Traineeship (IGERT) program may be an ideal place to start. Under IGERT, any professor can submit proposals and provide training in any area. A peer review provides competitive selection for proposals. Dr. Hamilton would like to see more proposals, especially for biofuels-related technologies. Dr. Ralph Cavalieri stated that in order to engage university faculty, grantors should increase the success rate for proposals. This requires providing more resources. Dr. Hamilton stated that NSF could explore a collaboration to target biofuels training. Under Secretary Dorr contributed that the new CSREES Under Secretary, Dr. Gale Buchanan, intends to establish more resources for education and training. He offered to facilitate a meeting, and aggressively seek opportunities in the area. Lou Honary stated the importance of long-term biobased products training to supply industry needs. DOE Assistant Secretary Karsner commented that his agency's Office of Science (SC) will be asked to coordinate with other agencies via the Board. SC is funding new Bioenergy Research Centers, which will be long-term, well-funded, broad consortia between academia and laboratories, and a valuable resource.

Jeff Serfass asked the Board what they consider the greatest challenge and the biggest weakness to achieving the *Vision's* aggressive goals. DOE Assistant Secretary Karsner's biggest concerns are areas in which the Department is disadvantaged, including its vulnerability to price fluctuations. His approach will include development of appropriate policy to achieve targets despite market changes. USDA Under Secretary Dorr expressed regret that renewable energy technologies did not receive much support during the 1980s, but is encouraged by significant recent biomass technology advances. He believes negative food vs. fuel arguments and concerns about viable commercialization of cellulosic technologies to be perceived weaknesses. He hopes that environmental issues can be handled with effective policy foundations.

John McKenna stated that his colleagues in the financial community have noted a lack of economic connection between the ethanol industry and government efforts to market the technology's return on investment. Committee member Bob Dinneen of the Renewable Fuels Association (RFA) has done an excellent job making this connection in the foreign arena, but the domestic production goals of the *Vision* will require a very large capital investment. Mr. McKenna asked the Board what they would do to convey the message that biofuels can be a low-risk investment opportunity with long-term profit potential. USDA Under Secretary Dorr replied that the potential of cellulosic conversion technologies could be explained better. The commercial integrated biorefineries solicitation required by EPAct will be the first significant cellulosic funding opportunity. Under Secretary Dorr had several concerns about the relationship between investors, federal agencies, and industry: prohibitive securities laws, ongoing infrastructure issues for biofuels, the variety of biofuels technologies, assessment of effective incentives, and the added step of the grower-refiner relationship. He added that USDA has a cooperative agreement with Booz Allen Hamilton to examine regulations, investment, and integration of distributed electricity production (i.e. anaerobic digesters and wind generation) into the regular system. This was discussed previously with the National Rural Electric Cooperative Association (NRECA), and former Committee co-chair Glenn English expressed interest. USDA's research does not aim to provide the best answers at this time, but to assist in defining the scope of future R&D.

DOE Assistant Secretary Karsner stated that when the financial sector communicates directly with scientists and engineers, it results in the most efficient production. One challenge for EERE is not just making biofuels available, but creating the capacity for nationwide supply. Policies to affect this level of production should be simple and durable, and directly result in increased yields. USDA Under Secretary Dorr asked Bob Dinneen and Terry Jaffoni to comment on their private sector experience and returns on biofuel investments. Bob Dinneen replied that while USDA Rural Development may currently fund biofuels technologies, industry cannot be certain of long-term support. In addition, he is not certain that government support is necessary for the next generation of ethanol production. The first challenge for achieving *Vision* goals will be turning a profit on cellulosic ethanol, and Mr. Dinneen requested continued support for commercialization of this technology. USDA Under Secretary Dorr responded that his experience in Rural Development has shown that an ordinary person should be able to

invest without the perceived risk or confusion. Federal support, whether political or financial, will be formed around that level of transparency, and build knowledge over time.

Eric Larson requested that DOE Assistant Secretary Karsner consider opportunities for collaboration between the EERE Fossil Energy and Biomass Programs. The offices share some technology avenues, such as carbon sequestration.

Assistant Secretary Karsner announced that Office of the Biomass Program (OBP) Manager Douglas Kaempf would be transferred to become Program Manager of the Industrial Technologies Program at DOE. Jacques Beaudry-Losique would become the new Program Manager in OBP. He also introduced John Mizroch, a Senior Advisor for EERE, who would respond to further questions, and thanked the Committee for their time, before departing.

The Committee broke for ten minutes.

Committee Chairman Tom Ewing directed the Board to consider the FY 2006 Committee recommendations to the Secretaries of Agriculture and Energy (Attachment A). Both agencies respond formally to each year's recommendations in the Secretaries' Annual Report to Congress. Chairman Ewing opened the floor for additional questions from the Committee and Board, and stated that the Committee also welcomes comments at any time during the year.

Jim Martin stated that recommendations regarding the use of Biomass R&D Initiative funds echo USDA Under Secretary Dorr's feeling that R&D efforts should support rural development. The Committee's recommendations state that robust technologies should be developed to convert multiple feedstocks at a scale that allows industry to take advantage of regional resources. Ralph Cavalieri requested that Board members continue to communicate with the Committee as they review the recommendations. He stated that diverse and geographically distributed feedstocks will be needed when millions of acres of one particular crop are not available. Ed White agreed, reiterating that biomass feedstocks vary widely by region, and universities and others are willing to collaborate nationally to develop a functional cellulosic feedstock supply system.

Tom Binder stated that overall recommendation number three notes the success of fuel tax abatement in promotion of biofuels. However, the policy should not advance fuels at the expense of bioproducts. A sensible, broader approach would more effectively decrease petroleum dependence in all areas. Tim Kline of the Department of Transportation responded that he will contact the commission on revenue as they examine alternate fuels tax measures.

Jim Martin directed the Board to the following recommendation in category B (Attachment B):



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

- 1. Joint Solicitation Review panel selections should be clear and transparent. (T. Jaffoni)

Mr. Martin stated that the recommendation emphasizes the ongoing diversion of biomass funding to a large number of Congressionally-directed projects, to the detriment of program goals at all agencies. The Committee advocates open, merit-based competition for funds.

Eric Larson referred to the first two recommendations under category A:

- A. Recommendations regarding the distribution and use of Initiative funds

- 1. DOE should establish a protein platform to work on non-cellulosic, non-sugar biomass feedstocks conversions. (J. Martin)
  - 2. Policies for the agricultural economics of biomass production should be given further study. (J. Martin)

He explained that they are intended to vary the focus of biomass technologies, including thermochemical conversion possibilities for a diverse R&D portfolio.

Jeff Serfass referred to recommendation C. 1:

- C. Overall recommendations to the Secretaries

- 1. The agencies 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. (J. Martin, M. Maher, T. Jaffoni).

He stated that there is an overall need for R&D implementation. Outreach and communications should address consumers, students, investors, and others. It is a difficult undertaking for the agencies, but an important one.

John Mizroch asked the Committee's opinion of DOE's Office of Science Bioenergy Research Centers funding opportunity announcement. Tom Binder responded that the opportunity might be divisive, as many universities want to host the centers and thus obtain the majority of the available funding. Committee Chairman Ewing requested a

related recommendation of Dr. Binder, who responded that complementary technology centers are a good idea, but that implementation of the centers so that universities collaborate, rather than compete, will be difficult. Ralph Cavalieri, a university research director himself, stated that the large solicitation is a net positive, and will prove galvanizing for faculty. Plant scientists in particular appreciate the renewed focus. However, the Bioenergy Research Centers solicitation timeline is shorter than the ideal for formation of successful consortia.

Committee Chairman Ewing asked Jim Barber to provide insight into the Policy subcommittee's Policy Gap Analysis work for the Board. Dr. Barber directed the Board to the document in their briefing materials (Attachment C). The Policy Gap Analysis is the result of subcommittee evaluation of current policy measures to identify any missing areas that could be implemented to speed achievement of the *Vision* goals. Distinct priorities for biofuels, biopower, and bioproducts arose:

- Maintain first-generation (corn-based) ethanol production incentives, while supporting technology development for cellulosic ethanol.
- Federal purchasing programs have been ineffective in stimulating bioproducts use. Incentives for bioproducts are lacking and should be implemented.
- Renewable standards for biopower vary and should be studied state-by-state before any adjustments.

USDA Under Secretary Dorr responded to the biobased procurement recommendation by requesting comment on activities to stimulate the program. Dr. Barber stated that the program is a good first step, but that product designation is still unclear and minimal, requiring each end-product to undergo designation, instead of ingredient qualifications, or petroleum displacement requirements. Committee Chairman Tom Ewing noted that the next day's agenda included a USDA presentation on biobased procurement. Tom Binder added that the Committee has previously commented on the USDA end-product approach, and expressed disagreement with the program's definition of "biobased," which excludes products originating before 1972. Jim Martin agreed that it is important to consider petroleum displacement value in bioproducts, because biorefining results in various chemical streams that can be used for other purposes. Also, while a car can run on biofuels, the plastic used in production is currently still petroleum-based. Canadian car manufacturers have pioneered biobased polymer use. John Mizroch asked why the same auto companies would only utilize biobased products in Canada. Mr. Martin stated that the parts manufacturer is more accepting of biobased technologies. USDA Under Secretary Dorr asked whether bioproducts incentives could cause issues with World Trade Organization standards. Mr. Martin replied that they could, but he does not consider himself a world trade expert.

Committee Chairman Tom Ewing thanked both the Board and Committee members for their time and contributions. He reiterated the Committee's intention to advise as requested throughout the Biomass R&D Initiative's annual reporting process and asked the Board's support for the updated *Vision* goals. John Mizroch of DOE thanked the Committee for its service and stated that his agency will respond effectively to

recommendations. USDA Under Secretary Tom Dorr offered his appreciation for the Committee's input and commitment over the past six years.

### **C. Public Comment**

Committee Chairman Tom Ewing recognized Ron Cascone of Nexant, Incorporated for public comment. Mr. Cascone read from a prepared statement (Attachment E).

### **D. Update from the Subcommittees**

Committee Chairman Tom Ewing next requested report-outs from the subcommittees. Jim Barber, chair of the Policy subcommittee, further discussed the group's Policy Gap Analysis work, thanking subcommittee members and BCS, Incorporated for their assistance in its development. The document was drafted in early 2006 and presented to the full Committee after subcommittee comment in August. Dr. Barber suggested the document could be reviewed for recommendations to the Secretaries, which would be included in the Committee's section of the annual report to Congress.

Designated Federal Officer (DFO) Neil Rossmeissl of the DOE Office of the Biomass Program (OBP) asked Dr. Barber whether the subcommittee would consider the ideal ethanol bid price per gallon for DOE implementation of a reverse auction per EPACT section 942. DOE is working with the Department of Defense, which procures biofuels for military vehicles, to implement the reverse auction by 2008, but an incentive bid price must be defined first. Dr. Barber replied that he would confer with the subcommittee before responding to Mr. Rossmeissl. Eric Larson stated that the subcommittee could provide valuable input. Bill Hagy of USDA Rural Development asked whether the Policy Gap Analysis could be made public after any adjustments based on the next day's biobased product procurement program discussion.

Committee members discussed establishing a formal process for subcommittees to submit documents to the Committee, and debated when such items would become public. Issues raised included the ability to issue documents in a timely manner, that discussions at public Committee meetings must be transparent, and whether subcommittee documents should be approved either by the Committee Chairperson, or by a majority vote. Recommendations from the Policy Gap Analysis could be valuable to 2007 Farm Bill discussions but would have to be prepared by March, separately from the regular annual recommendations timeline.

Jim Barber moved that the Policy Gap Analysis be submitted to the full Committee for consideration prior to the next public meeting February 13-14, 2007. Comments in the interim would be provided to the Committee secretariat. The motion was seconded. The Committee discussed whether recommendations from the document should be brought to vote during the current meeting as part of the annual recommendations for fiscal year 2007. David Anton asserted that external input during the next few months as per the motion would improve the value of the Policy Gap Analysis inputs to Farm Bill

development. There was no further discussion. Chairman Ewing called a vote. The motion carried unanimously.

The Committee broke for lunch.

Chairman Ewing called the meeting to order and recognized DFO Neil Rossmeissl. Mr. Rossmeissl introduced Jacques Beaudry-Losique as the incoming Biomass Program Manager. Mr. Beaudry-Losique, previously with General Electric Power Systems, welcomed the opportunity to apply his ten months' experience with DOE's Industrial Technologies Program to OBP and Committee tasks.

Chairman Ewing asked Ralph Cavaliere to begin the Analysis subcommittee report-out. Dr. Cavaliere thanked subcommittee members and asked new members to consider participation. The group was established to explore the validity and direction of biomass analysis conducted by DOE and USDA. Dr. Cavaliere gave a presentation (Attachment F) to update the Committee on Analysis subcommittee progress. Neil Rossmeissl thanked the subcommittee for their feedback and suggested they invite OBP Analyst Zia Haq to a future meeting for insight on current cost and infrastructure analysis. Mark Maher asked whether the subcommittee will have a steady stream of analysis documents to review in the future. Mr. Rossmeissl responded that the Posture Plan document, reviews of the CAFE environmental standards, and others are in the pipeline for completion. Mr. Maher further asked if analysis publications issued from national laboratories undergo sufficient review. Mr. Rossmeissl stated that the documents are reviewed but that they could benefit from additional independent scrutiny.

Mark Maher volunteered to join the Policy subcommittee.

John McKenna volunteered to join the Analysis subcommittee.

#### **E. Roadmap Update Discussion**

Committee Chairman Ewing moved the discussion to the next agenda item and called on Neil Rossmeissl to discuss the outcome of the proposed *Vision* release event. Mr. Rossmeissl explained that the agencies had unsuccessfully attempted to include a *Vision* release announcement in the October 10-12, 2006 Advancing Renewable Energy conference in St. Louis. While the Committee is not required to obtain agency approval for its documents, the agencies may attempt to announce major initiative-related publications at larger events, causing delays. In this case the *Vision* announcement is on hold for an undetermined event, and Mr. Rossmeissl hopes to obtain clarification in a few days. The Committee has a working history with USDA and DOE, which has been an advantage. Ralph Cavaliere asked whether the Committee, though independent, is supported by the agencies' press offices. Mr. Rossmeissl responded that the Committee technically reports to the Secretaries, not to Congress, though when the Secretaries' response is lacking, the Committee can take the initiative. By statute the Committee has the ability to publish its own documents without reporting to the Secretaries.

Committee Chairman Ewing expressed his opinion that agency R&D is most important and will continue regardless of Committee announcements. In addition, the President's or Secretaries' use of the *Vision* to enhance the cause of renewable energy is more meaningful within the boundaries of the existing working relationship. Announcements made with the support of either office will have a greater effect. Rodney Williamson agreed that administration support would be extremely beneficial. Jeff Serfass maintained that the document should be announced in the future. Mr. Ewing stated that the publication is ready for public review as of this quarterly meeting, though it may be announced again in the future.

Committee Vice-Chairwoman Terry Jaffoni asked Neil Rossmeissl to comment further on the interagency collaboration undertaken for the biofuels Posture Plan. Mr. Rossmeissl stated that DOE is working to support the President's Advanced Energy Initiative with the OBP objective to displace 40 billion gallons of gasoline by 2030. A workshop held in August 2006 identified auto and energy companies' priorities for government support to achieve this goal. USDA and DOE invited all agencies involved in biomass R&D to attend a Posture Plan workshop November 28-29. The workshop will establish a timeline, plan, and individual budget requests to eliminate interagency overlap, address funding gaps, and create the most streamlined approach to meeting industry and administration needs. The resulting plan will be issued by April 1, 2007. Vice-Chairwoman Jaffoni asked what level of resources could potentially be applied to achieve the biofuels goal. Mr. Rossmeissl speculated that the requests of all agencies could total \$1 billion.

Chairman Ewing asked Tom Binder to begin the overview of regional *Roadmap* update workshops. Dr. Binder gave a presentation (Attachment G) about the three regional workshops held in 2006 to gather information for pathways to achieve *Vision* goals. Lists of workshop attendees were included in Committee briefing materials (Attachment H).

Neil Rossmeissl commented that the Central *Roadmap* workshop, held first, proved difficult to administer due to the changing scope of discussion. The Western and Eastern *Roadmap* workshops, perhaps because they involved a greater diversity of industry representatives, had a different perspective. Dr. Binder responded that the Midwest has produced biodiesel and ethanol from surplus crops for some time. Infrastructure and lignocellulosic conversion present hurdles in the East and West. As for the perception of necessary feedstock volumes, he believes higher corn prices will provide more incentive for cellulosic feedstocks than assumed. Also, feedstock yields have increased significantly since 1960. This trend should continue.

Ralph Cavalieri continued the presentation (Attachment G) where Dr. Binder left off, discussing the Western *Roadmap* workshop, which he chaired. Workshop experts included those from non-governmental organizations, oil companies, auto manufacturers, and state agencies. California has a robust energy program and was well-represented at the meeting. Many barriers were unique to the West, and it was agreed that the *Billion-Ton Study* underestimates available feedstocks in the region.

The Committee broke for ten minutes.

Doug Hawkins continued the presentation (Attachment G) from Dr. Cavalieri, discussing the Eastern *Roadmap* workshop. He thanked Ed White and the State University of New York at Syracuse for hosting the meeting, which had a varied and large attendance (Attachment H).

Jim Martin asked whether there was any discussion of technology development with parallel protections for obsolescence of the pioneer production facilities. Mr. Hawkins replied that cellulosic ethanol proponents at the meeting expressed their willingness to be the first movers if government would share the risk. Their focus was primarily enzymatic conversion, which can be replaced by more advanced conversions within the same plant structure. Tom Binder contributed that some companies have licensed technology to protect against competition. Doug Hawkins added that thermochemical conversion technologies would be more difficult to upgrade.

Jim Martin asked whether adequate feedstocks would be available each day within the production facility's region. Mr. Hawkins responded that wheat straw residues were considered a viable feedstock, reflecting on the flexibility of plant pretreatment and handling technologies, though the cost per ton could affect profitability. Participants expected to operate at 700 tons per day, large-scale facilities. He stated that there is still plenty of work to be done with cellulosic technologies.

Committee Chairman Tom Ewing requested that the *Roadmap* workshop chairmen summarize their workshop outcomes and next steps. Tom Binder stated that one identified need is to engineer feedstocks' photosynthetic efficiency to provide higher yields for greater petroleum displacement. Another is crop sustainability and infrastructure availability for localized plants. Policy needs include outreach and increased federal support. Lou Honary added that genetic crop modifications should also be pursued to produce high-quality, low-cost bioproducts such as lubricants and oils.

Neil Rossmeissl asked whether the Committee had any comments on the final *Roadmap* format, given the broad range of input obtained during the workshops. Tom Binder requested that staff analyze the outputs for consensus on priorities, regional issues, issues with significant differences, and those with full support. They should build on previous documents.

Committee Chairman Tom Ewing noted that participants in infrastructure discussions have observed a decrease in railway transport. Ralph Cavalieri and Tom Binder agreed that branch line rail transport to plants would require special support, probably from states. Jim Martin added that biodiesel must be transported in a chemical tank car or lined barge for river transport. Both are difficult to obtain. Bob Dinneen advocated continued consideration of pipeline transport, stating that E95 denatured ethanol can be shipped and then blended at terminals without degradation. However, Vice Chairwoman Terry Jaffoni explained that blending cannot be done at most service stations. Mark Maher agreed that many small petroleum distributors rely on splash-blending at service stations but do not have the separate storage capacity for ethanol blending. He volunteered to investigate for

a future meeting the prevalence of splash blending and the ethanol quality issue for car performance. Jim Martin contributed that biodiesel blend varieties exist, but that the fuel is safer to handle than ethanol. Neil Rossmeissl asked the group to consider the federal role in streamlining standards and infrastructure for ethanol blends.

Committee Chairman Ewing asked the chairmen to discuss any feedstock stockpiling and delivery outcomes from the regional *Roadmap* workshops. Tom Binder stated that logistics of feedstocks handling and storage for a 1000 ton per day operation were considered. Feedstocks can be siloed or baled to store dry, and the time and transportation benefits of both methods vary. Ralph Cavalieri noted that the Western *Roadmap* workshop participants discussed how preprocessing with robust conversion technologies would allow use of a wide range of feedstocks without stockpiling, though preprocessing would require efficient, low-cost densification. Doug Hawkins noted that the Eastern *Roadmap* workshop participants discussed similar issues.

Tom Binder noted that some farmers have expressed the need for a farm loan payment program in support of energy crops. Jim Martin suggested this idea be included in the Policy Gap Analysis, as an incentive for farmers to take on risk when renting land.

Committee Chairman Tom Ewing thanked the workshop chairmen and the Committee for a valuable discussion.

#### **F. Introduction of Updated BRDI Website Capabilities and Committee Outreach Tools**

Michael Manella of BCS, Incorporated was invited to provide an overview of the updated Biomass R&D Initiative (BRDI) website (<http://www.biomass.govtools.us>). Mr. Manella stated that the site contains the same information, but that staff is working to increase user interaction. While not fully functional, some additions include a real-time calendar and perhaps a private log-in section for access to working documents. The updated *Vision* will be made public on the website immediately after the meeting.

#### **G. Public Comment**

Chairman Tom Ewing asked for further public comment. Ron Cascone of Nexant, Incorporated was recognized. He stated that product refineries are designed to facilitate splash blending. Gasoline is manufactured to meet Reid Vapor Pressure (RVP) requirements in different jurisdictions. Blending ten percent ethanol with gasoline increases the vapor pressure and requires some blending adjustments. E85 has a lower revapor pressure, requiring specialized pumps. Chairman Ewing asked at what percentage ethanol vapor pressure starts to decrease. Mr. Cascone was not sure. Ethanol is blended at ten percent to meet the oxygenate requirement.

There were no further comments. The meeting was adjourned.

**November 29, 2006**

**H. Presentation on USDA Energy Council Biomass & Bioproducts R&D  
Planned Initiative**

Committee Chairman Tom Ewing began the second day of the meeting by introducing Dr. Gale Buchanan, who gave a presentation on the USDA Energy Council Biomass & Bioproducts R&D Planned Initiative. The presentation was not publicly distributed.

Chairman Ewing asked where the six-year Initiative begins. Gassem Asrar from the USDA replied that the six-year plan is dependent on final FY 2007 budget appropriations. On Friday, December 1, 2006 there will be a joint meeting with up to 100 USDA scientists from the Agricultural Research Service (ARS) to define growth and get the job done. Dr. Buchanan stated that he has visited all regional laboratories except Peoria, and all are working on some aspect of cellulosic ethanol. Chairman Ewing asked whether the President's requested budget includes any pilot programs for cellulosic ethanol. Dr. Buchanan stated that his responsibility is R&D, though Rural Development is involved in critically important implementation activities. Bill Hagy of USDA Rural Development stated that staff are examining authorities for opportunities to expand biomass R&D efforts, perhaps in the Farm Bill under section 9006. Previous approaches have been implemented primarily for pre-commercialized projects, though the authority is broad enough to allow expansion to the end of demonstration or pilot phases. Some issues to be addressed include changes for regulatory needs, which impact program cost due to risk. Jeff Serfass asked about the Farm Bill timeline. Dr. Buchanan responded that USDA has been working on new Farm Bill recommendations for some time.

Dr. Buchanan continued, saying that R&D of sugarcane genetics is very important, because sugar converts more easily to ethanol. Though the crop can only be grown in certain regions, current crops could be expanded and combined with sweet sorghum. He advocated establishment of many smaller ethanol refineries. Jim Martin agreed, noting that the Committee has recommended the Secretaries consider scale and diversification.

Bob Dinneen asked Dr. Buchanan to elaborate on aviation fuel work done by the University of North Dakota, for which he had stated Federal Aviation Administration (FAA) engine certification is necessary. Carmela Bailey from USDA CSREES explained that the work was funded by a grant in 2000, and the fuel could only be used in a certain engine type. Mr. Asrar is working with the Defense Advanced Research Projects Agency (DARPA) to certify fuels for cargo planes and jet fighters. They are making great progress. Last week, the group tested engines at various throttle speeds with the goal of getting all to run at full throttle by spring 2007. The Department of Defense (DOD) is a significant fuel user, and USDA is committed to overcoming barriers to work with DOD.

Chairman Ewing thanked Dr. Buchanan. Dr. Buchanan invited Committee members to contact him directly with any questions.



## **I. Update on USDA Activities**

Committee Liaison Bill Hagy from USDA Rural Development gave a presentation (Attachment I) on USDA activities under the annual joint biomass R&D solicitation. Last year, the joint solicitation received 316 applications, and more are anticipated in this cycle. The joint solicitation is currently in the pre-application phase. Once those pre-applications are peer-reviewed, top-rated projects will be invited to submit full applications. USDA will then make recommendations to the Secretaries for final selections. USDA plans to provide up to \$14 million for awards under Farm Bill appropriations. The FY 2007 appropriations bill has not yet passed, so Congress may limit funding to \$12 million. FY 2007 is the last year of mandatory funding under the Farm Bill. Unless the legislation is reauthorized, joint solicitation projects will have to rely on discretionary funds starting in FY 2008. FY 2006 awards funded by USDA totaled \$12.6 million.

Peer reviewers are independent, and Mr. Hagy is working with Carmela Baily to identify FY 2007 reviewers with topic area familiarity from academia and elsewhere. They review projects based on set criteria obtained from the Biomass R&D Act of 2000 (Attachment J) and the Committee's *Roadmap* priorities. Charles Kinoshita asked if the percentage funding requirement for each technology area could change with the new Farm Bill. Mr. Hagy acknowledged this as a possibility.

The Office of Management and Budget is requiring that USDA publish a reporting burden package for purposes of public disclosure. This requirement has slowed the solicitation process by about two months. The solicitation may be cleared for issue by January, but an exact date is uncertain. Jim Barber asked why pre-applicants selected for full proposal submission are given 60 days, plus 60 days departmental review. Mr. Hagy stated that project selection takes some time to allow for Secretarial concurrence from two agencies. In addition, announcements sometimes are held for a formal event. Neil Rossmeissl added that members of Congress are pre-notified if their constituents are selected.

USDA has contracted with Booz Allen Hamilton to produce a report on the October 10-12, 2006 Advancing Renewable Energy conference. The final document will be available on the website: <http://www.advancingrenewableenergy.com>.

Gassem Asrar announced that the USDA Energy Council will issue its R&D plan by the end of the week.

## **J. Update on Action Items from the Designated Federal Officer**

Committee DFO Neil Rossmeissl stated that his primary responsibility is to make sure Committee activities fall within the legal framework of the Federal Advisory Committee Act. He gave a presentation regarding Committee progress and OBP activities (Attachment K).

Jim Barber and Lou Honary asked whether Congressionally-directed projects under OBP oversight are reviewed according to *Vision* goals or other criteria. Mr. Rossmeissl answered that OBP is required to run a biennial peer review of its entire R&D portfolio. The program also requires all discretionary-funded projects to undergo Stage Gate reviews, during which the recipient identifies where each project fits into the commercialization and research timeline, and receives an independent review. OBP provides all available review information to Congress, so it is possible to compare Congressionally-directed project performance with competitively-awarded projects. If Congressionally-directed projects decide not to participate, OBP notifies Congress.

Overall funds for FY 2007 OBP solicitations have not yet been appropriated. Project selection for the EPACT section 932 integrated commercial cellulosic biorefinery solicitation will provide for negotiated funding of plants at 60-40 cost share (up to 40 percent federal funding). Selections will be complete by the time appropriations are made. Loan Guarantee funding is subject to the same delay.

#### **K. Discussion of Proposed Outreach Subcommittee**

Committee Chairman Tom Ewing requested that members review Neil Rossmeissl's request to establish an Outreach subcommittee. Bob Sharp asked whether the group would have its own budget. Mr. Rossmeissl said that funds would be provided from the full Committee budget. Jeff Serfass asked whether press events or public relations (PR) activity would be new for the Committee, and Mr. Rossmeissl said it would. Terry Jaffoni asked what oversight the subcommittee would have. Mr. Rossmeissl responded that the subcommittee would report to the full Committee. Chairman Ewing asked whether a subcommittee could make announcements or press releases without full Committee approval. Mr. Rossmeissl answered that the full Committee has to agree by majority vote on any subcommittee actions, including those of the proposed Outreach group. Working groups do allow for timely completion of focused tasks. Bill Hagy asked how a subcommittee would interact with USDA or DOE press offices. Mr. Rossmeissl stated that the subcommittee was recommended to serve that purpose; communications offices at both agencies have requested Committee contacts for previous publication announcements. An informed subcommittee could provide effective, timely feedback in these cases. Jim Martin stated that the proposed group would also provide third-party credibility for any announcements. Mr. Rossmeissl noted that the agencies have not sought to alter or disagree with Committee documents, and that the proposed Outreach subcommittee would require full Committee approval for any actions. It would stand as a professional informative group to help the agencies communicate a unified message on key issues. BCS, Incorporated staff could work with the subcommittee to collaborate with the agencies on press releases or events.

Bob Dinneen stated that the subcommittee's role should be limited, and that education or curriculum development would best be undertaken by a larger entity. Jim Barber asked who the Committee contact should be. Mr. Rossmeissl replied that the subcommittee could nominate a chairperson to stand as the agencies' point of contact (POC) and coordinate with the Committee. Press requests can be scheduled with the POC via

conference call. Talking points can also be developed by Committee staff. Terry Jaffoni contributed that the effort could involve more time than anticipated due to increased public interest in biomass technologies and the industry. David Anton responded that the full Committee doesn't meet often enough to formally address all press issues, and should instead concern itself with long-term policy issues. He approved the subcommittee idea to handle public relations.

The Committee broke for ten minutes.

Committee Chairman Tom Ewing resumed the discussion by stating his belief that a sitting Committee co-chairman should chair the proposed Outreach subcommittee. Any message would therefore be streamlined and more easily communicated to the agencies. He further suggested that Jeff Serfass, David Anton, Bob Dinneen, and Jim Martin join him as members of the subcommittee.

Ralph Cavalieri moved that the subcommittee be created as described. Tom Binder seconded the motion. Lou Honary suggested input from an educational representative would be useful, combined with the National Hydrogen Association, biobased products, ethanol industry, and agricultural producer representatives already named. He moved to amend the motion and add himself as a sixth subcommittee member. John Hickman seconded the amendment. Jim Martin asked how the new subcommittee would interact with other Committee groups. Ralph Cavalieri, Analysis subcommittee chairman, and Jim Barber, Policy subcommittee chairman, stated that they welcomed communications from the new subcommittee when their input would be required.

The motion was put to a vote. Eleven Committee members were in favor, and four were opposed. The motion carried.

The subcommittee agreed to Neil Rossmeyssl's suggestion that they hold their first conference call after the winter holiday. In the meantime, subcommittee members could communicate via email and telephone regarding input for a draft statement of work and communications plan. An internal Committee website with private log-ins, document exchange, and possible voting capabilities could also be useful for this collaboration. Mike Manella and Harriet Foster of BCS, Incorporated will provide information regarding the development of this tool.

#### **L. Presentation on USDA BioPreferred Program**

Roger Conway and Marv Duncan from the USDA Office of the Chief Economist gave a presentation (Attachment L) about the Department's progress with its BioPreferred (previously "FB4P") federal procurement program.

Jim Barber asked whether they had a sense of how much BioPreferred procurement has occurred to date. Marv Duncan replied that Shana Love of the USDA Grain Inspection, Packers, and Stockyards Administration (GIPSA) could better answer the question. The one-year grace period for requiring purchase of designated items has not yet expired,

meaning agencies do not yet have to buy biobased products first. Nor is there a way to determine the dollar value of biobased products purchased. If procurement documents were tracked, the information could probably be obtained. Developing a tracking system is one challenge.

Bob Sharp asked how the USDA envisions a labeling program for biofuels interacting with the proposed EPA RFS labeling program. Mr. Duncan responded that ethanol and biodiesel are already preferred purchase items. Roger Conway acknowledged a potential overlap. OMB has made clear that the BioPreferred program must align with other efforts, including Energy Star and recycling programs. Recycling efforts are the only preferred program to precede BioPreferred. Mr. Conway will follow up with Margo Ogee at EPA.

Lou Honary raised the issue of hydraulic oils and greases recently sent through the labeling process, which is somewhat onerous. When products are labeled, manufacturers must then prove to the purchaser that they also meet standards, which delays demand. Solvents, cleaners, and truck grease, if they perform well in the market, could create federal interest. Marv Duncan responded that warranty issues also delay consumer acceptance. Near the end of formal acceptance, agencies could reach out to manufacturers to discuss warranty issues and preliminary end-use testing.

Ralph Cavalieri asked whether the program has been identified as a reciprocal effort by trade agreements such as the North American Free Trade Agreement or the Central American Free Trade Agreement, so that other nations must also implement a BioPreferred system. Mr. Duncan responded that he is not aware of any such requirement, though other countries, including Japan, have expressed increased interest. Bob Sharp asked the number of countries with which the United States has free trade agreements. Mr. Duncan offered to provide the Committee a list. Mr. Cavalieri further asked whether the BioPreferred program only pertains to materials containing carbon. Mr. Duncan said it does, but specifically organic – not fossil – carbon. Mr. Cavalieri could envision non-carbon products that have undergone a biological process and asked whether they would be excluded. Mr. Duncan explained that the program is still developing biobased content level requirements for each product.

John McKenna asked whether agencies attempting to utilize biobased fuels would receive incentives. For example, the U.S. Marine Corps is trying to purchase FFVs in a program that could possibly be eliminated due to overlap with the BioPreferred program. Mr. Conway stated that there are separate EPACT requirements for federal use of FFVs and alternative fuels. Congress sought to avoid conflicts. The General Counsel (GC) definition of BioPreferred allows for biodiesel and ethanol purchase (ethanol as a ten percent additive).

## **M. Public Comment**

Committee Chairman Tom Ewing opened the floor to additional public comment. Ron Cascone of Nexant, Incorporated noted that the Committee had not discussed

international development of biofuels technologies, including in Japan, Brazil, and Europe. Future outreach efforts could be expanded to an international scope.

#### **N. Discussion of Recommendations to the Secretaries for Fiscal Year 2007**

Chairman Ewing moved to the next agenda item, the Committee proposal and discussion of recommendations to the Secretaries of Agriculture and Energy for fiscal year 2007.

Jim Martin stated that a number of recommendations made during FY 2006 public meetings were not included in the final approved list. After some review, he intends to bring forward recommendations in 2007 which build on those. He recommended that DOE establish a protein platform to work on non-cellulosic, non-protein, and non-sugar-based biomass. He sees potential in this area for bioproducts in particular. In addition, the economics of biomass production could stand additional scrutiny by both departments.

Chairman Ewing stated that the agencies should examine biopower possibilities.

Jeff Serfass suggested that the Committee review and provide recommendations on the Policy Gap Analysis document before its February meeting.

Jim Martin requested that staff review the Committee's recommendations to the Secretaries since its inception and provide an analysis of departments' response and actions for each year. Mike Manella of BCS, Incorporated replied that staff have provided an R&D portfolio review to the Committee and will respond by augmenting this information with data on department activities since 2001. Neil Rossmeissl added that recommendations are provided to the agencies for a formal response with the fiscal year's Annual Report to Congress, and that the responses for fiscal years 2002 through 2005 can be reviewed in Committee briefing materials and online ([www.biomass.govtools.us](http://www.biomass.govtools.us)). However, there are times when program offices are not able to react immediately to recommendations due to a lack of discretionary funds.

Lou Honary stated that USDA and DOE need to present a more balanced approach to biomaterials in tandem with biofuels.

Mark Maher recommended that the agencies engage in learning more about a variety of biofuels blends.

John Hickman requested that the agencies review the timeliness of Committee member appointments.

Recommendations discussed were compiled and distributed after the meeting (Attachment M).

Committee Chairman Tom Ewing stated that further recommendations for FY 2007 will be collected at each public meeting, and can also be sent to BCS, Incorporated staff via email, phone, fax, or regular mail between meetings.

**O. Discussion of 2007 Meeting Dates**

The Committee discussed their availability for public meetings during the next year, and resolved to hold quarterly sessions on the following dates:

Feb 13-14, 2007

May 15(-16), 2007 (to be a two-day meeting if necessary)

Sept 11-12, 2007

Nov 28-29, 2007

The Committee broke for lunch.

**P. Discussion to Identify Major Committee Objectives for 2007 and Develop 2007 Work Plan**

Committee Chairman Tom Ewing called the meeting to order and asked Bill Hagy to discuss the USDA Agricultural Outlook Forum. Bill Hagy stated that the meeting will be held March 1-2, 2007 in Washington, DC, and that a few Committee members' input would benefit the 2007 Farm Bill. Those interested were directed to contact Mr. Hagy directly.

Chairman Ewing then began discussion of the last agenda item, the 2007 Committee Work Plan. He asked members to review the draft provided and identify major Committee objectives for the year. Members suggested discussion items and presentations to include in the Work Plan, which was updated accordingly (Attachment N).

**Q. Adjournment**

Committee Chairman Tom Ewing stated the Committee would be losing several valuable members when their terms expire at the end of the day's meeting. He thanked Ralph Cavalieri, who is eligible for reappointment. Chairman Ewing also thanked member Carolyn Fritz, who is at the end of her second term, Jack Huttner, Del Raymond, and Terry Jaffoni, who has acted as Vice-Chairwoman since 2000. Chairman Ewing expressed the hope that six replacement members could be appointed for the next public meeting in February.

The meeting was adjourned.

## **ADDENDUM A – ATTENDEES**

### **Biomass Research and Development Technical Advisory Committee Meeting November 28-29, 2006**

#### **Committee Members Present**

David Anton	Terry Jaffoni – Vice-chairwoman
Jim Barber	Charles Kinoshita
Tom Binder	Eric Larson
Butch Blazer	Mark Maher
Ralph Cavaliere	Jim Martin
Bob Dinneen	John McKenna
Tom Ewing – Chairman	Mitch Peele
Carolyn Fritz	Jeff Serfass
Doug Hawkins	Bob Sharp
John Hickman	Ed White
Lou Honary	Rodney Williamson

#### **Committee Members Not Present**

Jerrel Branson	Ed McClellan
Jack Huttner	Larry Pearce
E. Alan Kennett	Del Raymond
Scott Mason	

#### **Board Members Present**

Andy Karsner, Department of Energy – Co-chair  
Tom Dorr, U.S. Department of Agriculture – Co-chair  
Mike Catanzaro, Environmental Protection Agency (for unappointed EPA member)  
Bruce Hamilton, National Science Foundation  
Tim Kline – Department of Transportation (for John Bobo)  
Ed Pinero – Office of the Federal Environmental Executive  
Diane Jones – Office of Science and Technology Policy (for Sharon Hays)

#### **Federal Employees Present**

Gassem Asrar – USDA	Joe Dunn – USDA
Carmela Bailey – USDA	Douglas Faulkner - USDA
Dr. Gale Buchanan – USDA	William Hagy III - USDA
Roger Conway - USDA	John Mizroch - DOE
Marv Duncan – USDA	Neil Rossmeissl – DOE

**Total Public Attendees – 15**

**Total Attendees – 44**

**Designated Federal Officer – Neil Rossmeissl**

## **ADDENDUM B – AGENDA**

### **Agenda**

**Joint Public Meeting of the  
Biomass Research and Development Technical Advisory Committee and the  
Biomass Research and Development Board**

**November 28-29, 2006**

**8:00 a.m. – 4:30 p.m. and 8:00 a.m. – 3:00 p.m.**

**L’Enfant Plaza Hotel  
Ballroom and Renoir Room  
480 L’Enfant Plaza  
Washington, DC 20024**

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#### **Description of subjects for this meeting:**

- Take part in Federal Biofuels Posture Plan Workshop Plenary Session
- Meet with Biomass Research and Development (R&D) Board
- Review Committee recommendations for fiscal year 2006
- Discuss Analysis and Policy subcommittee business
- Provide input on update to *Roadmap*
- Receive update on USDA Federal Biobased Products Procurement Preference Program
- Receive update on USDA – DOE collaboration
- Receive update on DOE activities from the Designated Federal Officer (DFO)
- Receive update on USDA research portfolio analysis under Farm Bill section 9008
- Review status of 2006 and 2007 USDA – DOE joint biomass research solicitations
- Discuss organization of an Outreach subcommittee
- Discuss the new BRDI website
- Discuss recommendations for fiscal year 2007
- Review 2007 Work Plan and discuss 2007 meeting schedule



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**Day 1**

**November 28, 2006**

7:30 – 8:00 Continental Breakfast

***Main Ballroom – (In combination with the Federal Biofuels Posture Plan Workshop Plenary Session)***

8:00 a.m. – 8:20 a.m.	<b>Welcoming Remarks</b> Alexander "Andy" Karsner, Assistant Secretary for Energy Efficiency and Renewable Energy, DOE Thomas C. Dorr, Under Secretary for Rural Development and Chairman of the USDA Energy Council
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8:20 – 8:30 Break

***After the Welcoming Remarks are complete, the Federal Biofuels Posture Plan Workshop will continue as a private meeting. The joint meeting of the Committee and Board will take place in the Renoir Room.***

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***Renoir Room***

8:30 – 8:40 Welcome to the Public and Interagency Biomass R&D Board Members and Overview of Combined Agenda – *Committee Chairman Thomas Ewing*

8:40 – 9:40 **Committee Report to Board and Committee-Board Discussion –**  
*Committee Chairman Thomas Ewing*

- FY 2006 Recommendations to the Secretaries of Agriculture and Energy
- The Updated *Vision and Roadmap* and 2007 Biomass Research and Policy Goals
- Subcommittee efforts during 2006 and into 2007 (Policy, Analysis, and others)
- 2007 Biomass Research and Policy Goals

9:40 – 9:50 Break

9:50 – 11:30 **Continued Committee-Board Discussion**

11:30 Board meeting adjourns

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11:30 – 12:30 Lunch (*on your own*)

12:30 – 2:00 Subcommittee Discussions

12:30 – 1:15 Policy Subcommittee goals and 2007 work plan – *Jim Barber, subcommittee chairman*

1:15 – 2:00 Analysis Subcommittee goals and 2007 work plan – *Ralph Cavalieri, subcommittee chairman*

2:00 – 2:15 Break

2:15 – 4:15 *Roadmap* Update Discussion

2:15 – 2:45 Regional Workshop Highlights – *Regional Workshop Chairs*

- Central – *Tom Binder*
- Western – *Ralph Cavalieri*
- Eastern – *Doug Hawkins*

2:45 – 4:15 Discussion of Summarized *Roadmap* Workshop Outcomes

- Policy
- Feedstocks
- Processing & Conversion
- Product Uses & Distribution

4:15 – 4:30 Public Comment

4:30 Adjourn

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7:30 – 8:00 Continental Breakfast

***Renoir Room***

8:00 – 8:30 Presentation on USDA Energy Council Biomass & Bioproducts R&D Planned Initiative – *Dr. Gale Buchanan, Under Secretary for Research, Education, and Economics, USDA*

8:30 – 9:15 Update on Departmental Activities – *Bill Hagy III, Office of Rural Development, U.S. Department of Agriculture*

- Receive an update on the status of the FY 2007 joint solicitation
- Receive an update on the October 2006 USDA – DOE National Bioenergy Conference
- Receive an update on USDA Energy Council activities
- Receive update on USDA research portfolio analysis under Farm Bill section 9008

9:15 – 10:00 Update from the Designated Federal Officer - *Neil Rossmeissl, Office of the Biomass Program, U.S. Department of Energy*

- Review status of 2006 Annual Report
- Receive an update on the awardees of the FY 2006 joint solicitation
- Receive and update on the status of other current DOE solicitations for biomass R&D
- Introduce Outreach subcommittee concept

10:00 – 10:15 Break

10:15 – 10:45 Presentation on USDA BioPreferred Program – *Roger Conway and Marvin Duncan, USDA Office of the Chief Economist*

10:45 – 11:30 Determine Need for Outreach Subcommittee and Assign Responsibility

11:30 – 12:00 Introduction of Updated BRDI Website Capabilities and Committee Outreach Tools – *Michael Manella, Research Analyst, BCS, Incorporated*

12:00 – 12:15 Public Comment

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***Renoir Room***

12:15 – 1:15 Lunch (*on your own*)

1:15 – 1:45 Discussion of Recommendations to the Secretaries for Fiscal Year 2007

1:45 – 2:30 Discussion to Identify Major Committee Objectives for 2007 and Develop 2007 Work Plan

2:30 – 2:45 Discussion of 2007 Meeting Dates

2:45 – 3:00 Discussion

3:00 Adjourn

## **Attachment A**

## **FY 2006 Annual Recommendations from the Biomass R&D Technical Advisory Committee to the Secretaries of Agriculture and Energy**

Section 309(b)(1)(D) of the Biomass R&D Act of 2000 (Biomass Act) requires that biomass R&D 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 to Congress on the Biomass Initiative since 2002. These are posted publicly on the Committee website:

<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

The following are the recommendations approved August 10, 2006, during the last public quarterly Committee meeting of the fiscal year.

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

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

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

## **C. Overall Recommendations to the Secretaries**

1. Opportunities for workforce development in biomass-related disciplines should be pursued.
2. Outreach to the general public should be expanded to better communicate the benefits of biomass technologies.

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.
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.
5. The Committee encourages the agencies of the Interagency Biomass R&D 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.
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.
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.



## **Attachment B**

# *VISION*

## **FOR BIOENERGY AND BIOBASED PRODUCTS IN THE UNITED STATES**

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*Bioeconomy for a Sustainable Future*

2006



*Biomass Research and Development Initiative*

# Foreword



The *Vision for Bioenergy and Biobased Products in the United States* was initially created in 2002 to establish far-reaching goals to increase the role of biobased energy and products in our nation's economy. It represented the collective vision of the Biomass Research and Development Technical Advisory Committee established by the Biomass R&D Act of 2000. This document is an update to that Vision.

The process of updating the Vision began with an appraisal of our nation's progress toward the original Vision goals as mandated by Congress under the U.S. Energy Policy Act of 2005 (P.L. 109-58). A one-day workshop was held in November 2005 where 20 individuals from industry, academia, and government provided their expertise and insight toward updating the Vision (see Appendix A for a list of participants). The workshop participants evaluated progress toward the original goals, and what was needed to achieve these goals. The Vision update was followed by an independent peer review (see Appendix B for a list of participants) and final approval by the Biomass R&D Technical Advisory Committee and Interagency Biomass R&D Board. The long-term goals in the Vision are intentionally aggressive and challenging because the Vision defines what the nation can and should be doing to achieve a biobased economy. In addition, the Committee recommends the U.S. Departments of Agriculture and Energy conduct a longer-term analysis to benchmark current markets for biomass and opportunities under various economic and policy scenarios.

For more information on the Biomass R&D Act of 2000 and the Technical Advisory Committee, visit:

<http://www.biomass.govtools.us>

# Executive Summary

The United States is at a critical point in determining its energy future. One path will lead to continued dependence on fossil fuels for energy needs, the other toward a more balanced and diverse energy portfolio that includes domestic biomass resources. In 2004, fossil fuels supplied 86 percent of U.S. energy needs, with the majority, 40 percent, coming from petroleum.<sup>1</sup> In recent decades, U.S.

dependence on imported oil has reached untenable levels. In 2005, about 65 percent of crude oil and petroleum products were supplied by imports, out of which 17 percent came from the Persian Gulf region.<sup>2</sup> Natural gas imports accounted for 20 percent of the total U.S. natural gas consumption in 2005.<sup>3</sup> A continued dependence on oil and gas will increase our vulnerability to price fluctuations as well as increase our reliance on foreign nations to fuel our economy.

A more robust portfolio of feedstocks for our nation's energy supply must be found. Biomass resources are sustainable and offer an environmentally friendly feedstock which can contribute significantly to creating this diverse portfolio. Biomass technologies can help reduce global warming, a principal environmental impact of fossil fuel consumption. Achieving this shift from fossil-fuel-based energy supply to bioenergy will infuse dollars back into the domestic economy creating new markets and jobs.

In order to realize this opportunity, the Biomass R&D Technical Advisory Committee established the *Vision for Bioenergy and Biobased Products in the United States*.<sup>4</sup>

It established aggressive goals for biopower, biofuels and biobased products, defining market share targets and consumption for 2010, 2020, and 2030. These targets were set to benchmark the progress toward achieving the 2030 Vision of a “well established, economically viable, bioenergy and biobased products industry.” A November 2005 assessment of the current status on the nation's progress toward these targets revealed that in some cases the nation is not on track to meet them. This document updates the 2002 Vision. While recognizing the current shortfalls, it does not change the original 2010 goals but does make minor changes to its 2020 and 2030 goals. Additionally, the document establishes 2015 goals to define interim milestones that must be achieved to reach the aggressive targets set for 2020 and 2030. Updated Vision goals are shown below.

Achieving the Vision will require a blend of research and demonstration, and policy measures, as well as efforts to educate future scientists and engineers on biomass feedstocks and conversion technologies for the biobased economy. A number of common misconceptions have hindered positive public perception of biomass. In order to realize the Vision, it is important to educate the public, decision makers, and others about the real costs associated with using fossil fuels.

“ Vision Statement -  
By 2030, a well established, economically viable, bioenergy and biobased products industry will continue new economic opportunities for the United States, protect and enhance our environment, strengthen U.S. energy security, provide economic opportunity, and deliver improved products to consumers. ”

## Vision Goals

	Units	2000	2004	2010	2015	2020	2030
Biofuels	Market share (%)	0.7	1.2	4.0	6.0	10.0	20.0
	Consumption (billion gasoline-equivalent gallons)	1.1	2.1	8.0	12.9	22.7	51.0
Biopower	Market share (%)	3.0	3.0	4.0	5.5	7.0	7.0
	Consumption (quadrillion Btu)	2.0	2.1	3.1	3.2	3.4	3.8
Bioproducts	Production (billion lbs)	12.8	17.6	23.7	26.4	35.6	55.3

*Biomass Research and Development Technical Advisory Committee*

2005 Members		2006 Members	
Name	Organization	Name	Organization
J. Wayne Barrier	Metropolitan Energy Systems, Inc.	James Barber	Metabolix, Inc.
Thomas Binder	Archer Daniels Midland	Arthur Blazer	New Mexico State Forestry
Robert Boeding	National Corn Growers Association	Jerrel Branson	Biocrude, LLC
Jerrel Branson	Biocrude, LLC	Ralph P. Cavalieri	Washington State University
William Carlson	Carlson Small Power Consultants	Bob Dinneen	Renewable Fuels Association
Ralph P. Cavalieri	Washington State University	Tom Ewing*	Davis & Harman, LLP
Tom Ewing*	Davis & Harman, LLP	Carolyn Fritz	Allylix Inc.
Carolyn Fritz	Allylix Inc.	Douglas Hawkins	Rohm and Haas Company
Charles Goodman	Southern Company	John Hickman	John Deere
Jack Huttner	Genencor International, Inc.	Jack Huttner	Genencor International, Inc.
F. Terry Jaffoni	Clean Transportation Fuels	F. Terry Jaffoni	Clean Transportation Fuels
Kim Kristoff	GEMTEK Products	Charles Kinoshita	University of Hawaii at Manoa
David Morris	Institute for Local Self Reliance	Eric Larson	Princeton University
Gary Pearl	Fats and Proteins Research Foundation, Inc.	Jim Martin	Omni Tech International, LTD.
Delmar R. Raymond	Weyerhaeuser Company	Scott Mason	Conoco Phillips
Philip L. Shane	Illinois Corn Marketing Board	Larry Pearce	Governors' Ethanol Coalition
	* Interim Member	Delmar R. Raymond	Weyerhaeuser Company
		Ed White	SUNY College of Environmental Science and Forestry



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# Introduction: Benefits of Achieving the Vision

**Biomass** – Any plant or plant-derived material, including animal manure and waste materials, which can be converted into fuels, products, or power through various conversion processes.

The United States has become increasingly dependent on imports to meet its growing petroleum needs. In 2005, over 65 percent of U.S. crude oil and petroleum products were supplied by imports, while natural gas imports accounted for 20 percent of U.S. total natural gas consumption.<sup>5</sup> In recent years, the demand for petroleum and natural gas has been escalating globally as economies of developing countries are growing rapidly, mounting pressure on world energy markets and prices. Crude oil prices have risen sharply, while natural gas prices in all sectors have increased threefold from 1985-2005, exacting high costs for consumers, industry, and nations as a whole.<sup>6</sup> Such volatility in petroleum prices combined with the extensive U.S. reliance on fossil fuels is testing the limits of our nation's economic, environmental, and homeland security.

A more robust portfolio of domestically produced feedstocks for our nation's energy and chemical supply must be found. Biomass resources are sustainable and offer an environmentally friendly feedstock which can contribute to diversifying our energy portfolio. Electricity, transportation fuels, chemicals, and materials currently produced from petroleum and natural gas can instead be produced from biomass resources. These resources include crops and trees; industrial, municipal and forestry residue; and byproducts from production processes in the agricultural, forest products, and pulp and paper industries. This prospect holds great promise for our economy and is critical for our strategic security.

The *Vision for Bioenergy and Biobased Products in the United States* (Vision) established by the Biomass Research and Development Technical Advisory Committee defines a set of achievable quantitative goals to help the United States transition from a fossil-fuel-based economy to a biobased economy. These goals will help achieve greater economic and resource sustainability, economic security, and a healthier environment. Looking to the future, the Vision can be used by policy makers, educators, government, and industry as a tool to guide the nation toward a viable biomass-based economy.

Realizing the Vision goal of a viable bioenergy and biobased products industry will result in important benefits in each of the areas discussed in the remainder of this section.

## BALANCE OF TRADE

In 2005, the United States relied on imported oil to meet 65 percent of its demand for crude oil and petroleum products, up significantly from previous decades.<sup>7</sup> In the U.S., crude oil imports increased 194 percent from an average of 3,426 thousand barrels per day in 1984 to 10,055 thousand barrels per day in 2005.<sup>8</sup> This trend will continue unless a concerted effort is made to increase energy production from domestic resources and/or reduce energy consumption. The U.S. balance of trade for petroleum was at a deficit of \$231 billion in 2005 – representing 30 percent of the total U.S. trade deficit.<sup>9</sup> Increasing demand combined with spikes in petroleum prices suggest that U.S. petroleum imports will further exacerbate the U.S. trade deficit. More critical to the deficit is the price inelasticity of oil. Even small changes in the price of oil have a large impact on the deficit. According to The Economic Policy Institute, the dramatic increases in the cost of petroleum products and the volume of imports were responsible for more than one-third of the increase in the trade deficit in 2004.<sup>10</sup> If domestically produced biobased products and bioenergy can begin to replace a portion of petroleum products, those dollars could remain in the U.S. and provide an opportunity to fuel domestic economic growth.

## ECONOMIC GROWTH

Biomass resources are varied, ranging from agricultural crops and residues to forest resources and energy crops. They are available in every region of the United States. Achieving the Vision will infuse dollars back into the domestic economy by creating a market for business output, generating income, and encouraging capital investment, which, in turn, will further increase the demand for business output – the “multiplier effect.” In essence, for rural America, renewable energy means creating new markets, industries, and jobs. The inherent wealth of biomass feedstock in rural land provides opportunities for rural distributed energy systems, and localized biomass production and processing facilities. The untapped potential of rural America can help provide a conduit for the renewable energy industry to grow.

In 2004, the ethanol industry alone supported creation of 147,000 jobs in all sectors of the economy, boosted U.S. household income by \$4.4 billion through increased economic activity and new jobs, and added \$1.3 billion in federal tax revenue and \$1.2 billion in state and local tax revenues.<sup>11</sup> Such biomass-based industries will help provide new markets and product diversification to farmers, ensuring economic vitality for years to come. Moreover, new value products from forest and agriculture industry residuals will open new market opportunities for these industries, for example, conversion of biomass — including forest residues, agricultural residues and spent pulping liquor (black liquor) — into ethanol and syngas; and conversion of syngas, carbonaceous solids and oils into fuels, power, chemicals (such as hydrogen, hydrogen carriers, and butanol) and other high-value materials.

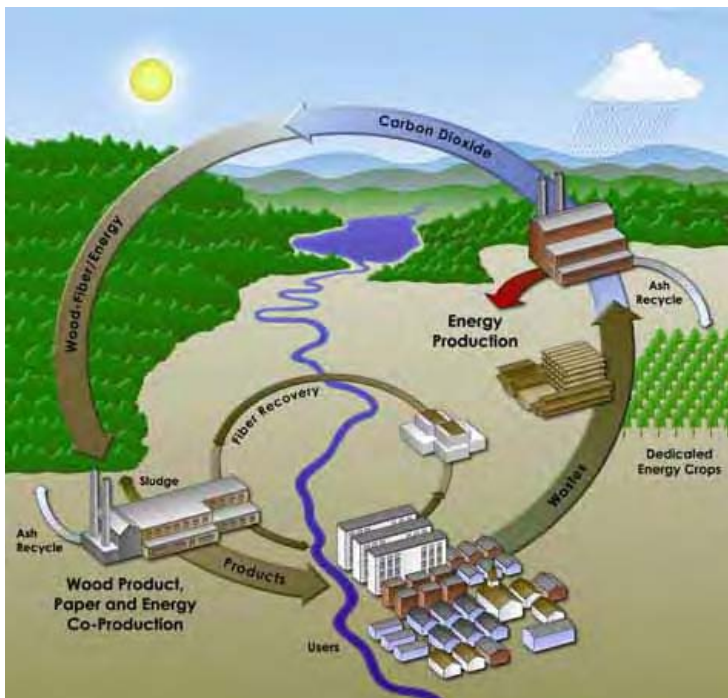




## ENVIRONMENTAL ISSUES

Biomass technologies can help to reduce global warming, the principal environmental impact of petroleum consumption. Since biomass has relatively low net (fuel-cycle) carbon emissions, substituting biofuels and biobased products with those derived from petroleum can result in significantly lower greenhouse gas emissions (see Exhibit 1).

*Exhibit 1: Carbon Cycle: Benefits of Biomass*



Source: Oak Ridge National Laboratory

**Net Carbon Benefits** — Since bioenergy is made from crops and trees that absorb carbon dioxide, the cycle of their growth and oxidation is carbon neutral and their substitution with petroleum-based fuels and feedstocks can help to reduce net greenhouse gas emissions. By increasing growth rates and efficient production methods, we can potentially reduce CO<sub>2</sub> concentrations by increasing our use of bioenergy.

Biomass has the biggest potential near-term impact in the transportation sector, which accounts for 65 percent of U.S. oil consumption and is the predominant source of air pollution.<sup>12</sup> The transportation sector produced 1,770 teragrams of CO<sub>2</sub> in 2003, accounting for 32 percent of the total U.S. CO<sub>2</sub> emissions. The transportation sector also was responsible for as much as 90 percent of carbon monoxide (CO) in urban air — both gases contribute either directly (CO<sub>2</sub>) or indirectly (CO) to global warming.<sup>13,14</sup> Biomass could also have an important impact on power generation through co-firing, gasification, and pyrolysis technologies, especially if biopower replaces electric generation that would otherwise have been generated from coal. Electricity generators rely on coal for over half of their total energy requirements and accounted for 93 percent of all coal consumed for energy in the United States in 2003.<sup>15</sup> Electricity generators consumed 35 percent of U.S. energy from fossil fuels and emitted 41 percent of the CO<sub>2</sub> from fossil fuel combustion in 2003.<sup>16</sup>

The Clean Air Act mandated that the Environmental Protection Agency establish emission standards for NO<sub>x</sub> and other pollutants. Currently, CO<sub>2</sub> emissions are not regulated as a pollutant under the Clean Air Act. As the contribution of CO<sub>2</sub> to global warming has become more widely accepted, however, some states have independently adopted limits on vehicle tailpipe CO<sub>2</sub> emissions, and it is possible that other CO<sub>2</sub> emission limits may be imposed in the future. Biopower and co-firing can help industry meet such new requirements. Similar benefits could be achieved by biorefineries which produce a suite of fuels, power, and biobased products. Reducing the amount of fossil fuels we use and replacing them with cleaner-burning bioenergy will also decrease air pollution and related public health costs. Sustainable production of forest and agricultural feedstocks provides bioenergy as well as continual CO<sub>2</sub> uptake by well-managed crops and forests.

There are other environmental benefits associated with biomass utilization. For example, we could remove, and use for energy, excessive levels of biomass found on our forest lands. Active management may reduce the risk of catastrophic wildfires, provide better wildlife habitat, allow forests to become more resilient to insects, disease and drought, and enhance the rate of growth of trees. Benefits to the environment may include enhanced air and water quality because excess forest and woodland growth is used rather than burned in debris piles. Conservation activities can be completed using fast-growing crops, wood plantations, and agro-forestry that provide clean water and soil protection.

## ENERGY DIVERSITY AND SECURITY

The issue of energy security in the United States is largely an issue of oil and gas supply security. The United States has only 4 percent of the world's population but consumes about 25 percent of the world's produced oil.<sup>17</sup> Vulnerability to even short-term disruptions in oil and gas supply was illustrated during the Gulf Coast hurricanes of 2005. The nation is dependent on foreign sources of oil, with 65 percent of its 2005 annual oil consumption coming from imports, including approximately 17 percent from the Persian Gulf region.<sup>18</sup> The price of crude oil has also increased from an annual average of \$36.98 per barrel in 2004 to \$50.23 per barrel in 2005, and \$59.30 per barrel in 2006 to date.<sup>19</sup>

U.S. reliance on oil imports also results from indirect oil imports in the form of manufactured goods. This includes the energy used to produce the goods along with the petroleum-based materials that comprise products such as plastics. Often countries that manufacture these goods are themselves reliant on imported oil, further exacerbating U.S. and global energy security issues. Although the Energy Information Administration (EIA) and the International Energy Agency (IEA) do not make estimates of these indirect imports, analysts speculate it would add at least 1.0 million barrels per day (MMBD) to the current 10.1 MMBD of total U.S. oil imports.<sup>20</sup>

Although not matching the pace of petroleum, imports of natural gas have also increased in recent years and imports accounted for 20 percent of total consumption in 2005.<sup>21</sup> This has been led largely by a near tripling in liquefied natural gas imports. There has been a dramatic increase in construction of liquefied natural gas (LNG) terminals. Currently, there are five LNG terminals in the U.S. with a capacity of about 5.2 Bcf/day.<sup>22</sup> Another 13 have been approved by the Federal Energy Regulatory Commission (FERC) and the U.S. Coast Guard which will bring the total to 22.1 Bcf/day.<sup>23</sup> An additional 25 LNG terminal sites in the U.S. have been proposed to FERC and the Coast Guard.<sup>24</sup>

It seems only prudent that the U.S. government and industry begin to make significant investments to diversify the country's portfolio of energy resources. The U.S. needs to build greater resiliency into its energy sector to lessen the impact of natural disasters, external attacks, industry downturns, or other factors that may impact energy supply.



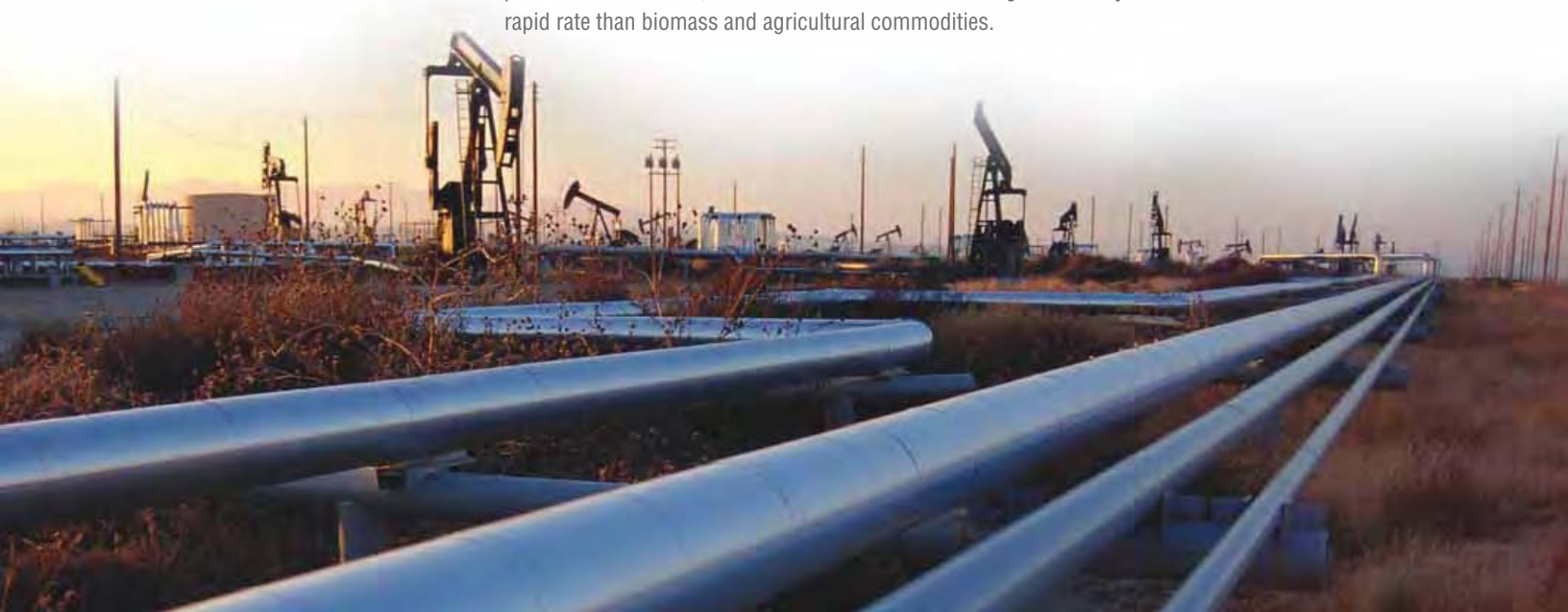
Geographically dispersed biorefineries could provide an alternative and an additional flow of domestically produced products that could partly reduce the economic insecurity stemming from increased dependence on fossil fuels. Further, biofuels can be a component of the renewable hydrogen energy future, and thus this effort supports both near- and long-term energy and environmental security goals. Biomass feedstocks can replace fossil fuels to support the hydrogen economy, limiting greenhouse gas emissions and detrimental reliance on foreign petroleum suppliers. Biomass can also provide a feedstock for other advanced biobased fuels such as biobutanol.

## SUSTAINABLE ENERGY SUPPLY

World oil demand continues to increase with the U.S. leading the way. Continued economic expansion in populous countries such as China and India is further fueling this demand. In the coming decades, world oil production is predicted to “peak” after which worldwide production of oil will begin to decrease, raising the oil prices rapidly. Analyses published over the past three decades have varied widely in their estimate of when world oil production will peak, ranging from as early as 1989 to 2050.<sup>25</sup> A recent EIA study estimates world oil production to peak in 2044.<sup>26</sup>

The basic counter argument to any prediction of early “peak oil” production is that new technologies and increased investment can overcome any production barrier. The IEA estimated that the total necessary investment cost for worldwide upstream operations and transport of oil by 2030 would amount to \$16 trillion – or roughly \$568 billion a year, between 2003 and 2030.<sup>27</sup> A study by the Center for Strategic and International Studies suggests that this estimate may actually be too conservative.

No matter what the exact date of the expected peak in oil production, looking at the increasing reliance of the U.S. economy on fossil fuels and the uncertainty of the long-term future of fossil fuels, the United States must begin to prepare for a transition to alternate energy now. To start with, the United States must begin to make significant investments to diversify its portfolio of energy resources. Geographically distributed biorefineries could produce a steady flow of bioenergy and bioproducts into the U.S. economy, reducing some of our reliance on petroleum imports and reducing economic insecurity from threats, both domestic and external. Regardless of when peak production is reached, the cost of crude oil and natural gas will likely continue to increase at a more rapid rate than biomass and agricultural commodities.





## Current Status of Bioenergy and Biobased Products

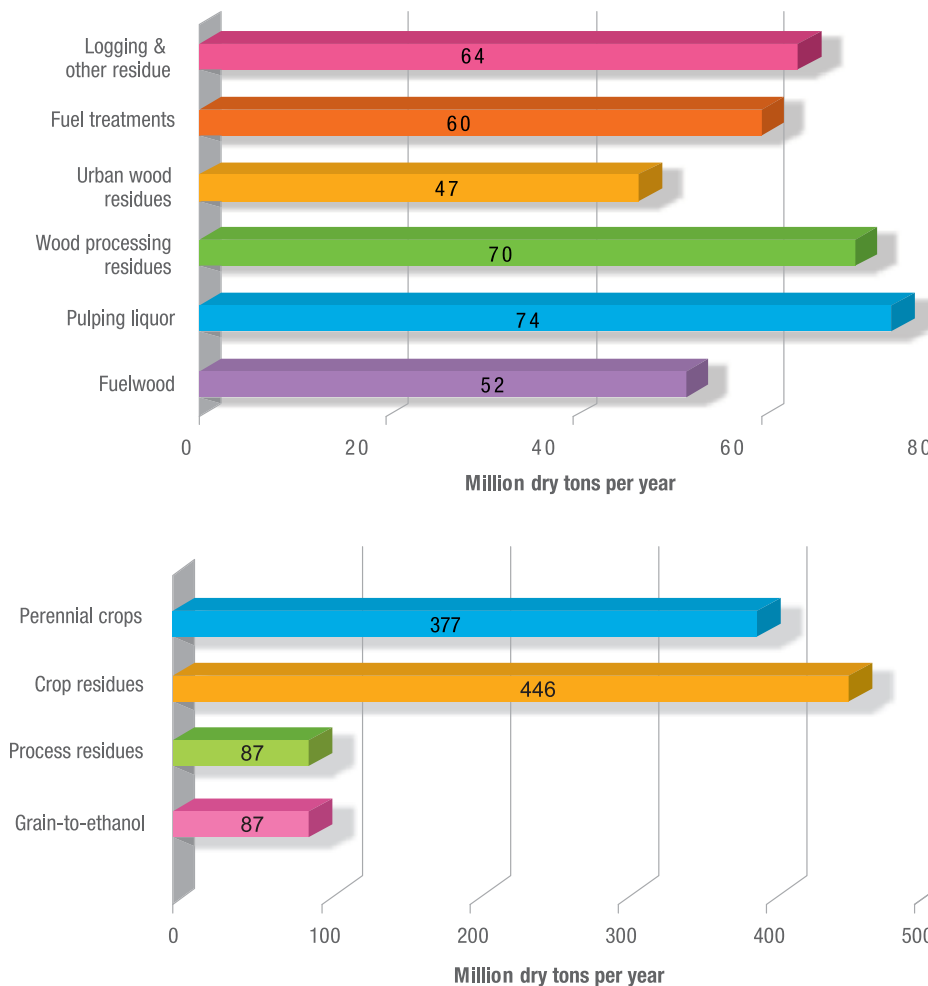
Currently, biomass accounts for about 4 percent of the total U.S. energy consumption but has the potential to contribute much more. Biomass resources are diverse and are found in every state in the United States. Feedstocks from the agriculture and forestry industries such as corn stover or spent pulping liquor can be converted into liquid fuels, power, chemicals and other higher-value materials. According to a 2005 report by U.S. Department of Agriculture (USDA) and U.S. Department of Energy (DOE), there are approximately 1.3 billion tons of biomass available in the United States for conversion to fuels, power and products (Exhibit 2).<sup>28</sup> Biomass is used to produce heat and power in industry, to produce electric power for sale to the electrical grid, and to produce biobased fuels such

as ethanol and biodiesel. Biomass is also used to produce a range of chemical and material products that are otherwise produced from petroleum-based feedstocks.

Heat and power produced by biomass was estimated at 2.1 quadrillion Btu (quads) in 2004, and accounted for about 3 percent of the market share for power production. Consumption of biofuels in the transportation sector was approximately 2.1 billion gasoline-equivalent gallons in 2004, about 1.2 percent of the market share for transportation fuels.<sup>29</sup>

In its original Vision, the Committee set aggressive goals for biofuels, biopower and biobased products for 2010, 2020, and 2030. In updating its Vision, the Committee evaluated the current status of biofuels, biopower, and bioproducts in the United States to track the progress toward achieving the original goals stated in the Vision. It found that the U.S. is on track to meet the Committee's original biofuels goals for 2010, but is not on track to meet its 2010 goals for biopower. It is difficult to assess progress in achieving its goals for biobased products due to lack of data.

**Exhibit 2: Summary of Potential Forest and Agriculture Resources**



**Source:** Biomass as a Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply. 2005. It should be noted that the forest feedstock analysis looks only at residues and wastes and does not take other wood sources into account.

Liquid fuels in transportation are measured in gallons, with the most common fuel being gasoline. The energy content of each fuel type is different. The Btu content for gasoline (130,000 Btu/gallon) is higher than the content for ethanol (89,000 Btu/gallon) or biodiesel (128,000 Btu/gallon). For comparison purposes, the Vision uses **gasoline-equivalent gallons** when discussing transportation fuel consumption.

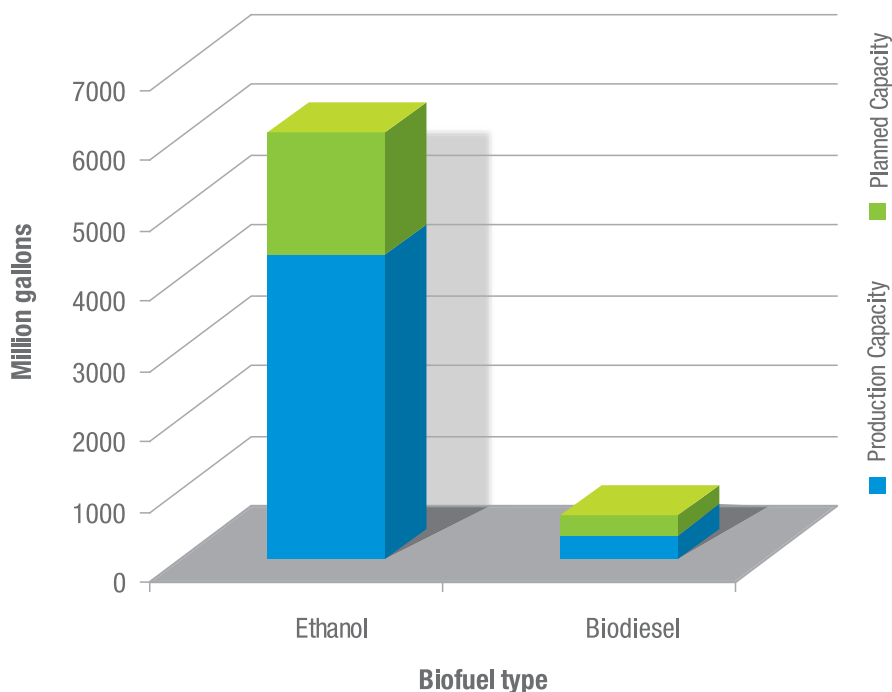
## BIOFUELS

The current U.S. biofuels production capacity (existing and planned) is illustrated in Exhibit 3. As of January 2006, there exists over 4,336 million gallons per year of ethanol production capacity with over 1,743 million gallons per year in new planned capacity.<sup>30</sup> Current dedicated biodiesel and oleochemical production capacity is estimated to be 395 million gallons per year with 714 million gallons per year in planned capacity.<sup>31</sup>

Overall demand for transportation fuels has increased 19 percent in the past 10 years with the vast majority of this growth reliant on imported petroleum.<sup>32</sup> Increased use of domestically produced biofuels in the transportation sector represents a near-term opportunity to help offset petroleum demand and rising oil imports. Biofuels include ethanol blended with gasoline, such as E85, biodiesel, or other advanced biofuels still under development.

As shown in Exhibit 4, there has been sizeable growth in consumption of virtually all biofuel categories, reaching a total consumption of 2.1 billion gasoline-equivalent gallons in 2004 – a 1.2 percent capture of the total annual vehicle fuel consumption in the United States.<sup>33</sup> If the biofuel consumption growth continues at this rate, the original Vision goal of 8.0 billion gasoline-equivalent gallons or 4 percent of market share by 2010 can be reasonably met. This will exceed the Renewable Fuels Standard (RFS) established by the Energy Policy Act of 2005 (EPAAct), which aims to double the amount of ethanol and biodiesel in the U.S. fuel supply over the next seven years. The RFS requires 7.5 billion gallons of biofuels (5 billion gasoline-equivalent gallons) production by 2012.

*Exhibit 3: Biofuels Production Capacity, January 2006*



**Sources:** 2006 Annual Industry Outlook, Renewable Fuels Association; Fact Sheet: U.S. Biodiesel Production Capacity, May 2006, National Biodiesel Board.

*Exhibit 4: Estimated Consumption of Biofuels and Traditional Fuels in the United States 2001-2004 (Thousand Gasoline-Equivalent Gallons)*

	2000	2001	2002	2003	2004	Avg. Annual % Change 2000 04
E85	*12,084	14,623	17,783	20,092	22,405	14%
E10	1,085,800	1,143,300	1,413,600	1,792,900	2,052,000	14%
Biodiesel	6,816	7,076	16,917	26,758	36,599	31%
<b>Total Biofuels</b>	<b>1,104,700</b>	<b>1,164,999</b>	<b>1,448,300</b>	<b>1,839,750</b>	<b>2,111,004</b>	<b>15%</b>
Gasoline	125,720,000	127,768,000	131,299,000	132,961,000	136,374,000	2%
Diesel	36,990,370	37,085,270	38,305,630	39,930,170	40,740,760	2%
<b>Total Fuel Consumption</b>	<b>163,032,677</b>	<b>165,201,691</b>	<b>169,983,219</b>	<b>173,303,895</b>	<b>177,561,958</b>	<b>2%</b>

*Source: Alternative Fueled Vehicles. Renewable and Alternative Fuels. Energy Information Administration.<sup>34</sup>*

*\*E85 in 2000 includes 13,000 gasoline-equivalent gallons of E95. 2001-2004 E95 is zero.*



## Biofuels

- Fuel ethanol (C<sub>2</sub>H<sub>5</sub>OH)** ..... An anhydrous denatured aliphatic alcohol intended for gasoline blending.
- Oxygenated gasoline** ..... Finished motor gasoline, other than reformulated gasoline, having an oxygen content of 2.7 percent or higher by weight.
- E10** ..... A fuel containing a mixture of 10% ethanol and 90% gasoline.
- E85** ..... A fuel containing a mixture of 85% ethanol and 15% gasoline.
- E95** ..... A fuel containing a mixture of 95% ethanol and 5% gasoline.
- Biodiesel** ..... Produced through transesterification, a process in which organically derived oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. Biodiesel can be made from soybean or rapeseed oil, animal fats, waste vegetable oils, or microalgae oils.
- Fischer-Tropsch (FT) Synthesis** ..... One route to produce green fuels is the combination of biomass gasification (BG) and Fischer-Tropsch (FT) synthesis, wherein biomass is gasified and, after cleaning, the biosyngas is used for FT synthesis to produce long-chain hydrocarbons that are converted into “green diesel” (e.g., biodiesel and ethanol).

**Quads** — Energy is measured in British thermal units or Btus. U.S. energy consumption's order of magnitude is in **quads**, short for one quadrillion ( $10^{15}$ ) Btus. A Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit and is equal to 252 calories. For example: a gallon of gasoline contains 124,000 Btu; a kilowatt of electricity contains 3,412 Btu; and in 2004, U.S. energy consumption was about 100 quads (including all residential, commercial, transportation, industrial and electric power sector energy consumption).

## BIOPOWER

The United States is not on track to reach the 2010 Vision goal for biopower of 3.3 quads or 4 percent of market share. Biopower includes biomass resources used to produce heat and power in the industrial sector for both onsite use and sale to the grid. Biopower also includes biomass used for electric power production by the utility sector. As shown in Exhibit 5, the use of biomass to produce biopower has been relatively unchanged since 2000, decreasing marginally from 2.23 quads in 2000 to 2.13 quads in 2004. The Committee recognizes that although combined heat and power is an important aspect of the “biorefinery concept” and is important to the overall objectives of achieving the Vision, the value-added nature of biofuels, biochemicals, and other bioproducts will have a more significant economic impact in displacing fossil energy sources.

*Exhibit 5: Biomass Share of Electricity and Heat Demand in Utilities & Industry (Quadrillion Btu)*

	Biomass Consumption for Heat & Power (Industrial Sector) <sup>a</sup>	Biomass Consumption for Electric Power (Electric Utility Sector) <sup>a</sup>	Total	Total Energy Consumption (Industrial & Electric Utility Sectors) <sup>b</sup>	Biomass Share of Electricity & Heat Demand in Utilities & Industry <sup>a</sup>
2000	1.78	0.45	2.23	72.93	3.06 %
2001	1.59	0.45	2.04	70.03	2.92 %
2002	1.56	0.51	2.08	70.86	2.94 %
2003	1.53	0.52	2.05	70.61	2.91 %
2004	1.62	0.50	2.13	71.93	2.96 %

*Source:* <sup>a</sup>Renewable Energy & Alternative Fuels. EIA.<sup>35</sup> <sup>b</sup>Annual Energy Review. EIA.<sup>36</sup>

## BIOPRODUCTS

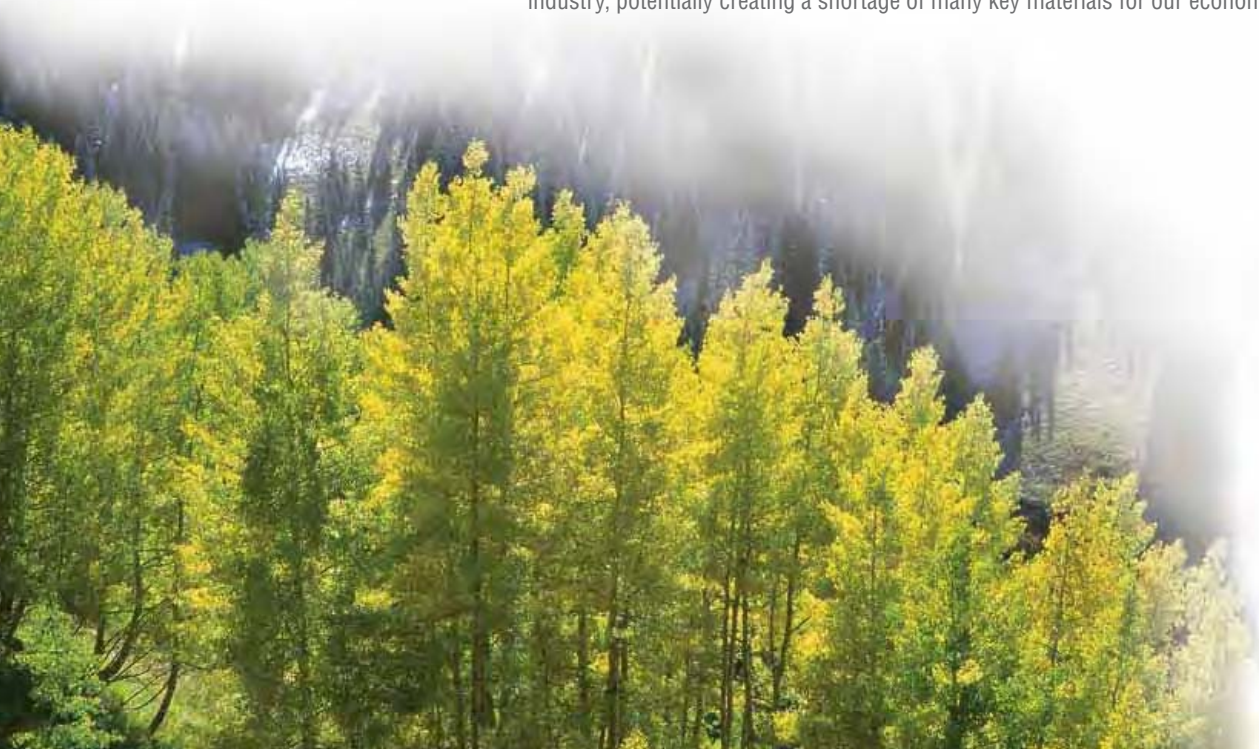
As it has since the early 1900s, the United States continues as the world's leader in chemicals production. In 2005, the U.S. chemicals industry produced 23 percent of the world's total chemicals shipments.<sup>37</sup> The chemicals industry is energy intensive, relying on oil and gas not only for process energy but also using petroleum as feedstock for the manufacture of many of its products. In 2004, the energy equivalent consumed by the U.S. chemicals industry for these purposes amounted to 6.4 quads or 6.4 percent of the total U.S. energy consumption.<sup>38</sup> Energy used for fuel, power, and electricity accounted for 3 quads of this total, with the remaining 3.4 quads used for hydrocarbon feedstocks.<sup>39</sup> These hydrocarbon feedstocks are sourced primarily (99 percent) from petroleum and natural gas, with the remaining 1 percent from coal and biomass.<sup>40</sup>

The Biomass R&D Technical Advisory Committee defines targeted biobased products as any product generated from biomass that would otherwise be produced using fossil fuel feedstocks.

When the original Vision document was published in 2002, the production of biobased textile fibers, polymers, adhesives, lubricants, soy-based inks, and other products was estimated at 12.8 billion pounds per year or roughly 5 percent of the market share (see Exhibit 6). Based on the 2005 estimate shown in Exhibit 6, biobased products now constitute about 17.6 billion pounds per year, or about 8 percent of the total target market share.<sup>41</sup> However, note that these estimates use some references that are not updated annually for tracking the volume of bioproducts. The production entry for Cellulose Polymers has not changed from the 2002 baseline, not because the market has not grown, but because more recent data reflecting the current state of its market is unavailable.

Due to lack of publicly available data on production of biobased products, it is uncertain how close U.S. industry is to achieving the original Vision goal of capturing 12 percent market share of products by 2010. In its updated Vision, the Committee has expanded the list of key biobased products which it will include in its slate of biobased products. In addition to those products listed in Exhibit 6, new biobased products which are projected to enter the market are: polylactic acid from lactic acid, succinic acid, 1,3 propanediol (PDO), polyhydroxy-alkanoate (PHA), and 3 hydroxypropionic acid (3-HP). These biobased products will be direct replacements for current petrochemicals such as polyolefin thermoplastics (e.g., polyethylene and polypropylene). Although there are many unknowns with respect to current bioproduct production capacity, the outlook is very promising for bioproducts.

As in the energy sector, diversifying the chemical industry's feedstock base to include more biomass can help to ensure greater security and reduce vulnerability to oil and gas price swings. Increasing prices for crude oil and natural gas have contributed to rapid price increases for commodity chemicals such as propylene, ethylene, and benzene, as well as their downstream intermediates, ultimately leading to cost increases for polymers and resins used in virtually every type of manufactured goods from automotives to textiles. This price squeeze affects the global competitiveness of the entire manufacturing sector from major manufacturers to small fabricators throughout the country. Rising natural gas prices will continue to have a large effect on the chemicals, agricultural, metals, cement and other industries. Major disruptions in oil and gas supply would deliver a serious blow to the U.S. industry, potentially creating a shortage of many key materials for our economy.





*Exhibit 6: Estimated Production of Biobased Products (Million Pounds)*

	2002	2004 2005
Organic Acids	576	987
<i>Lactic Acid</i> <sup>1</sup>	114	600
<i>Citric Acid</i>	462	387
Ethanol for Industrial Use	1757	1971
Starch <sup>2</sup>	3000	6684
Sorbitol <sup>3</sup>	515	697
Glycerol/Glycerine <sup>4</sup>	410	432
Alkyd Resins <sup>5</sup>	550	682
Soy-Based Products <sup>6</sup>	654	934
Specialty Oils/Aroma Chemicals <sup>7</sup> *	9	8.9
<i>Spearmint</i>		1.7
<i>Peppermint</i>		7.1
Forest Chemicals*	2826	2740
<i>Crude Sulfate Turpentine</i> <sup>8</sup>		1202
<i>Tall Oil</i> <sup>9</sup>		1094
<i>Pine Rosin</i> <sup>10</sup>		444.6
Cellulose Polymers	2500	2500
<i>Cellulose Fibers</i>	360	** NA
<i>Cellulose Derivatives</i> <sup>11</sup>	2140	696
<b>TOTAL</b>	<b>12,797</b>	<b>17,635</b>
<b>% Market share</b>	<b>5%</b>	<b>8%</b>

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\* 2002 estimates for Specialty Oils and Forest Chemicals do not include detailed breakdown of subcomponent quantities due to lack of publicly available data on production.

\*\* The 2005 estimate for Cellulosic Polymers uses 2002 totals because no new public information was available.

## Vision Goals



The original Vision established aggressive goals for biopower, biofuels and biobased products defining market share targets for each 2010, 2020, and 2030. These targets were set to benchmark the progress toward achieving the 2030 Vision of a “well established, economically viable, bioenergy and biobased products industry.”<sup>42</sup>

The updated Vision does not change the original 2010 goals but recognizes that in some cases the nation is not on track to meet them. The Vision makes minor changes to its 2020 and 2030 goals and establishes 2015 goals to define interim milestones that must be achieved to reach the aggressive targets set for 2020 and 2030. Vision goals are shown below in Exhibit 7.



### BIOFUELS

The Committee strongly supports efforts to improve transportation fuel economy. However, the Committee also believes that it is critical to diversify our portfolio of transportation fuels and that biofuels should account for 4 percent of transportation fuel demand by 2010, 10 percent by 2020, and 20 percent by 2030. Biofuels consumption in 2004 was 2.1 billion gasoline-equivalent gallons, or 1.2 percent of the market share of total motor vehicle fuel consumed. If current trends are an indication of future demand for biofuels, the original 2010 target can be met. It is the longer-term goals which present a challenge. DOE has established an objective to achieve cost-competitive production of cellulosic ethanol by 2012 per the President's Advanced Energy Initiative and to displace 30 percent of 2004 levels of gasoline consumption with biofuels by 2030. Thirty percent of the 2004 market for gasoline consumption is about 60 billion gallons of ethanol, or 40 billion gasoline-equivalent gallons.



The Vision's long-term goal for biofuels is to capture 20 percent of the 2030 market for transportation fuels. Using forecasts for 2030 transportation fuels consumption, this requires production of an estimated 51 billion gasoline-equivalent gallons or 85 billion gallons of ethanol.

Exhibit 7: Vision Goals

	Units	2000	2004	2010	2015	2020	2030
<b>Biofuels</b> <sup>43</sup>	Market share (%)	0.7	1.2	4.0	6.0	10.0	20.0
	Consumption (billion gasoline-equivalent gallons)	1.1	2.1	8.0	12.9	22.7	51.0
<b>Biopower</b> <sup>44</sup>	Market share (%)	3.0	3.0	4.0	5.5	7.0	7.0
	Consumption (quadrillion Btu)	2.0	2.1	3.1	3.2	3.4	3.8
<b>Bioproducts</b> <sup>45</sup>	Production (billion lbs)	12.8	17.6	23.7	26.4	35.6	55.3

<sup>†</sup> Estimate for biobased products are for 2001 as reported in 2002 Vision.

## BIOPOWER

Biopower constitutes biomass-derived heat and electric power produced in industry and utilities (see Exhibit 5). It includes power produced from biomass used in co-firing, waste-to-energy conversion, gasification of biomass and possibly liquid fuels. It does not include residential and commercial sector use of wood energy. The United States is not currently on track to meet original Vision goals for biopower. The Committee will continue to maintain its challenging goals for biopower, believing that it should represent 4 percent of energy use in industry and utilities by 2010, 5.5 percent by 2015, and level off at 7 percent by 2020. In order to meet its biopower goals, strong incentives and policies are needed. A good example in which state and local governments are leading biopower development is through implementing the Renewable Portfolio Standards (RPS) policy. RPS require a certain percent of the total energy portfolio to come from renewable sources of energy such as wind, solar, or biomass.

## BIOBASED PRODUCTS

The Committee believes that production of biobased products should increase from its current estimated baseline of 17.6 billion lbs to 23.7 billion lbs by 2010, 26.4 billion lbs by 2015, 35.6 billion lbs by 2020, and 55.3 billion lbs by 2030. The original Vision defined biobased products as biobased textile fibers, polymers, adhesives, lubricants, soy-based inks, and other products. As previously mentioned, the Vision update defines biobased products as any product generated from biomass that would otherwise be produced using fossil fuels. The Committee adopted this change to highlight the important role that biomass can play in diversifying chemical industry feedstocks.



## Achieving the Vision Goals

The Vision will provide the framework for action to achieve our goals. However, major progress is needed in several areas. A critical component is the need for a biomass champion. Industry has been hesitant to shift from petroleum to biomass, citing the huge cost to do so. A well-organized movement led by an industry champion must, therefore, be launched to encourage lawmakers to implement policies and provide critical incentives and funding needed to begin the transition to a bioeconomy. Further, long-term public policies are needed to create an environment which reduces the risk to investors. This would enable funding and deployment of demonstration projects to prove the technical and commercial feasibility of existing biomass technologies. Public- and private-sector R&D is working toward decreasing the cost of harvesting, transporting, storing, handling and converting feedstocks, and deploying and commercializing biomass technologies. The updated *Roadmap for Bioenergy and Biobased Products in the United States* will further outline the strategies needed in each of these areas.

### RESEARCH AND DEVELOPMENT

Important research priorities have been outlined in documents such as the Committee's *Roadmap for Bioenergy and Biobased Products in the United States*, *Feedstock Roadmap*, and *Agenda 2020: Advancing the Forest Biorefinery*. Biomass research and development pathways are outlined in the Committee's Roadmap.

Areas of focus for research and development include the following:

- Improving basic plant science to increase sustainable biomass production rates
- Ensuring the ability of agricultural and forest lands to supply large volumes of biomass in a perpetually reliable manner without degrading our resources and environment and identifying the environmental factors associated with expanded production of biofuels and biobased products, including land-use changes; effects on biodiversity; use of water; runoff of pesticides, herbicides and nutrients; effects on soil and water quality; erosion; and net emissions of greenhouse gases and criteria pollutants
- Optimizing the utilization of traditional crop and forest resources and byproducts while also working on developing new and improved feedstocks, sustainable management systems, more cost-effective harvesting systems, and improved transportation systems
- Developing land management practices that will be necessitated by the transition from the conventional roles of agriculture and forestry to the role of providing energy, fuels, and a wider variety of biobased products and changing land management policies to allow longer-term and larger projects
- Reducing harvest, transportation, conversion and manufacturing costs
- Improving the efficiency and effectiveness of priority biological and thermochemical pathways
- Reducing the cost of fermentation
- Enabling greater conversion of lignocellulosic biomass
- Developing more robust enzymes and catalysts
- Developing new uses for biomass and improving the competitiveness of biomass products in chemical markets
- Analysis of the impacts from reduction in corn and soy exports as they transition to use in bioenergy

A successful research strategy will require sufficient funding and supportive policies to encourage federal, university, industry, and state R&D partnerships for collaborative research and deployment.



## AGRICULTURAL AND FOREST PRODUCTION

The role of agricultural and forest production for human food, animal feed, and fiber could be transformed to include additional bioenergy, bioproducts, and fuels. There is a need to identify the environmental factors associated with expanded production of biofuels and biobased products, such as land-use changes; effects on biodiversity; use of water; runoff of pesticides, herbicides and nutrients; effects on soil and water quality; erosion; and net emissions of greenhouse gases and criteria pollutants. The critical sectors of agriculture and forestry products need to be the growth engine for new sustainable jobs, ensuring an improved standard of living. Compared to agricultural crops and residues, wild grasses and other energy crops such as wood and wood residuals derived from forest resources offer many compelling advantages as a process feedstock. It will be important for R&D to improve feedstock production efficiencies, provide the technologies for sustainable and reliable biomass resource production management and harvesting, and develop required infrastructures in local communities. Agricultural and forest-based commodities must continue to generate incomes adequate to produce a profit for farmers and forest land owners. It is vital that they remain in the economic chain and that they too benefit from the biobased economy. To this end, it is imperative that realistic business models be developed and communicated to farmers, ranchers, the pulp and paper industry, and forest owners/operators, along with public officials and industry, to spur public and private investment in necessary production, land management, harvesting, transportation, and storage infrastructure expansion.

## POLICY

Long-term policies and financial incentives should be developed to promote biomass applications across all sectors of the economy. These could include effective tax incentives for greater flexibility in utility interconnection policies, green purchasing requirements, emission taxes or regulations, and/or tax credits for research and investments in renewable energy. The Committee believes that market-based mechanisms should credit the environmental, energy, and security advantages of bioenergy and biobased products. Moreover, government agencies should provide leadership by purchasing biobased products, biofuels, and biopower. Bioproducts equivalence testing and preferred purchase of bioproducts should be a priority. Opportunities for biobased products will no doubt increase with new legislation such as that guiding the Federal Biobased Products Preferred Procurement Program (FB4P). The federal government should help communicate federal standards for purchasing biobased products and encourage states to adopt similar standards. The existing lack of data on biobased products makes it difficult to measure progress in achieving Vision goals and further research is needed to benchmark and track the role of biobased products in the U.S. economy.

## DEMONSTRATIONS

Commercial-scale demonstration projects are needed to help prove the techno-economic viability of biomass technologies and biorefineries to potential investors, decision-makers and others, this will act as a catalyst for opening credit markets. Greater investment is needed on prototyping and education to address this important gap in realizing the benefits of biomass technology advances. Demonstration of biorefineries will illustrate the ability of the agriculture and forest industries to maximize utilization of energy streams, minimize waste and develop new value products.



## PARTNERSHIP/CHAMPION

Efforts such as the forest and paper industry's Agenda 2020 Technology Alliance, and the 25x25 Initiative are stressing the important role of biomass technologies. These are coalitions of various agriculture- and forest-related industry groups and researchers who have come together to address common goals related to their industries. But industries which comprise the bioeconomy are varied and not well coalesced, which has hindered progress. An association or industry-led coalition is needed to represent one voice for the biomass industries. By establishing a champion and setting aggressive targets, the Vision can help farmers, forest land owners, refiners, developers, and other members of the biomass industries to come together in their efforts toward achieving a viable bioeconomy.

## FINANCING

The capital investment required will be significant to develop and establish new feedstock production systems and build new bioenergy, biofuel and biochemical production plants and distribution infrastructure. Financing needs to be complimented by supporting long-term planning, assessments, and policy. Business models are needed to quantify investment requirements as well as operating costs and returns. Realizing the Vision will require significant increases over the current federal investments. Federal agencies should identify sources of sustained unencumbered financing to invest in biomass technology, research, development, and deployment. Increased use of public/private partnerships should be pursued, as well as loan guarantees and other financial incentives outlined in the Energy Policy Act of 2005. In addition, greater investment should be sought from the automotive, chemicals, fuels, and other industries with vested interests.

## PUBLIC EDUCATION AND OUTREACH

A number of common misconceptions impede a positive public perception of biomass. These include, but are not limited to, issues of biomass availability and net energy benefits. A 2005 report produced by the U.S. Departments of Agriculture and Energy showed that currently there are enough sustainable resources available to offset 30 percent of current annual petroleum demand.<sup>46</sup> In terms of energy benefits, a July 2005 study, *Updated Energy and Greenhouse Gas Emissions Results of Fuel Ethanol*, by the Center for Transportation Research, Argonne National Laboratory compares the net energy balance of corn ethanol with that of petroleum. The report states that ethanol requires 0.74 Btu of input compared to 1.23 Btu of input for petroleum to produce the same output of energy.<sup>47</sup> It is important to educate the public and the biomass community on the real costs associated with using fossil fuels, including negative environmental and geopolitical externalities, and balance of trade effects, and on the sustainability benefits of biomass. The biomass community should disseminate success stories highlighting the benefits of biobased products and also educate consumers that biomass is available nationwide and that it can benefit local economies throughout the country. Educating the public has long been the domain of the Land-Grant University Extension system with local educators in almost every county in our nation. The Extension system should become fully informed and engaged in this important public educational outreach.

## WORKFORCE EDUCATION

Universities should develop research and development programs in biomass, which will result in engagement of the faculty with this important issue. Academic departments should incorporate biomass-related topics into undergraduate and graduate educational curricula that will prepare future professionals for employment in the biomass economy. Existing agency R&D programs should be further developed to supply critical science and technology for feedstock production, management, harvest, transportation, conversion, and distribution.

The U.S. workforce has traditionally been trained to use petrochemicals. Transitioning to a bioeconomy requires a workforce trained and educated in carbohydrate chemistry and the science related to biomass production and conversion. Universities should have access to national resources to develop research and educational programs in biomass that will catalyze the creation of undergraduate and graduate curricula in carbohydrate, protein, and lignin chemistry, and other relevant science and engineering topics to support the emerging biomass industry.

Multi-disciplinary projects are required in order for the bioeconomy to be successful. This will require involvement by the forest, agriculture, chemicals, finance, and other sectors. The capacity to transition to and be successful in a bioeconomy is an important step in accomplishing the Vision goals. Future scientists and engineers need to train with biomass feedstocks, supply systems, conversion processes, and applications so that our nation has the creative, well-prepared workforce that will help the nation realize the Vision.

## CHARTING A ROADMAP

Lessons learned from the original 2002 Vision show that without effective policies and well-planned R&D, efforts to achieve the Vision goals will be ineffective in reaching the accelerated goals for biomass utilization in the near future. The updated Vision will be the basis for future regional Roadmap workshops to chart the technical research, development, and demonstration activities needed to achieve a biobased economy. These regional Roadmap workshops will also outline the institutional and policy changes needed to remove the barriers to economically and environmentally sound development of sustainable biomass systems.



## End Notes

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- <sup>40</sup> Guide to the Business of Chemistry. August 1, 2005. American Chemistry Council. p. 115.
- <sup>41</sup> Lack of data on biobased products makes it difficult to measure progress in achieving Vision goals. Further research is needed to benchmark and track the role of biobased products in the U.S. economy. To this end, the U.S. Department of Energy is in the process of conducting data research to gain better data on current production levels of bioproducts and also to solicit the industry's input on the Committee's revised Vision targets for bioproducts.
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# Appendix A

## *Vision Workshop Participants*

Name	Organization
Tom Binder .....	Archer Daniels Midland
David Canavera .....	MeadWestvaco
Ralph Cavalieri .....	Washington State University
Shulin Chen .....	Washington State University
Roger Conway .....	Office of the Chief Economist, USDA
Mark Downing .....	Oak Ridge National Laboratory
Larry Drumm .....	Biotechnology Group
Vernon R. Eidman .....	University of Minnesota - St. Paul
Harriet Foster .....	BCS, Incorporated
Ken Green .....	BCS, Incorporated
Tom Johnson .....	Southern Company
Douglas Kaempf .....	Office of the Biomass Program, DOE
Melissa Klembara .....	Office of the Biomass Program, DOE
Michael Manella .....	BCS, Incorporated
Lori Perine .....	American Forest & Paper Association
Edan Prabhu .....	Flex Energy
Cindy Riley .....	National Renewable Energy Laboratory
Neil Rossmeissl .....	Office of the Biomass Program, DOE
Phil Shane .....	Illinois Corn
Hossein Shapouri .....	Office of the Chief Economist, USDA
Bryce Stokes .....	Forest Service, USDA
Larry Walker .....	Cornell University

## Appendix B

### *Vision Peer Reviewers*

Name	Organization
Ron Buckhalt .....	Agricultural Research Service, USDA
Rob Fireovid .....	Agricultural Research Service, USDA
Emory Ford .....	MTI Technology Corporation
Michael Foster .....	BP
John Hanby .....	Washington Pulp and Paper Foundation
Al Lucier .....	National Council for Air and Stream Improvement
Bill McKean .....	University of Washington
Bill Nicholson .....	Potlatch Corporation (retired)
Jim Simnick .....	BP

## Appendix C

### *Vision Review - Interagency Biomass R&D Board Members\**

Name	Organization
<b>Co-Chairs</b>	
Thomas C. Dorr .....	U.S. Department of Agriculture
Alexander A. Karsner .....	U. S. Department of Energy
<b>Members</b>	
Bruce Hamilton .....	National Science Foundation
Ashok G. Kaveeshwar .....	Department of Transportation
Johnnie Burton .....	Department of the Interior
Sharon Hays .....	Office of Science and Technology Policy
Dana Arnold .....	Office of the Federal Environmental Executive

\* EPA membership is in transition



## **Attachment C**

# Policy Gap Analysis

Policy Subcommittee  
Biomass R&D Initiative Technical  
Advisory Committee

- During FY 2006, Chairman Jim Barber guided subcommittee members in the creation of a document to report on current policy measures in biomass technologies, and consider their effectiveness against industry and public need.

- This report was distributed to the Policy Subcommittee as well as the Committee. All comments received were addressed.
- The final document (with revisions) has been provided to the full Committee prior to this meeting for review and comment.
- Committee Chairman Tom Ewing will discuss the main points of the report with the Board, including recommendations from the Policy subcommittee to the full Committee.



- Policy Subcommittee Members:
  - Jim Barber
  - Bob Dineen
  - Tom Binder
  - Carolyn Fritz\*
  - Terri Jaffoni\*
  - Kim Kristoff\*
  - Scott Mason
  - Larry Pierce

- Interviews, literature reviews, and research was conducted to gather information. Interviews included:
  - Larry Schaefer of the Renewable Fuels Association;
  - Helena Chum, Rich Bain, and Ralph Overend\* of the National Renewable Energy Laboratory (NREL);
  - Zia Haq of the Department of Energy office of the Biomass Program\*\*;
  - Committee member Jim Martin from OmniTech International.
  - Mark Downing, Oak Ridge National Laboratory
  - Bob Perlack, Oak Ridge National Laboratory
  - Burtraw, Dallas. Palmer, Karen. Resources for the Future;
  - Cooper, Jeff. National Corn Growers Association;
  - Gallagher, Paul. Shapouri, Hosein., USDA;
  - Greene, Nathanael. Mugica, Yurina. Natural Resources Defense Council;
  - Pew Center, Global Climate Change, Regional Initiatives;
  - Western Governor's Association

\*Ralph Overend was working with NREL at the time of the interview, he is now retired

\*\*Zia Haq was working at the Energy Information Administration at the time of the interview

- The Federal Government should establish an even broader-based RFS for the transportation sector, targeting a higher percentage of consumption of biofuels. Incentives should have longer time horizons to attract the long-term capital investments needed for the development of the production and distribution network required to achieve biofuels goals.
- Reduce overall consumption of transportation fuels by measures such as improved automotive efficiency. Increase share of biofuels in overall transportation fuels demand. Diversification of the feedstocks for biofuels including lignocellulosic feedstocks will strengthen continued growth of biofuels. R&D support should be expanded if the \$1.07 per gallon cost target is to be met.
- Federal Fleet Requirement is a gateway policy for more widespread use and creates a base market for renewable fuels. Continued development of the mandate and incentives, not preferences, should be instituted as federal (and local) policies.
- Continued application of environmental programs and regulations such Clean Cities, the CAA, and Regional Environmental Greenhouse Gas agreements will encourage the increased use of biomass for fuels, power, and products.

- DOE should develop incentives to encourage the development of bioproducts using whatever feedstock is most feasible, not restricting itself to cellulosic feedstocks in the short term.
- Broaden the definition of bioproducts and strengthen the federal mandate for purchasing of bioproducts. This could be tailored after the Federal Fleet requirement incentive for biofuels.
- Provide incentives for the production and use of bioproducts analogous to those in place for biofuels. For example, these include tax credits for displaced hydrocarbons such as an incentive of \$0.10/lb of petrochemical feedstock replaced. Provide incentives for the construction of bioproducts infrastructure. This can be accomplished through tax rebates, taxes on non-biobased products, and “green” labeling. There are successful examples of incentives for biofuels such as the VEETC, which provides a \$0.51 per gallon credit, could be adapted to bioproducts.
- Revisit regulatory policies and test methods to assure applicability to biobased products i.e. replace EPA Test Method 24a for VOC emissions with vapor pressure testing as currently being instituted by several states, and revise vegetable oil storage requirements to differentiate from petroleum storage as being done by the US Coast Guard and others.

- Target the development of new biopower capacity so biopower can provide a significant percent share of renewable electric power as part of a Renewable Portfolio Standard (RPS). Specifically, this recommendation could be supported by Feed Laws providing a clear consistent purchase price for renewable energy by power utilities.
- The United States should establish carbon cap-and-trade programs to incentivize adoption of bio-based power. R&D is needed to assure the U.S. has a positive LCA / energy balance for the carbon trading.
- The PTC should include “open loop” biomass in its definition of renewable energy production. This will create the amounts of feedstocks needed to impact energy production in the United States. In addition, biomass tax credits under the PTC should be equal with those of wind and solar. Extend the sunset provisions

- Establish stable funding for bioenergy programs based on the premise that many of the benefits represent public goods which accrue to all Americans.
- Leverage federal research and development (R&D) efforts and improve coordination to realize greater investment in biomass.

- The Committee needs to finalize this document and discuss how it should be used.



**INTERNAL DRAFT**  
**THE BIOMASS R&D INITIATIVE FEDERAL ADVISORY COMMITTEE**  
**POLICY SUBCOMMITTEE**  
**POLICY GAP ANALYSIS**

**FINDINGS & POLICY RECOMMENDATIONS FOR THE BIOMASS SECTOR**

**BIOFUELS: Findings and Recommendations**

1. The Federal Renewable Fuels Standard in EPAct 2005 mandates 7.5 billion gallons per year of renewable fuels production by 2012. Current renewable fuels production is on track to meet this near term goal. Ethanol from corn is in line to meet goals over next few years (estimate: 1 billion gallons per year of sustained growth) although growth of ethanol from corn sugar beyond 15 billion gallons per year targets faces several significant barriers, including agricultural inputs (cost of fuel, fertilizer), scarcity of land (urbanization and the scarcity of arable land), feedstocks (feedstocks other than corn e.g., sugar cane, sugar beet, switchgrass). Moreover, tax incentives with short term sunset clauses do not provide the investment community the level of comfort needed to make long-term investment.

*Recommendation: The Federal Government should establish an even broader-based RFS for the transportation sector, targeting a higher percentage of consumption of biofuels. Moreover, incentives should have longer time horizons to attract the long-term capital investment needed for the development of the production and distribution network required to achieve biofuels goals.*

2. In 2004, ethanol and biodiesel constituted approximately 1.5% and 0.9% of the gasoline and diesel markets respectively. Ethanol has received sustained federal support via the excise tax credit, but only recently have Federal programs begun to support other biofuel options such as biodiesel through the Small Agri-Biodiesel Producer Credit for biodiesel. VEETC is a \$0.51 per gallon tax credit for blenders who blend ethanol with gasoline. It has been one of the most successful biofuels policies to date, although the current market demand for increased oxygenates is in itself adequate to drive growth of ethanol by 1 billion gal per year through 2012.<sup>1</sup> Demand for oxygenates in 2004 was 1.2 percent of total 2.1 billion GGE transportation fuels (gasoline and diesel).

*Recommendation: Continued diversification of biofuels is needed to achieve the Committee's 2030 Vision goals.*

*Diversification of the feedstocks for biofuels to include lignocellulosic feedstocks will strengthen continued growth of biofuels. R&D support should be expanded if the \$1.07 per gallon cost target is to be met.*

**BIOPRODUCTS: Findings and Recommendations**



1. Biobased products have the potential to displace petrochemical products based on petroleum and natural gas, contributing to US energy independence. The Committee has set as a goal that 55,300 million lbs of petroleum-based products could be displaced by biobased products by 2030. Up to XXX GGE could be displaced.
2. In its current form, FB4P provides weak encouragement for federal procurement of biobased products and does little to encourage purchasing of biobased products. The definition of bioproducts is currently very narrow.
3. Outside of FB4P, there are no federal policies to promote biobased products.

*Recommendation 1: Broaden the definition of bioproducts and strengthen the federal mandate for purchasing of bioproducts. This could be tailored after the Federal Fleet requirement incentive for biofuels.*

*Recommendation 2: Provide incentives and/or mandates for the production and use of bioproducts analogous to those in place for biofuels. These might include tax credits for displaced hydrocarbons to similar to credits for biofuels, for example.*

*Recommendation 3: Provide incentives for the construction of bioproducts infrastructure. This can be accomplished through tax rebates, taxes on non-biobased products, “green” labeling, etc. There are successful examples of incentives for biofuels such as the VEETC which provides a \$0.51/gallon credit, which could be adapted to bioproducts. For infrastructure the Commodity Credit Corporation (set to expire late, 2006) provides funding for capital investments to bioproducts producers. The CCC Charter Act, as amended, aids producers through loans, purchases, payments, and other operations, and makes available materials and facilities required in the production and marketing of agricultural commodities. DOE released a biorefinery solicitation to design, construct, build and operate an integrated biorefinery employing lignocellulosic feedstocks for the production of combinations of (i) liquid transportation fuels; (ii) biobased chemicals; (iii) substitutes for petroleum-based feedstocks and products; and (iv) energy in the form of electricity or useful heat.*

## **BIOPOWER: Findings and Recommendations**

1. Electricity Feed Laws and Advanced Renewable Tariffs (ARTs), widely used in Europe, have been successful policy mechanisms for stimulating the rapid development of renewable energy. There are currently eight countries in Europe, and four states in the U.S. which have considered or have introduced programs patterned after Renewable Energy Tariffs.
2. Renewable Portfolio Standards and Green Power Purchasing Programs, implemented at the state level in the U.S., have created markets for renewable energy enabling them to compete with less expensive modes of power production.

*Recommendation: Target the development of new biopower capacity so that biopower can provide a significant percent share of renewable electric power as part of a Renewable Portfolio Standard (RPS). Specifically this recommendation could be supported by Feed Laws providing a clear consistent purchase price for renewable energy by power utilities.*

3. [Regional agreements and partnerships have begun cap-and-trade programs and emissions trading systems. These programs (once they enter into force) will mandate companies to lower greenhouse gas emissions in the electrical power sector, creating incentives for renewable such as biopower production.

*Recommendation: Continued development of regional agreements for greenhouse gas emissions abatement need to occur.*

*There is already an existing commodities and exchange market for carbon credits. As federal legislation catches up with state and local legislation, power companies will be required to reduce greenhouse gasses and other air pollutants.*

4. The Production Tax Credit (PTC) provides 1.9 cents-per- kilowatt-hour (kWh) payment, payable over ten years, to private investors as well as to investor-owned electric utilities for electricity from renewable energy sources including closed-loop biomass facilities. Closed loop biomass refers to any crop specifically grown to produce energy. Currently, power projects using “open-loop” biomass received the PTC at only one half the rate for wind, solar, and geothermal energy projects. The federal distinction between “open loop” and “closed loop” biomass has hampered development of widely available biomass resources, the use of which could contribute significant energy production. In addition, the PTC has a sunset (2008) clause which creates a disincentive for capital investments in biopower.

*Recommendation: The PTC should include “open loop” biomass in its definition of renewable energy production. This will create the amounts of feedstocks needed to impact energy production in the United States.*

<b>Biofuels</b>						
<b>Goals</b>	<b>Status</b>	<b>Gaps</b>	<b>Barriers</b>	<b>Policies</b>	<b>Effectiveness of policy (a)</b>	
<u>Biofuels Consumption</u> 2010: 8 B GGE 2015: 13 B GGE 2020: 23 B GGE 2030: 50 B GGE	<u><b>Biofuels Consumption</b></u> 2004: 2.1 billion GGE renewable fuels consumed in transportation sector. 2005: Ethanol production was 4.3 B gal with 1.7 B gal in planned capacity; 2005: Biodiesel production was 354 million gal with 278 million gal in planned capacity.	Production, distribution, transportation, and storage infrastructure for biofuels is inadequate to meet Vision goals.	Motor gasoline production and distribution infrastructure is mature.	<u>Production</u> - Clean Fuel Tax Deduction - Ethanol and Biodiesel Tax Credit (VEETC) - Small Ethanol Producer Credit - Small Agri-Biodiesel Producer Credit	P E P P	
				<u>Consumption</u> - The Clean Air Act and Federal RFG Required Areas - Federal Fleet Requirements - Federal Renewable Fuels Standards - State & Alternative Fuel Provider Rule	E E N/A	
				<u>Distribution/Infrastructure</u> - Alternative Fuel Infrastructure Tax Credit - Federal CCC Bioenergy Program <sup>ii</sup>	N/A E	
		<u><b>Ethanol Cost</b></u> Ethanol from corn: \$1.10/gal. Ethanol from cellulose: \$2.25/gal;	Significant technical gaps to achieving ethanol from cellulose@ \$1.07/gal by 2012.	Petroleum prices historically have been relatively low resulting in a lack of investment in alternative fuels.		
		<u><b>Feedstock Availability</b></u> (5/2/06) Corn - \$2.11/bushel Soy - \$5.39/bushel	Corn production only sufficient to meet 2015 volume target (13-15 B GGE) without impacting food supply. <sup>iii</sup>	Perception of food vs. fuel and its impact on food prices.		
		<u><b>Consumer Acceptance</b></u>		Consumers must accept biofuels' performance and characteristics. Lack of public knowledge of biofuels.	- Alternative Motor Vehicle Credit - Hybrid Motor Vehicle Credit	E N/A
	<u><b>Market Prices</b></u> (4/06) <sup>iv</sup> Ethanol & Gasoline Component Spot Market Ethanol \$2.72/gal. Gasoline \$2.37/gal. Biodiesel & Diesel component Rack Market Biodiesel \$3.15/gal		Motor gasoline market and infrastructure is mature. Prior to recent surge in oil prices, gasoline and diesel prices were about 15-25% below biofuels.			

	Diesel \$2.28/gal			
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(a): E = effective; P = partially effective; I = ineffective; C = counterproductive

## **Biofuels-related Policy Findings and Recommendations**

### **Findings & Recommendations**

- The Federal Renewable Fuels Standard in EPA Act 2005 mandates 7.5 billion gallons per year of renewable fuels production by 2012. Current renewable fuels production is on track to meet this near term goal. Ethanol from corn is in line to meet goals over next few years (estimate: 1 billion gallons per year of sustained growth) although growth of ethanol from corn sugar beyond 15 billion gallons per year targets faces several significant barriers, including agricultural inputs (cost of fuel, fertilizer), scarcity of land (urbanization and the scarcity of arable land), feedstocks (feedstocks other than corn e.g., sugar cane, sugar beet, switchgrass). Moreover, tax incentives with short term sunset clauses do not provide the investment community the level of comfort needed to make long-term investment.

*Recommendation: The Federal Government should establish an even broader-based RFS for the transportation sector, targeting a higher percentage of consumption of biofuels. Moreover, incentives should have longer time horizons to attract the long-term capital investment needed for the development of the production and distribution network required to achieve biofuels goals.*
- In 2004, ethanol and biodiesel constituted approximately 1.5% and 0.9% of the gasoline and diesel markets respectively. Ethanol has received sustained federal support via the excise tax credit, but only recently have Federal programs begun to support other biofuel options such as biodiesel through the Small Agri-Biodiesel Producer Credit for biodiesel. VEETC is a \$0.51 per gallon tax credit for blenders who blend ethanol with gasoline. It has been one of the most successful biofuels policies to date, although the current market demand for increased oxygenates is in itself adequate to drive growth of ethanol by 1 billion gal per year through 2012.<sup>v</sup> Demand for oxygenates in 2004 was 1.2 percent of total 2.1 billion GGE transportation fuels (gasoline and diesel).

*Recommendation: Continued diversification of biofuels is needed to achieve the Committee's 2030 Vision goals. Diversification of the feedstocks for biofuels to include lignocellulosic feedstocks will strengthen continued growth of biofuels. R&D support should be expanded if the \$1.07 per gallon cost target is to be met.*
- Federal Fleet Requirements are mandates that the federal fleets must meet. These can be through the use of alternative vehicles and/or fuels.

*Recommendation: Federal Fleet Requirements are a gateway policy for more widespread use and creates a base market for renewable fuels. Continued development of mandates, not preferences, must be instituted as federal (and local) policies.*

4. The Clean Air Act Amendments require that reformulated gasoline (RFG) be used in cities with the worst smog pollution to reduce harmful emissions of ozone. As the phase out of MTBE as a fuel oxygenate is near completion, ethanol has become the primary oxygenate additive increasing ethanol consumption and production.

*Recommendation: Continued application of environmental programs and regulations such Clean Cities, the Clean Air Act, and Regional Environmental Greenhouse Gas agreements will encourage the increased use of biomass for fuels, power and products*

<b>Bioproducts</b>						
<b>Goals</b>	<b>Status</b>	<b>Gaps</b>	<b>Barriers</b>	<b>Policies</b>	<b>Effectiveness of policy (a)</b>	
<u>Consumption &amp; Production</u> 2010: 24 B lbs 2015: 26 B lbs 2020: 36 B lbs 2030: 55 B lbs	<u>Consumption &amp; Production</u> 2005: 17.6 B lbs biobased products produced. DOE analysis has identified high opportunity products (sub-tables 1-3a&b).	The cost of sugars from cellulosic feedstocks is currently higher than the cost of sugars from corn grain (starch).  Reducing the cost of processing to convert sugar streams or lignin streams to products.	Cost of incumbent products - Petroleum based chemicals and materials are already widely used by the industry and are relatively inexpensive.	- Federal Biobased Products Preferred Purchasing Program (FB4P)  Creates federal purchasing preferences for specific biobased products. Numbers in () represent percentage of product which must be biobased) <ul style="list-style-type: none"> <li>• Mobile equipment, hydraulic fluids (44%)</li> <li>• Roof Coatings (20%)</li> <li>• Water Tank Coatings (59%)</li> <li>• Diesel Fuel additives (90%)</li> <li>• Penetrating lubricants (68%)</li> <li>• Bedding, bed linens, and towels (12%)</li> </ul>	I	
	<u>Markets</u> Markets for emerging biobased products remain small with little to no purchasing incentive.	Markets for most biomass extractives, for hemicellulose-derived xylose (beyond as a feedstock for production of xylitol), and for lignocellulosic process residues are largely non-existent.				
	<u>R&amp;D</u> DOE analysis has identified high opportunity products (sub-tables 1-3a&b).	Mixed sugars and other intermediates (and new products) that will be produced in a lignocellulose-based biorefinery are still relatively expensive.				

(a): E = effective; P = partially effective; I = ineffective; C = counterproductive

## **Bioproducts-related Policy Findings and Recommendations**

### **Findings & Recommendations**

1. Biobased products have the potential to displace petrochemical products based on petroleum and natural gas, contributing to US energy independence. The Committee has set as a goal that 55,300 million lbs of petroleum-based products could be displaced by biobased products by 2030. Up to XXX GGE could be displaced.
2. In its current form, FB4P provides weak encouragement for federal procurement of biobased products and does little to encourage purchasing of biobased products. The definition of bioproducts is currently very narrow.
3. Outside of FB4P, there are no federal policies to promote biobased products.

*Recommendation 1: Broaden the definition of bioproducts and strengthen the federal mandate for purchasing of bioproducts. This could be tailored after the Federal Fleet requirement incentive for biofuels.*

*Recommendation 2: Provide incentives and/or mandates for the production and use of bioproducts analogous to those in place for biofuels. These might include tax credits for displaced hydrocarbons to similar to credits for biofuels, for example.*

*Recommendation 3: Provide incentives for the construction of bioproducts infrastructure. This can be accomplished through tax rebates, taxes on non-biobased products, “green” labeling, etc. There are successful examples of incentives for biofuels such as the VEETC which provides a \$0.51/gallon credit, which could be adapted to bioproducts. For infrastructure the Commodity Credit Corporation (set to expire late, 2006) provides funding for capital investments to bioproducts producers. The CCC Charter Act, as amended, aids producers through loans, purchases, payments, and other operations, and makes available materials and facilities required in the production and marketing of agricultural commodities. DOE released a biorefinery solicitation to design, construct, build and operate an integrated biorefinery employing lignocellulosic feedstocks for the production of combinations of (i) liquid transportation fuels; (ii) biobased chemicals; (iii) substitutes for petroleum-based feedstocks and products; and (iv) energy in the form of electricity or useful heat.*

<b>Biopower</b>					
<b>Goals</b>	<b>Status</b>	<b>Gaps</b>	<b>Barriers</b>	<b>Policies</b>	<b>Effectiveness of policy (a)</b>
<p><u>Consumption &amp; Production</u>            2010: 3.1 Quads            2015: 3.2 Quads            2020: 3.4 Quads            2030: 3.8 Quads</p>	<p><b><u>Consumption &amp; Production</u></b>            2004: 2.13 Quads (4% share) of renewable power produced by electric utilities and industrial sector.</p> <p>Renewable Portfolio Standards exist in 22 states and promote biopower along with other renewables.</p> <p>\$7.25/MMBtus in 2005 (corresponding to 6.86 cents per kWh of electricity) estimated cost of producing syngas from biomass</p>	<p>Reduce syngas cost to \$5.25 per million Btus (corresponding to 6.18 cents per kWh of electricity) in FY 2011.</p>	<p>Coal is inexpensive and plentiful in the U.S.</p>	<p>Production Tax Credit (PTC)            Feed Laws            Regional Air Quality Agreements            RPSs at state levels            Advanced Renewable Tariffs (ARTs) (Europe)</p>	<p>I            E            N/A            ?            E</p>
	<p><b><u>Infrastructure</u></b></p>	<p>The relatively large scale and large capital costs of thermochemical process facilities, including the cost and payback of systems.</p>	<p>Electrical infrastructure is more conducive to large centralized power production facilities, not distributed power generation which is most characteristic of biomass.</p>	<p>Commodity Credit Corporation (CCC)            The CCC Charter Act, as amended, aids producers through loans, purchases, payments, and other operations, and makes available materials and facilities required in the production and marketing of agricultural commodities. DOE released a biorefinery solicitation to design, construct, build and operate an integrated biorefinery employing lignocellulosic feedstocks for the production of combinations of (i) liquid transportation fuels; (ii) biobased chemicals; (iii) substitutes for petroleum-based feedstocks and products; and (iv) energy in the form of electricity or useful heat.</p>	<p>E</p>



	<b><u>R&amp;D</u></b>	<p>Knowledge of how to effectively integrate thermochemical and biochemical (Sugars) process technology in biorefinery configurations.</p> <p>Thermochemical conversion of biomass to power needs new clean-up technologies and better, more efficient turbines.</p>			
	<b><u>Education</u></b>	Widespread availability of personnel with knowledge of operation and maintenance of thermochemical systems.			

(a): E = effective; P = partially effective; I = ineffective; C = counterproductive

## **Biopower-related Policy Findings and Recommendations**

### **Findings & Recommendations**

1. Electricity Feed Laws or Advanced Renewable Tariffs (ARTs), widely used in Europe, have been noted as successful policy mechanisms for stimulating the rapid development of renewable energy. There are currently eight countries in Europe implementing ARTs. There are four states in the U.S. which have considered or have introduced programs patterned after Renewable Energy Tariffs.

Below is a summary of ARTs most important elements. These are not necessarily common to all countries implementing ARTs.

- Biomass Tariff: \$0.11/kWh, plus \$0.0352/kWh for generation on peak
- Inflation Adjustment: 20% excluding Solar PV
- Term of Contracts: 20 years
- Project Size Limit: 10 MW (10,000 kW)
- Contracts are Open to All
- Simplified Interconnection

- No Cap or Limit on the Program
- Existing Systems Included
- Program Review Every Two Years

2. Renewable Portfolio Standards and Green Power Purchasing Programs have created markets for renewable energy enabling them to compete with less expensive modes of power production.

*Recommendations: Target the development of new biopower capacity, in addition to other renewable energy capacity, so that biopower can provide a significant percent share of renewable electric power as part of a Renewable Portfolio Standard (RPS). Specifically this recommendation could be supported by Feed Laws providing a clear consistent purchase price for renewable energy by power utilities.*

3. Regional agreements and partnerships have begun cap-and-trade programs and emissions trading systems. These programs (once they enter into force) will mandate companies to lower greenhouse gas emissions in the electrical power sector, creating incentives for production of renewable power, including biopower.

Below is a summary of the most important agreements:

- Regional Greenhouse Gas Initiative (RGGI);
- The Conference of New England Governors and Eastern Canadian Premiers (NEG-ECP);
- Western Governor’s Association (WGA);
- Powering the Plains;
- West Coast Governors’ Initiative; and
- Southwest Climate Change Initiative.

*Recommendations: Continued development of regional agreements for greenhouse gas emissions abatement need to occur. There is already an existing commodities and exchange market for carbon credits. As federal legislation catches up with state and local legislation, power companies will be required to reduce greenhouse gasses and other air pollutants.*

4. The Production Tax Credit (PTC) provides 1.9 cents-per- kilowatt-hour (kWh) payment, payable over ten years, to private investors as well as to investor-owned electric utilities for electricity from renewable energy sources including closed-loop biomass facilities. Closed loop biomass refers to any crop specifically grown to produce energy. Currently, power projects using “open-loop” biomass received the PTC at only one half the rate for wind, solar, and geothermal energy projects. The federal distinction between “open loop” and “closed loop” biomass has hampered development of widely available biomass resources, the use of which could have significant environmental benefits. In addition, the PTC has a sunset (2008) clause which creates a disincentive for capital investments in biopower.

5. There is a clear gap in R&D for biopower generation. The cost (per MWh) must decrease.  
*Recommendations: Expand the PTC to include “open loop” biomass in its definition of renewable energy production. This will create the amount of feedstock needed to impact energy production in the United States. Extend the sunset provisions significantly.*
  
6. There is a gap in education of both the public on the advantages of Biopower (or the disadvantages of fossil fuel power) as well as the workforce to utilize biomass feedstocks as sources of power generation.  
*Recommendations: Policies to promote public education of the workforce and public perception need to be developed and implemented.*

## **Parking Lot**

### **Cross-cutting Findings:**

1. For renewable transportation fuels, tax credits and tax exemptions are used to promote the use of renewable fuels, with the goal of displacing petroleum use in the transportation sector. There are four Federal tax subsidies for the production and use of alcohol transportation fuels: (1) a 5.4 cents-per-gallon excise tax exemption, (2) a 54 cents-per-gallon blender's tax credit, (3) a 10-cents-per-gallon small ethanol production tax credit, and (4) the alternative fuels production tax.
2. The biomass sector has suffered from an uncertain regulatory climate and lack of a long-term pricing structure. Many facilities have experienced an extended period of a combination of electricity price uncertainty, fuel availability and pricing, and in some cases, operational issues that have resulted in economic hardship. Power pricing for most facilities after mid-2006 has yet to be determined.
3. There is a need for new policies to modify or create new infrastructure to help reduce transportation costs of biomass. What separates solid biomass most from other renewable energy options is the need to collect, transport, and store feedstock. Biomass, with its low energy density compared to fossil fuels, is relatively expensive to transport, limiting most projects to collection radii of roughly 50 miles. The recent rise in diesel fuel prices (for truck transport of biomass) has had a noticeable impact of biomass power plant viability.
4. The bioenergy industry is fragmented and composed of fuel providers (i.e. farmers, foresters, agricultural processors, and urban operators), fuel producers (i.e., companies that collect, process, and transport biomass residues to end users), and fuel users (i.e., power plant operators, landscape companies, and liquid fuel manufacturers). As a result, each segment of the industry has competing interests and faces differing regulations that make it difficult for the industry to address common issues or speak in a uniform manner on regulatory issues.

### **Cross-cutting Recommendations:**

1. Establish stable funding for bioenergy programs based on the premise that many of the benefits represent public goods that accrue to all Americans.
2. Leverage federal research and development (R&D) efforts and improve coordination to realize greater investment in biomass.
3. Direct the Congressional Appropriations Committees, in conjunction with State collaborations and the U.S. Department of Energy, to fund a select number of demonstration and pilot projects that are designed to prove the commercial readiness of biofuels production technologies that use lignocellulosic feedstocks.
4. Federal agencies should purchase biofuels, bio-based products, and biopower, including combined heat and power where possible, with specific targets for 2010 and 2020. Local governments and public institutions should be encouraged to follow the federal agencies' lead.

5. Direct biomass stakeholders to develop an integrated and coordinated plan to create a favorable regulatory environment for bioenergy development, while maintaining the required oversight of the existing utility, transportation fuel, and waste management industries.
6. The federal government should review and revise statutory definitions that may be preventing the development of environmentally acceptable waste management alternatives known as conversion technologies and to seek amendments to existing law to provide diversion credits to local jurisdictions for solid waste processed by eligible conversion technologies meeting environmental standards.
7. The U.S. Food and Drug Administration (USFDA), U.S. Department of Agriculture (USDA), and the U.S. Forest Service (USFS) should develop a plan to determine how to gain better access to biomass resources and to continue basic and applied research to identify the highest value use for forest fuel and harvest residues. They should coordinate activities with Bureau of Land Management (BLM) to ensure that criteria for watershed protection and water quality are met.

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### Appendix A: Bioproducts targeted for market impact

<b>Table 1: Estimated Production of Biobased Products</b>		
	<b>Million Pounds</b>	
	<b>2002</b>	<b>2004-2005</b>
<b>Organic Acids</b>	208	987
<i>lactic acid</i>	114	600
<i>(Polylactic acid from lactic acid)*</i>	15	280
<i>citric acid</i>	462	387
<b>Ethanol for Industrial Use</b>	<b>1757</b>	<b>1971</b>
<b>Starch</b>	<b>3000</b>	<b>6684</b>
<b>Sorbitol</b>	<b>515</b>	<b>697</b>
<b>Glycerol/Glycerine</b>	<b>410</b>	<b>432</b>
<b>Alkyd resins</b>	<b>550</b>	<b>682</b>
<b>Soy-based Products</b>	<b>654</b>	<b>934</b>
<b>Specialty Oils/Aroma Chemicals*</b>	<b>9</b>	<b>8.9</b>
<i>Spearmint</i>		1.7
<i>Peppermint</i>		7.1
<b>Forest Chemicals*</b>	<b>2826</b>	<b>2740</b>
<i>Crude Sulfate Turpentine</i>		1202
<i>Tall Oil</i>		1094
<i>Pine Rosin</i>		444.6
<b>Cellulose Polymers</b>	<b>2500</b>	<b>2500</b>
<i>Cellulose fibers</i>	360	** NA
<i>Cellulose derivatives</i>	2140	696
<b>TOTAL</b>	<b>12,429</b>	<b>17,635</b>
<b>% Market share</b>	<b>4%</b>	<b>5%</b>

<b>Table 2: Top Value Added Chemicals From Biomass</b>
1,4 succinic, fumaric and malic acids
2,5 furan dicarboxylic acid
3 hydroxy propionic acid
Aspartic acid
Glucaric acid
Glutamic acid
Itaconic acid
Levulinic acid
3-hydroxybutyrolactone
Glycerol
Sorbitol
Xylitol/arabinitol

<b>Table 3a: Low Molecular Weight Lignin Products and Classes Identified in “Top Ten Lignin” Study</b>	
Compound or Class	Product Examples
Simple Aromatics	Biphenyls, styrene, benzene, toluene, xylenes
Quinones	Anthraquinone
Hydroxylated aromatics	Phenol, catechol, propylphenol, eugenol, syringols, aryl ethers, resols/novolaks, alkylated methyl aryl ethers
Aromatic aldehydes	Syringaldehyde, vanillin
Aromatic acids and diacids	terephthalic Acid, vanillic acid
$\beta$ -keto adipic acid, aliphatic acids	New polyesters
Aromatic and aliphatic polyols	Cyclohexane diol
Alkanes	cyclohexane

<b>Table 3b: High Molecular Weight Lignin Products and Classes Identified in “Top Ten Lignin” Study</b>
Carbon fiber; Polymer fillers; Polyelectrolytes ; Thermoset resins; copolymers with furfural; wood; adhesives; wood preservatives



## **Appendix B: Biomass Policy Descriptions**

See attached Excel File: Appendix B - Biomass Policy Descriptions

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<sup>i</sup> Personal communication from Jeff Cooper, NCGA, in April, 2006. Numbers are still being vetted in final report.

<sup>ii</sup> 2006 Farm Bill is being discussed during the summer of 2006 and may include extension of the Commodity Credit Corporation vehicle. This would extend and effective policy for capital investments in biofuels production and sales.

<sup>iii</sup> Personal communication from Jeff Cooper, NCGA, in April, 2006. Numbers are still being vetted in final report.

<sup>iv</sup> *Fuel Ethanol and Biodiesel Report*. May 1, 2006. OPIS.

<sup>v</sup> Personal communication from Jeff Cooper, NCGA, in April, 2006. Numbers are still being vetted in final report.

Policy Title	Topic Area	Potential Applicants	Originating Legislation	Type	Incentive Amount	Effective Date	Description	Assessment of Effectiveness
Clean Fuel Tax Deduction	Purchase of New clean fuel vehicles, cost of retrofitted clean fuel vehicles, costs of storing and dispensing of alternative fuels	Businesses, personal tax payers, fuel dispensers	EPAAct 1992, Working Families Tax Relief Act of 2005, EPAAct 2005 § 1348	Tax Deduction	Varies by vehicle type – see below	Ends December 31, 2005	Purchase of New clean fuel vehicles, cost of retrofitted clean fuel vehicles, costs of storing and dispensing of alternative fuels. Maximum allowable deductions are: Buses with seating capacity of 20+ adults: \$50,000; Truck or van with GVWR of 26,000+ lb: \$50,000; Truck or van with GVWR of 10,000-26,000 lb: \$5,000; All other vehicles (excluding off-road): \$2,000. The tax deduction will phase out at the end of 2005.	
Alternative Motor Vehicle Credit	Purchase of New dedicated alternative fuel vehicles: light-, medium-, & heavy-duty vehicles; fuel cell; hybrid; dedicated natural gas, propane, & hydrogen; light-duty lean burn diesel vehicles	Consumers; vehicle sellers if purchaser is a non-tax-paying entity	EPAAct 2005 § 1341	Tax Credit	50% of incremental cost of vehicle, plus 30% of incremental cost of vehicles with near-zero emissions	January 1, 2006 – December 31, 2010	Purchase of New dedicated alternative fuel vehicles. The tax credit equals 50% of the incremental cost of the vehicle, plus an additional 30% of the incremental cost for vehicles with near-zero emissions (SULEV or Bin 2 for vehicles <14,001 lb GVWR). The following are incremental cost limits for dedicated AFVs: \$5,000: 8,500 GVWR or lighter; \$10,000: 8,501 - 14,000 GVWR; \$25,000: 14,001 - 26,000 GVWR; \$40,000: 26,001 GVWR and heavier. The credit expires December 31, 2010.	
Hybrid Motor Vehicle Credit	Purchase of Hybrid vehicles	Consumers	EPAAct 1992, EPAAct 2005 § 1341	Tax Deduction through December 2006, Tax Credit after December 2006	Varies by year vehicle purchased	December 2006 – December 31, 2010	Clean Fuel Vehicle Property Tax Deduction through 2006: Purchase Year/Maximum Deduction Per Vehicle - 1992-2003/\$2,000; 2004/\$1,500; 2005/\$1,000; 2006/\$500. This tax credit expires December 31, 2010.	
Federal Fleet Requirements	Alternative fuel use in federal fleets	Federal entities with vehicle fleets	EPAAct 1992, EPAAct 2005, Executive Order 13149 (Greening the Government through Federal Fleet and Transportation Efficiency) EPAAct 2005 § 701/703/1831/E.O. 13149	Legislated Requirement	75% of light-duty vehicles in federal fleets must be AFVs & all federal fleets must use alternative fuels in AFVs – or – must receive a waiver from the Secretary of Energy if fuels are not available – or – must choose a petroleum reduction path – and – reduce petroleum use by 20%	No set beginning or end dates	75% of light-duty vehicles in federal fleets must be AFVs & all federal fleets must use alternative fuels in AFVs – or – must receive a waiver from the Secretary of Energy if fuels are not available – or – must choose a petroleum reduction path – and – reduce petroleum use by 20%. No set beginning or end dates.	
State & Alternative Fuel Provider Rule	Alternative fuel use in state fleets; cost of installation of clean-fuel vehicle refueling equipment (includes E85, natural gas, compressed natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, biodiesel [B20 or higher])	State entities with vehicle fleets; fueling station owners/fuel providers	EPAAct 1992, EPAAct 2005 § 703	Legislated Requirement, Tax Credit	75% of new light-duty state fleet vehicles must be AFVs; 90% of light-duty alternative fuel providers fleet vehicles must be AFVs – or – must choose a petroleum reduction path – and – fueling stations are eligible for a 30% credit for the cost of installing clean-fuel vehicle refueling equipment	Present – December 31, 2010	75% of new light-duty state fleet vehicles must be AFVs; 90% of light-duty alternative fuel providers fleet vehicles must be AFVs – or – must choose a petroleum reduction path – and – fueling stations are eligible for a 30% credit for the cost of installing clean-fuel vehicle refueling equipment. Present – December 31, 2010	
Ethanol and Biodiesel Tax Credit (VEETC)	Blending, retailing, and producing alcohol, ethanol, and biodiesel fuels	Blenders, retailers, producers	American Jobs Creation Act of 2004, EPAAct 2005 § 1344	Tax Credit	Varies by fuel and blend	Ethanol: January 2005 – 2010; Biodiesel: January 2005 – December 2008	\$0.51/gallon for ethanol. Expires in 2010 but will most likely be renewed. The credit is given to the blender because corn-to-ethanol is already profitable. The intent is to get more ethanol blended into fuels. Note production costs (excluding capital costs) for ethanol are approximately \$1.10/gal and for conventional gasoline \$1.58/gal in 2005. Sunset for Ethanol January 2005 – 2010; Biodiesel: January 2005 – December 2008	
Small Ethanol Producer Credit	Ethanol production	Small ethanol producers (less than 60 million gallons/year)	EPAAct 2005 § 1347	Tax Credit	\$0.10/gallon up to 15 million gallons annually; capped at \$1.5 million per year per producer	2005	Ethanol production: \$0.10/gallon up to 15 million gallons annually; capped at \$1.5 million per year per producer	This tax credit is too small to effect any substantive volume and isn't included in EIA NEMS model.
Small Agri-Biodiesel Producer Credit	Small agri-biodiesel producers (less than 60 million gallons/year)	EPAAct 2005 § 1345	Tax Credit	\$0.10/gallon up to 15 million gallons	N/A	2005	Biodiesel production: \$0.10/gallon up to 15 million gallons. No sunset date.	N/A
Alternative Fuel Infrastructure Tax Credit	Cost of Alternative Refueling Property: natural gas, propane, hydrogen, E85, biodiesel mixtures above B20	Refueling station owners (business and residential); equipment sellers if refueling business owner is a non-tax-paying entity	EPAAct 1992, Working Families Tax Relief Act of 2004, EPAAct 2005 § 1342	Tax Credit	30% of the cost of alternative refueling property, up to \$30,000 for business, \$1000 for residential	Equipment put into service after December 31, 2005, to expire on December 31, 2009	30% of the cost of alternative refueling property, up to \$30,000 for business \$1000 for residential. Sunset date: January 1, 2006 – December 31, 2010	
Federal Renewable Fuels Standard	Increasing the production of biofuels		EPAAct § 1501	Regulation	N/A	2005	Requires 7.5 million gallons of ethanol produced by 2012.	This requirement based on current production and planned capacity of the ethanol industry, will be met by 2012.
The Clean Air Act and Federal RFG Required Areas	Fuels/Emissions	Cities failing to meet Clean Air Act Standards enforced by EPA	Clean Air Act 1990 § 211	Regulation	N/A	1990	This is a State/Federal issue. EPA designates regions of low air quality and enacts regulations to meet those requirements. The regions then can meet those regulations however they like. Related to this issue - when ethanol is an additive it increases the octane rating and volatility of the fuel; creating high VOC volumes which lower air quality standards.	

## **Attachment D**

# **The Biomass R&D Initiative: A History of Collaboration**

Thomas Binder

Archer Daniels Midland

Biomass R&D Technical Advisory Committee

*Vision and Roadmap* Subcommittee Chairman

- The USDA - DOE Biomass R&D Initiative (BRDI) was established by the Biomass Research and Development Act of 2000 (Biomass Act). The Biomass Act has since been amended by the Energy Policy Act of 2005 (EPAct).
- The Biomass Act:
  - Outlines technical biomass R&D objectives
  - Organizes interagency collaboration, including the Biomass R&D Board (Board)
  - Establishes the Biomass R&D Technical Advisory Committee (Committee), to provide outside expert input on current and future research
  - Requires the Committee to provide input for the Initiative's annual report to Congress
  - Establishes an annual USDA-DOE joint competitive solicitation for biomass R&D projects according to the Biomass Act's technical objectives

The Board is a panel consisting of Senior Level representatives from:



- U.S. Department of Agriculture (**co-chair**)
- Department of Energy (**co-chair**)
- National Science Foundation
- Environmental Protection Agency
- Department of Interior
- Office of Science and Technology Policy
- Office of the Federal Environmental Executive
- Department of Transportation (new)

Other Departments with biomass interests currently in consideration for membership: Defense, Commerce, Treasury

- Under Secretary for Rural Development **Thomas Dorr** is the Initiative point of contact and Board co-chair for the U.S. Department of Agriculture



- Assistant Secretary of Energy Efficiency and Renewable Energy Alexander “**Andy**” **Karsner** is the Initiative point of contact and Board co-chair for the Department of Energy

# Board Membership

- **Dr. Bruce Hamilton**, Director, Biochemical and Biomass Engineering Program, NSF
- **John Bobo**, Administrator, Research and Innovative Technology Administration, DOT
- *In transition*, EPA
- **C. Stephen Allred**, Assistant Secretary, Land and Minerals Management, DOI
- **Dr. Sharon Hays**, Associate Director for Science, OSTP
- **Dana Arnold**, Chief of Staff, OFEE



- The BRDI is a multi-agency effort to coordinate and accelerate *all* Federal biobased fuels and products research and development
- The annual USDA/DOE Joint Solicitation has combined those agencies' available funding to support four years of cutting-edge biomass R&D:

<u>Year</u>	<u>Total Awarded</u>
2002	\$79 million
2003	\$24 million
2004	\$26 million
2005	\$13 million
2006	\$17.5 million

# Federal Biofuels Posture Plan Development

Board representatives have appointed points of contact from their respective agencies to participate in development of the **Federal Biofuels Posture Plan**, including this workshop:

**Doug Faulkner** for Rural Development, USDA

**Neil Rossmeissl** for Energy Efficiency and Renewable Energy, DOE

**Dr. Bruce Hamilton** for the National Science Foundation

**William Chernicoff** for the Department of Transportation

**Mike Catanzaro** for the Environmental Protection Agency

**Peter Teensma** for the Department of the Interior

**Kevin Hurst** for the Office of Science Technology and Policy

**Dana Arnold** for the Office of the Federal Environmental Executive

*Points of contact not currently on the Board*

**William Bolten** for the Department of Defense

**Stefan Osborne** for the Department of Commerce

- The Biomass Act established an external advisory panel consisting of 30 representatives and experts from industry, academia, non-profits, and state and tribal government.
- The Committee operates under Board oversight. They collaborate to provide research and policy recommendations to Congress and the public through annual reports, public meetings, formal statements, and analytical goal-setting publications such as the *Vision and Roadmap*.

- The *Vision for Bioenergy and Biobased Products in the United States* was created by the Committee in 2002
- It established far-reaching goals to increase the role of biobased energy and products in our nation's economy
- EPA Act required that the *Vision & Roadmap* be updated to reflect the current bioenergy environment
- *Roadmap* Regional Workshops have been completed.
- Final *Roadmap* update will be in 2007
- *Vision* update is complete

# Updated *Vision* Goals

- The updated *Vision* does not change the original 2010 goals but recognizes that in some cases the U.S. is not on track to meet them.
- The *Vision* makes minor changes to its 2020 and 2030 goals and establishes 2015 goals which describe the types of activities that must occur to reach that goal and move down the path to the aggressive targets for 2020 and 2030.

	Units	2000	2004	2010	2015	2020	2030
<b>Biofuels</b>	Market share (%)	0.7	1.2	4.0	6.0	10.0	20.0
	Consumption (billion gasoline-equivalent gallons)	1.1	2.1	8.0	12.9	22.7	51.0
<b>Biopower</b>	Market share (%)	3.0	3.0	4.0	5.5	7.0	7.0
	Consumption (Quadrillion Btu)	2.0	2.1	3.1	3.2	3.4	3.8
<b>Bioproducts</b>	Production (billion lbs)	12.8	17.6	23.7	26.4	35.6	55.3

- Thomas Ewing, Committee Chairman

## **Attachment E**

**Statement by Ronald F. Cascone of Nexant, Inc. to  
the Joint Public Meeting of the  
Biomass Research and Development Technical Advisory Committee and the  
Interagency Biomass Research and Development Board**

L'Enfant Plaza Hotel  
Washington, DC 20024  
November 28-29, 2006

Ladies and Gentlemen:

Nexant appreciates the opportunity to contribute our thoughts to this deliberation. Nexant is a global energy and chemical industry consultancy, which is a spin off from Bechtel of several groups expert in energy technology, planning and related areas. Nexant grew since 2001 by acquisition of other consultancies, including mine, the former Chem Systems group. My practice area, Oil and Gas, has been increasingly involved in advising major players in biofuels, most recently by completing a global multiclient study entitled, "Liquid Biofuels: Substituting for Petroleum", with subscribers on four continents. This study focuses on current, emerging and potential future technologies to produce biogasoline and biodiesel, considering all of the key elements of the value chain, including agricultural, logistics, and processing, and emphasizing techno-economic modeling. It details development trends around the world and analyzes key policy drivers, including rural development, energy independence, and reduced carbon footprint.

Relevant to this deliberation, Nexant concludes in this study that fatty acid methyl ester biodiesel is a transition technology, which will be capable of substituting for only a small fraction of global diesel demand, but this biodegradable, low toxicity product will likely hold market share far into the future. Bioethanol from grains and sugar, though an excellent high octane gasoline blendstock, has many practical problems and is also likely transitional for the long term. We agree with many others that the next phase of development is likely to be ethanol made by fermentation of sugars made by hydrolysis of biomass. We also conclude that, perhaps sooner than some others believe, integrated thermochemical platforms will take the lead in producing both gasoline and diesel range biofuels, probably together with electric power and chemicals. This alternative should be and probably will be pursued contemporaneously with developing biomass based ethanol. We also believe that ethanol will eventually need to be dehydrated to hydrocarbon gasoline fractions. In doing all of this, society will make trade-offs between renewable, sustainable biofuels that are biodegradable, with low toxicity, but are limited in their supply potential, against others that are not as biodegradable or are more noxious, but are more attractive in other ways.

While crop biotechnology may provide a more productive, varied, and stable feedstock platform for a biofuels industry, the potential for early conflict with food is probably underestimated. Though the role of byproducts such as DDGS, and possibly biodiesel glycerine, in balancing animal nutrition supplies is conversely underrated or even missed by many analysts, the markets' mere perception of competition with biofuels for sugar



and grains in the food and feed sectors seems to be enough to cause dislocations. We already see evidence of this in markedly higher prices in late 2006 for U.S. corn, Brazilian sugarcane, and European rapeseed, the primary biofuel feedstock in each venue.

Nexant projects that a highly attractive, “model of least resistance” for developing the global biofuels industry would have the following elements:

- For the current sugar platform, continued genetic improvement of commodity starch, sugar and oilseed crops, but also including others like palm, cassava and sorghum that have received less attention because of limited interest in North America and Europe
- For fermentation or thermochemical routes, highly productive biomass feedstocks appropriate to diverse climates and conditions, including switchgrass, energy cane, willow, and alternative oilseeds such as jatropha and Chinese tallow tree, developed largely by genetic modification
- Agronomic technical and business models appropriate to optimizing practical sourcing and sustainability of these feedstocks, including strategies for conserving and recovering potassium and phosphorous nutrients, which unlike nitrogen, are conventionally obtained from limited fossil resources
- Fermenting sugars from biomass by a “once-through” approach, which would optimize, rather than maximize, conversion of C5 sugars, and burn or gasify the residues, along with lignin, for heat and power
- Converting ethanol by catalytic dehydration to butanol, olefins, or hydrocarbon gasoline fractions
- Biomass gasification-based integrated facilities, based on learning from current experience and developments in gasification of coal and petroleum residuals
- Preparing biomass in the field by low-oxygen pyrolysis (called torrefaction) that results in friable, granular, energy-enhanced dry solids and pyrolysis oils, for easier handling, shipment, storage, and feeding and more efficient, less expensive, higher yield gasification
- From syngas, producing biogasoline of any of a number of types, including ethanol, higher alcohols, and hydrocarbons, by various routes, including fermentation of carbon monoxide to make ethanol with a hydrogen co-product, while also co-producing biodiesel, typically, by Fischer-Tropsch routes
- Co-producing power, heat, and chemicals from syngas

We believe that for the interim strategy of fermenting sugars from biomass, too much attention has been lavished on enzymatic depolymerization of cellulose and hemicellulose, at the expense of solvent lignocellulosic deconstruction (as being developed in Brazil), and thermal utilization of fermentation complex residues. For the thermochemical platform of the future, torrefaction, gasification, and system optimization need more attention.

Thank you for your attention. If you have any comments or questions, I can be reached at [rcascone@nexant.com](mailto:rcascone@nexant.com).

## **Attachment F**

**DEPARTMENT OF ENERGY BIOMASS ANALYSIS  
DOCUMENTS:  
REVIEWER COMMENTS**

**PREPARED FOR: THE BIOMASS R&D INITIATIVE  
TECHNICAL ADVISORY COMMITTEE'S ANALYSIS  
SUBCOMMITTEE**

**PREPARED BY: ANALYSIS SUBCOMMITTEE CHAIRMAN RALPH  
CAVALIERI, OF WASHINGTON STATE UNIVERSITY, IN  
COLLABORATION WITH BCS, INCORPORATED**

**November 27, 2006**

Analysis subcommittee members have volunteered 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. During the latter half of 2006 the subcommittee reviewed several biomass analysis project documents from the Departments of Agriculture and Energy. This report contains comments on each document. Reviewers considered both the details and the overall sense of documents, both to gain insight for future subcommittee focus, and to provide direct independent feedback to the authors.

Subcommittee members for November 2005 – November 2006 were:

Ralph Cavalieri – Chairman

Doug Hawkins

John Hickman

Charles Kinoshita

Eric Larson

Del Raymond

Edwin White

The documents reviewed by the subcommittee include a selected mix of documents, covering various biomass topics from the past few years that are considered to be “foundational” documents upon which policies and priorities have been developed. The committee was asked to provide a high level assessment of the documents and its members decided to focus their comments on: (1) each document’s key assumptions; (2) the analysis methods used; (3) the data quality, and (4) the quality of independent reviews prior to publication.

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.

The details of the subcommittee’s reviews follow.. Some of the reviews produced suggestions for improvement of the documents and/or a list of suggested future analysis topics.

The subcommittee’s next steps will be to summarize the comments from the first set of documents as a report to the Biomass Technical Advisory Committee, to review our procedures, and to select the next set of documents to review.

The topic, titles, authoring organization, and summary comment page are as follows:

<b>Topic</b>	<b>Author</b>	<b>Page</b>
<b>Thermochemical Conversion</b>		
<i>The Potential of Thermochemical Ethanol via Mixed Alcohols Production</i>	National Renewable Energy Laboratory (NREL)	3
<i>Preliminary Screening- Technical and Economic Assessment of Synthesis Gas to Fuels and Chemicals with Emphasis on the Potential for Biomass-Derived Syngas</i>	NREL	4
<b>Biochemical Conversion</b>		
<i>Lignocellulosic Biomass to Ethanol Process Design and Economics Utilizing Co-Current Dilute Acid Prehydrolysis and Enzymatic Hydrolysis for Corn Stover</i>	NREL	4
<i>Updated: Development of Two Process Assessment Cases: 2003 State of Technology and 2002 Experimental Parameters</i>	NREL	4
<b>Feedstocks</b>		
<i>Development of a Multi-Criteria Assessment Model for Ranking Biomass (corn stover) Collection and Transportation Systems</i>	Oak Ridge National Laboratory (ORNL)	4
<i>Costs of Wet Corn Stover Harvest, Large-Pile Storage, and Transport</i>	ORNL	5

***The Potential of Thermochemical Ethanol via Mixed Alcohols Production***

- The analysis performed justifies the conclusions.
- The report is very useful.
- Basic assumptions could use further examination.
- Ethanol yield data in this NREL report corroborates that in the other NREL Thermochemical Analysis document reviewed.
- Authors discuss improving economics of thermochemical ethanol conversion via one specific gasification technology (the tar reformer), without justification for choosing that technology. Fixing on one technology without discussing the implications inherent in other options may impair the overall conclusion’s validity.
- A sensitivity analysis would help highlight factors (other than the tar cracker performance) that should be the focus of further development efforts.
- Cost results are more positive than in previous studies. Are the reasons for this improvement well understood?
- In the future, analysis should be conducted for gasification-based conversion including carbon capture and storage. Synergies with fossil fuel efforts should be pursued.

***Preliminary Screening – Technical and Economic Assessment of Synthesis Gas to Fuels and Chemicals with Emphasis on the Potential for Biomass-Derived Syngas***

- How is DOE using the results from this study?
- Final cost comparison shows ethanol via syngas fermentation to be the most promising (leaving aside H<sub>2</sub> and MeOH), and mixed alcohols least promising, but says that uncertainties are high. NREL subsequently chose to pursue further analysis of mixed alcohols, but not ethanol from syngas fermentation. Why?
- Having summary descriptions of syngas to fuels/chemicals technologies and costs in one document is very useful, though they are not very detailed.
- The report should include more emphasis on biomass-based fuels from thermochemical conversions, to provide better cost estimate data to DOE.
- The report provides a literature review of data from four or more years ago. Technology advancements since then should be included in updated analysis.

***Lignocellulosic Biomass to Ethanol Process Design and Economics Utilizing Co-Current Dilute Acid Prehydrolysis and Enzymatic Hydrolysis for Corn Stover***

- Techniques used are sound and are based, to the extent possible, on reasonable data and models.
- In many cases, research has not been done, and equipment has not been produced and evaluated – one can expect a high degree of error in such numbers.
- Analysts were given a cost per gallon and asked to provide data to achieve that goal. It would be preferable to build a case from the ground up, providing a financially acceptable selling price given more reasonable assumptions in process parameters.
- Process parameter assumptions were overly optimistic.

***Updated: Development of Two Process Assessment Cases: 2003 State of Technology and 2002 Experimental Parameters***

- Reviewers found the document extremely difficult to read and felt it should have been given in conjunction with the original 2002 Design Study, which was often referred to.
- The original Design Study case provided a cost estimate for ethanol which was lower than in the Update. It was difficult to understand the difference between the assumptions in both, and therefore the validity of this analysis.

***Development of a Multicriteria Assessment Model for Ranking Biomass feedstock Collection and Transport Systems***

- Conclusions are highly dependent on criteria weighting factors, which were presented without justification.
- The quantitative models used for decision making in harvesting and transportation would be useful to industry.
- Some definitions were difficult to understand.
- The analysis assumes the refinery will cover biomass collection and transportation costs. Previous experience with hay crops and bagasse provide reasonable conclusions in this report.

### *Costs of Harvesting, Storing and Transporting Corn Stover in a Wet Form*

- Conclusions are valid, though the data is a bit dated.
- Odor problems, lack of available equipment, updated cost/price data, and scale of operations should be considered in practical application of the data generated in this analysis.

## Appendix: Full Review Texts

### *The Potential of Thermochemical Ethanol via Mixed Alcohols Production*

#### Assumptions

##### Reviewer 1:

- Probably should take closer look at assumptions dealing with high-sensitivity factors:
  - Feedstock cost \$30/ton is questionable for large quantities of biomass (particularly from dedicated feedstock supplies).
  - Price of natural gas (\$5.28/MMBTU) fits into present-day spot price (7/14/06).
  - Check price for/revenue from electricity (\$0.0474/kWh) and assumption that sale and purchase price are same.
- Need to review markets and sensitivity of markets to projected amounts of higher alcohols produced (will quantities anticipated saturate existing markets?).

##### Reviewer 2:

- The reason for the choice of gasification technology (indirectly-heated BCL gasifier) is not adequately justified. There are several fundamentally different designs that could have been considered [e.g., pressurized fluidized-bed with partial-oxidation (with air or with O<sub>2</sub>), staged (e.g., Choren-type design)], but evidently they were not. An objective of this type of analysis should be to determine the most promising technology path to competitive mixed alcohols from biomass. By fixing the gasification technology without examining alternatives, it is not obvious that the best approach has been chosen for detailed analysis.
- The reason for choosing to configure processes to maximize alcohol production is not adequately justified. Clearly, it is important that alcohol be a major product, but the economics of alcohol as a major product might be improved considerably if co-product electricity were produced. The authors note (p. 16) that the idea of co-producing electricity should be examined, especially if alcohols production is being considered in the context of an integrated biochemical/thermochemical refinery model.
- The authors extensively review the state of knowledge regarding mixed alcohol synthesis catalysts. They indicate that there is considerable literature available describing behavior of catalysts with different H<sub>2</sub>/CO syngases, but they (correctly) conclude that there are little data available describing impact of recycling unconverted syngas to synthesis reactors and impact of other syngas components (e.g., CH<sub>4</sub>). These latter factors are critical issues for the type of process design the authors envision. The authors acknowledge (p. 13) that under these conditions, a kinetic model of the synthesis reaction system is needed to get the most reliable performance predictions, and that kinetic models have been reported in the literature that could be adopted. However, the authors take a much-simplified approach, citing the complexity of the kinetic models and time constraints facing their project. The simplified approach appears to mix and match different parameter values from different literature sources, effectively determining the synthesis yield independent of actual syngas parameters. Based on kinetic modeling of mixed alcohols synthesis that I am currently involved with, the authors' results appear optimistic compared to catalyst kinetic performance that has been publicly reported. On the other hand, there are several start-up companies in the U.S. working to commercialize technology for mixed alcohol synthesis from syngas, and most of these claim catalyst performance exceeding that predicted by the NREL analysis. (Public data are not available to substantiate these claims.)



- Total project investment cost is assumed to be 3.7 times total estimated purchased equipment cost. This may be a rather conservative (high) multiplier, but is evidently consistent with values used in other NREL studies.
- In the discounted cash flow rate of return analysis, higher alcohols are assumed to be sold as chemicals at prevailing market prices, and a resulting minimum selling price for the ethanol component is calculated. Are chemicals markets large enough to absorb all of the higher alcohols output from a vibrant biorefinery-ethanol industry in the future? I suspect not. If so, the authors should also calculate the price for the alcohols when sold as a mixture for fuel. This would bracket a range for minimum selling price.

### Methodologies

Reviewer 1:

- Yes, a suitable and adequate methodology was followed.

Reviewer 2:

- Using Aspen Plus for process design and mass/energy balance simulation is a good approach.
- The approach of calculating a “current” and “goal” case is a reasonable one for helping to show the potential impacts of successful R&D.
- The capital cost estimation approach is sound.
- The discounted cash flow rate of return analysis is a reasonable approach, though I might quibble with the choice of 10% IRR (a little on the low side) and 100% equity (high).
- The economic sensitivity analysis results are shown only for variations of “current” case parameters. Given the large difference in economic result between the baseline “current” and “goal” cases, it would be of greater interest to see the sensitivity analysis for the goal case.

### Data quality

Reviewer 1:

- Most of data seem to be best available at the time (although, some of the references are quite old).
- Some experts (e.g., catalyst companies) were consulted.

Reviewer 2:

- Except for process components for which literature data area lacking (synthesis, as noted above), the authors appear to have access to good technical data.
- The cost database used to develop capital cost estimates seems sound.

### Conclusions

Reviewer 1:

- Generally, “yes,” the analysis performed justifies the conclusions.
- Interestingly, yield for ethanol via mixed alcohol is reported to be 30% versus 18-30% for mixed alcohol production (in other, “Preliminary Screening...” NREL report); it would seem that yield for single alcohol (with byproduct alcohols sold separately and presumably not included in yield) would be lower than yield of entire suite of alcohols. Cost for ethanol is reported to be \$1.19-1.85/gal. This compares with \$2.40-2.80/gal for mixed alcohols in other NREL report.

Reviewer 2:

- The authors conclude that improving the tar reformer has the most significant impact on improving economics from “current” to “goal” case. This emphasizes the importance of the

assumption to limit (without apparent justification) the analysis to a gasification technology based on the BCL design. Another gasification approach, which may not require a tar reformer at all, may give a very different result.

- The sensitivity analysis, if applied to the goal case, would help highlight factors (other than the tar cracker performance) that should be the focus of further development efforts.
- The authors correctly indicate that better data (through more research) are needed regarding mixed alcohol synthesis performance.

#### Review prior to publication

Reviewer 1:

- Review was performed in-house (oddly, one reviewer was an author – not a good practice).
- Suggest that experts in areas relating to high-sensitivity factors be asked to review the report.

Reviewer 2:

- The cover sheet indicates who the reviewers of the report were. This is a good practice. The two reviewers were Rich Bain and Pam Spath. Both are NREL staff, and one (Spath) is an author of the report. Reviewers should be independent to ensure that review comments cannot be perceived as biased and also to bring new perspectives to the work. An author is not an independent reviewer. It is reasonable that another staff member not directly involved in the work (Bain) reviews the work, but there should also be at least one, and preferably two, additional reviewers from outside NREL/DOE. These reviewers should have acknowledged expertise in relevant areas. They could be anonymous reviewers if they so wished to be. They should be expected to provide detailed comments and suggestions, and they should be offered honoraria to help offset the time they are expected to commit to the review (1-2 days for this type of report).

#### Other

Reviewer 1:

- The report is very useful.
- The items listed under the basic assumptions might be examined further. The NREL report lists several areas needing additional work (perhaps detailed kinetics need not be incorporated, but additional work should be done to determine whether ASPEN's RSTOIC model is appropriate).

Reviewer 2:

- The cost results in this study are very much more positive than those of the preliminary screening study (Spath and Dayton). Are the reasons for this improvement well understood?
- In future, analysis and activities relating to gasification-based biomass conversion should include carbon capture/storage, since this will be an increasingly important technology option. Linkages/synergies with fossil fuel related efforts should also be sought.

## ***Preliminary Screening – Technical and Economic Assessment of Synthesis Gas to Fuels and Chemicals with Emphasis on the Potential for Biomass-Derived Syngas***

### Assumptions

Reviewer 1:

- Have the FTL cost calculations taken into account the latest developments with cost reduction for small (2000 bbl/day) modular FT synthesis units (BP, Syntroleum)?

Reviewer 2:

- Feedstock cost \$30/ton probably is not valid for large quantities of biomass (certainly not from dedicated feedstock supplies).
- Life cycle analysis projects energy output/fossil energy input >10 for most biofuels. Did life cycle analysis adequately include fossil energy required for feedstock production?

Reviewer 3:

- Much of the economic comparison in the body of the report is referenced to natural gas at \$1/MMBtu. With today's prices and beliefs about the future perhaps the comparisons should be to a very different base.
- The economics appear to assume that chemical byproducts can be sold at 2002 -2003 commodity prices. This builds in the assumption that wide scale implementation of some of these technologies will not saturate these markets. This will not likely always be the case.
- The assumptions on raw material cost and electricity cost and value should be looked at carefully and vetted to a broad audience of knowledgeable people since these assumptions are key to sustainable economics.
- It would be good to have a section that lists all of the assumptions in the report in one place and the logic for the assumptions.

### Methodologies

Reviewer 1:

- This is primarily a literature review. It is an excellent literature review.
- Nice effort (Section 10) to compare performance and economics of different products from biomass (albeit a preliminary comparison).

Reviewer 2:

- Yes, a suitable and adequate methodology was followed.

Reviewer 3:

- The methodology was largely well conceived.
- It might be more useful to look at sensitivities around a different base case given the changes since the report was written.

### Data Quality

Reviewer 1:

- Many of the literature sources cited are good data sources.

Reviewer 2:

- Most of data seem to be best available.

### Conclusions

Reviewer 1:

- Authors indicate that the “best products to pursue are hydrogen and methanol”. It is unclear what this means, especially given that there is currently no fuel market for either of these.
- Authors note the potential benefits of scale economies to improved economics of biomass-to-fuels. They suggest co-feeding of biomass with fossil fuel may be one way to expand renewables share in the market (similar to the way co-firing with coal for power generation is being practiced). This is an excellent suggestion. What follow-up at DOE?
- Authors conclude that there is a wide cost range expected for some fuels from biomass (e.g., FTL in Fig. 15). Identifying the most promising process designs for lowest cost would seem to be an important follow-on task.

Reviewer 2:

- Generally, “yes,” the analysis performed justifies the conclusions.
- Note that biomass to MeOH scenario projects efficiencies of 29-65%, whereas NREL’s EtOH/mixed alcohol study (“... Thermochemical Ethanol Via Mixed Alcohols...” report) projects efficiency of only ~30% for EtOH production.

Reviewer 3:

- Most of the conclusions are logical to me based on information contained and the assumptions and economic data used. However, I would recommend an update using today’s known facts, assumptions and projections about future markets and costs. This could change several conclusions.
- The exception for me is Hydrogen as stated above.

#### Review Prior to Publication

Reviewer 1:

- No indication is given as to whether the report was reviewed internally or externally prior to publication.

Reviewer 2:

- Unknown (none shown on electronic document provided to reviewers).

Reviewer 3:

- Unable to determine.

#### Other

Reviewer 1:

- How is DOE using the results from this study?
- Final cost comparison (Fig. 15) shows ethanol via syngas fermentation to be the most promising (leaving aside H<sub>2</sub> and MeOH), and mixed alcohols the least promising, but also says the uncertainties are largest in these results. NREL subsequently chose to pursue further analysis of mixed alcohols, but not ethanol from syngas fermentation. Why these choices?

Reviewer 2:

- The report is very useful. Having the descriptions of the different syngas to fuels/chemicals technologies and costs in a single document is very good. The descriptions are not very detailed (almost textbook-like) but are, nevertheless, very useful summaries. Of greatest interest is how to convert biomass into a syngas that can then be converted to fuels/chemicals. The section dealing specifically with biomass, while the most important section, was given less attention than warranted.
- The report should be updated with greater emphasis on the last section that deals with biomass-based fuels. Though the cost of producing certain biofuels seems quite competitive,

it does not appear that USDOE is interested in the thermochemical conversion route. Some effort should be made to bring cost estimates to consistent, current values.

- Reviewer 3:
- The report appears to be more of a literature review than a screening and as such I believe it has significant value.
- In the 4+ years since the data used on the report was derived much has happened both in the advancement of key technologies (eg biomass gasification and FT synthesis technologies and in the prices of natural gas and petroleum).
- In this same time frame other studies and roadmaps have been or are about to be published that should be considered, (eg the Forest Products Industry – Agenda 2020 biorefinery roadmap and the Larsen led study of fuels and chemicals from biomass).
- I found the Hydrogen analysis confusing – in many places the report reiterates that hydrogen production comes out looking the best. However, according to the report 92% of current hydrogen production is used at the production site and the 8% that is merchandised can cost as much as \$45/GJ. There are no viable solutions that I have read about for large scale transportation, storage, distribution and even use directly in vehicles.
- DME is mentioned but not dealt with in detail. Given current developments in Europe and Scandinavia DME may need a more thorough look.
- MEOH is presented as looking very interesting. However, I have been told by some of the oil companies that it is a nonstarter in the US as a fuel due to its toxicity. Yet the report states that it is less toxic than gasoline. If it is as good as presented perhaps policy makers should take a new look.
- I applaud the attempt in Section 10 to make economic and life cycle analysis on an equivalent basis – given the points above I would recommend this be updated.
- I particularly liked section 10.4, “Petroleum Product Replacement” - given a major goal of the Administration is to reduce petroleum inputs this kind of analysis is key and not often done well.
- Section 5 on Ethanol from syngas and section 6 on mixed alcohols appear weak and not up to the standard of the rest of the report.

## *Lignocellulosic Biomass to Ethanol Process Design and Economics Utilizing Co-Current Dilute Acid Prehydrolysis and Enzymatic Hydrolysis for Corn Stover*

### Overview:

- This report provides details into the process and economics for the conversion of baled dried corn stover to ethanol via a process of pretreatment followed by a combined enzymatic treatment and fermentation to ethanol. Numerous assumptions are made, many of which hinge on other studies performed by ORNL, NREL, or other DOE laboratories and contractors. The overall conclusion is that it is possible to produce ethanol at \$1.07/gal via this process.

### Assumptions:

- Feedstock issues:
  - Removal of 2 MT/acre of corn stover is sustainable. I am not sure if this has been demonstrated and validated. It may also not be generally true in all areas.
  - When considering the area around the plant from which corn stover would be collected, they assume that 75% of the land is farm land with the remaining area used for infrastructure, commerce, housing, etc. There are certainly areas where this assumption is valid, others where it would not be valid. Perhaps some combination of this assumption with other work on the total biomass feedstock availability would help to keep in perspective the number of areas in which this assumption would be valid.
  - Stover collection and transportation. The overall assumption is that stover can be delivered for \$30/ton. Other studies indicate much higher levels – closer to \$55/ton. This assumption and the cost of feedstock has a huge impact on the cost of ethanol – about \$0.20/gal of ethanol if the stover cost is \$50 instead of \$30/ton. It is not clear to me that farmers will act to collect the stover for a potential \$20/acre profit on the sale of the stover. Based on the references quoted, I believe that the \$30/ton figure is too low.
  - Stover handling – the report assumes forklifts will be used to unload bales from trucks. With the huge volume of stover to be moved, it is probably more economical to contemplate an overhead crane system for moving this material – lifting multiple bales and depositing on conveyors for processing.
  - The storage area for bales of stover. Because the corn stover is harvested at one time in the year, an entire year's worth of stover must be collected and stored. The estimated space for this is 400-500 acres. From what I could tell, this report assumes that this material will be stored on the farms for most of the time, with only a smaller amount of stover being stored at the plant site. There is no provision for storage cost, nor do I see a provision for purchase and maintenance of the 400-500 acre storage facility.
  - There are studies underway to investigate the bulk, rather than baled, storage and handling of stover. This appears to make more sense – allows wet stover to be collected during the one pass harvest, moving of bulk material avoids costs of baling and of unbaling. This would make the material moving look more like movement of coal – bulk trains/trucks, moving by bulldozer and conveyor belt. I would like to see an analysis of the impact this change would have in the overall process cost.

- Plant/engineering assumptions and issues.
  - Saccarification is proposed to be done in 1 million gallon fermentation vessels. To my knowledge these do not exist in the industry today. Perhaps a 200,000 gal fermentor would be more reasonable?
  - This process uses lots of water and is done hot. This implies a lot of heat energy applied to the process.
  - Scale issues. Some of the experiments on which this work is based have only been done in shake-flask in the laboratory. There may be a high degree of uncertainty in the scale up of these small experiments to the industrial scale. How accurate is it to make assumptions from the 800 mL scale up to the 950,000 gallon scale?
  - Steam turbine efficiency seems low (15%). Is this a realistic efficiency for a biomass combustor and steam turbine?
  - Capital cost breakdown shows that a large amount of capital is required for the boiler/turbo (\$38.3 MM out of a total \$113.7 MM). This raises the issue of the advantage that might be gained by co-location with a coal fired plant that would be able to take the lignin as a co-firing feed.
  - The feedstock handling systems are highly speculative as they have not been developed and demonstrated at this scale. There is thus a high degree of uncertainty in the cost of these components which represent about \$34 MM of the \$113.7 MM direct equipment costs).
- Process assumptions and issues.
  - Assumption is that cellulose enzymes will be available for purchase at a cost of \$0.10/gal of ethanol. These costs have come down as a result of research, perhaps this is attainable.
  - Waste production is substantial. This plant will produce 7.2 MT/hr of gypsum. That is a big pile of gypsum for disposal – perhaps working on finding an alternative process or a viable use for the gypsum would be useful?
  - Carbon dioxide. There is no mention of capture of the CO<sub>2</sub> produced in the fermentation. Is this not a normal practice, to capture and sell the CO<sub>2</sub> for carbonation?
- Cost and Energy Balance
  - Energy Balance is highly confusing in terms of assumptions made for various materials. This would be an interesting area for discussion with the authors. They made choices with regard to heating values, which materials to consider as having no heat energy, etc. that were difficult to follow or rationalize. The bottom line of the energy balance was that ethanol energy content is large (174 out of 346 MM Kcal/hr output). The electricity sold is very small at only 16 MM Kcal/hr while the cooling tower and exhaust have large amounts of energy (79 and 54 MM Kcal/hr respectively).
  - Cost and sensitivity analysis – good use of MonteCarlo and sensitivity analysis. Demonstrates the importance of feedstock price, the electricity credit for sale to the grid, and the need to have low cost, efficient enzymes.

#### Data Quality and Conclusions

- The techniques used are sound and are based, to the extent possible, on reasonable data and models. In many key cases, the research has not been done and equipment has not been produced and evaluated – thus one can expect a high degree of error in such numbers. The one difficulty I have with the process used is that the authors chose (or were asked) to fix the price of ethanol at \$1.07/gal and to figure out how one could obtain those economics. I

would have preferred an approach in which they built the case from the ground up to determine the selling price for ethanol that could be financially acceptable given reasonable assumptions in the process parameters.

- I believe the assumptions made were overly optimistic. It is likely that the corn stover feedstock will cost more than \$30/ton. The logistical challenge of collection, storage and handling of the corn stover presents a very large challenge that was not covered in this report.
- Overall, based on the sensitivity analysis, I think it is more likely that the cost of ethanol from a corn stover plant would be substantially higher than the \$1.07/gal figure. A more realistic cost might be \$1.20-1.25/gal (based on the assumptions used by the authors for this report – which, on their own are probably overly optimistic).

#### Methodology:

- A reasonable methodology was followed, similar to industry standards – data were used for most of the assumptions. There are questions about the ability to scale that lab data to plant scale and there are many unknowns that must be addressed by further research. The authors point out each of these in the course of the report. The authors made good use of consultants and engineering firms in the industry to develop process flows models, estimate costs for equipment and installation. All of these are sound practices. The use of Monte Carlo technique to determine likely cost of ethanol based on variability of major inputs was sound.
- One would always like to have more and better data – representative from various regions of the country, stover from different seed lines, from different growing conditions, pilot scale data for plant design, etc. In the absence of this information, the authors did a good job of making estimates of each of these areas and the impacts they would have on the process and economics.

#### Internal Review Process:

- I could not tell what kind of internal review of this document had been done, so I cannot really comment on the process.



***Updated: Development of Two Process Assessment Cases: 2003 State of Technology and 2002 Experimental Parameters***

Overview:

- This report provides information related to experimental programs at NREL related to several key process areas proposed for the conversion of lignocellulosics to ethanol.
- The report is difficult to read. It uses terminology such as “2002 design case”, “SOT 2003 case” and “2002 Experimental case” that can be confusing to read. It took me a few readings to finally begin to understand what this document was saying and what to do with the data and analysis.

Conclusions:

- The conclusions from this report are a bit scary for cellulosic ethanol. Instead of a selling price of \$1.09/gal for cellulosic ethanol, the 2002 experimental and 2003 state of the technology cases produce selling prices in the range of \$2.44-\$2.73/gal. I suppose that the reader should understand from this that there is a lot of work required to reach the lower economics of the original design case. The other conclusion is that the original case was way too optimistic and produced an unrealistically low selling price for ethanol. The authors so not really help the reader to understand which of these conclusions is correct.
- I think a few pages of additional discussion regarding the differences between the original design case assumptions and the SOT or experimental conditions would be very helpful. As it is, the reader is left not really knowing what to believe is an accurate estimate for the cost to make cellulosic ethanol.

Internal Review Process:

- I could not tell what kind of internal review of this document had been done, so I cannot really comment on the process.

## *Development of a Multicriteria Assessment Model for Ranking Biomass feedstock Collection and Transport Systems*

### Assumptions

Reviewer 1:

- Assumptions are that the “data” created as output from another model are of sufficient quality to conduct the multi-criteria assessment presented in this report. The authors should have conducted a sensitivity analysis to see how errors in their input “data” would affect the results of this study. They did not report that they did this, but they did report a sensitivity study for the effect of weighting factors applied to each criterion. The Integrated Biomass Supply Analysis and Logistics (IBSAL) model, which was the source of much of the “data” for the harvesting portion of the reported ranking study, may have provided excellent input data to the multi-criteria study, but the authors do not address the potential problem.
- A second problem with assumptions is that the qualitative assumptions were “based on the experience of the authors, in discussion with the industry and in informal consultation with the experts in the area.” While recognizing that qualitative data are difficult to use in a model and that the authors of the study attempted to use the opinion of knowledgeable individuals, I am surprised that the journal did not require them to elaborate more thoroughly on the specifics of the process they followed.

Reviewer 2:

- Assumptions of system parameters are valid.

### Methodologies

Reviewer 1:

- It is fairly clear what methodology was used and there are references that could be examined for additional detail, however the methodology for developing the qualitative data is not described sufficiently.

Reviewer 2:

- Methodology is well-described and followed, since it is the subject of the paper.

### Data Quality

Reviewer 1:

- Data quality is difficult to evaluate in that the majority of the harvesting study data are the output of the (IBSAL) model, which was not reviewed in this manuscript. Consequently, the validity of the data that were used is unknown. A similar statement pertains to the qualitative data that was developed from the opinion of the authors and others. No details are provided to assess the quality of this data. On the surface, it appears to be opinion rather than data.

Reviewer 2:

- Data quality is good.

### Conclusions

Reviewer 1:

- Conclusions are highly dependent on criteria weighting factors which are presented without justification.

Reviewer 2:

- Conclusions are highly dependent on weighting factors which are not defended at all.

### Review Prior to Publication

Reviewer 1:

- The authors acknowledge that no review was done prior to publication. It appears that this article is a paper that was presented at a conference and may have been published without benefit of scientific peer review in a journal that does not specialize in this type of analysis.

Reviewer 2:

- No information or review prior to publication.

### Other

Reviewer 1:

- If this is a “foundational” study for decision making regarding harvesting and transportation, I think it falls short as a report. Perhaps there is more information available in other documents, but this one is neither comprehensive nor convincing.
- Well done paper using quantitative models to select best options. Paper must have had good reviews before publishing. Would be interesting to use models to test wood flow transport systems to pulp mills? Seems like the new biomass industry could learn from the pulp & paper industry on transport of biomass. Models continue to show results, e.g. drawing circles for biomass similar to those developed over decades by the P&P industry.
- Key is to actually have a refinery collect/ pay and transport biomass. Ag experiences with hay crops, bagasse and other crops should give reasonable conclusions. The two efforts above actually conclude what one would expect based on previous experiences in both ag and forestry operations. Key is to get more involvement from the Ag groups and forestry groups.

Reviewer 2:

- Although not important, I believe an unstated assumption is that  $f(a)$  must range from 0 through 1. I don't understand the definitions and they may not be consistent

## *Costs of Harvesting, Storing and Transporting Corn Stover in a Wet Form*

### Assumptions

Reviewer 1:

- Assumption that corn stover will be the only feedstock for a biorefinery is no longer valid as DOE has moved to recognize regional feedstocks; also utilizing woody biomass avoids the problems with short harvest seasons for ag crops.

Reviewer 2:

- All the assumptions are described and are reasonable.

Reviewer 3:

- This is a preliminary engineering economic assessment that is based on published literature and the authors' assumptions of many factors and scenarios. The assumptions and scenarios considered appear to be appropriate. It would be an improvement to indicate the assumed value with a +/- range of error.

### Methodologies

Reviewer 2:

- Methodology is appropriate.

Reviewer 3:

- Methodology is appropriate for a preliminary engineering economic study, which is typically good for an initial look at competing possibilities. An improvement that is needed is to assign error bars to the various assumptions, parameters, and carry those through to the final result. I suspect the range of error among the cases considered is probably in the 30 to 40% range, but may be higher or lower. There is no way to determine from the report.

### Data Quality

Reviewer 1:

- Large, wet storage under anaerobic conditions can produce major odor problems; equipment for one pass harvest of grain and stover not developed; costs and prices could be updated to current values but would not change conclusions; question of scale is important as smaller, regional refineries may be better than central larger; there is need to test some assumptions, eg storage losses, demonstration of large pile storage but authors recognize these.

Reviewer 2:

- Some data on operations costs come from a limited set of experiences but not much is available.

Reviewer 3:

- Most data comes from analogous materials but virtually none of it comes from measured data on stover handled in the manner described. Operating cost of equipment data is probably very good.

### Conclusions

Reviewer 1:

- Overall well done, conclusions valid but dated, data valid.

Reviewer 2:

- Conclusions are supported by the analysis.

Reviewer 3:

- Conclusions. The authors do not indicate any confidence levels for the numbers reported for each case. I think a sensitivity analysis is needed to determine where more data should be collected to increase the reliability of the results of the analysis.

Review Prior to Publication

Reviewer 2:

- I have no information on the review prior to publication.

Reviewer 3:

- I have no information on the review prior to publication.

## **Attachment G**

Federal Biomass R&D Technical Advisory  
Committee: *Roadmap* Update  
Process

Regional *Roadmap* Chairs

Central: Tom Binder

West: Ralph Cavalieri

East: Douglas Hawkins

# EPACT 2005 and the *Vision & Roadmap*

- EPACT 2005 Mandates the *Vision* and *Roadmap* to be updated by the Secretaries of Energy and Agriculture.
- The Committee wrote the original *Vision* and *Roadmap*, discussed an update, and fulfilled the EPACT 2005 mandate in agreement with the Board.
- The Committee has updated the *Vision* and is currently updating the *Roadmap*



# Updated *Vision* Goals

- The updated *Vision* does not change the original 2010 goals but recognizes that in some cases the U.S. is not on track to meet them.
- The *Vision* makes minor changes to its 2020 and 2030 goals and establishes 2015 goals which describe the types of activities that must occur to reach that goal and move down the path to the aggressive targets for 2020 and 2030.

	Units	2000	2004	2010	2015	2020	2030
<b>Biofuels</b>	Market share (%)	0.7	1.2	4.0	6.0	10.0	20.0
	Consumption (billion gasoline-equivalent gallons)	1.1	2.1	8.0	12.9	22.7	51.0
<b>Biopower</b>	Market share (%)	3.0	3.0	4.0	5.5	7.0	7.0
	Consumption (Quadrillion Btu)	2.0	2.1	3.1	3.2	3.4	3.8
<b>Bioproducts</b>	Production (billion lbs)	12.8	17.6	23.7	26.4	35.6	55.3

- The Committee has completed three regional *Roadmap* Workshops, chaired by a Committee member from each region
  - Central – April 11-12, 2006 Chicago, IL
  - Western – August 8-9, 2006 Sacramento, CA
  - Eastern – September 19-20, 2006 Syracuse, NY
- Data has been collected; Analysis of results and development of an updated *Roadmap* is underway
- The updated *Roadmap* will outline research and policy needs for achieving the *Vision* goals
- The final document should be completed in early 2007

- Regional *Roadmap* Workshops were attended by over 100 experts from industry, academia, and government from around the U.S.
- Participants mapped out the Phases of Biomass:
  - Plant Science, Genetics, Harvesting, Conversion, End Use, etc.
  - Identified Barriers to achieve the Vision Goals

# Roadmap Process (continued)

- Identified Policies and R&D needed to achieve the *Vision* goals for increased use of biofuels, biopower and biobased products
- Prioritized key barriers, policies, and R&D
- Identified region-specific needs

- Finish Regional Summaries
- Analyze Results
- Draft document
- Committee and Independent Peer Review

- Largest pipeline network is in the region; Study feasibility of larger pipelines. Opportunities to use it in test loop.
- Pipelines from Midwest to East and West coasts
- Maximize river use in central region: channel depth requirements; new locks facilitate barge transport; river management

- **Feedstocks**

- Decentralization - Modular pretreatment, processing and fractionalization – “on farm methods to add value”
- Farm Profitability – Feedstocks and products diversification, one-pass systems

- **Processing and Conversion**

- Economic analysis (modeling) of opportunities for oil and proteins to displace petrochemical and use to focus R&D; Understanding risks and trade-offs
- Understanding fundamentals of biochemistry in nature; Ruminates process & breakdown
- Joint solicitation from NSF, NIH, DOE, USDA in “\$\$ billions”

## Product Uses and Distribution

- Transportation & Distribution Systems
  - Multi-modal transport study to identify high opportunity modes
  - Quick-cheap densification
- Certification and Specifications
  - Bio industry needs to set the standards before another industry does
  - Incorporate whole-system certification that goes back to the feedstock
- Procurement Requirements
  - Need market pull and push
- Increase Product Uses and Applications
- On-farm processes for producing methane
  - Studies on scalability
- Regulation throughout the System



## **Policy Needs to Achieve the *Vision* Goals**

- Education & Training
  - Lack of funding for basic science research
  - Training at all levels (for industry)
- Public Outreach
  - White paper (specific funding in platform areas)
- Reduce Uncertainties in the Investment Community
- Incentives
  - Long-term policies
  - Petroleum displacement credits
  - LCA
- Coalition Building

- **Barriers to Achieving the *Vision* Goals**
  - Management of dispersed feedstocks
  - Lack of transmission and interconnection
  - Water availability
- **Policy Needs to Achieve the *Vision* Goals**
  - Shift incentives to production (away from non-production)
  - Consolidate & coordinate permitting process
  - Incentives to reduce water consumption
- **R&D Needs to Achieve the *Vision* Goals**
  - R&D that minimizes water & fertilizer input
  - Quantify biomass potential in West

## **Barriers to Achieving the *Vision* Goals**

- Lack of long term consistent energy policy and commitment to R&D
- Equipment development costs
- Financial return to farmers
- Capital cost and scale of technology
- Public perception and consumer education
- Workforce education

## **Policy Needs to Achieve the *Vision* Goals**

- Incentives for capital investment in biofuels
- Consistent policies for fuels mandates/incentives - federal/state, state/state regional, and regionally.
- Expand graduate training fellowships and expand funding for university research and trade programs for biofuels and bioproducts;
- Require best practices, development as industry grows
- Monetize CO<sub>2</sub> emissions & sequestration

## **R&D Needs to Achieve the *Vision* Goals**

- Develop data on feedstock characteristics
- Educational curricula (K – 12 and university level)
- Conversion processes that accept diverse feedstocks
- Develop and use value-added co-products
- Increase integration of national labs w/universities
- Feedstock R&D (yield, harvesting, reducing inputs, densification)
- R&D on harvesting solutions for a variety of forest residues
- Research on national fuel standards

## Eastern-specific R&D Needs to Achieve the *Vision Goals*

- **Plant science and feedstock production: Resource Management**
  - Enhance / support “bio” species evaluation for eastern region (mid-term)
- **Plant science and feedstock production: Agronomics**
  - New agronomic practices (double cropping) increase land use efficiency (tons/acre/year); plant cold-resistance for northeast region (mid-term)
  - Increase productivity to grow biomass on less land (mid-term)
- **Plant science and feedstock production: Genomics and Breeding**
  - Region-specific feedstock yield research (i.e. poplar, willow, etc.)
- **Conversion - Integration**
  - Create model Biorefinery for eastern feedstocks (near-term)

## **Eastern-specific Barriers & Policy to Achieve the *Vision* Goals**

- **Barriers**

- Many small landowners; woody biomass; lack of farm policies for biomass; lack of experience among growers
- Transportation: mitigating long haul transportation

- **Policy**

- Target biomass within renewable portfolio standards (especially in the southeastern states)

- **Barriers to Achieving the *Vision* Goals**
  - Risk management; no bridge funding for valley of death; first mover syndrome; government share of risk for new technology;
  - Sustainability, environmental resources; feedstock opposition to food vs. fuel
  - Long term government policy/funding coherence;
- **Policy**
  - Biofuels “Manhattan Project”,
  - First commercial plant(s) must be constructed ASAP;
  - DOE/USDA need to share financial risk at early stages



- **R&D Needs to Achieve the *Vision* Goals**
  - Plant science and feedstock production: Genomics and Breeding: Continue gene mapping of plant species; improve yield, drought and insect tolerance (urgent for perennials (near-term))
  - Conversion Integration: Separation technologies more efficient and cost effective (mid-term)
  - Focus Areas – 2009:
    - Develop understanding of soil/ecosystem impacts of different types of biomass removal. (Modeling) and field studies
    - Develop end-use applications for industrial products i.e., polymers and materials (2007-12)

- R&D Needs to Achieve the *Vision* Goals
  - TIMELINE – biorefineries 700 tons/day minimum
    - 2007 – 1st plants – shovel in ground
    - 2009 – 1st plants – operational; 2nd plants shovel in ground
    - 2010 – 3rd plants – shovel in ground
    - 2011 - 2nd plants operational
    - 2012 – 3rd plants/co-operating; technology stabilized

## **Attachment H**

**Attendee List**

<b>Surname</b>	<b>Family Name</b>	<b>Affiliation</b>
Tom	Binder	Archer Daniels Midland
Stuart	Birrell	Iowa State
Rod	Bothast	Southern Illinois University Edwardsville
Beth J.	Calabotta	Monsanto
Jill	Euken	Iowa State
Catherine E.	Grégoire Padro	Los Alamos National Laboratory
Bill	Hagy	USDA, Rural Development
Emily	Heaton	University of Illinois
Steve	Heilmann	3M
John	Jechura	National Renewable Energy Laboratory
Glenn	Kimball	Archer Daniels Midland
Jim	Martin	Omnitech International
Ron	Modl	Kansas State University
Erin	O'Driscoll	Dow Chemical
Shri	Ramaswamy	University of Minnesota
Tom	Richard	Penn State University
Don	Riemenschneider	USDA Forest Service
Neil	Rossmeyssl	U.S. DOE, Office of the Biomass Program
Kevin	Shinners	University of Wisconsin
Seth	Snyder	Argonne National Laboratory
Lyle	Stephens	John Deere
Bala	Subramaniam	Center for Environmentally Beneficial Catalysis
Al	Vasys	Vista Group
Eric	Veech	Archer Daniels Midland
Tom	Wedegaertner	Cotton Incorporated
Ed	White	SUNY-College of Environmental Science and Forestry
Wally	Wilhelm	USDA-ARS/U of Nebraska - Lincoln

# West Regional Roadmap Workshop

August 8-9, 2006  
Sacramento, California

## Attendee List

First Name	Last Name	Affiliation
Arthur	Blazer	New Mexico State Forestry
Dan	Burica	ThermoChem Recovery International
Ralph	Cavalieri	Washington State University
Carl	Hansen	Utah State University
Doug	Hawkins	Rhom and Haas
Denny	Hunter	Weyerhaeuser
Kelly	Ibsen	National Renewable Energy Laboratory
Jeffrey	Jacobs	Chevron Technology Ventures, LLC
Terry	Jaffoni	Clean Transportation Fuels
Charles	Kinoshita	University of Hawaii at Manoa
Jim	Martin	Omni Tech International, LTD
Steve	Miller	Chevron Technology Ventures, LLC
Mike	Pacheco	National Renewable Energy Laboratory
William Lee	Pan	Washington State University
Lori A.	Perine	Agenda 2020
David W	Sjoding	Washington State University
Don	Stevens	Pacific Northwest National Laboratory
Candace S.	Wheeler	GM Research & Development Center
Randy	Lewis	Brigham Young University
Val	Tiangco	California Energy Commission
Gary	Banowetz	USDA/ARS
Ann	Bordetsky	Natural Resources Defense Council
Bill	Hagy	USDA, Rural Development
John	Hickman	John Deere
Michael	Kazz	Zelen Environmental, Tucson AZ
Tad	Mason	TSS Consultants
Marcia	Patton-Mallory	US Forest Service
Bentham	Paulos	Energy Foundation
Neil	Rossmeissl	U.S. Department of Energy, Biomass Program
Steve	Shaffer	California Department of Food and Agriculture
John	Shears	The Center for Energy Efficiency and Renewable Technologies
Luke	Tonachel	Natural Resources Defense Council
Doug	Wickizer	California Department of Forestry and Fire Protection
Rick	Zalesky	Chevron Technology Ventures, LLC; Biofuels & Hydrogen Business Unit

# East Regional Biomass Roadmap Workshop

September 19-20, 2006  
Syracuse, New York

## Attendee List

First Name	Family Name	Affiliation
Philip C.	Badger	Renewable Oil International LLC
Marco	Baez	Dyadic International, Inc.
Larry	Biles	Southern Forest Research Partnership, Inc.
Tom	Binder	Archer Daniels Midland
Akwasi (Kwesi)	Boateng	U.S. Department of Agriculture
David	Bransby	Auburn University
Ralph	Cavaliere	Washington State University
Jessica	Crawford	O'Brien and Gere
Jennifer	DeCesaro	Clean Energy Group
Kevin J.	Edgar	Eastman Chemical Company
Mark	Emptage	DuPont
Ken	Green	BCS, Incorporated
Bonnie R.	Hames	Ceres, Inc.
Stewart	Hancock	Hancock Public Affairs, LLC
Doug	Hawkins	Rohm and Haas
Maurice	Hladik	IOGEN Energy Corporation
Lou	Honary	University of Northern Iowa, NABL Center
Judy	Jarnefeld	New York State Energy Research Development Authority
Tom	Johnson	Southern Company
Coleman	Jones	General Motors
George	Kervitsky	BCS, Incorporated
Robert	Kozak	Atlantic Biomass
Eric	Larson	Princeton University
F. Henry	Lickers	Mohawk Council of Akwesasne, Environmental Division
Tom	Lindberg	New York State Agriculture & Markets
Mike	Manella	BCS, Incorporated
Jason	Masters	Northern Biodiesel
Daniel H.	Moenter	Marathon Petroleum
Cristina	Negri	Argonne National Lab
Mitch	Peele	North Carolina Farm Bureau
Gary	Pollock	Society of Automotive Engineers (SAE)
Neil	Rossmeissl	U.S. Department of Energy, Biomass Program
Corinne	Rutzke	Cornell University
Jeff	Serfass	Technology Transition Corporation
Samantha	Slater	Renewable Fuels Association
Bryce	Stokes	U.S. Department of Agriculture, Forest Service
Chris	Veit	Novozymes
Tim	Volk	State University of New York, College of Environmental Science and Forestry
Brian	Ward	CSX Corporation, Inc.
Edwin	White	State University of New York
Rodney	Williamson	Iowa Corn Promotion Board
Jetta	Wong	Environmental and Energy Study Institute
Mae	Wu	Argonne National Lab

## **Attachment I**



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*Biomass R&D Technical Advisory*

*Committee Meeting*

*Washington, DC*

*November 29, 2006*

*William F. Hagy III*

*Deputy Administrator, Business Programs*

*USDA Rural Development*





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## *Biomass Initiative Update*

- *Update on USDA's Fiscal Year (FY) 2006 Awards*
- *Update on FY 2007 Solicitation*
- *Update Section 9008 Portfolio Analysis*
- *Update on USDA – DOE Advancing Renewable Energy Conference*
- *Secretary's Energy Council*



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## *USDA's FY '06 Section 9008 Awards*

- *Notice to Awardees/Non-awardees – 10/13/06*
- *14 Awardees – Grant Closing Package – Issued 11/24/06*
- *Deadline for Return of Executed Grant Agreement – 60 days*



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## *FY '07 Section 9008 Solicitation*

- *Federal Register Pre-application Notification*
- *Deadline for Pre-applications – 45 days*
- *Merit Review Committee Panel – 30 days*
- *Notification of Pre-application Review – 60 days*

*Total = 135 days*



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## *FY '07 Section 9008 Solicitation (continuation)*

- *Full Application due – 45 days*
- *Merit Review Committee Panel – 30 days*
- *Announce Awards – 60 days*

*Total – 135 days*



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*Advancing Renewable Energy*  
*An American Rural Renaissance Conference*

- *1350 Attendees*
- *Results / Next Steps*
- *<http://www.usda.gov>*

*Spotlights! Renewable Energy*



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## *USDA'S Energy Council*

- *Purpose: Coordinate Department Collaboration and Leveraging of Resources for Renewable Energy/Energy Efficiency Development.*
- *Three Committees*
  - *Research & Development (R&D)*
  - *Commercialization*
  - *Marketing / Outreach*





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# *USDA'S Energy Council*

## *(continuation)*

- *R&D Committee*
  - *R&D Plan*
- *Commercialization Committee*
  - *Matrix*
  - *Intra-agency Coordination*
- *Marketing / Outreach Committee*
  - *Renewable Energy Conference*

## *Farm Bill – Energy Title*

### *Section 9006 – Renewable Energy Systems and Energy Efficiency Improvements Program*

- Establishes a grant, loan, and loan guarantee program to assist eligible farmers, ranchers, and rural small businesses in purchasing renewable energy systems and for making energy efficiency improvements.*





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## *Section 9006 Funding Activity FY 03 thru 06 Renewable Energy/Energy Efficiency*

	<i>No.</i>	<i>Amount</i>	<i>Leveraged Funds</i>
<i>Biomass</i>	167	\$29,628,908	\$224,877,087
<i>Wind</i>	168	33,227,041	487,265,950
<i>Solar</i>	40	2,224,639	5,924,634
<i>Geothermal</i>	15	921,282	2,763,869
<i>Hybrid</i>	<u>12</u>	<u>2,521,236</u>	<u>185,682,033</u>
<i>Totals</i>	402	\$78,523,106	\$906,513,573

*Energy Efficiency Improvements: 426 - \$9,442,879; Leverage Funds \$27,635,898*

*Guaranteed Loans (Biomass): 20 - \$34,258,862; Leverage Funds \$37,441,264*

*Grant Total: 848 - \$122,224,847; Leveraged Funds \$971,590,735*



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# *Questions*



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**THE END**

## **Attachment J**

## **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 cochairpersons 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 cochairperson of the Board;
  - (2) the point of contact of the Department of Agriculture designated under section 304(b)(1)(A), who shall serve as cochairperson 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 2 or 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 1 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 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 years 2006 through 2015.

## **Attachment K**

# The Biomass R&D Technical Advisory Committee

## **Update on Action Items**

November 29, 2006

Neil Rossmeissl

- The FY 2006 Report has been approved by DOE Assistant Secretary Karsner, and provided this version to USDA Under Secretary Dorr for review and approval.
- This document is due to Congress by December 20.
- The FY 2006 Report, has broken all land speed records on approvals.

- 2006 Nominee information was reviewed by each agency's POC and the nomination package is in process.
- 6 Nominees and a Co-Chair were submitted.



## DOE Awards

- **Edenspace Systems Corporation** - Energy Corn Consortium - \$1,926,970
- **Lucigen Corporation** - Novel Enzyme Products for the Conversion of Defatted Soybean Meal to Ethanol - \$1,259,000
- **Center for Technology Transfer, Inc.** - Value Prior to Pulping - \$1,521,763

## USDA Awards

- **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 - \$813,450
- **Ceres, Inc.** - Biotechnological Improvement of Switchgrass - \$1,572,460
- **Drexel University** - Moisture Management in Polylactide and Polylactide Copolymers - \$1,312,389

- **Virent Energy Systems, Inc.** - High-Value Chemical Production from Biodiesel-Derived Glycerol - \$2,000,000
- **The Pennsylvania State University** - Lignin Conversion to Value-Added Materials - \$579,340
- **Iowa Corn Promotion Board** - Adding Value to Commercial Polymers through the Incorporation of Biomass Derived Chemistries - \$1,762,157
- **Louisiana State University Agricultural Center** - Thermoplastics composites Reinforced with Natural Fibers and Inorganic Nano-Particles - \$791,865
- **Ceres, Inc.** - A Plant-based Production System for Methacrylate - \$1,523,530
- **Argonne National Laboratory** - Enhancing Animal Feed Values in Corn Dry Mills with Biobased Solvents - \$400,000
- **Western Governors' Association** - Strategic Development of Biomass in the Western States -\$290,246
- **Southern Illinois University** - Technical Area 4; Expansion of ethanol production: evaluation of costs and benefits to rural communities in the Upper Mississippi River Basin - \$676,722

- **Clarkson University** - Analysis for Strategic Guidance Demonstrating the Value of Waste Biomass Feedstocks for Fuel Ethanol Production from Energy Policy Perspectives - \$250,001
- **Michigan State University** - Life Cycle Assessment to Improve the Sustainability and Competitive Position of Biobased Chemicals - 376,616
- **North Carolina State University** - Strategic Positioning of Biofuels in the Economic Context of Agriculture, Crude Oil, and Auto-Manufacturing. - \$435,997

- EPACT 932 Solicitation
  - 24 Proposals submitted and reviewed
  - Oral defense underway
  - Awards expected for negotiation late December, early January
- Ethanologen Solicitation
  - Proposals due January 4, 2007
  - Awards by April 2007

- **Coordinating information in government and industry efforts to improve crop yields, harvesting techniques, and to gather technology advances and research to accelerate biomass's development as an energy source**
- **Coordinating information from the Analysis Subcommittee on other energy sources, life cycle assessments, and carbon footprints**
- **Coordinating information from the Policy Subcommittee on developing and supporting consistent policy positions that favor biomass**
- **Developing educational curriculum materials**
- **Leading consumer education efforts**

# Questions?

You can contact the Biomass Initiative at:

[harriet.foster@ee.doe.gov](mailto:harriet.foster@ee.doe.gov)

202-586-4541

## **Attachment L**

# **STATUS OF USDA'S BIOPREFERRED PROGRAM**



**PRESENTED TO THE  
BIOMASS RESEARCH AND  
DEVELOPMENT FACA**

**November 29, 2006**

**Washington, DC**

Dr. Roger K. Conway

and

Dr. Marvin Duncan

OFFICE OF ENERGY  
POLICY AND NEW USES

# PROGRAM HAS BEEN RENAMED

- Renaming done by USDA leadership to better represent Program purpose
- It is now the Bio Preferred Program
- This name embraces all aspects of the program

# FEDERAL BIOPREFERRED PROGRAM

- Provides that Federal agencies must give purchasing preference to biobased products designated by this program
- Authority for the program included in the Farm Security and Rural Investment Act (FSRIA) of 2002
- Section 9002 provides for both preferred procurement and labeling programs

# SECTION 9002 OF FSRIA SETS OUT FEDERAL AGENCY REQUIREMENTS

- The Act defines biobased products as commercial or industrial products that are composed, in whole or in significant part, of biological products or renewable **domestic** agricultural materials (including plant, animal, and marine materials) or forestry materials

# DOMESTIC CONTENT

- For purposes of preferred procurement, domestic content is interpreted to include feedstock from other countries with which the United States has preferential trade agreements
- Countries that are signatories to NAFTA and CAFTA, for example, will have their qualifying biobased products treated the same as U.S. domestic products
- Interpretation necessary to gain USTR approval

# FOR PURPOSES OF THE VOLUNTARY LABELING PROGRAM

- A one word change in the statutory definition of a biobased product is necessary
- “Or” will be changed to “including” renewable domestic agricultural products ---
- Change is necessary to obtain USTR agreement to publish the rule
- Change is expected to be inserted in legislation at the earliest feasible opportunity

# WHAT DOES THE PROGRAM REQUIRE?

- All Federal agencies must give preference to biobased products that have been designated by the program, unless:
  - The products are not reasonably available
  - The products fail to meet performance standards for the application intended
  - The products are available only at an unreasonable price



# PROGRAM IS INTEGRATED WITH OTHER FEDERAL PREFERENCE PROGRAMS

- RCRA'S recycled products program has priority over the biobased procurement program
- Where environmental attributes are available in a biobased product, but not a RCRA product, biobased product may have priority over RCRA
- Energy Star, Environmentally Preferable, and other preference programs are to be implemented by Federal agencies in integrated manner

# DESIGNATING ITEMS FOR PREFERRED PROCUREMENT

- Items are generic groupings of products
- Items are designated by rule making
- Once designated, all 'qualifying' products within a designated item are eligible for preferred procurement
- Federal agencies have up to one year to implement procurement preference

# WHAT IS A 'QUALIFYING' BIOBASED PRODUCT?

- It is consistent with definition in statute
- Biobased content is known
- Environmental and health effects of product use are available
- Product performance, as tested against industry recognized standards, is known
- Designation is based on providing reliable and relevant information to Federal agency

# EXCLUSIONS FROM THE PROGRAM

- The following product groups are excluded from the program by statute:
  - Food and feed
  - Motor vehicle fuels
  - Electricity

# AGENCIES' SPECIFICATIONS MUST COMPLY

- Within one year after final guidelines issued, agency specifications require use of biobased products
- Agencies must create procurement program
  - A biobased products preference program
  - An agency promotion program
  - An annual review and monitoring of effectiveness of agency's program
- Within one year after designation, agencies' must give procurement preference to items

# REQUIREMENT APPLIES TO:

- Purchase or acquisition of a procurement item where the purchase price exceeds \$10,000, Or,
- Where the quantity of such items purchased in the preceding fiscal year was \$10,000 or more
- Requirement is applied at agency level

# TO USE THE PROGRAM A MANUFACTURER CAN:

- Claim coverage under the program for all products for which items (generic groupings of products) have been designated by rule making
- Certify that a product's biobased content is consistent with statutory definition
- Certify biobased content meets minimum requirement, using ASTM standard test
- Certify that a product will perform in the use to which it will be put

# BIODEGRADABILITY REQUIRED

- To be designated for preferred procurement, items of single use bioplastic products must meet appropriate ASTM standard for biodegradability
- Some examples are:
  - Cutlery
  - Garbage bags
  - Food containers



# FEDERAL AGENCIES MAY ASK FOR PRODUCT INFORMATION

- Federal agencies may ask the manufacturer for the following information:
  - Biobased content information using ASTM test
  - Environmental and health effects of product use using BEES analysis or ASTM standard
  - Product's life cycle cost using same standards
  - Results of product performance testing against industry recognized performance standards

# REVIEW PROCESS IS EXTENSIVE

- All rules, significant or not, must be reviewed by the Office of Management and Budget
- Extensive review by major government agencies is required
- NASA's space applications and DOD's tactical activities are exempted from preferred procurement

# STATUS OF THE PROGRAM

- Final rule to establish program (of ten items each published in *Federal Register*, January 11, 2005
- Final rule to designate the first six items (groupings of products) for preferred procurement published in the *Federal Register*, March 16, 2006
- Rounds 2 and 3 proposed rules published in *Federal Register*, August 17, 2006 – final rules being drafted
- Round 4 proposed rule published October 11, 2006
- Round 5 rule in formal clearance within USDA by mid December
- Round 6 of proposed designation rules in formal clearance by end of January, 2007

# EXAMPLES OF ITEMS PROPOSED FOR DESIGNATION

- Metal working fluids
- Composite panels
- Biodegradable containers
- Hand cleaners and sanitizers
- Hydraulic fluid for mobile uses
- Durable plastic films
- Biobased carpet
- Biodegradable cutlery
- Greases
- De-icers
- Clothing products

# BIOBASED PRODUCTS MARKET PLACE

- **170** Items (generic groupings of products) identified so far
- **2,026** companies identified that produce or market **about 10,377** biobased products
- For the first five rounds of designation, **2,756** individual biobased products identified

# DESIGNATING PRODUCT ITEMS

- Must be done by rule making process
  - Proposed rule
  - Public comment period
  - Final rule
- USDA must consider information on
  - Product availability
  - Economic and technological feasibility of use, including life cycle costs

# DESIGNATING PRODUCT ITEMS

- USDA must also provide information to Federal agencies concerning:
  - Relative price
  - Performance
  - Environmental and public health benefits
  - And, where appropriate, recommend a level of biobased content in the procured product

# MANUFACTURERS CAN HELP USDA GET PRODUCTS DESIGNATED

- We need information on a number of individual products within an item (generic grouping) in order to designate that grouping by rule making
- Please contact **Steve Devlin at Iowa State University** with product information. His phone is **641-613-3298**
- Our website: **[www.biobased.oce.usda.gov](http://www.biobased.oce.usda.gov)** is a good source of information on this program



# VOLUNTARY LABELING PROGRAM

- Qualifying biobased products may gain use of **U.S.D.A. CERTIFIED BIOBASED PRODUCT** label and logo
- Authority to use label granted for limited number of years with re-authorization
- Proposed rule to establish labeling program being drafted by USDA
- Expected to apply to qualifying products under designated items

# USDA'S MODEL PROCUREMENT PROGRAM

- Under leadership of Departmental Administration
- In coordination with the Office of Federal Procurement Policy of OMB
- This program will be available to all Federal agencies
- Its purpose is to train agencies, educate, and promote use of biobased products

# CONCLUSION

- A final rule establishing the program has been issued on January 11, 2005
- The final rule to designate six items for preferred procurement published on March 16, 2006
- Three proposed rules published in *Federal Register*
- Two more proposed rules (10 items each) in clearance before end of January, 2007
- Model procurement program to aid Federal agencies in purchasing biobased products
- Proposed rule for a voluntary labeling program is being drafted



## **Attachment M**

The revised Biomass R&D Act of 2000 discusses the Committee's advisory duties in section 306(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.

**During its November 29, 2006 public meeting, members of the Biomass R&D Technical Advisory Committee suggested the following recommendations for further discussion:**

- A. Recommendations regarding the distribution and use of Initiative funds
  1. DOE should establish a protein platform to work on non-cellulosic, non-sugar biomass feedstocks conversions. (J. Martin)
  2. Policies for the agricultural economics of biomass production should be given further study. (J. Martin)
  3. The agencies approach biomaterials with greater balance, increasing the emphasis on biobased materials in tandem with biofuels. (L. Honary)
  4. The agencies continue exploration of a variety of biofuels technologies, but continue to emphasize publicity for E85 and biodiesel. (M. Maher)
- B. Recommendations regarding the independency and transparency of the annual joint solicitation awards/ Recommendations regarding the independent merit-based review of solicitation applications
  1. Joint Solicitation Review panel selections should be clear and transparent. (T. Jaffoni)

C. Overall recommendations to the Secretaries

1. The agencies 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. (J. Martin, M. Maher, T. Jaffoni).
2. That the agencies continue to emphasize timeliness of Committee member appointments. (J. Hickman)

## **Attachment N**



**2007 Work Plan**  
**December 1, 2006 – November 30, 2007**  
**Biomass R&D Technical Advisory Committee**

**Background**

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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.

### **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.

### **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.

### **2007 Deliverables**

- Revised *Roadmap* document.
- Matrix tracking the progress of USDA and DOE biomass R&D portfolios.
- 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.

## **Timeline for Generation of Recommendations**

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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 [harriet.foster@ee.doe.gov](mailto:harriet.foster@ee.doe.gov). Submission via other means is possible by contacting Harriet Foster at 202-586-4541. 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.

## 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	<ul style="list-style-type: none"> <li>▪ Receive Status of the FY 2007 Joint Solicitation</li> <li>▪ Discuss <i>Roadmap</i> Update first draft</li> <li>▪ Review Policy Gap Analysis - discuss Committee comments and decide on recommendations to propose for inclusion in annual report</li> <li>▪ Review Analysis Subcommittee Efforts</li> <li>▪ Presentation on Cellulosic Ethanol Economic/Scenario Model</li> <li>▪ Review Communications Subcommittee Statement of Work &amp; Outreach Plan</li> <li>▪ Discuss Local and State Biomass R&amp;D Efforts, including any local projects funded under the biomass R&amp;D joint solicitation</li> <li>▪ Discuss FY 2007 Recommendations to the Secretaries</li> </ul>
May 15(-16), 2007 1 or 2-Day Meeting	<ul style="list-style-type: none"> <li>▪ <i>New Member Orientation</i></li> <li>▪ Receive an update on the FY 2007 joint solicitation</li> <li>▪ Discuss <i>Roadmap</i> Update</li> <li>▪ Discuss Policy, Analysis, and Communications Subcommittee Efforts</li> <li>▪ Presentation from DOE OBP on Transition Modeling Efforts</li> <li>▪ Presentation from Woody Biomass Utilization Group</li> <li>▪ Presentation from Pulp &amp; Paper Industry</li> <li>▪ Review of National Biofuels Action Plan</li> <li>▪ Discuss Interagency Biomass R&amp;D Portfolio Analysis</li> <li>▪ Presentation of USDA Analysis of Projects Funded by Farm Bill section 9008</li> <li>▪ Discuss Local and State Biomass R&amp;D Efforts, including any local projects funded under the biomass R&amp;D joint solicitation</li> <li>▪ Receive report on agency reactions to 2002-2006 recommendations</li> <li>▪ Discuss FY 2007 Recommendations to the Secretaries</li> </ul>
September 10-11, 2007 2-Day Meeting	<ul style="list-style-type: none"> <li>▪ Receive an update on the status and awardees of the FY 2007 joint solicitation</li> <li>▪ Approve FY 2007 Recommendations to Secretaries</li> <li>▪ Discuss Policy, Analysis, and Communications Subcommittee Efforts</li> <li>▪ Presentation from Wall Street/investment/financial bioenergy perspective</li> <li>▪ Presentation from Argonne National Laboratory regarding Life Cycle Analysis</li> <li>▪ Presentation from USDA Agricultural Resource Service regarding financial analysis of feedstocks pricing</li> <li>▪ Discuss Local and State Biomass R&amp;D Efforts, including any local projects funded under the biomass R&amp;D joint solicitation</li> </ul>
November 28-29, 2007 2-Day Meeting	<ul style="list-style-type: none"> <li>▪ Meet with the Biomass R&amp;D Board to Discuss Recommendations, Research, and Policy</li> <li>▪ Develop topics for the 2008 Work Plan</li> <li>▪ Discuss Policy, Analysis, and Communications Subcommittee Efforts</li> <li>▪ Discuss Local and State Biomass R&amp;D Efforts, including any local projects funded under the biomass R&amp;D joint solicitation</li> </ul>